Increasing physical activity levels of primary school-aged children and its effects on physical health and psychological well-being: Evaluations of a home-based and a school-based behavioural self-management intervention

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Bachelor of Arts (Psychology) HONS

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I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution.

...........................................................

Cath Price
Abstract

Physical activity (PA) has been a focus for both treatment and prevention programs for obesity and other related health problems in childhood. The aims of the present research were to assess the extent to which children can self-manage increases in physical activity under free living conditions (at home and school) as a result of daily self-monitoring with a pedometer and education in the use of additional behavioural strategies packaged in a home-based intervention – the Moving It Program (MIP) and a school-based intervention - The Health and Programmed Physical Education (H.A.P.P.E.) Classroom Project. A secondary aim was to assess to what extent beneficial outcomes in physical health and psychological well-being can be monitored as a result of increases in PA. Study I presents four single-case evaluations of the MIP with inactive and overweight primary school-aged children at home over a monitoring period of approximately 5 months. Study II presents four separate quasi-experimental evaluations of The HAPPE Classroom ‘Climb Mt Fuji Challenge’ conducted with a total of 127 primary school children, in groups aged 7-8 years, 9-10 years and 11-12 years, from two Western Australian metropolitan primary schools. Each HAPPE evaluation was conducted during one school term (approximately 9-weeks). Primary dependent variables were mean steps monitored on weekdays (including steps in-school and out-of-school in the HAPPE evaluations) and on weekends with pedometers on a continuous, daily basis. In Study I, all children made notable changes in their daily activity levels in the MIP, though not all maintained these increases. Two of the children made greater gains in mean steps on weekdays compared to weekends, while the other two made greater gains to steps on weekends compared to weekdays. Participants also showed positive changes in measures of body composition and
psychological well-being. In Study II, proportions of children meeting recommended daily step counts on weekdays and weekends increased significantly in the control and experimental groups compared to baseline. Increases in mean daily steps on weekdays and out-of-school in the experimental ‘Ped + HAPPE’ condition significantly exceeded increases in mean daily steps in the Comparison ‘Ped Only’ condition in 3 of the 4 trials. Pre versus post analysis of health indicators revealed both groups made significant increases in height without significant increases in weight or BMI, as well as significant decreases in resting heart rate. Raw scores on the Child Depression Inventory and Revised Child Manifest Anxiety Scale (RCMAS) in the control group and raw scores on the RCMAS in the experimental group all reduced significantly. Educating children in the use of pedometers to self-monitor steps on a daily basis, in combination with additional behavioural strategies enabled ‘at risk’ and typical children to self-manage increases in PA to currently recommended levels, with increases in PA generalising across the home and school contexts. However, caution must be applied when attributing the changes in physical health and psychological well-being from the pre- to post-measurements to increases in PA. Further research is needed to determine the extent to which self-managed increases in children’s PA are maintained and, using alternative PA monitoring methods, further clarify the extent to which changes in health and well-being in childhood is related to acute/short-term increases in the different types (intensities) of PA. The preliminary success of a low cost, minimalist behavioural self-management intervention delivering reliable improvements in children’s PA in the short-term, and with the potential to benefit health and well-being at the individual level provides a hopeful outlook in the context of the global threat from NCD. It is anticipated that if the HAPPE is delivered to all school children as part of a widespread ongoing initiative, then population-based targets to increase PA levels will be achieved.
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Ken Price, thank you for hanging in there till the end, I’m so relieved you were able to live long enough to see it completed. And to Stephen Price, thank you for helping me enjoy life when I needed it, we can finally open that bottle of Moët now!
Executive Summary

There is a complex mix of health problems – known as non-communicable ‘lifestyle’ diseases - that are rapidly developing in populations across the globe. A decade ago, The World Health Organisation (2004) identified physical activity (PA) as an important behaviour to target in the prevention of obesity and related non-communicable disease (NCD). Primary school-aged children were identified as the optimal group to target in interventions to increase physical activity levels (World Health Organization, 2009). PA guidelines for children prescribe a minimum of 60 minutes of moderate-to-vigorous physical activity (MVPA) every day, and no more than 2 hours of ‘screen’ time (Department of Health and Ageing, 2004). However, it is not fully understood how physical inactivity in childhood influences development of NCD. It is less clear which behaviours should be of most concern. This thesis argues that the problem of children’s physical inactivity needs to be inclusive of all the problems of 1) insufficient MVPA, vigorous PA and/or specific/organised exercises, 2) insufficient levels of lifestyle PA/ Non-exercise physical activity (NEAP) / Non-exercise activity thermogenesis (NEAT), 3) excessive participation in sedentary activities, and 4) prolonged bouts of sedentary behaviour. All are separate behaviours determined by their own set of conditions, occurring in different contexts of a child’s daily life. Interventions to increase children’s PA to date have not adequately dealt with all of these issues.

In response, the primary aim of this thesis was to evaluate, firstly, a home-based and, secondly, a school-based intervention program designed to educate and assist children in the use of behaviourul self-management strategies to achieve increases in PA, by measuring steps on a daily basis with a pedometer. Overall, this thesis aimed to
address three overarching research questions. Firstly, can children ‘self-manage’ increases in their daily steps to levels recommended sufficient for health benefits levels? Secondly, do these increases generalise across contexts – from weekdays, ‘in school’ to ‘out of school’ and weekends? And, thirdly, what are the short term effects on children’s physical health and psychological well-being?

Study I presents four single-case evaluations of the Moving It Programme (MIP) with inactive and overweight primary school-aged children at home. While all children made notable changes in their daily activity levels, not all maintained these increases. Two of the children made greater gains in mean steps on weekdays compared to weekends, while the other two made greater gains to steps on weekends compared to weekdays. Participants also showed positive changes in measures of body composition and psychological well-being over monitoring periods that ranged from 11 to 20 weeks.

Study II presents results from four quasi-experimental evaluations of The Health and Programmed Physical Education (HAPPE) Classroom ‘Climb Mt Fuji Challenge’ with groups of primary school children at two schools, aged 7-8 years, 9-10 years and 11-12 years. Overall results showed mean steps per day increased significantly on weekdays (both ‘in school’ and ‘out of school’) and on weekends. The proportion of children in the overall sample meeting guidelines for ‘sufficient activity’ also increased significantly. Significant differences in the proportion of ‘sufficiently active’ children between the experimental and comparison groups were also found and the hypothesis was confirmed in three of the four HAPPE trials - participants in the experimental group exposed to additional behavioural self-management components in the HAPPE Classroom ‘Climb Mt Fuji Challenge’ significantly increased mean steps on weekdays, out of school and on weekends during the intervention when compared to baseline and the comparison ‘Pedometer only’ group. Unexpectedly, results also indicated potential utility of the comparison ‘Ped only’ condition to significantly increase children’s steps.
Resting heart rate showed a significant decrease from pre-post measurement in both groups. Measures of psychological well-being show changes in the desired direction. Results from paired samples t-tests show raw scores on the Depression Inventory and Anxiety Scale in the control group and raw scores on the Anxiety Scale in the experimental group all reduced significantly. Unexpectedly, however changes in physical health and psychological well-being were not significantly correlated with changes in mean overall steps in either the experimental group or the comparison group.

The MIP and the HAPPE programs demonstrated that when primary school aged-children were individually supported to use behavioural strategies of self-monitoring, goal setting, feedback, planning and positive consequences they can self-manage significant increases in PA behaviours which generalises across the school and home contexts. Significant increases in steps can be achieved in as little as three weeks with the biggest gains in PA levels ‘out of school’ on weekdays and on weekends. Additionally, comparison group participants significantly increased steps after daily self-monitoring with the pedometer for 8 weeks, but these increases did not generalise consistently to the home context. Significant improvements in physical health (resting heart rate and weight maintenance) and psychological well-being (reductions in anxiety and depression scores), were observed in the short term, though it is not possible in this study to attribute these changes to the increases in PA. Further research is needed to determine the extent to which self-managed increases in children’s PA are maintained and, using alternative PA monitoring methods, further clarify the extent to which changes in health and well-being in childhood are related to increases in the different types (intensities) of PA. The preliminary success of a low cost, minimalist behavioural intervention delivering reliable improvements in children’s PA at the individual level provides a hopeful outlook. It is anticipated that if the HAPPE is delivered to all school children, then population-based targets to increase PA levels will be achieved.
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Section I:

The problem with children’s physical activity levels and how best to go about increasing them
Chapter 1

Increasing Children’s Physical Activity Levels to Fight the ‘Lifestyle’ Disease Pandemic

It is the great paradox of our time that as living standards rise, a group of *lifestyle* related diseases have become the biggest global killer in the past 60 years (Heath, 2009; World Health Organisation, 2009a; World Health Organisation, 2011a). Also known as non-communicable disease (NCD), the causes are believed to be largely preventable and associated with human lifestyle factors, affecting populations in both developed and developing countries (World Health Organisation, 2009a; World Health Organisation, 2011a). NCDs such as cardiovascular disease, diabetes, cancer and respiratory disease are insidious, complex health problems which can take many years to develop, causing severe long term disability and premature death. A whole range of socio-economic, biological, environmental and behavioural risk factors are thought to be involved. Four common habitual behaviours - physical inactivity, tobacco smoking, alcohol consumption and a poor diet - have been identified as major risk factors for NCDs and premature death (World Health Organisation, 2009a). Efforts to address the problems of tobacco and alcohol began many decades ago. Along with individuals changing (and eliminating) their smoking and drinking behaviours, the treatment and prevention effort also involved a remarkable collective action against the ‘big tobacco’ manufacturers and greater governmental regulation of the industry (Wolfson, 2001). Similar work to address dietary problems is ongoing, although reluctance from the food and beverage industry to help has meant there is still much work to be done (Lustig,
In comparison, however, relatively little has been done to address the problem of physical inactivity despite it being recognised as a major issue (Kohl et al., 2012).

Physical activity (PA) is a behaviour fundamental to the survival of the human, yet its role in maintaining health has been taken for granted. Over the past 100 years, as human lifestyles have ‘developed’ with advances in industry and technology, the necessity for physical activity as a part of everyday life has diminished. This change in lifestyle has led to large numbers of the population in the developed world habitually participating in activities that require long periods of sedentary behaviour (e.g., sitting) and only brief intervals of low levels of physical activity (e.g., walking). General awareness of a large scale physical inactivity problem began to spread after 1996, with the release of the U.S.’s Report of the Surgeon General on Physical Activity and Health, which detailed some of the beneficial effects of physical activity and exercise, and moderate –to-vigorous intensity physical activity in particular, on health and longevity (U.S. Department of Health and Human Services, 1996). Since this report, efforts to encourage children, youth and adults to be more physically active have been the subject of much research, as it is claimed to offer individuals the greatest protection from premature mortality related to NCD (NCD Alliance, 2011; U.S. Department of Health and Human Services, 1996; World Health Organisation, 2009b).

A decade has now passed, however, since the endorsement of the World Health Organization (WHO) Global Strategy on Diet, Physical Activity and Health (WHO, 2004) yet very little has changed. In 2000, it was estimated that physical inactivity accounted for 21.5% of ischaemic heart disease, 11% of ischaemic stroke, 14% of diabetes, 16% of colon cancer and 10% of breast cancer (Bull et al., 2004). Currently, however, it is being claimed that death as a result of physical inactivity is in pandemic proportions and it is now estimated to be “the fourth leading cause [emphasis added] of death worldwide” (Kohl et al., 2012, p. 294). Unfortunately, global prevalence rates of
NCDs are expected to increase dramatically due to the rapid expansion of populations entering the ‘middle class’ in the large developing countries across Asia and South America. For example, in countries such as China and India, NCDs are already a major cause of premature death in people under 60 years (WHO, 2011a; WHO, 2011b). It has also been predicted that the burden of caring for the millions of individuals affected with chronic lifestyle disease and the premature deaths associated with them could lead to widespread economic and social devastation on a global scale (Bloom et al., 2011; WHO, 2011a).

It is a perverse reality that something so seemingly innocuous - the daily habits of the modern human lifestyle – could become the leading causes of premature disability and death of millions. This particular period in the evolution of human civilisation reflects Darlington’s (1969) dark idea that,

> Every new source from which man has increased his power on the earth has been used to diminish the prospects of his successors. All his progress has been made at the expense of damage to his environment which he cannot repair and could not foresee (p. 673).

The Director-General of the World Health Organization, Dr Margaret Chan, has described the NCD situation as a “slow-motion disaster” in response to the globalization of unhealthy lifestyles” (Chan, 2012, para. 2). However, there is still reason to hope for a better future. Given that progression is slow, a valuable window of opportunity still exists for people to change their physical activity behaviours. Governments, health agencies and industry still have a chance to globalise healthy lifestyles to reduce risk and prevalence rates of NCD. For example, a preliminary analysis of the cost of illness attributable to physical inactivity in Australia found that if the prevalence of people engaging in “sufficient” physical activity for health increases (that is, to nationally recommended PA levels), the incidence and fatality from specific
diseases will fall (Stephenson, Bauman, Armstrong, Smith & Bellew, 2000). It was also tentatively estimated that 122 deaths per year from coronary heart disease, non-insulin dependent diabetes and colon cancer could be avoided for every one per cent increase in the proportion of the population who achieve a level of sufficient and regular physical activity (Stephenson et al., 2000).

Unfortunately, population estimates such as these are as vague as they are hopeful. It is not yet known what impact increasing children’s physical activity to sufficient levels will have on Stephenson et al.’s (2000) formulation of the physical inactivity problem. While current recommendations exist for adults and children to attain daily and weekly amounts of different types of PA, this is a topic of ongoing debate, particularly regarding what types of physical activity are required and what constitutes a sufficient amount for health benefits in childhood. Indeed, there is not yet consensus on how best to increase children’s physical activity to sufficient levels. Underlying these problems are fundamental issues around how PA is defined, and the accurate monitoring of PA and physical inactivity.

1.1 Defining and Monitoring Physical Activity, Physical Inactivity and Children’s Recommendations for ‘Sufficient’ PA for Health

1.1.1 Defining Physical Activity

PA is conceptualised as one of the three major components of human energy expenditure; the largest of the three is "resting" energy expenditure (e.g., sleep), followed quantitatively by PA (e.g., which could involve any movement of the human body that is not during sleep), and then the energy expended due to the thermic effect of digesting food (MCrady-Spitzer & Levine, 2012). PA can be performed at a range of intensities, such as light, moderate and vigorous. These terms, or a combination such as
“moderate –to – vigorous” physical activity (MVPA), provide an estimate of the level of exertion a person experiences while participating in PA (Tremblay, et al., 2010; Ward, Saunders & Pate, 2007). Metabolic equivalent of task (METs) is a unit developed to quantitatively express the intensity and energy expenditure of a range of different PA’s as a multiple of the resting metabolic rate (RMR) and are used as a classification system in PA research to standardize the MET intensities of PAs (for example, the Compendium of Physical Activities Tracking Guide) (Ainsworth, et al., 1993).

Using this system, 1 MET is considered as the resting metabolic rate obtained during quiet sitting (energy expended while asleep is equated to 0.9 METs) and sedentary behaviour is defined between the ranges of 1.0-1.5 METs. Light-intensity activities are defined as 1.6 MET to 2.9 METs, moderate-intensity activities are defined as 3.0 to 5.9 METs and vigorous-intensity activities are defined as 6.0 METs or more (Haskell, et al., 2007). However, individual differences in energy expenditure for the same activity can be large, due to individual differences in body mass, adiposity, age, sex, efficiency of movement, geographic and environmental conditions in which the activities are performed and the true energy expenditure of an individual may or may not be close to the stated mean MET level (Ainsworth, et al., 1993).

The term “physical activity” defined by Caspersen, Powell and Christenson, (1985) as “any bodily movement produced by the skeletal muscles that results in energy expenditure,” is also used widely by those seeking to quantify and objectively monitor PA (p.423). The term ‘exercise’, while sometimes used interchangeably with PA, is a distinct form of PA, defined as “a type of physical activity that is planned, structured, repetitive, and participated in with the intention to maintain or improve health or physical fitness” (Caspersen et al., 1985, p.423). Sedentary behaviours, on the other hand, refer to a lack of bodily movement of the large skeletal muscles, particularly those in the legs, back and trunk which are typically required for upright movement (Cliff et
al., 2014; Hamilton, Hamilton & Zderic, 2007). Thus, time spent in sedentary
behaviour, such as sitting for a prolonged period, represents a lost opportunity for
cumulative energy expenditure from the thousands of intermittent muscular contractions
throughout the 16 wakeful hours of a typical day (Hamilton et al., 2007). Levine’s
(2004) concept of Non-Exercise Activity Thermogenesis (NEAT) relates to “the energy
expended for everything we do that is not sleeping, eating or sports-like exercise” and
includes a wide range of activities, for example “occupation, leisure, sitting, standing,
walking, talking, toe-tapping, fidgeting, playing guitar, dancing and shopping” (Levine,

Thus, NEAT is similar to Caspersen et al.’s definition of PA, and can also be
classified by the term Non-Exercise Physical Activity (NEPA) (Ekblom-Bak et al.,
2014). All of these definitions of PA overlap with the concept of “lifestyle” physical
activity, which has been defined in adult populations as “self-selected activities, which
includes all leisure, occupational, or household activities that are at least moderate to
vigorous in their intensity and could be planned or unplanned activities that are part of
everyday life” (Dunn, 2009, p.11S). Lifestyle PA, NEAT / NEPA can be highly
variable, for example levels of NEAT have been known to fluctuate between 15% to
50% of total daily energy expenditure per day, depending on the daily routine of the
individual (Levine, Vander Weg & Klesges, 2006).

1.1.2 Monitoring physical activity

Despite the range of ways PA and its different types have been classified, PA is
ultimately defined in any given context by the means it which is monitored. A barrier
facing research in this area, however, is that measuring bodily movements that result in
energy expended above that of other normal metabolic processes is a difficult task. The
‘doubly labelled water’ method is considered the most accurate method for quantifying
energy expenditure and involves drinking a solution containing an isotopic formula and
measuring (in a laboratory) the quantity eliminated in urine after seven days (Welk, Corbin & Dale, 2000). However, this is an expensive and inflexible method and daily rates of energy expenditure can only be estimated by averaging the total amount by the number of days between urine tests.

There are alternative ways of measuring PA and, depending on the purpose of the research, they tend to focus on either the metabolic or mechanical effects of PA on the body and then estimating the energy expended. For example, measurements of children’s PA have included self-reports of leisure-time activities (e.g., using surveys, interviews, or diaries), time spent in activities of differing levels of intensity, direct observations, body worn motion sensors and counters (e.g., pedometers and accelerometers) and heart rate monitoring (Welk et al., 2000). The strengths and limitations of each method depend on whether PA is monitored under laboratory or “free living” conditions, and have been debated in depth by others (Bull et al., 2004; Ellery, Weiler & Hazell, 2014; Loprinzi & Cardinal, 2011; McCormack & Giles-Corti, 2002; Rowlands, Eston & Ingledew, 1997; Ward et al., 2007; Welk et al., 2000). The consensus from this debate however, is that there is no one universal measurement tool that captures children’s PA or sedentary behaviour perfectly.

A popular method of measuring physical activity levels in large epidemiological studies has (in the past) relied on surveys of how children and adults spend their leisure time, requiring children to recall their involvement in a number of activities over the past seven days or up to two weeks. However, there is doubt over findings from research based on such ‘self-report’ methods, because there is a tendency for bias where participants overestimate PA levels, and relatively little is known about the specific cognitive skills required to complete self-reports and if it is reasonable to expect children to accurately recall their past activities (Sallis, 1991; Sallis & Saelens, 2000; Welk et al., 2000). Furthermore, monitoring leisure time is inadequate as a proxy for
overall physical activity as it could only ever represent one (likely small) portion of the day, and physical activity is behaviour fundamental to a range of tasks required for daily living.

Small and lightweight, body worn motion sensors such as accelerometers and pedometers are now the preferred method in epidemiological and intervention research, as they are typically able to provide objective estimates of daily physical activity across all the contexts an individual may encounter during the day. The accelerometer measures the frequency and magnitude of the body’s acceleration during movement, generating an ‘activity count’ over a programmed time interval or epoch (e.g., per 1 second, 5 seconds, 15 seconds, 30 seconds or 1 minute) (Loprinzi & Cardinal, 2011). This data can be used to estimate the proportion of time an individual spent not moving (often used to estimate sedentary time) as well as time in light, moderate or vigorous intensity activities. However, each unit can be expensive (relative to other monitoring methods), and estimates of PA intensity can vary significantly between different research studies as there is no one universal cut-off point for epoch length, making comparisons difficult (Ellery, et al., 2014; Loprinzi & Cardinal, 2011; Welk, et al., 2000).

The pedometer, similar to the accelerometer, is a small electronic device that counts each step a person takes as a result of bodily movement of the lower limbs. It is particularly well suited to measuring steps during PA behaviours such as walking and running (Gao et al., 2010; Jago, et al., 2006; Schneider et al., 2004), as well as skipping, jumping, and leaping; that is, activities that encompass most types of childhood physical activity encountered as part of daily living (Tudor-Locke et al., 2009; Ward, et al., 2007). The inability of pedometers to assess the intensity, frequency or duration of physical activity like the accelerometer, however, is a limitation of this measurement approach. Additionally, while both devices are limited equally in that they cannot
accurately capture a record of all activities (such as riding a bike, swimming, rough and tumble play or contact sports) they are perhaps the best objective measures available for the purpose.

Despite measuring only steps rather than intensity, frequency, or duration, a key advantage of pedometers is that they are more suitable than other forms of PA monitoring, such as accelerometers, when their purpose is to function as a motivational tool not just as a measurement device. The pedometer is of relatively low cost compared to accelerometers (Ellery, et al., 2014), and it provides an objective measure of physical activity behaviour that can be easily and immediately interpreted by the wearer. Newer models of pedometers have the capacity to store daily step count data for up to 7 days, resetting automatically at midnight each night to begin recording the new day’s data, making possible the objective measurement of children’s PA over the longer term (for example, Yamax Digi-walker CW-701 (Yamax Corp., Kumamoto, Japan)). Pedometer output can be accessed easily by looking at the digital display screen showing the cumulative step count, whereas typically accelerometer output (particularly the specific breakdown of time spent in MVPA) cannot be viewed until it has been downloaded, using special computer software.

Thus, pedometers are particularly useful in applied research such as clinical and community-wide interventions seeking to increase activity, as they can potentially function as a motivational tool to increase activity through walking (Bravata et al., 2007; Kang, Marshall, Barriera, & Lee, 2009; Lubans, Morgan & Tudor-Locke, 2009; Tudor-Locke et al., 2009). For example, the use of a pedometer has been integral in interventions where the participant is encouraged to self-monitor their PA levels, set step goals, and immediate feedback from the pedometer can inform the wearer of their progression towards their step goal and provides an individually tailored, wearable cue to be more active. Furthermore, unlike accelerometers, there are international norms for
pedometer step counts for normal weight and overweight adults and children, and pedometer step count equivalents of the global recommendations for PA have also been computed (Tudor-Locke et al., 2009; Tudor-Locke et al., 2011). Thus, comparisons of pedometer-based intervention effectiveness can be made across international populations, and individuals monitoring their daily step counts using a pedometer can determine easily and objectively whether they are meeting a level of physical activity recommended for health benefits.

### 1.1.3 Physical activity and health

Activities performed at different intensities results in different volumes of energy expenditure, and can have different effects on the body and its physiological processes. Much of the understanding of the health benefits of PA has come from exercise studies typically monitoring PA performed at higher intensities (i.e., MVPA). For example, time in MVPA was significantly and beneficially associated with all cardiometabolic risk outcomes (independent of gender, age, and sedentary time) in a large sample of over 20,000 children and youth aged 4 to 18-years (Ekelund et al., 2012). However, the risk and/or benefits to health as a result of an individual’s pattern of PA and sedentary behaviours can also interact with genetic factors and current health status. For example, in children with a family history of obesity, Saunders et al. (2013) found strong evidence that breaks in sedentary time and shorter bouts of sedentary behaviour were independently and beneficially associated with markers of cardiometabolic risk. There is also growing evidence that maintaining a high volume of daily light-intensity PA may be important (independent of the amount of daily moderate-vigorous physical activity) for a number of metabolic risk factors for coronary artery disease (Ekblom-Bak, Ekblom, Vikström, de Faire & Hellénius, 2014; Hamilton et al., 2007; McMurray & Ondrak, 2013). Thus, while some risk factors are mainly affected by high intensity or
even resistance training, other risk factors may be affected more by lower intensity PA or the total amount of PA and total energy expenditure (McMurray & Ondrak, 2013).

Excessive participation in sedentary behaviours over a prolonged period can also have a negative effect on health and can increase risk of NCD, independent of the amount of NEAT or MVPA an individual might accumulate (Henson et al., 2013; Mitchell & Byun, 2013). Recent research has suggested that simply by encouraging both normal weight and overweight children to increase their levels of daily physical activity (inclusive of all types, not just MVPA) and reduce their sitting time may help them to avoid excess weight gain and reduce their risk of developing the early signs of CVD and other NCDs associated with obesity (Maffeis & Castellani, 2007; Hamilton et al., 2007).

1.1.4 Physical activity recommendations

Current recommendations for PA have been based on research attempting to determine the volume and type of PA sufficient to receive a health benefit (e.g., to reduce weight or improve other health indices of risk for NCD). However, the question of what is a sufficient amount is central to ongoing research and debate, particularly as it is intricately linked with issues over the accurate monitoring of PA, and not all types or amounts of PA have been investigated equally.

Health authorities in Canada, the US, the UK and the World Health Organization (WHO), promote to children the daily accumulation at least 60 minutes of MVPA should lead to improvements in cardio-respiratory (heart and lungs) and muscular fitness, bone health, and cardiovascular and metabolic biomarkers (Tremblay et al., 2011a; Tremblay et al., 2011b; WHO, 2010). It is currently recommended that Australian children aged 5-12 years should accumulate a minimum of 60 minutes of moderate-to-vigorous physical activity (MVPA) every day, and no more than 2 hours of
‘screen’ time (e.g., time spent watching television or using other electronic media) (Department of Health and Ageing, 2004; Department of Health, 2014).

Boys who accumulate at least 15,000 steps and girls at least 12,000 steps each day on a regular basis (e.g., on at least 5 days in the past seven) are considered to be sufficiently active in accordance with the guidelines that children should accumulate at least 60 minutes of MVPA per day for health benefits (Tudor-Locke et al., 2004; Tudor-Locke et al., 2011). Physical inactivity is typically defined as failure to attain these recommended levels of physical activity.

1.2 The Problem of Children’s Physical Inactivity

Several data sources have confirmed that Australian children’s physical inactivity levels are considerable. Results from the 2007 Australian National Children's Nutrition and Physical Activity Survey showed approximately 46% of boys and 33% of girls aged 9–13 years self-reported having met the recommended daily 60 minutes of MVPA (Commonwealth Scientific and Industrial Research Organisation (CSIRO), Preventative Health National Research Flagship & University of South Australia, 2008). In the same survey, younger children’s activity was monitored with pedometers and found only 32% of boys and 50% of girls aged 5–8 years old met the recommended number of steps, while only 24% of boys and 33% of girls aged 9-13 years met the recommended number of steps (CSIRO et al., 2008).

Specific to Western Australia (WA), data from the 2008 Child and Adolescent Physical Activity and Nutrition (CAPAN) Survey found less than half (41.2%) of primary school boys (i.e., aged 5-12 years) and only 27.4% of primary school girls reported participating in a daily 60 minutes or more of moderate to vigorous physical activity on all of the previous seven days (Martin et al., 2010). Whereas, slightly more than one-third of primary school children surveyed in the CAPANS recorded the
recommended pedometer step counts in both the 2008 survey (37.7%) and the 2003 survey (36.6%). Thus, based on the self-report data (which is typically biased towards an overestimate of PA (Sallis, 1991; Sallis & Saelens, 2000) approximately 58.8% of boys and 72.6% of girls aged 5-12 years in Western Australia could be described as “physically inactive”. This is comparable to the figures in the national sample where 54% Australian boys 67% of Australian girls aged 9–13 years could be described as physically inactive (CSIRO et al., 2008).

However, even children who engage in at least 60 minutes per day of moderate-vigorous physical activity can still be considered sedentary if they spend a great deal of their time sitting or lying down. The 2007 Australian National Children's Nutrition and Physical Activity Survey found very low levels of observance of the daily two hour time limit on ‘screen time’ (typically used as a proxy for sedentary time), with only 5% of boys and 10% of girls aged 9-13 years adhering to the recommendation. The CAPAN survey also found the majority of WA primary school boys (70.9%) and girls (75.2%) reported participating in more than two hours of electronic media activity on all of the previous seven days (Martin et al., 2010). With such a large majority of both boys and girls exceeding the guidelines on the appropriate amount of daily electronic media time, there is certainly cause for concern about both the physical activity and the sedentary behaviour habits of both Western Australian children and all children in broader Australia.

Indeed, the significance of Australian children’s physical inactivity and sedentary behaviour problems could be appreciated from an international perspective at the 2014 Global Summit on Children’s Physical Activity Levels. Fifteen developed and developing countries participated in constructing a ‘Report Card’ to self-assess the physical activity of children in their nation. Assessment was based on a number of domains including, for example, overall PA levels, organised sport participation,
physical education in schools, active play, active transportation, sedentary behaviours, family and peers, community and the built environment, government strategies and investments (Tremblay et al., 2014).

Australian children were given a “D minus” for both overall physical activity levels and sedentary behaviours (Schranz et al., 2014). These grades were based on the recent results from the 2011-2012 Australian Health Survey which revealed only 19% of Australian children aged 5 to 17 years self-reported meeting the “60 minutes of MVPA daily” recommendation across all seven days prior to the survey, although almost half (48%) met the recommendation on at least five out of seven days (Australian Bureau of Statistics (ABS), 2013). The average amount of time spent in sedentary screen–based activities for 5–17 year olds was over two and a quarter hours (136 minutes) per day, with just 6 minutes of this being for homework. Only 29% of children aged 5-17 years met the two hour time limit on daily screen–based entertainment on all previous seven days, although 59% met the recommendation on at least five out of seven days (ABS, 2013).

The Report Card on the physical activity of Australian children awarded grades of $B^-$ for organised sport participation, $B^-$ for school infrastructure, policy and programming, an $A^-$ for community and built environment infrastructure, policy and programming and a $C^+$ for Government strategies and investments (Schranz et al., 2014). Yet, after monitoring for almost a decade, epidemiological surveys confirm that the physical activity levels and sedentary behaviours of Australian children remain a concern, with many still failing to meet recommended guidelines on PA and sedentary behaviours. Thus, the investments in programmes, infrastructure and government strategies have not translated into the desired changes in individual children’s PA behaviours. Clearly our efforts to encourage children to be more active are not working. One possibility is that there is a problem with the recommendations themselves.
Rowland (1998) and King et al. (2007) described a tendency where a person who is aware they have achieved their recommended minutes of moderate-vigorous PA (usually in a single bout of exercise) may then compensate with increased sedentary behaviours and a decrease in NEAT throughout the day. This can result in an overall reduction in energy expenditure due to a decrease in the amount of lifestyle or non-exercise physical activity (NEAT) as well as potential increases in the amount of energy consumed (King et al., 2007; Rowland, 1998; Tremblay et al., 2010). While PA was only monitored for seven days, observational evidence of PA compensation was found in Ridgers, Timperio, Cerin, and Salmon’s (2014) study with primary school-aged children. The PA compensation phenomenon – also known as the ‘activitystat’ hypothesis - is concerning and several researchers (e.g., Wilkin, 2011; Wilkin, Mallam, Metcalf, Jeffery & Voss, 2006) say it may partly explain why, despite wide promotion of the recommendations and education on the health benefits of PA, so little has changed in epidemiological surveys of children’s PA levels. Bouchard et al. (1999) and King et al. (2007) also argue that given the range of individual metabolic and behavioural responses that can occur following an increase in PA, generic and one-size-fits-all exercise prescriptions might not be appropriate.

It is generally accepted that physical activity is good for children and that it should be encouraged. Yet, understanding the effects of children’s PA on health outcomes is confused by the lack of consensus on tackling the fundamental issues of defining and monitoring PA. Many surveys and interventions focus on only a narrow set of behaviours (e.g., generally increasing MVPA or a specific/standardised exercise training) and in only a select range of contexts (e.g., PE class or afterschool programmes). Even then, there is variation in the literature with regards to the definition of PA, how PA is monitored, which type or intensity is related to health outcomes, and
in what context (e.g., in the laboratory or under free living conditions) that definitive conclusions are hard to come by.

Thus, it is clear that the current recommendations for PA for health benefits fail to take into account the role of increasing other types of physical activities, such as light intensity, lifestyle and non-exercise activities, to gain further health benefits. This may be due to a lack of information on the beneficial effects of light intensity PA, and NEAT on health in general, although evidence to this effect is emerging in adult populations (Dunn, 2009; Ekblom-Bak et al., 2014; Ekblom-Bak, Hellenius & Ekblom, 2010). It is argued here that in the context of health and NCD prevention, the problem of children’s physical inactivity needs to be inclusive of all the behavioural problems of 1) insufficient MVPA, vigorous PA and/or specific/organised exercises, 2) insufficient levels of lifestyle PA/ NEAT or NEPA, 3) excessive participation in sedentary activities, and 4) prolonged bouts of sedentary behaviour; none of which are restricted to any single specific location and can occur in all contexts of a child’s daily life.

Promoting increases in daily self-selected, lifestyle PA behaviours, that is not necessarily organised, over trying to increase adherence to more prescriptive, standardised and vigorous intensity exercise programs is a growing trend (Dunn, 2009; Lubans, et al., 2009). This move has proved to be beneficial for adults intending to improve health outcomes as well as with those already diagnosed with chronic illnesses (Dunn, 2009; Dunn, Andersen & Jakicic, 1998). While an intervention to increase children’s lifestyle PA would be in harmony with children’s natural tendency to participate in brief bursts of spontaneous PA throughout the day (Bailey et al., 1995), there is limited research on the effectiveness of this approach to increasing children’s physical activity levels so that they can align with the current daily recommendations on sufficient PA for health benefits. However, given that light intensity, non-exercise physical activities and sedentary behaviours may take up the majority of a child’s
waking hours (see Figure 1.1) there is potential for even greater improvements in health and prevention of NCD can be gained from targeting these behaviours in addition to the current MVPA recommendations. It may also help mitigate the potential for any metabolic or behavioural compensation effects on total energy expenditure (King et al., 2007; Ridgers et al., 2014; Rowland, 1998) as a result of focussing merely on adherence to MVPA guidelines.

**Figure 1.1** How children typically allocate their time spent sedentary and in light and moderate-to-vigorous intensity physical activity, based on population data from the 2003-2006 NHANES survey (Owen et al., 2014., p. 175).

### 1.3 Changing Physical Activity Behaviours

Despite the limitations of the current PA recommendations, reaching consensus on a target for children’s physical activity levels is an important first step to changing physical activity behaviour. However, it is still unclear how this target can be achieved so that more children are capable of achieving a ‘sufficient’ level of regular physical activity. Changing behaviour can be a complex process for an individual, particularly if
that behaviour is performed habitually, such as everyday physical activity (Ewart, 2004), and the effort required to change physical activity behaviour to lead to tangible population health outcomes is likely to extend beyond education and the provision of information (National Preventative Health Taskforce and the Obesity Working Group, 2009).

Currently, the field of physical activity intervention research is a multidisciplinary mix of trends, hypotheses, findings and debate between researchers representing a range of different disciplines including biomedicine; exercise and sports science; neuroscience; clinical, developmental, health, educational and behavioural psychology; physiology; paediatric and preventative medicine; education; and health promotion. Even within psychology itself, for example, those concerned with behaviour change approaches vary considerably. Reports of evaluations that showed successful approaches to increasing children’s PA, for example, define ‘success’ quite differently depending on the theoretical approach taken and the monitoring methods used. Collectively, we are struggling to address the need for population strategies to support individuals in making the necessary lifestyle changes to increase overall physical activity levels and circumvent the dire consequences of the NCD pandemic.

The WHO 2008-2013 Action Plan for the global strategy for the prevention and control of NCDs highlighted governmental responsibility for investing in NCD prevention by reducing individuals’ exposure to physical inactivity and reducing population levels of physical inactivity (WHO, 2009b). However, the most notable efforts by the Australian health authorities to invest in PA related NCD prevention seem to have focused predominantly on increasing population levels of exposure to health promotion messages to “be active” and “get moving” communicated via the mass media, with the intention that children and adults’ physical activity levels will increase. Unfortunately, this has been at the expense of neglecting the development of effective
intervention approaches that focus on actual (i.e., monitored) changes in individuals PA behaviours, which also has the potential to be applicable at a population level.

1.3.1 Health promotion campaigns via the mass media.

In 2000, the State Premier of Western Australia announced the establishment of a Physical Activity Task Force (PATF) to develop a strategy to improve physical activity (PA) levels in the Western Australian Community. The original vision of the PTAF was that "... the individual and community benefits of physical activity will be recognised, valued and supported by community and government; and environmental and policy supports will allow a 5% increase in physical activity levels by 2011" (Physical Activity Taskforce Communications Working Group, 2002, p.5). Specifically, this meant the Task Force was aiming to support an increase in the proportion of Western Australians who could be considered ‘sufficiently active’ from 58% to 63% over 10 years. At the time of its inauguration, it was estimated the PTAF would require approximately $10 million over 10 years to achieve its vision (Physical Activity Taskforce Communications Working Group, 2002).

Similarly, in June 2004 efforts by the Commonwealth Government of Australia involved the commitment of $116 million over four years to tackle the “growing problem of the declining engagement in physical activity by Australian children” (National Health and Medical Research Council (NHMRC), 2003, p. 42). This involved initiatives to establish after-school physical activity programs, incorporate more physical activity into an already crowded school curriculum and develop marketing messages for television (and other media) as part of a national Get Moving campaign which was broadcast in 2006. In Western Australia, other various health promotional campaigns, such as Find Thirty and Unplug and Play were initiated by the WA Heart Foundation and state government health agencies. Yet the effectiveness of broad based
messages in public campaigns to increase habitual participation in sufficient physical activity is questionable.

It is often claimed that “when run in conjunction with the delivery of policies and programs, [campaigns] play an important role in assisting behaviour change and increasing population levels of physical activity” (Davies, van Bueren, & Price, 2011, p.17). Unfortunately, despite substantial financial support these mainstream government efforts lack systematic and objective experimental evaluation of their effectiveness in changing individual physical activity behaviours. Government mass media campaigns typically claim to increase the ‘awareness’ and ‘motivation’ of the community to increase physical activity but lack any objective measurement of the behaviour they are trying to modify. All this is without any attempt to monitor for tangible health benefits the behaviour is purported to cause. It is astonishing that such campaigns are the preferred approach of governments when they are yet to justify their expenditure.

At the time of writing this review, no objective evaluation of a campaign that sought to measure changes in physical activity behaviour as a direct result of the campaign could be located. A report prepared for the Department of Health and Ageing provided a limited evaluation of the national Get Moving campaign from 2006 (Woolcott Research, 2007). The report described the campaign’s primary target audience as children aged 5-12 years; however, the sample in the evaluation was limited to a survey of 9-12-year-old children at baseline (n=300), Pre-Campaign (n=96) and follow-up (n=116). The report described the campaign’s communication objectives as including “awareness”, “attitudes” and “intentions”. Under the heading “intentions”, for example, it was stated that the objective was “to generate intentions to include at least 60 minutes of moderate to vigorous physical activity every day as an integral component of children’s lifestyles” (p. 8).
The evaluation study of the *Get Moving* campaign reported that 93% of the child respondents stated they were aware of the advertising campaign, with the majority recalling the main messages of the campaign (Woolcott Research, 2007). However, there was no significant change in the proportion of children correctly stating the recommendations of “at least one hour of physical activity a day” between the pre-campaign (49%) and follow-up (49%). There were also no significant differences between baseline and follow-up surveys in the proportion of children who perceived PA to be important, or the extent to which children agreed with the statements “My family thinks I should be physically active”, “My parents show or tell me that they like it when I am physically active”, and “If I asked my parents to do physical activity with me, they probably would”. On a three point scale of Agree, Disagree and I don’t know, 93% of children who reported seeing the campaign agreed that they had taken action as a result of the *Get Moving* campaign. While the authors highlighted this as evidence of the campaign having “influenced positive attitudes and beliefs regarding physical activity” (p. 55), no information regarding the type of action that respondents may have taken was requested or reported on. It seems that the nation’s goal of increasing children’s physical activity *behaviour* was somehow overlooked.

The objectives of the *Get Moving* campaign suggest that if the intention to be physically active could be measured and demonstrated to have increased as a result of the campaign, then success would have been achieved. Unfortunately, these intentions were also not measured in the children’s sample of the survey and, even if they were, there is limited evidence to support the notion that only increasing intentions, attitudes or awareness will increase desired changes in measurable behaviour. The authors concluded, “in an overall sense, the campaign has therefore worked well in terms of heightening community awareness” (p. 77). Yet the results showed the majority of children surveyed already considered physical activity to be important and had
knowledge of the PA recommendations before the campaign started. While it was not
the primary aim of the evaluation to assess PA behaviours, they also reported there was
no significant change in self-reported participation in organised sports across the
baseline, pre-campaign or follow-up surveys.

It requires a leap of logic and guesswork to assume that a message communicated
(e.g., via a television advertisement) can cause individuals to change their PA
behaviours, as it is likely that those behaviours have been learnt and maintained by the
contingencies in their environment and have become habitual over many years. These
electronic messages are further compromised as they compete for our attention among
other advertisements that simultaneously compel us to do the exact opposite – namely,
to buy more, eat more, and sit down and watch more television. Redman, Spencer and
Sanson-Fisher (1990) conducted a review of studies evaluating mass media
programmes aiming to modify cardiovascular risk behaviour and safety restraint use
among adults. They found little evidence to support the effects of mass media
programmes designed to alter these health risk behaviours. They found behaviour
change and health outcomes were more successful when combined with a community
component, such as when a media message had been used to set an agenda and support
a specific community intervention. However, Redman et al. (1990) highlighted that
there was no evidence that the media component made a major contribution to the
effectiveness of such combined programmes, and indirect evidence suggested that the
media role was less important than has been previously assumed.

1.3.2 Individual behavioural self-management
interventions.

On the spectrum of approaches to change behaviour, perhaps the polar opposite of
the one-size-fits-all mass media campaign is the individual behavioural self-
management intervention, which can be specifically tailored or adapted to an
individual’s unique circumstances. Efforts to deal with the problem of children’s physical inactivity so far have focused predominantly on changing higher level systems and policies. While traditional environmental and policy interventions can be highly effective in changing human behaviour such as, regulation through legislation in the case of smoking cessation (World Bank, 1999). Yet, physical inactivity is a very complex behaviour and policy efforts to address it so far (such as, persuasion) have been superficial (Kahn et al., 2002; Sallis, Bauman & Pratt, 1998).

In contrast, this thesis argues that it is because we have neglected to equip individual children en masse with the skills necessary to make changes to their lifestyle PA and sedentary behaviour patterns, little progress has been made in increasing population levels of PA, and an evidence-based approach to changing individual behaviour can be utilised to achieve policy goals. A greater emphasis on investigating effective individual approaches is now required, so that children can learn to self-manage their changes in PA and sedentary behaviour patterns, in spite of the sedentary biased environments they may continue to encounter on a daily basis. Individually-adapted behaviour change interventions can address the need for NCD prevention efforts to reduce individuals’ exposure to physical inactivity and reduce population levels of physical inactivity (WHO, 2009b). Using this approach, interventions can be tailored that not only increase individual physical activity behaviour to ‘sufficient’ levels, but can also be adapted and scaled up to reach broad sections of the population.

Fundamentally, individually-adapted health behaviour change programmes are interactive and based on the individual learning how to self-manage their own behaviour by taking into account their own specific circumstances, interests and preferences (Kahn et al., 2002). Participants are trained to apply behavioural self-management skills, (e.g., self-monitoring, goal-setting and interpreting feedback in regards to progress toward those goals; reinforcement of healthy behaviours through
self-reward; structured problem solving; building social support for new behaviours; and prevention of relapse into sedentary behaviour) to incorporate physical activity into their daily routines (Kahn et al., 2002).

Derived from the principles of operant conditioning, initially developed by Skinner (1954), behavioural self-management strategies have long formed the basic procedural components of many Applied Behaviour Analytic approaches to behaviour change. These skills, when applied by the individual, have been demonstrated to be effective in increasing and/or reducing behaviours, teaching new behaviours, promoting the transfer of behaviour and maintaining behaviours in a range of contexts and populations (Sulzer-Azaroff & Mayer, 1991). PA interventions have used a combination of behavioural self-management techniques, but may do so based on an understanding of PA behaviour through any one of the many behavioural theories circulating today, some of which include for example, social cognitive theory (SCT), theory of planned behaviour (TPB), behaviour choice theory, family systems theory or self-determination theory. Thus, what is considered the outcome of importance differ among evaluations based on different theoretical orientations. However, the theoretical orientation of this thesis rest firmly within the behaviour analytic approach to understanding PA behaviours and operant learning theory.

A behaviour analytic view of the physical inactivity problem would hypothesise that inactive/sedentary behaviour is maintained via some combination of reinforcement for inactive/sedentary behaviour and punishment and/or a lack of reinforcement for healthy physically active alternatives. Based on this, an individually-adapted behavioural self-management intervention should be designed to increase exposure to positive consequences of healthy physically active behaviours, thereby increasing the likely reoccurrence of such behaviour and potentially reducing the likelihood of future unhealthy inactive/sedentary behaviour. In this respect, intervention should be regarded
as a planned learning experience, in which participants experience positive consequences from increased participation in PA, thus learning that increased PA can be good for them. Of course, learning this is dependent on the extent to which an increase in PA can be achieved.

Self-management skills can be applied to almost any behaviour that requires change. In children, behavioural self-management techniques have been successfully applied in individually adapted behavioural interventions to treat obesity, obsessive-compulsive disorder (OCD), attention-deficit/hyperactivity disorder (ADHD), phobias, conduct disorders, enuresis (bed-wetting), generalized anxiety disorder, separation anxiety disorder; and the techniques are also taught widely in parenting training programs (Epstein, et al., 2001; O’Donohue & Ferguson, 2006). They have also been used successfully in the treatment of behavioural problems associated with developmental disorders in children, perhaps most notably in the area of autism (Koegel, et al., 1992; Stahmer & Schreibman, 1992; Sulzer-Azaroff & Mayer, 1991). However, in the context of NCD prevention, behavioural self-management techniques have not been widely taught to whole populations of children as part of individually-adapted behavioural interventions solely to increase physical activity behaviours.

They have been used in adult interventions to increase lifestyle PA levels, as described by Dunn (2009). Additionally, individual behavioural self-management interventions have been applied to help adults learn to self-manage treatment of chronic disease, including diabetes (Snoek, Skinner & Steed, 2009; Tudor-Locke, 2009) and coronary artery disease (Schoenberg, Moser, Mulligan & Osman, 2009). Thus, it is plausible that the same behavioural techniques used to treat NCD in adults could also be effective in the prevention of these diseases, where children would be taught behavioural skills to self-manage and modify the same lifestyle behaviours as part of an individual behavioural self-management intervention.
In the treatment of paediatric obesity, Epstein and colleagues have relied on behaviour change strategies, such as self-monitoring and feedback, positive reinforcement (in the form of praise and other contingent reinforcers), and stimulus control as well as modelling and teaching social skills (Epstein, 1996). Epstein, Roemmich and Raynor (2001) concluded that while most of their behavioural treatments for paediatric obesity have focused on diet, physical activity and behaviour change, it was the behaviour change components that made the treatments unique as “many people know what they should be doing, but knowledge often is insufficient to change behaviour” (p. 983). Epstein regards the use of behaviour change methods as critical to long-term success in treatment of paediatric obesity, where behavioural interventions are applied independently or in concert with diet and exercise components to determine outcomes with regards to the adoption of new behaviours and whether or not these are maintained. For example, Epstein (1998) argued that,

…it is important to keep in mind the importance of choice and the perception of control in developing options for being active. There is a delicate balance between aggressively promoting, encouraging and reinforcing physical activity and the need to boost self-regulation and control. At a policy level, it is often assumed that restriction of things that are bad for you is the best approach, and the more restriction, the better the approach will work. However, restriction is a powerful method for increasing the reinforcing value of the behaviour that is being restricted. Reduction can also take place by reinforcing people for reducing their behaviour, rather than restricting access to the behaviour (p. 262).

In an attempt to identify which were the most effective behavioural self-management strategies at bringing about behaviour change, Michie, Whittington,
Abraham, McAteer, and Gupta (2009) conducted a meta-analysis of 122 evaluations of healthy eating and physical activity interventions with adults. They hypothesised that interventions including the self-management techniques of setting goals, monitoring behaviour, receiving feedback, and reviewing relevant goals in light of feedback would be more effective than other techniques. They found that “self-monitoring” explained the greatest amount of between-study variance, and interventions combining self-monitoring with one or more of the other behavioural self-management techniques were significantly more effective than interventions not including these techniques. In Greaves et al.’s (2011) recent analysis of reviews of dietary and physical activity interventions with ‘at risk’ adults, increased effectiveness was also associated with the use of a similar specific cluster of self-managed behaviour change techniques, that is, self-monitoring, goal setting, problem solving, and reinforcement.

van Sluijs, Krielmer and McMinn (2011) conducted a review of the effects of family interventions on young people’s PA levels up to October 2010. While many of the interventions also targeted other nutrition and diet related behaviours, they highlighted family-based interventions promoting children’s PA delivered in the home were effective as long as they included the self-monitoring of PA. When investigating why empirical evaluations of therapies designed to improve behavioural self-management skills have not yet demonstrated success in ensuring long-lasting behaviour change, Kirschenbaum (1987) was perhaps the first to conclude that disengagement from self-monitoring was a major factor contributing to “self-regulatory failure” in the long term (p. 77).

Pedometers have come to be useful as cost effective, self-monitoring tools for promoting lifestyle PA in a variety of populations (Bravata et al., 2007; Kang et al., 2009; Lubans et al., 2009; Normand, 2008; Van Wormer, 2004) and can thus form the basis of an effective behavioural self-management intervention that could be adapted to
reach broad populations of children. Lubans et al. (2009) reviewed much of the available evidence of pedometer-based interventions in youth. They found that the majority of the studies had successfully increased PA levels of children and adolescents. However, the pedometer-based / behavioural self-management interventions to date have not overcome the combined problems of children’s physical inactivity – that PA needs to be increased in all contexts of daily life (i.e., *generalised increases*) and can ideally affect all types of PA (i.e., increasing NEAT, exercise, MVPA, interrupting prolonged bouts of sedentary time, etc). *And*, that benefit to health and wellbeing can also be demonstrated as a result of the intervention.

Despite the limitations of the pedometer as a measure of PA, overall support for pedometer-based PA interventions (and perhaps evidence of their superiority compared to other approaches) can be found in a very recent meta-review by Heath et al. (2012). The mean effect size estimates were compared between reviews of the effectiveness of specific types of PA interventions grouped according to common intervention themes or components, such as the context of the intervention (e.g., in workplaces or schools), the population studied (e.g., healthy or obese populations) and the type of intervention evaluated (e.g., behavioural approaches or self-efficacy). Heath et al. (2012) found that pedometer-based PA interventions yielded a markedly higher mean effect-size compared to those obtained in other reviews of PA interventions, where the next best were found to be after-school interventions with children, interventions with obese populations and website delivered interventions.

When considering the mechanisms behind the effectiveness of pedometer-based lifestyle PA interventions, they are perhaps best summarised by Tudor-Locke (2009):

*Pedometers are designed to be most sensitive to detecting ambulatory, or walking, behaviors. Walking is commonly encouraged and most commonly reported, especially in the form of walking for exercise. However, because*
Pedometers are worn throughout the day in pedometer-based programs such as the FSP, they detect walking undertaken for all purposes, including for transportation, occupation, chores, and leisure pursuits beyond just exercise. Pedometers also offer these data in a simple and straightforward output that is user friendly and a direct indicator of movement as a result of behavior choices. Because pedometers are also affordable and relatively small and unobtrusive to wear, they represent an accessible technology that is immediately personalized (each individual is equipped with his or her own instrument). Finally, the cumulative and readily available visual feedback provides a constant and changing reflection of personal behavior choices as they occur in real time, making them the perfect accessory for promoting and tracking lifestyle physical activity (p. 52S).

1.4 What Needs to Happen Next?

At the 2014 Global Summit on Children’s Physical Activity Levels a paradox in children’s PA and sedentary behaviour patterns was identified. Patterns of higher PA and lower sedentary behaviour occurred in countries reporting poorer infrastructure, whereas lower PA and higher sedentary behaviours occurred in countries reporting better infrastructure (Tremblay et al., 2014). For example, Australia has some of the best facilities, programs and policies at the school and community level, exceptionally ideal weather conditions, and the highest rates of organised sports participation. Yet Australian children’s overall PA levels are among the lowest in the world, and sedentary behaviours among the highest. Thus, given the complexity and fast pace of our modern day, urbanised lifestyles and a reliance on technology -which only seems to be increasing - it is still relevant to be asking “how do we encourage children to be more physically active?”
Controversially, however, in a recent review of the effectiveness of PA interventions with children with objectively measured outcomes, Metcalf, Henley and Wilkin (2012) concluded that there was little to be gained by efforts to increase PA levels with children. Their meta-analysis of 30 studies (involving 14,326 participants) of controlled trials using accelerometers to measure whole day PA levels resulted in a small to negligible pooled intervention effect across all studies. They reported that the pooled intervention effect did not differ significantly between any of the subgroups they compared, such as age differences (<10 years and ≥10 years), differences in body mass index, study duration (≤6 months and for >6 months), or home/family based or school based interventions. The authors of this meta-analysis concluded that interventions to increase children’s PA only had a small effect of approximately 4 minutes more of walking or running per day on children’s overall activity levels.

There are certainly doubts about whether interventions - including those that are objectively evaluated - can have a significant effect on children’s PA levels. However, there are several limitations of Metcalf et al.’s (2012) review. Firstly, 4 minutes more of walking or running per day may add up to be a substantial increase if it is maintained in the long term. Secondly, only studies that used the accelerometer to monitor PA levels were included. The authors considered accelerometers the criterion method for measuring free living activity as they correspond well to activity related energy expenditure. However, accelerometers are limited in their ability to be used as part of the intervention, like the pedometer can. With some models of accelerometers, wearers cannot view feedback related to their accelerometer output, and if they can it is not until after the activity has happened, and typically not until the next day at the earliest. Even then, the feedback it provides may be too abstract for many children to understand in relation to their PA behaviour (e.g., providing a running total of PA ‘counts per minute’). The pedometer, however, provides immediate access to feedback, and where
every count relates directly to the number of times the individual moved their legs (e.g.,
in the act of walking). This leads to the third problem. Metcalf et al. (2012) did not
identify what components /strategies were used by the interventions in their meta-
analysis to increase PA. Perhaps it was that the interventions used ineffective strategies
to increase PA. Certainly, not all intervention approaches are as effective as each other,
as demonstrated in the discussion of health promotion campaigns via mass media.
Consequently, it would appear that Metcalf et al.’s conclusion that there is little to be
gained by efforts to increase PA levels with children is too broad a generalisation.

While important, it is clear that setting recommendations for physical activity and
communicating these via mass media campaigns is inadequate to ensure all children
will achieve sufficient levels of PA. Additionally, investing in systems and
infrastructure that support more a physically active lifestyle are also only one part of the
solution. While there is promise of an effective way to change children’s PA and
sedentary behaviour patterns through individually-adapted behavioural self-
management interventions, there is still uncertainty about which behaviours should be
targeted (e.g., MVPA, NEAT, specific intense exercises, reductions in television
watching and other sedentary behaviours) and to what level they must be increased /
decreased to gain health benefits in childhood, and that may reduce risk for NCD in
adulthood. Though it is becoming apparent that we need more than just exercise and
adherence to MVPA guidelines to keep us healthy (Hamilton et al., 2007; Maffeis &
Castellani, 2007), and walking has become a recommended form of physical activity,
particularly for obese children, due to its ease of measurement and perceived ease of
adoption (Schultz et al., 2011). Increasing walking behaviours also conforms to the
message that a lifestyle approach should be taken when seeking to modify PA levels for
NCD prevention, and increases can be achieved in all types of PA (including NEAT,
and at light, moderate and vigorous intensities) across the whole day. The pedometer is
well suited as a tool for self-monitoring behaviours involving walking - an essential component of behavioural self-management.

Strong evidence supports the use of individual behavioural self-management programs and pedometer-based interventions to increase habitual PA levels with adults (Heath et al., 2012; Kahn et al., 2002); however less is known about the effectiveness of this approach with children (Lubans et al., 2009). As primary school-aged children have been targeted as the ideal population to work with in the NCD prevention effort, evaluating the effectiveness of individually adapted behavioural programs to increase children’s walking / lifestyle PA levels is now a research priority.

A pedometer-based behavioural self-management approach to increasing children’s lifestyle PA could achieve all of this. An intervention is needed that can potentially affect all the behavioural problems related to children’s physical inactivity, including, 1) insufficient MVPA, VPA or specific exercises, 2) insufficient levels of lifestyle PA (or NEAT or NEPA), 3) excessive participation in sedentary activities, and 4) prolonged bouts of sedentary behaviour. There is also a need for such an intervention to demonstrate the generalisation of increases in PA from one context (e.g., at school) to another (e.g., the home) and on different days (weekdays, weekends and even during school holidays). This is important for two reasons: one is to be able to assess if compensation occurs in one context as a result of increases in PA in another context, while the other is to maximise the chance that an increase in PA behaviours will lead to tangible benefits to children’s health and well-being. So far, these problems have not been adequately addressed. Given the context of urgency to prevent a worst-case-scenario related to the increasing global prevalence of NCD’s this thesis aims to address these issues.
1.5 Aims and Delimitations of the Present Thesis

The primary aim of this thesis was to examine the effectiveness of a home and school-based individual-adapted behavioural self-management intervention on increasing the number of steps children take across the whole day on weekdays (in school and out of school) and weekends, and to monitor these increases in light of the public health guidelines for daily steps. A secondary aim was to monitor health indicators related to NCD and well-being factors related to the maintenance of PA behaviours, with pre and post measures of body composition and psychological well-being.

An individually adapted behavioural self-management intervention package was designed to give children the opportunity to use pedometers on a daily basis to monitor their everyday walking behaviours, while learning additional self-management skills, including goal setting, feedback, the use of reinforcement (e.g., contingent on achieving PA goals) and other planning and problem solving strategies. The first study was a series of in-depth, qualitative single-case studies, designed to evaluate the intervention with overweight/inactive ‘at risk’ children in a home-based setting (The Movin’ It Project (MIP)) as a scoping study. The second study was a quasi-experimental evaluation of the intervention with classrooms of typical children of all weight ranges (The Health and Programmed Physical Education (HAPPE) Classroom Project) that could be run by class teachers during one school term. The HAPPE intervention was also evaluated against a comparison group of children at the same school in a parallel class. Study II also aimed to demonstrate the replicability of behavioural outcomes by conducting four separate school-based trials of the intervention at different schools, with different teachers, at times of the year and with children in different age groups.

The Movin’ It Programme and the HAPPE Classroom Project were based on behavioural principles and strategies to increase children’s daily physical activity levels.
at home and at school. They were designed to be a minimal, low-cost approach to increase activity levels based on the best components evidenced in the literature (discussed in Chapter 2). The programs were implemented in collaboration with either a parent (at home) or a teacher (at school) and did not require special sports equipment (with the exception of the pedometer) or planned/standardised physical training regimens. The programs aimed to encourage children to increase daily levels of all types of physical activity through changing daily habits and activities, over and above any changes that may result simply from self-monitoring PA with the pedometer. During consultations, participants were educated in the use of additional behavioural self-management strategies (including goal setting, feedback, positive consequences and planning and problem solving) to aid in their attempt to add to their habitual PA levels over time.

It shall be delineated here that this thesis is primarily a psychological one and concerned more with addressing the problem of changing children’s PA behaviour, rather than directly addressing the problems that prevent a better understanding of the effect of PA and sedentary behaviour on health. Specifically, this thesis presents evidence which demonstrates the effectiveness of a behavioural intervention designed to educate and assist primary school-aged children to self-manage increases in habitual, lifestyle physical activity levels. This thesis also aims to provide accurate data on the short term effects of a generalised increase in children’s lifestyle PA on a select range of health and well-being measures, thought to be related to risk of NCD and the maintenance of a physically active lifestyle.

Thus, the main focus of this thesis is with the techniques employed to change PA behaviours and the extent to which change occurred in different contexts. It is proposed here that teaching children behavioural self-management techniques will allow them to better self-manage their own PA behaviours and is the most promising way for
individuals to change habitual PA behaviours. Easily adapted to a broad range of individuals in a range of contexts and for a low cost, the individual behavioural self-management interventions presented in this thesis could play an important role in the prevention of NCD. While it is acknowledged that the potential health benefits associated with PA is also of great importance to the task of increasing children’s PA levels, these issues are a secondary focus of the present thesis. However, it is hoped this thesis will have merit as a multidisciplinary attempt to inform fellow researchers of the impact that generalised increases in children’s lifestyle PA might have on specific health and well-being outcomes thought to be related to risk of NCD in the short term.

1.6 Summary

In dealing with the problem of physical inactivity as part of the NCD prevention effort there is both good news and bad news. The good news is that as physical inactivity is a globally recognised problem and both developed and developing nations around the world have agreed to take action with support from the WHO. It is also an area of research that has received a lot of attention and common features of successful PA policies and interventions have been identified: it is recommended that a life course approach be taken to promote health from the earliest stages of life as well as a focus on physical activities that can be integrated into daily life and not solely on sport or planned exercise (NCD Alliance, 2011). It has also been claimed that any type of PA or exercise increases energy expenditure and fat utilisation when compared to being sedentary and that promoting a change in lifestyle that mainly reduces sedentary behaviours, will be necessary to prevent and treat obesity (Maffeis & Castellani, 2007). The World Health Organisation has identified primary school-aged children as the optimal group to target for interventions on physical activity (World Health Organization, 2009b). This is rather fortunate as there is already ample scientific
evidence which has identified effective ways to change children’s behaviours: by teaching children skills to self-manage their behaviour through an individually-adapted behavioural intervention.

However, there is bad news. First, the global response to physical inactivity has been incomplete, unfocused, misdirected and underfunded particularly in comparison to the other risk factors for NCDs (Kohl et al., 2012). Second, individual behavioural self-management interventions have not yet been rigorously applied and evaluated with regards to children’s physical activity behaviours. Third, the global NCD prevention effort is based on an assumption that increasing children’s PA levels will hopefully lead to long term beneficial health and wellbeing outcomes that will lower risk for NCD later in life (Rowland, 2001). However, even the fundamental assumption that increasing children’s PA levels will lead to beneficial health and wellbeing outcomes in the short term has been difficult to demonstrate consistently (Stone et al., 1998). Fourth, while many intervention efforts with primary school-aged children may claim to have successfully increased PA levels they have been very limited in their approach; targeting, for example, only increases in specific types of PA (such as moderate-to-vigorous PA only) and only in specific contexts (such as during school only or during PE class only). Most interventions neglect to target and monitor increases in all types of PA across the whole day, in all contexts of a child’s daily life. Not only does this approach fail to mitigate the potential behavioural compensation of increased MVPA in one context with decreased PA/increased sedentary behaviours in another context, it also fails to promote the change in lifestyle that is required to prevent NCD’s from developing.

There is a need for a behavioural approach offering primary-school-aged children interventions that can be individually tailored and target increases in lifestyle physical activity behaviour through direct and objective monitoring (using pedometers) in a
naturalistic setting, where the strategies of behavioural self-management are taught to children to establish generalised changes in their daily PA routines to increase the likelihood that these changes will be maintained in the longer-term. This thesis presents the evaluations of two such interventions, in a home-based and a school-based version.

The MIP and the HAPPE Classroom Program aim to educate and assist children in the use of behavioural techniques to self-manage increases in their physical activity behaviours (inclusive of PA at all intensities and for all purposes), in a range of contexts (including on weekdays, in school, out of school and on weekends), while also monitoring for changes in tangible, beneficial health outcomes. Once embedded within the normal routine of the family or the structure of an institution, there is little reason to expect that individually-adapted behavioural self-management interventions would be more expensive to implement than a one off broad based mass media campaign. Yet there is every reason to expect that objectively monitored, beneficial changes in children’s PA and sedentary behaviours will be achieved, and this increase may lead to tangible, beneficial health outcomes. Thus, the results from the evaluations presented in this thesis will demonstrate how a low cost, individually-adapted behavioural intervention could be applied to address the global problem of children’s physical inactivity and NCD prevention.
Chapter 2

Increasing Physical Activity Levels of Primary School-Aged Children: What they need to do to keep healthy and how they can make it a habit

With greater understanding of the way different types of PA affects health and well-being across the lifespan, individuals who have developed a strong preference for sedentary behaviours and an inactive lifestyle may have a chance to alter their behaviours, in order to minimize their risk of developing NCD. Energy expenditure from PA is highly variable, both at the individual level from day to day as well as between individuals (Levine et al., 2006; Ridley et al., 2009; Wickel et al., 2007) and so far it has been difficult for interventions to control. Nevertheless, there is evidence to suggest that increasing certain types of PA can treat and reduce risk for disease and improve wellbeing (both in childhood and adulthood). Thus, if a child was to start increasing their PA it is helpful to know what they could be doing to keep healthy.

Part A of this chapter provides a summary of the synthesised evidence (predominantly from meta-analytic and systematic reviews) to provide an expectation of what benefits to health and well-being children might experience if they can increase their PA and/or modify sedentary behaviours, whether they have a typical health profile or are already obese / ‘at risk’. In the context of NCD, children termed ‘at risk’ are typically defined as such based on their weight status (indicated by body composition measures, such as a BMI indicating obesity), cardiometabolic health profile (indicated by measures of cardiovascular fitness and metabolic health), and their physical activity and sedentary behaviour habits (e.g., in relation to recommended levels). Thus, the
outcomes related to these specific health measures, as well as outcomes in mental health and psychological well-being will be discussed. Though meta-analyses and reviews often include physical activity data obtained from self-reports and other monitoring methods, an effort has been made to only include findings from studies and reviews based on objective measures of children’s PA, such as with a pedometer or accelerometer.

In Part A, it is argued that it is highly likely that children (including obese children) will need more than a specific standardised exercise prescribed to them to achieve and maintain health. It is further argued that a prudent approach for PA interventions concerned with NCD prevention would be to encourage children to increase all types of PA to achieve a higher overall level of daily energy expenditure, focusing particularly on those activities they find enjoyable. However, this leads to the question: how do you get children to do more than just exercise, when, in many cases, exercise is already habitually avoided and often too hard? This is examined in Part B, with a review of selected studies evaluating interventions that aimed to educate children in the use behavioural strategies to self-manage increases in their lifestyle PA behaviour – that is, PA that is part of their everyday lives, particularly at home and at school.

2.1 PART A: Health and Well-Being Outcomes to be Expected When Children Increase Their PA Levels

In the past, attempts to analyse a dose-response relationship evaluated the effects of specific exercises on health outcomes such as, body weight (fat and muscle mass), body mass index, and other cardiometabolic indicators of NCD risk. The prescribed exercises were often carried out in a laboratory or similar controlled setting for a series of weeks or months, and were in addition to an individual’s typical lifestyle PA and sedentary behaviour pattern. Yet, the picture of what and how much PA and sedentary
behaviour children habitually participate in and its effects on healthy development, well-being, and risk for later NCD is incomplete.

Previously, it was recommended that Australian children aged 5- to 12-years participate in a daily minimum of 60 minutes of MVPA, and do not exceed more than two hours per day of screen time (e.g., watching television, using the computer) (Department of Health and Ageing, 2004; Tremblay et al., 2010). However, the spotlight of this research field has been shifting towards understanding the effects of overall increased energy expenditure levels (inclusive of all types of PA) as well as the effects of reduced energy expenditure from excessive or prolonged sedentary behaviours (Hamilton et al., 2007; McMurray & Ondrak, 2013; Miller & Dunstan, 2004). In keeping with this shift, Australia’s guidelines on children’s PA were recently updated to include a recommendation to also interrupt long periods of sitting as often as possible (Department of Health, 2014). However, given this shift has occurred relatively recently (i.e., less than a decade) little is known about how much energy should be expended by children per day by participating in PA - particularly the effects of lifestyle PA, NEAT and/or light-moderate PA – for children to receive benefits to health and wellbeing, particularly those related to NCD prevention.

2.1.1 Body composition, adiposity and obesity.

Similar to the problem of physical inactivity, being overweight or obese is also a problem in pandemic proportions across the globe in both children and adults. Childhood obesity can lead to a variety of adverse health outcomes in childhood, including Type 2 diabetes, obstructive sleep apnoea, hypertension, dyslipidemia, and the metabolic syndrome (Daniels et al., 2005), and is also considered a major risk factor for many NCD’s (WHO, 2009a). Traditionally, a person’s body mass index (BMI) - the ratio of one’s body mass (weight) relative to height - had been used to define underweight, normal weight, overweight or obese status. However, the prevalence of
abdominal obesity or central adiposity has increased among children and adolescents in
the last two decades in the USA and UK (Li et al., 2006; McCarthy & Ashwell, 2006),
and measures of waist circumference (WC), waist-to-hip ratio (WHR) and waist-to-
height ratio (WtHR) are also considered important indices of fat distribution.

The physical laws of thermodynamics and the energy balance equation have
been applied to understanding the cause of obesity. The law suggests that obesity results
from an energy imbalance where energy intake (e.g., from food) persistently exceeds
energy expenditure (e.g., from physical activity) over time. Some evidence exists for the
hypothesis that low energy expenditure resulting from physical inactivity is an
important contributing factor in the maintenance of childhood obesity. Obese children
have a tendency to be less active than non-obese children at times when PA is
determined by free choice, particularly outside of school time, and heavier children
often choose sedentary activities to escape negative activity situations (Hassink et al.,
2008).

With the majority of overweight and obese children growing to become
overweight and obese adults and about a third of lean children also become obese as
adults (Clarke & Lauer, 1993; Craigie et al., 2011), the prevention and treatment of
childhood obesity is very important for the prevention of obesity as well as NCD. For
example, with regards to cardiovascular disease (CVD), a recent study of 3850 German
children found increased WtHR was the strongest predictor of traditional CVD risk
factors, followed by increased skin-fold thickness and BMI (Haas, Liepold & Schwandt,
2011).

Physical activity is an important factor in the regulation of body weight, and any
type of physical activity increases energy expenditure when compared to being
sedentary (Maffeis & Castellani, 2007; Malina, 1989). However, in relation to specific
exercise interventions Malina (1989) identified that “regular training often results in a
decrease in fatness and an increase in fat free mass, quite often with an increase [emphasis added] in body weight” (p. 249). Thus, in interventions where children participate in specialised or specific exercise regimes, an increase in body mass may not be unfavourable in all cases. Additionally, the outcome may depend on what group of children are targeted and different responses may be anticipated for at risk and overweight children compared with children of healthy weight (Flynn et al., 2006).

However, walking is commonly prescribed for obese children as the intensity at which it is performed can be easily modified, no special skills are required, and walking at slower speeds can increase fat oxidation and improve blood lipid profiles (Hassink et al., 2008; Shultz et al., 2011). Walking is a PA behaviour that fits in easily with Maffeis and Castellani’s (2007) claim that promoting a change in lifestyle, mainly in reducing sedentary behaviour, will be necessary in the prevention and treatment of obesity. However, understanding the deceptively simple energy balance equation and the regulation of the mechanisms involved remains elusive, particularly in the case of children where increases in body mass are expected in the course of normal growth and maturation, yet a reduction in BMI and indices of obesity are desired.

2.1.1.1 Prevention of obesity in healthy kids.

In regards to typical children with a healthy weight, it is hypothesised that increasing physical activity “protects individuals from the development of obesity by increasing energy expenditure and resting metabolic rate, leading to favourable fuel utilization” (Goran, Reynolds & Lindquist, 1999, p.18). Yet the evidence for the influence of PA on adiposity in typical children is not clear, and the amount of physical activity necessary in childhood or adolescence to prevent excessive weight gain in later childhood or even adulthood is yet to be prospectively defined (Dietz, 2005; Strong et al., 2005). Although, recent evidence may suggest that habitual sedentary behaviour
levels in middle childhood may predict unhealthy weight gain in later childhood and adolescence (Ekelund et al., 2012; Saunders, Chaput & Tremblay, 2014).

A total of 147 intervention programmes developed to treat and prevent childhood obesity in a wide range of settings were reviewed by Flynn et al. (2006) in an attempt to synthesise evidence into recommendations for best practice. They concluded that health status indicators, such as body composition, chronic disease risk factors and fitness, can all be positively impacted by school-based PA interventions. Of the 147 intervention programmes developed to treat and prevent childhood obesity, the majority of the programmes in school settings (27 out of 37) reported a reduction in ‘fatness’ following the intervention. Additionally, engagement in physical activity emerged as a critical intervention in obesity prevention and reduction programmes, where school-based interventions that involved actual engagement in PA were more likely to report improvements in body composition compared to other interventions, for example, only involving education about PA (Flynn et al., 2006).

In contrast, Harris et al.’s (2009) meta-analysis of 18 studies of controlled trials concluded there was no improvement in children’s BMI as a result of participating in a school-based PA intervention. The type, duration and frequency of the PA interventions varied among studies: nine focussed on increasing MVPA, five focussed on increasing time devoted to general PA, two studies implemented a new weight-bearing exercise, one focussed on activities using large muscle groups and one introduced a physical education program personalised for each student. However, no study objectively measured adherence to the physical activity program at the individual level, and whether the PA interventions had even succeeded at increasing children’s PA levels was assumed. Only two studies used accelerometers to measure PA before and after the intervention phase, yet no difference between the experimental and control groups were found (Lohman et al., 2002; Webber et al., 2008). Comparably, Dobbins et al.’s (2009)
review concluded school-based interventions had been effective at increasing the
duration of PA and in reducing television viewing. However, from the fourteen school-
based interventions that reported results for BMI, it was concluded these were not
effective in either reducing BMI or in limiting the extent to which BMI increases with age.

Thus, it seems simply providing an increased “dose” of PA to children during
school hours has so far been ineffective to improve children’s BMI. The Flynn et al.
(2006) review noted that half of the school-based programmes involved children that
were at higher risk (i.e., recruited specifically for being identified as overweight).
Children defined ‘at risk’ due to weight status have more to gain (or lose in this case)
with regards to benefits to body composition in response to increasing PA levels and
may explain why Flynn et al.’s results are more positive than those of Harris et al.
(2009) and Dobbin et al. (2009). It also highlights the necessity of reviewing the
outcomes of prevention programmes separately to treatment programmes, although
many reviews have combined results from both approaches.

The efficacy of interventions with exclusively non-overweight children that
aimed to change lifestyle behaviours, such as increasing physical activity and
decreasing sedentary activity (rather than participating in a prescribed exercise routine)
to prevent obesity were summarized by Kamath et al. (2008). Yet results from their
meta-analyses were underwhelming, with a pooled effect size for physical activity
interventions (22 comparisons; n = 9891 participants) of only 0.12, though there was a
trend favouring interventions that included reinforcement. Pooled effect size for
sedentary behaviour interventions (14 comparisons; n = 3003) was -0.29, with almost
nil effect for dietary interventions. They also sought to assess the effect of these
interventions on BMI, yet found the pooled effect of interventions on BMI (43
comparisons, n = 32,003) was trivial (-0.02) compared with control groups. While it
could be argued that no change in BMI in non-obese children may actually be a favourable outcome (i.e., BMI did not increase during the time of intervention), Kamath et al. (2008) concluded that the efficacy of lifestyle interventions to encourage healthy lifestyle behaviours to prevent paediatric obesity remains unclear.

2.1.1.2 Treatment of ‘at risk’ / obese kids.

In the treatment of overweight and obese children with a physical activity intervention, a favourable change in body composition can be indicated by a decrease in BMI. While it is possible to lose weight with physical activity alone, the amount of physical activity to achieve significant weight loss is likely to be beyond what is practicable for most people in today's world, and could require children to be vigorously active for more than two hours per day (Maffeis & Castellani, 2007). Additionally, due to the effects of training on the body outlined above, other changes in body composition (indicated for example, by WC, WtHR, or skin folds) suggesting a decrease in fat mass with an increase in fat free or muscle mass would also be desirable, even if overall body mass or BMI increased (Malina, 1989).

Several reviews of physical activity or weight loss intervention studies with obese children (Janssen & LeBlanc, 2010; McGovern et al., 2008; Steinbeck, 2001) have argued for the success of controlled / prescribed exercise interventions improving body composition and insulin sensitivity. Although, of the 24 intervention studies included in Janssen and LeBlanc’s (2010) review only 50% observed significant changes in measures of BMI, total fat, and/or abdominal fat in response to exercise training and effect sizes were small. The amounts of exercise prescribed typically ranged from 2 to 3.5 hours per week, which averaged out to 17 to 30 minutes per day, and interventions ranged in length from 4 weeks to 2 years, with most being 4 to 6 months in duration (Janssen & LeBlanc, 2010). Additionally, McGovern et al.’s (2008)
review of “exercise only” treatments for paediatric obesity found while there was evidence for a moderate treatment effect of physical activity on adiposity (i.e., body fat), there was limited or no effect of these treatments on BMI. The generalisability of findings from these studies is also limited, exclusively to obese children willing and able to participate in a supervised program of specific exercises. Also, the unfortunate issue of exercise compensation that may occur following participation in a specific exercise protocol has not been addressed by assessing for changes (or lack thereof) in total daily PA or energy expenditure (King et al., 2007; Rowland, 1998). Thus, it is highly likely that children (including obese children) will need more than just exercise to achieve and maintain weight loss, and obese children are likely to need a great deal of extra support to maintain an exercise regime. For example, other lifestyle changes will need to be made to accommodate the new exercise prescription in their daily lifestyle and ensure that it does not lead exercise compensation, (i.e., the development of a new habit of decreased energy expenditure at other times of the day when not exercising).

However, even in the absence of weight loss or changes in body composition, interventions to increase energy expenditure through physical activity are thought to be successful in reducing health risk in obese children because they can lead to small but clinically meaningful improvements in glycaemic control, possibly due to the increased use and efficiency in muscle mass burning fat (Miller & Dunstan, 2004). Additionally, regular physical activity in adults has been shown to lessen the burden of obesity-related comorbidities, including reductions in blood pressure, increased insulin sensitivity, and decrease in liver disease (Hassink et al., 2008). Moreover, while obesity is a condition that is intricately linked with NCD, both obese and lean individuals are vulnerable to health risks associated with an inactive lifestyle and excessive sedentary behaviours (Hamilton et al., 2007). Thus, other health risk factors, such as measures of cardio
metabolic health and psychological wellbeing are also important outcomes to monitor in all children, regardless of their weight status.

2.1.2 Cardiometabolic health and risk of chronic disease.

Cardiometabolic health is a measure of risk for diabetes and heart disease and can be determined by a set of conditions or risk factors, including body composition and weight status, as well as cardiovascular (heart and arterial) fitness and metabolic health. Physical activity and exercise is beneficial for preventing heart disease in adult populations and in many cases is an important part of disease treatment via its effect on cardiometabolic health (Dalby & Gjesdal, 2012). While cases of child morbidity and mortality from CVD are extremely rare, the risk factors that lead to CVD in adulthood can be detected in childhood and often persist into adulthood; the most obvious being excess adiposity and overweight / obese status (McMurray & Ondrak, 2013). However, cardiovascular fitness and measures of the heart’s functionality can also be easily assessed in child populations. A healthy heart efficiently pumps blood at a steady rate, and lower measures of systolic and diastolic blood pressure (SBP and DBP) and a lower resting heart rate (RHR) indicate healthy cardiovascular function. Higher levels of BP and RHR may indicate increased risk of CVD due to the heart being under strain to pump blood more efficiently (Dalby & Gjesdal, 2012).

Other traditional major risk factors for CVD detected in children include measures of metabolic health or blood lipid profiles. These include measures of the amount of fat (triglycerides (TG)), sugar (glucose) and cholesterol (including high density lipoproteins (HDL) and low density lipoproteins (LDL)) in the blood stream, where higher levels of LDLs can cause extra strain on the heart as they block or disrupt the flow of blood through the arteries (McMurray & Ondrak, 2013). These measures require blood samples to be taken and tests can be expensive. Thus, it has become more
common for a combination of multiple CVD risk factors or markers of cardiometabolic health to be used as a composite score to determine cardiometabolic risk in children. These can include analyses of different combinations of variables including, gender, body mass and height, skinfolds, blood pressure, cardiovascular fitness (assessed by oxygen consumption at peak performance), and fasting levels of glucose, insulin, lipids, adiponectin, C-reactive protein (CRP), tumour necrosis factor (TNF)α, soluble TNF receptor-1 (sTNFR1), interleukin (IL)-6 and IL-1 receptor antagonist (IL-1Ra) circulating in the blood (Andersen et al., 2010). Froberg and Andersen (2005) reported that as many as 15% of 9-year-old European children had clustered risk, with most of the overweight and obese among these. Although many of the children with clustered CVD risk factors were also lean, inactive children, and the authors concluded that efforts to increase physical activity participation should be a key part of any programs initiated in the prevention of CVD in European children (Froberg & Andersen, 2005).

### 2.1.2.1 Interventions to modify children’s PA behaviours and its effects on cardiometabolic risk factors.

With regards to lowering risk of CVD and NCD in childhood, interventions have targeted whole populations or children ‘at risk’, such as obese children. Although it has been established that both lean children and obese children can exhibit risk factors for cardio metabolic health and the development of CVD (Froberg & Andersen, 2005), the majority of interventions reducing CVD risk factor have focused exclusively on overweight and obese children. These interventions often target weight loss as the primary outcome, typically achieved through specific exercise/PA routines and/or dietary changes - and in many cases do not provide an objective measure of total PA. However, it has been suggested that obesity may confound the association between PA and cardiometabolic health (Andersen, 2013). Thus, other CVD risk reduction interventions have targeted an increase in fitness levels, usually achieved through
prescribed exercise interventions. However, these interventions may also be inadequate as individual fitness levels are influenced by a large genetic component which, in some cases, can limit the health benefits of exercise (Andersen, 2013).

Unfortunately, there is a lack of PA interventions exclusively targeting changes in PA behaviours with whole populations of children that have objectively monitored PA levels and reported the benefits to outcomes indicating CVD risk. Thus, it has been difficult to establish that changes in cardiometabolic health were actually the result of quantifiable changes to PA behaviours, relative to baseline levels of PA. While PA interventions to reduce CVD risk have exclusively targeted changes to PA, almost no studies have examined the effects of lifestyle PA, NEAT or NEPA on lowering childhood CVD risk.

Rather, evaluations so far have focused on the effects of specific exercise regimes at high intensities. For example, of the intervention studies reviewed by Andersen et al. (2011), most required participants to undertake between 60 to 180 minutes per week of prescribed aerobic exercise training, which typically led to significant reductions in systolic and diastolic blood pressure with large effect sizes reported. Andersen et al. (2011) concluded that specific PA/exercise interventions of at least 30 minutes, 3 times per week at an intensity sufficient to improve aerobic fitness can be effective in reducing blood pressure in children with hypertension. Whereas, a minimum of 40 minutes of moderate intensity activity five days per week for at least four months is required to achieve improvements in lipid and lipoprotein levels (Andersen et al., 2011). However, generalisability of these findings is limited as it is not typical for children under ‘free living’ conditions to habitually engage in these types of physical activities without a great deal of extra support. Additionally, the financial and time commitments required for children to participate in an extracurricular sports
programme that might expose them to the weekly dose of PA highlighted by Andersen et al. (2011) is unlikely to be feasible for many families to maintain.

While schools have been highlighted previously as an obvious setting in which to intervene with whole populations of free living children, their effectiveness at lowering CVD risk factors in children has not been consistently supported. Most school-based interventions do prescribe certain PA/exercise routines and require, for example, the scheduling of ‘PA breaks’ in addition to a regular PE curriculum either during class time, directly before or after school, or during the morning or lunch time recess. Specific activities may also be organised by the teacher to supervise children’s participation, however the dose of PA offered is rarely as big as the amount concluded by Andersen et al. (2011) to achieve metabolic changes (i.e., 40 minutes, five days a week). Thus, perhaps it was not surprising that Strong et al.’s (2005) review found school-based interventions designed to increase PA were not effective in improving lipid and lipoprotein levels. However, this contrasts with Dobbins et al.’s (2009) review of school-based physical activity programmes to promote PA and fitness, who concluded they could be effective in reducing cardiometabolic risk factors. Four out of seven studies in Dobbins et al. (2009) review that evaluated CVD risk factors reported a significant decrease in total blood cholesterol in grade school children (aged 6-10 years) and adolescents. Accordingly, there may be potential for school based interventions to be enhanced to reduce children’s cardiometabolic risk.

Nonetheless, there is also a clear need to encourage increased PA beyond the school environment and encourages a change in lifestyle PA habits, particularly given the increasing amount of children exceeding screen time recommendations. Given that McMurray and Ondrak’s (2013) review highlighted that while some risk factors are mainly affected by high intensity or even resistance training, other risk factors may be affected more by the total amount of PA and lower intensity PA. Perhaps adopting
lifestyle PA habits in childhood that provide a healthy level of exposure to all types of PA (i.e., at a range of intensities), may be the key to minimizing the development of NCD risk. Additionally, Saunders et al. (2014) summarized studies demonstrating children’s sedentary behaviour (mostly indicated by screen time) was associated with increased cardiometabolic disease risk in childhood, independent of physical activity, socioeconomic status and family history of diabetes.

Lifestyle interventions have demonstrated promising results in adult populations. For example, Dunn’s (2009) review of lifestyle PA intervention studies summarised that when combined with healthy changes in diet, they have demonstrated the ability to normalize blood glucose levels and help to regulate weight. A lifestyle PA approach also confers with the recent findings by Ekblom-Bak et al. (2014) who examined the association between non-exercise physical activity (NEPA) and cardiovascular health in a longitudinal cohort study of 4,232 Swedish adults over the age of 60. They found that compared to low levels of NEPA, high NEPA was associated with more preferable waist circumference, high-density lipoprotein cholesterol and triglycerides in both men and women and lower insulin and glucose levels in men. Yet the most significant point from Ekblom-Bak et al.’s (2014) findings was that these health benefits existed regardless of whether an individual was a regular exerciser or not, and simply living a generally active daily life was key to cardiovascular health and longevity. Although no evidence exists to link childhood PA levels with longevity in adulthood, perhaps encouraging children to practice living a generally active daily life in childhood may provide some inoculation against developing a generally sedentary daily life - thought to develop at some point in later childhood - as PA levels decrease (Kin-Isler et al., 2009; Nader et al., 2008) and the body’s metabolic rate begins to slow (Malina et al., 2004; Sallis & Owen, 1999). This may also lead to some health benefits either in childhood or
later in adulthood as a result of maintaining a habit of higher NEPA levels, and higher overall energy expenditure.

### 2.1.3 Mental health and psychological well-being.

Despite a great deal of research attention, it has been difficult to establish more conclusive links between childhood PA levels and indices of childhood physical health and risk of disease. On the other hand, while research on the psychological benefits of PA and exercise is sparse (particularly in child samples), the evidence that does exist is relatively strong compared to evidence for the benefits of PA to health. This may provide a solid rationale for promoting appropriate levels of PA in all children, which Rowland (1996) has argued might “far outweigh those of diminishing risk for future disease” (p.308). However, understanding the effects of increasing children’s PA on mental health and psychological well-being is important in the context of NCD prevention. Experiencing improvements in mental health and psychological well-being as a result of increasing PA in the short term bodes well for the maintenance of increased PA levels in the longer term, as it can act as a natural reinforcer, and thus may play an important role in the prevention of disease risk through adolescence and into adulthood.

While not specific to child populations, reviews of the positive influence of participation in PA/exercise psychological well-being have been attributed to diversion; social reinforcement; experience of mastery; improved self-efficacy; increased neurotransmission of catecholamine or endogenous opiates (or both); and improved response to stress through reduced muscle tension, heart rate, skin conductance, and catecholamine, glucocortochoid or lactate production (Taylor, Sallis & Needle, 1985). However, research into mental health and well-being in youth and PA has typically focussed on measures of anxiety, depression, self-concept and self-esteem.
One study that escaped inclusion in a review was Parfitt and Eston’s (2005) investigation of the correlation between pedometer measured habitual physical activity and psychological well-being in 70, 10-year-old children. They found habitual physical activity was significantly, moderately and negatively related to anxiety and depression, and positively related to global self-esteem. When using partial correlations, however, only the significant relationship between PA and self-esteem remained, suggesting improvements in anxiety and depression may somehow be mediated by the effect of PA and exercise on self-esteem. Parfitt and Eston (2005) also found children walking more than 12,000 steps per day had more positive ‘psychological profiles’ than children walking less than 9200 steps per day. For example, anxiety scores were significantly lower in the high-activity group (>12,000 steps/day), and depression significantly decreased and self-esteem significantly increased, when comparing the low-activity group through to the high-activity group (Parfitt & Eston, 2005). They noted that step counts associated with more positive psychological well-being were in line with pedometer equivalent guidelines proposed by Rowlands and Eston (2005) where boys ought to accumulate a minimum of 13,000 steps/day and girls 12,000 steps/day.

However, as in the literature on physical health and PA, the direction (or bi-directionality) of the relationship between mental health, well-being and PA is not yet clear. A case can be made to support both views that children who ‘do more’ feel better about themselves, as well as children who feel good about themselves ‘do more’. Understanding directionality may help to better target interventions; if, for example, an increase in PA levels is desired, perhaps improving mood and self-esteem through counselling might also be an effective route to increasing PA. Alternatively, if improving psychological health and wellbeing in children is the primary outcome, perhaps encouraging children to participate more in sports and exercise might be an effective treatment.
2.1.3.1 Interventions modifying children’s PA behaviours and its effects on mental health and psychological well-being.

Certainly this area has been investigated in adult populations experiencing clinical depression and in some cases of mild to moderate depression exercise treatments have been as successful as treatment using antidepressant medication (Dinas, Koutedakis & Flouris, 2011; Fox, 1999; Taylor et al., 1985). However, there is no universal agreement for a definitive exercise treatment for all elements of mental health promotion, and Fox (1999) has stated that different formulas of frequency, intensity and duration of PA and exercise may apply for different mechanisms and perhaps different populations. It has been claimed however that anyone participating in PA and exercise can experience benefits to subjective feeling of wellbeing, and benefits can be enhanced when people focus on personal goals to improve PA (Fox, 1999).

Livingstone et al. (2003) reviewed studies that showed physical activity reduced behaviours typical of depression and anxiety, and offered opportunities for promoting self-esteem, particularly in children who were disadvantaged and with low initial self-regard. Experimental studies reviewed by Strong et al. (2005) showed strong, positive influences of PA and improvements on measures of anxiety and depression in predominantly adolescent samples. Strong et al. (2005) also summarised results from quasi-experimental studies that found strong, positive relationships between PA and physical and global self-concepts and weaker positive relationships between PA and social and academic self-concept. Although, as is the case with adiposity and cardiometabolic factors, Strong et al. (2005) also stated that the influence of physical activity on anxiety and depression symptoms varies with mode of activity. Similar findings on the effects of PA on self-concept and self-esteem were also reported in the reviews by Ekeland et al. (2005), Trost (2005), and Sallis and Owen (1999).
Generalising from these findings is difficult, however, as the samples used in these studies were quite often with adolescents who already exhibited emotional or behavioural problems or deficits in self-esteem. Additionally, Daley (2008) was concerned with the poor methodological quality of trials, such as a possible overestimation of treatment effects and a lack of data regarding the long term benefits, and cautiously recommended that PA and exercise interventions should only be in combination with other evidence based treatments for mental health problems. For example, Newman and Motta’s (2007) trial of aerobic exercise treatment with adolescent girls suffering PTSD, found an increasing trend in anxiety scores during the follow-up period, suggesting the benefits of exercise are not maintained when the exercise programme ceases.

Rasmussen and Laumann (2012) more recently reviewed the literature on the psychological benefits of exercise in healthy children. They noted there was almost a complete lack of studies on the relationship between exercise and positive emotions or positive moods in the general population of children. One study they reported showed adolescents in a high intensity aerobic exercise group had significantly lower depression and stress scores when compared to adolescents in the other groups, including a moderate intensity aerobic exercise group, a flexibility training group and a no treatment control group. However, they stated that while positive trends were seen in terms of exercise benefiting emotional well being, there was not enough evidence available to make any conclusions.

Notably, all the reviews cited above have alluded to a lack of research (quality and otherwise) on this important area of mental health, psychological well-being and physical activity in the general population of children, as well as those ‘at risk’. Understanding the relationship between these factors has so far been neglected, perhaps due to the booming prevalence in physical health problems related to physical
inactivity, and much more research is needed. A more holistic approach to evaluating the effects of increases in PA is also warranted, where measures of both physical health and psychological well-being are included as outcomes.

### 2.1.4 Summary

Overall, this section has highlighted evidence that, the benefits of physical activity among healthy children can include the regulation of body weight and subjective feeling of wellbeing and enhanced mood. Children already ‘at risk’ (e.g., obese, hypertensive, high cholesterol, or depressed), however, seem to benefit most from increases in PA relative to their risk status. Although the type and intensity of PA required for health benefits differ depending on what health outcome is assessed.

Typically, interventions required participation in sustained moderate-to-vigorous and vigorous intensity PA. Interventions also prescribed a range of activities, including aerobic exercise training, resistance training, circuit training, Pilates, moderate-to-high strain aerobic activities, impact resistance training, high impact weight bearing, flexibility exercises and jumping exercises, usually performed frequently throughout the week and maintained over several months.

Unfortunately, many interventions have been poorly evaluated, and studies using an objective measure of PA as a primary outcome are surprisingly rare. Even a measure of adherence to the exercise protocols has not always been reported. Thus, the underlying reasons for success or failure (that is, response or non-response) are not always clear. For example, are health benefits not obtained/detected because a) PA was not actually increased to a ‘sufficient’ level, b) heterogeneity in the group of children confounded results (e.g., perhaps some did respond significantly while others did not respond at all), or c) children need more than just specific exercise ‘A’ to derive detectable and reliable health benefits? It is quite likely that all of these factors may play a role.
Despite the limitations, it is generally agreed that setting recommendations and targets for children to attain healthful PA levels is worthwhile and more research is needed to determine effective interventions to promote a healthy level of PA among all children (Janssen & LeBlanc, 2010; Rowland, 2007; Sallis & Owen, 1999; Trost, 2005). Additionally, directly targeting an increase in PA levels as a primary outcome (inclusive of all types of PA) in treatment studies may be a plausible route to lowering risk of CVD with whole populations of children, even in the absence of significant weight change or fitness improvements. Among the advantages of PA interventions highlighted by Andersen (2013) and McMurray and Ondrak (2013), there are virtually no negative side effects, and beneficial effects of PA on health are widespread. For example, while changes in each risk factor may be modest and depend on a specific type of PA being performed, the total effect on health can be substantial (Andersen, 2013). In addition to capturing children ‘at risk’ due to their weight status, physical activity interventions can target whole populations of children and also capture those individuals who are normal weight but who may have a high clustering of cardiometabolic risk factors (perhaps due primarily to low physical activity or fitness levels) as identified by Froberg and Andersen (2005) and Wildman et al., (2008).

Yet, there is still a lack of consensus on what is required in interventions to increase children’s lifestyle PA behaviours so that it becomes habitual. It has already been established that we need more than just education to make us exercise; thus, in the context of PA promotion and NCD prevention, the next question that needs to be addressed is: how can children be encouraged and supported to increase their PA levels to maintain a generally active daily life, and meet the guidelines for ‘sufficient’ PA for health and well-being? This question will be explored in the next section, with a critique of intervention studies that have evaluated the use of behavioural self-management techniques to increase PA levels of primary school-aged children.
2.2 PART B: How Children Can Increase PA in Everyday Life to Sufficient Levels

With regards to understanding how children can be encouraged and supported to increase PA behaviours in their everyday lives, much can be learnt from the ‘lifestyle’ interventions developed to treat and prevent paediatric obesity. It is a widely accepted approach for interventions in this field to educate children in the use of behavioural self-management techniques (including, for example, stimulus control, self-monitoring, contingency management, goal setting, modelling and problem solving) so they can self-manage both diet and PA related behaviours (Dalton & Kitzman, 2012; Epstein, 1996; Shields, 2009). However, many of these interventions do not typically highlight PA as their primary dependent variable and many only report weight loss outcomes. Thus, it is not known if these findings can be extrapolated to typical children who are lean but may nonetheless benefit from increasing PA levels due to being habitually inactive, having a strong preference for sedentary activities over physical activities, exhibiting high cardiometabolic risk and/or mental health issues.

In PA interventions, self-monitoring of PA behaviour has been the most frequently employed self-management technique, typically requiring individuals to keep a written record of their physical activity habits, such as self-reporting the number and duration of exercise sessions per week or the number of pedometer measured steps per day (U.S. Department of Health and Human Services, 1996). Maintaining a regular habit of self-monitoring has been identified as an effective measurement strategy and an essential component in the successful self-regulation of a variety of behaviours, including smoking, weight control, disruptive classroom behaviour, hallucinations, vocal tics, and competitive swimming (Kirschenbaum, 1987; Normand, 2008). Self-monitoring increases one’s awareness of the behaviour, the situations in which it occurs and the consequences of it (Clemes & Parker, 2009; Looney & Raynor, 2013). While
Pedometers have been used to effectively promote PA among youth in a range of ways (Lubans et al., 2009), it is generally thought that the simple act of self-monitoring PA with a pedometer is insufficient to produce significant changes in children’s PA behaviours; for example, after the initial novelty effects from wearing a pedometer and accessing its feedback have worn off (i.e., after no more than a few days, up to two weeks at the most) (Butcher, et al., 2007; Eastep et al., 2004; Foley, Beets & Cardinal, 2011; Lubans et al., 2009; Tudor-Locke & Lutes, 2009).

At this stage, it is not known what additional behavioural strategies are necessary for children to master so they can effectively self-manage their PA levels to achieve, at the very least, recommended guidelines for health and well-being. Identification of what type and amount of behavioural strategies are necessary in a self-management program to lead to maximum behavioural change will aid in the development of interventions that are not only effective but also more efficient. This could also translate to increased cost effectiveness – a favourable characteristic for any intervention, particularly when population change is required. The purpose of this section is to examine what type and how behavioural strategies have been used with children in interventions to increase everyday PA behaviours under free living conditions; that is, at home and/or at school.

A critique of selected studies (i.e., those that met inclusion criteria) evaluating the use of behavioural / self-management techniques to increase PA levels of primary school-aged children is presented. A study was included for review if it was (i) an evaluation of an individually adapted program to increase PA levels employing behavioural self-management principles, (ii) with primary school children aged between 5-12 years, (iii) that aimed to increase objectively monitored ‘everyday’ physical activity, such as measuring ‘steps’ with a pedometer, with no additional targets such as diet or sedentary behaviour, (iv) under naturalistic or ‘free-living’ conditions, such as
within the home or school environments, and (v) used a single-case or controlled group experimental design. Few studies could be found that met the selection criteria, thus only a small selection of studies could be included for review and not all included matched the criteria exactly. The four studies evaluating home-based interventions that best matched the inclusion criteria are described in Table 2.1. The five studies evaluating school-based interventions that best matched the inclusion criteria are described in Table 2.2.

2.2.1 The type and amount of behavioural self-management techniques used.

All four of the home-based interventions and three of the five school-based interventions showed positive outcomes in increasing PA levels in a statistically significant or clinically meaningful way. It seemed that the biggest gains were made when a broader range of behavioural techniques were incorporated in the intervention. This was also found in Dalton and Kitzman’s (2012) review of behavioural lifestyle interventions for paediatric overweight, and perhaps when it comes to acquiring skills to self-manage PA behaviours “more is more”. However, given that cost considerations often dictate decisions to implement an intervention widely for public health promotion, finding what type/amount of behavioural strategies is necessary for children to achieve sufficiently active levels (i.e., in accordance with recommended guidelines) would be a prudent approach. The home- and school-based studies typically incorporated a combination of at least two or more behavioural self-management strategies such as, daily self-monitoring of PA, setting PA goals, providing feedback on PA levels, planning and problem solving, role modelling, and the use of behavioural contracts with planned positive consequences. Though the specific application of these behavioural techniques / self-management strategies varied from one study to the next, particularly from the home to the school context, and it is not known if/how different application
approaches or contexts affects the outcome. A brief discussion of how these techniques were applied to promote increases in primary school-aged children’s PA is presented in the next section.
Table 2.1

*Home-based studies educating children in the use of behavioural self-management techniques to increase PA*

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample</th>
<th>Design/ measures</th>
<th>Intervention components</th>
<th>Assessment</th>
<th>Outcomes</th>
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<tr>
<td>Shulman et al. (1978)</td>
<td>10-year-old hypoactive boy</td>
<td>Single-case design.</td>
<td>Mean ‘Activity counts’ per session. &lt;br&gt;<strong>Feedback</strong>: an immediate ‘audible beep’ from the ‘biomotometer’ when threshold for activity counts per minute was achieved. &lt;br&gt;<strong>Tangible Rewards</strong>: contingent on achieving target number of activity counts</td>
<td>Intervention evaluated over 10 conditioning sessions, of 30 minutes, in an indoor ‘free play’ setting. Increases relative to baseline levels. Target achievement: certain number of beeps during the session.</td>
<td>PA: Mean activity counts during the intervention nearly doubled baseline levels. &lt;br&gt;Target counts were exceeded in six out of 10 trials. Of the four trials where target was not met the child’s activity counts were still above mean baseline levels. Effects did not generalize in the return to baseline phase</td>
</tr>
<tr>
<td>Study</td>
<td>Sample</td>
<td>Design/ Measures</td>
<td>Intervention components</td>
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<td>Taggart, et al (1986)</td>
<td>12 primary school-aged children diagnosed as “low fitness” by PE teacher after a baseline fitness assessment.</td>
<td>Single-cases and Intervention group. Changing criterion design. PA: Number of ‘activity points’ accumulated during PA sessions (day) per week (based on direct observation by family members); ‘Activity points’ were monitored during out-of-school hours on weekdays and across the whole day on weekends. PA Goal achievement Fitness: standardised fitness tests</td>
<td>Daily Self-monitoring: accumulation of “activity points” Goal setting: negotiated between parents and child, child agreed to increase daily levels progressively (relative to baseline levels) to meet the pre-set weekly criterion (an agreed on number of activity points) Reinforcement: family contingency contract agreed-upon “contingent reward” such as tangibles, praise, family outings. Planning: functional analysis, stimulus control Modelling: parental involvement</td>
<td>1-week Baseline (inclusive of four sessions). Intervention phase ranged from 5 to 8 weeks (four sessions each week).</td>
<td>PA: 11 of 12 participants increased activity which approximated their individual weekly goal. Group summary data showed 88% of all goals set for all participants were achieved. Overall, there was a 100% mean increase in ‘activity point’ accumulation from baseline to intervention. This was due to an increase in time spent in activity - increasing by 49% over mean baseline levels, and an increase in the intensity at which activities were performed with the onset of the intervention (high intensity / vigorous PA earned the most points). Positive maintenance data was reported anecdotally for three participants. Fitness: 7 of 11 participants who failed endurance run test at baseline, passed following the intervention. Seven of 7 participants who failed the back strength test at baseline, passed following the intervention.</td>
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</tbody>
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Table 2.1 cont.d

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample Description</th>
<th>Design</th>
<th>Measures</th>
<th>Intervention components</th>
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<th>Outcomes</th>
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</table>
| Conwell et al. (2010) | 15 obese, Australian children and youth, aged between 8 and 18 years. Six pre-pubertal and nine pubertal children | Intervention group | *PA*: Mean daily step counts     | Daily Self-monitoring: pedometer                                                        | 1-week Baseline; 10-week Intervention | *PA*: Differences from baseline PA levels were statistically significant from week 3 onwards. The group’s mean (±SE) steps/day increased from 10,800 (±919) at baseline to a peak of 14,120 (±1191) at week 6, and decreased to 13,667 (±1117) at week 10.  
*Health*: No significant changes in blood pressure and fasting lipid concentrations. Significant increase in weight although no significant change in BMI. Significant increase in insulin sensitivity following the intervention (also maintained at follow-up), even though none of the participants had diabetes or impaired fasting glycaemia at baseline. |
Table 2.1 cont.d

*Home-based studies educating children in the use of behavioural self-management techniques to increase PA*

<table>
<thead>
<tr>
<th>Study</th>
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<tbody>
<tr>
<td>Hardman et al.</td>
<td>10-year-old girls</td>
<td>Randomly assigned to one of two Experimental groups: Experimental or Control</td>
<td>Mean ‘steps’ per day (children and parents), segregated by weekdays and weekends.</td>
<td><em>Daily Self-monitoring:</em> pedometer Feedback: plotted daily step totals on a chart Goal setting: daily attempt to increase 2000 steps per day relative to baseline Reinforcement: tangible rewards offered daily if step goal was achieved. Praise from parents. Modelling: parental involvement and the fictional Fit ‘n’ Fun Dudes Only experimental group exposed to 10-week maintenance phase (wore pedometers and self-managed intervention components) following intervention and prior to follow-up.</td>
<td>Steps monitored for 8 continuous days (6 weekdays, 2 weekend days) Baseline, Intervention and Follow-up (12 weeks after Intervention)</td>
<td><em>PA</em>: Children in the experimental group were significantly more active than control group on weekdays and weekends during the intervention, showing a mean increase of +4112 steps/day on weekdays and +5318 steps/day on weekend days during the intervention (the effect remaining at follow-up on weekend days only). Parents in the experimental group increased their physical activity on weekend days also.</td>
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Table 2.2

**School-Based studies educating children in the use of behavioural self-management techniques to increase PA**

<table>
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<tr>
<th>Study</th>
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<tbody>
<tr>
<td>Sallis et al. (1997)</td>
<td>7 schools, 955 students in Years four and Five (USA)</td>
<td>Experimental. 3 groups: Two intervention groups, either led by PE specialist or a Trained classroom teacher, or a ‘no intervention’ Control</td>
<td>PA: Out of school physical activity levels were monitored with a one-day PA recall (i.e., self-report) questionnaire. Accelerometer measured out of school PA on 1 weekday per semester and 1 weekend per school year. Health related fitness: Several fitness tests, Mile-run, sit-up, sit-and-reach and pull-ups. Anthropometric measures included height, weight and calf and triceps skin folds.</td>
<td>SPARK was a 2-year intervention delivered by either Classroom teacher or specialist PE teacher in classroom in a ‘self – management session’ once a week. Daily Self-monitoring: Out of school physical activity monitored daily using daily activity logs (one-day recall questionnaire). Goal setting: not explained Self-Reinforcement: when goals were achieved. Planning, Problem solving, stimulus control. SPARK ‘Enhanced’ PE classes were also provided three times a week.</td>
<td>Post-intervention comparison between groups. All measures were adjusted for baseline age and values, except the accelerometer, were no baseline data was available.</td>
<td>PA: No Significant group differences on accelerometer measures of weekday or weekend PA. No significant differences between groups on self-reported out of school PA. Health: Significant intervention effects found on two of five fitness measures. In the mile –run and Sit-up tests, girls in the specialist-led condition improved more than those in the control condition. No significant intervention effects on skin-folds, sit-and-reach or pull-ups</td>
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### Table 2.2 cont.d

**School-Based studies educating children in the use of behavioural self-management techniques to increase PA**

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<tr>
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<th>Outcomes</th>
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<tbody>
<tr>
<td>Pangrazi et al.</td>
<td>606 fourth graders from</td>
<td>Experimental, 4 groups:</td>
<td>PA: Sealed pedometers</td>
<td>PLAY was a 12-week intervention facilitated by classroom teachers who also arranged a</td>
<td>Post-intervention comparison of mean steps/day</td>
<td>PA: Significant differences in mean steps/day</td>
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<tr>
<td>(2003)</td>
<td>35 schools (USA)</td>
<td>PLAY &amp; PE; PLAY only; PE only; no treatment</td>
<td>objectively monitored total steps/day for four consecutive weekdays after the intervention.</td>
<td>daily 15-minute activity break, during class time. The self-management components were introduced in week 4, including: Self-monitoring: Out of school physical activity monitored daily using daily activity logs (one-day recall questionnaire). Goal Setting: achieving a goal of 30 minutes or more of daily PA independent of the teacher Planning: Teacher initiated frequent discussions about what types of activities students could participate in outside of school Modelling: teachers were instructed to be physically active with children</td>
<td>between the 4 groups</td>
<td>day between the PLAY &amp; PE and ‘no treatment’ groups and between the PLAY only and ‘no treatment’ groups. Significant differences for girls mean steps/day between PLAY &amp; PE and ‘no treatment’ groups and between the PE only and ‘no treatment’ groups. No significant differences between groups in boys’ steps/day. Health: no significant differences in BMI found between groups</td>
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<td>Study</td>
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<td>Butcher et al. (2007)</td>
<td>177 primary school students, mean age 9-years (UK)</td>
<td>Experimental 3 groups: Control; 'Pedometer only'; 'Pedometer plus information'</td>
<td><strong>PA</strong>: unsealed pedometers monitored steps/day for 5 consecutive days</td>
<td><strong>Daily Self-monitoring</strong>: pedometer Feedback: accessed immediately from the pedometer display throughout the day and end of day step total. Goal setting: increase following day’s steps relative to previous day (no specific goal set) Planning: In ‘feedback plus information’ only – received information, and suggestions on how to increase daily steps by maximising available opportunities.</td>
<td>Daily Pedometer steps/minute (in school only) over 5 days (1 day baseline, 4 day intervention)</td>
<td><strong>PA</strong>: Significant differences between groups where ‘Feedback Plus’ had higher mean steps/min than the ‘Feedback only’ and Control groups. Mean steps/min show a string increasing trend over the five days of monitoring ‘Feedback Plus’ group.</td>
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<td>Horne et al. (2009)</td>
<td>100 children, aged 9-11 years, from two primary schools. (UK)</td>
<td>Experimental 2 groups: Experimental school and Control school</td>
<td>Pedometer measured mean steps/day.</td>
<td>8-day intervention: <em>The Fit n fun Dudes</em></td>
<td>Baseline, intervention, and 12-week follow-up</td>
<td><em>PA</em>: Boys and girls in the experimental group both significantly increased their mean steps/day during the intervention phase compared to baseline levels and compared to the control group’s mean steps. Control boys and girls showed significant increases in mean steps/day during the follow-up phase relative to their baseline phases.</td>
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<tr>
<td><em>Fit n Fun Dudes</em></td>
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<td>Daily Self-monitoring: pedometer</td>
<td>Comprised the 8-day measurement phases. Steps monitored on weekdays only (over two consecutive weeks).</td>
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<td><em>Feedback</em>: plotted daily step totals on a chart; immediate access to pedometer step display.</td>
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<td><em>Goal setting</em>: daily attempt to increase 1,500 steps per day above baseline</td>
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<td><em>Reinforcement</em>: small tangible rewards offered daily if step goal was achieved</td>
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<td><em>Modelling</em>: The fictional Fit ‘n’ Fun Dudes</td>
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<td></td>
<td>Only the experimental group exposed to 10-week maintenance phase (wore pedometers and ‘self-managed’ intervention components) following intervention and prior to follow-up.</td>
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Table 2.2 cont.d

*School-Based studies educating children in the use of behavioural self-management techniques to increase PA*

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<tbody>
<tr>
<td>Hardman, et al. (2011)</td>
<td>386 children, aged 7- to 11-year-old, from three primary schools (UK)</td>
<td>Experimental 3 groups: Full intervention; no-rewards intervention; pedometer only control</td>
<td>PA: 12-day intervention</td>
<td>12-day intervention: Pedometer measured mean steps/day. Daily Self-monitoring: pedometer steps per day. Feedback: plotted daily step totals on a chart. Goal setting: daily attempt to increase 1,500 steps per day relative to baseline. Reinforcement: small tangible rewards offered daily if step goal was achieved - for Full intervention group only. Modelling: the fictional Fit ‘n’ Fun Dudes. During 14-week ‘taper phase’ beginning immediately after intervention phase, intervention groups exposed to maintenance procedures: wore pedometers, self-monitored steps on weekdays and weekends and offered praise and social recognition by teacher in front of their school peers for effort at achieving step goals. Control group continued to wear pedometers if they wished.</td>
<td>Measuremen t phases: Baseline (8 days), intervention (12 days), and taper phase (final 8 days only). Steps monitored on consecutive weekdays only. BMI and waist circumference also measured at each phase.</td>
<td>PA: Mean steps/day between schools equivalent at baseline. During intervention, mean steps/day significantly higher in ‘Full intervention’ compared to ‘no rewards’ and ‘pedometer only control’. The ‘no rewards’ group also significantly higher mean steps/day than ‘pedometer only control’. During intervention, ‘full intervention’ showed largest significant increase in PA relative to baseline (+2456 steps/day), with smaller significant increase in ‘no-rewards’ school (+1033 steps/day). At end of the taper phase, PA in ‘no rewards’ continued to increase (+2030 steps/day) with significantly higher mean steps/day than ‘Full intervention’ (whose PA had returned to baseline levels) and ‘pedometer only control’ - between whom mean steps/day were not significantly different. No significant change in ‘pedometer only control’ mean steps/day over the monitoring period. Health: no change in BMI or waist circumference in any group over time.</td>
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</table>
2.2.1.1 Self-monitoring.

Ideally, self-monitoring involves the precise measurement of PA behaviour by the participant, so that changes can be measured and evaluated unambiguously (Sulzer-Azaroff & Mayer, 1991). Two of the four home-based studies pre-dated the widespread use of pedometers. Shulman, Stevens, Suran, Kupst & Naughton’s (1978) intervention did not ask children to self-monitor their PA behaviour, and Taggart, Taggart and Siedentop (1986) asked participants to self-monitor their daily accumulation of “activity points”, based on direct observation by family members.

The other two home-based studies used the pedometer as a self-monitoring tool as well as an objective measure of their dependent variable (that is, total steps per day) (Hardman, Horne & Lowe, 2009; Conwell, Trost, Spence, Brown & Batch, 2010). Children used specially designed Fit ‘n’ Fun Dudes charts to record their step totals at the end of each day during a 2-week intervention by Hardman et al. (2009) and pedometers were checked by the parent at the child’s bedtime. Both parents and children then recorded their daily pedometer counts in Fit ‘n’ Fun Dudes diaries provided during a 10-week maintenance phase (following the intervention phase and prior to the 12 week follow-up).

Participants in Conwell et al.’s (2010) intervention kept a personalised diary to recorded the time of day the pedometer was put on and taken off, the number of steps accumulated at the end of the day and the duration of any PA’s performed while not wearing the pedometer (including swimming, bike riding and trampolining). Conwell et al. (2010) stated that self-monitoring of PA was an acceptable task for children and youth to complete considering that 11 of their 15 participants completed the self-monitoring task for all 10 weeks of the intervention.

In the school-based studies, three of the five studies reviewed used the pedometer as a self-monitoring tool and children could freely access their pedometer to
view their step counts throughout the day (Butcher, Fairclough, Stratton & Richardson, 2007; Horne, Hardman, Lowe & Rowlands, 2009; Hardman, Horne & Lowe, 2011). Children in Butcher, et al.’s (2007) 5-day pedometer intervention wore pedometers only while they were at school and step counts were recorded at the end of each school day. Horne et al. (2009) also used pedometers throughout the 8-day *Fit n Fun Dudes* intervention and experimental participants were instructed to record their daily step counts in diaries. In Hardman et al.’s (2011) component analysis of the *Fit n Fun Dudes* intervention, researchers recorded pedometer step counts during baseline and the 2-week intervention phases. During the 14-week taper phase participants were instructed to self-record their daily step counts in *Fit n Fun Dudes* diaries. While self-monitoring was incorporated in Sallis et al.’s (1997) 2-year SPARK program, and Pangrazi, Beighle, Vehige & Vack’s (2003) 8-week PLAY program, they relied on self-reported physical activity where children recalled their physical activity from the previous day by ticking items on a checklist of 20 activities, usually at the beginning of each school day.

### 2.2.1.2 Goal setting.

Goal setting is when a value or level to be accomplished (often by a particular time) is identified in advance (Sulzer-Azaroff & Mayer, 1991). This component seemed to be most effective when goals were specific, set individually and/or based on baseline performance (Conwell et al., 2010; Hardman et al., 2009; Hardman et al., 2011; Horne et al., 2009; Taggart et al., 1986). Two home-based studies also took into account the context of the individual, prior performance in meeting previous PA goals and any upcoming circumstances that may be beyond their control (Conwell et al., 2010; Taggart et al., 1986). School based studies used a variety of goal setting approaches. Time-based goals were used in the PLAY program, where children were encouraged to independently increase daily PA by 30 minutes or more (Pangrazi et al., 2003). Horne et al. (2009) and Hardman et al. (2011) provided participants with daily individual PA
targets (in a personalised letter from the ‘Fit n Fun Dudes’) to increase their pedometer step counts by 1,500 steps per day relative to their baseline.

2.2.1.3 Feedback.

Sulzer-Azaroff and Mayer (1991) define feedback as “information transmitted back to the responder following a particular performance: seeing or hearing about specific features of the results” (p.509). For example, Shulman et al.’s (1978) participant was instructed to “use more energy by moving around more”. They heard a ‘beep’ when they had exceeded a designated number of activity counts during a set time interval and were told that “the more beeps you hear, the more energy you are using” (Shulman et al., 1978, p. 149). Also, Butcher et al.’s (2007) feedback groups were asked to look at their step totals at the end of the day and to attempt to increase them during the following school day (though no specific goals were set). Feedback in these cases simply indicates the occurrence of the desired behaviour. However, when feedback is provided that also accurately informs participants of their progression towards a goal, the reinforcing effect of such feedback on the desired behaviour can be enhanced (Locke & Latham, 2002; Shilts, Horowitz and Townsend, 2004; Sulzer-Azaroff & Mayer, 1991; Tudor-Locke, 2009) such as in the home-based studies by Conwell et al. (2010) and Hardman et al. (2009) and the school-based studies by Horne et al. (2009) and Hardman et al. (2011).

The power of pedometer feedback was also enhanced when participants could access immediate feedback on their accumulated step count (Butcher et al., 2007; Conwell et al., 2010; Hardman et al., 2009; Hardman et al., 2011; Horne et al., 2009). When monitoring was continuous over longer time periods it may allow children to develop pedometer ‘literacy’ by immediately assessing their own step counts during different activities, across contexts of home and school and over time, as well as in the progression towards their goals (Conwell, et al., 2010; Hardman et al., 2009). However,
this was not possible in other school-based studies because steps were not monitored continuously (Pangrazi et al., 2003; Sallis et al., 1997), nor was physical activity monitored separately in different contexts (Butcher et al., 2007). Unfortunately, the majority of studies included for review lacked a clear description of the type or form in which feedback was provided to participants. For example, feedback can be provided by plotting PA data on a chart and discussing trends in the data with participants. It is important to consider the way feedback is provided as it could be argued that how and what information regarding PA behaviour is presented to an individual could potentially influence the extent to which an individual values the need to increase their PA levels in the first place. Generally, however, feedback combined with praise or other reinforcers, or feedback combined with goal setting, is likely to be more effective than feedback alone (Sulzer-Azaroff & Mayer, 1991).

2.2.1.4 Reinforcement.

Reinforcement is the process by which a behaviour is strengthened (i.e., increases or persists) as a result of the event that occurs as a consequence of, or contingent on, the response (Sulzer-Azaroff & Mayer, 1991). Potential reinforcers may occur naturally, such as a physiological response of the body to increased PA (e.g., such as the release of adrenaline), receiving positive attention and praise from a teacher or sharing a positive social experience with peers, (e.g., as often occurs in team sport). Potential reinforcers can also be planned, such as receiving a tangible reward (e.g., pens, badges, stickers) or a positive consequence (e.g., in the form of a family outing) in response to an increase in PA. Either way, a reinforcer is defined solely by its function of increasing or maintaining the behaviour (Sulzer-Azaroff & Mayer, 1991). Exposure to natural reinforcers was relied on by Pangrazi et al., (2003) who encouraged children to participate in the physical activities they enjoyed most, with the aim that these would provide sufficient reinforcement for PA behaviours. Also, Butcher et al. (2007) relied
on access to immediate feedback from the pedometer and social reinforcement (in the form of attention and praise) from the teacher.

Tangible rewards and planned positive consequences were more commonly used. Behavioural contracts were often in place when goal setting was used. This would involve stating to participants they would receive a tangible reward or a planned positive consequence when they achieved their PA goal. One exception was the Shulman et al., (1978) study, where the participant was not informed of the criteria for reward. Some interventions offered rewards on a weekly basis (Conwell et al., 2010; Sallis et al., 1997; Taggart et al., 1986) and others on a daily basis (Hardman et al., 2009; Hardman et al., 2011; Horne et al., 2009; Shulman et al., 1978). Conwell et al., (2010) typically used family-oriented PA outings or special events as rewards, such as skating or going to the beach. Taggart et al., (1986) used a variety of individual reinforcers for each participant, and included money and other tangibles, social outings, food, watching television, social praise, joint parental participation in physical activity, free time, having friends sleep over, and time for special physical activities (e.g., extra swimming time). Parents involved in Taggart et al.’s (1986) study were also instructed how to gradually replace the use of more expensive rewards (e.g., movies) with those freely available in the natural environment (e.g., social praise).

However, Hardman et al.’s (2011) results suggest tangible rewards should be used with caution. They evaluated two versions of their *Fit n Fun Dudes* school-based intervention: the full intervention, and a “no-rewards” intervention. During the 2-week intervention the full intervention school showed the largest increase in daily steps, while the no-rewards intervention school showed a significant but more modest increase. By the end of the 14-week taper phase where neither condition received rewards, the full intervention school’s mean steps had returned to baseline levels while the no rewards intervention school continued to increase their steps. Hardman et al. (2011) concluded
that the absence of rewards produced the most favourable effects over a longer time period.

**2.2.1.5 Planning and problem solving.**

Interventions involving planning and problem solving relied on the application of several behavioural strategies, such as functional analysis and stimulus control. These were used to maximise the opportunities for participants to be physically active, and to maximise exposure to natural positive consequences of healthy physically active behaviours, thereby reducing the likelihood of future unhealthy inactive/sedentary behaviour. For example, in the studies that used the pedometers as a self-monitoring tool (Butcher et al., 2007; Hardman et al., 2009; Hardman et al. 2011; Horne et al. 2009), information on step counts could be accessed immediately at the whim of each individual participant and, thus, served as an individually-adapted cue to be more physically active, particularly if specific step goals had been set (Hardman et al., 2009; Hardman et al., 2011; Horne et al., 2009).

In Conwell et al.’s (2010) home-based intervention, a research assistant (RA) conducted a brief analysis using a semi-structured interview of how a participant spent his/her time, to identify PA’s that were enjoyable and to identify time periods when sedentary activities could be replaced by more active pursuits and identify strategies to overcome barriers related to achieving previously set step goals. In the counselling session, the RA worked with participants to create a plan to achieve the step goal, by identifying strategies to increase both incidental PA (e.g., walking to school or the shops) as well as planned activities (e.g., a 15-minute brisk walk with their pet dog).

In the school-based programmes by Pangrazi et al. (2003) and Butcher et al. (2007), discussions on the types of physical activities available to students outside of school were facilitated with the class. Students and their teachers were also taught to become more aware of the different opportunities in the school day for physical activity,
and suggestions were made as to how to maximize these opportunities. For example, they were encouraged to take part in activities as much as possible during classroom-based lessons, PE classes, and on the playground. They were also told how helping the teachers with setting up equipment, running errands, and getting changed quickly for PE would all help increase their accumulated step counts. Teachers were also encouraged to facilitate increased PA among their classes by incorporating activity breaks in the classroom, facilitating active recess by providing activity equipment and organizing games, not withholding recess or PE as punishment, and making PE lessons more efficient by increasing the time that students had to actively practice, play, and perform.

**2.2.1.6 Modelling.**

In the context of behaviour change, a model is a person whose behaviour is imitated (Sulzer-Azaroff & Mayer, 1991). In several of the home-based studies, one or more family members were encouraged to participate in physical activities with their child (Taggart et al., 1986) and/or were given pedometers to wear so they could also participate in the self-monitoring of PA levels and serve as models (Conwell et al., 2010; Hardman et al., 2009). In school-based interventions, teachers were encouraged to be physically active and peers in the intervention group who were successful at increasing their PA levels also acted as potential models. Children in the interventions by Hardman et al. (2009), Horne et al. (2009) and Hardman et al. (2011) were introduced to fictional role models, called the ‘Fit n’ Fun Dudes’, via specially created audio and visual intervention materials.

**2.2.2 The role of the setting in delivering the intervention.**

While self-management is the ultimate goal of the intervention, the intervention itself often requires educating and assisting children to use the behavioural self-management techniques. Key benefits of interventions delivered in the home include the
ability to target out of school and weekend physical activity levels (Hardman et al., 2009; Taggart et al., 1986), as well as the added involvement of parents or other family members to provide social support and serve as models (Conwell et al., 2010; Hardman et al., 2009; Taggart et al., 1986) and potentially assist with the implementation of the intervention at the same time (Hardman et al., 2009; Taggart et al., 1986). For example, the goals of Conwell et al.’s home-based intervention program involved teaching participants (and not necessarily their parents) to use specific behavioural skills related to adopting and maintaining physically active lifestyles and applying these skills to achieve an increase in their daily participation in PA as measured in steps/day. However, in such home-based interventions, the use of a research assistant to conduct regular ‘counselling’ sessions at the participant’s home to assist with delivering the different components of the intervention was often necessary, particularly in the interventions continuing longer than two weeks (Conwell et al., 2010; Taggart et al., 1986).

Individually tailored, home-based interventions that require regular face-to-face contact with a clinician or skilled professional to administer the components can be costly financially. It is also difficult to engage large numbers of children in such interventions, particularly as they rely on a family self-referring to the program. Additionally, while these interventions may be particularly beneficial for ‘at risk’ children who are more likely to have lower activity levels compared to their peers (Conwell et al., 2010; Taggart et al., 1986), they may also add to the stigma already experienced by such children as they are specifically targeted and the learning experience is not shared with their typical peers.

School-based programs, on the other hand, have the ability to target large cohorts of children simultaneously and are non-discriminatory. The school-based interventions reviewed here tended to rely on the classroom teacher or a specialist PE
Designing programs to be implemented by either a classroom or specialist PE teacher, and using resources that already exist within schools, provide a considerable advantage in terms of social validity, feasibility and acceptability for children in a natural environment and a model for governmental departments attempting to establish population wide changes. For example, Butcher et al. (2007) devised a simple intervention which would appeal to schools, as it can be easily implemented and incorporated by a classroom teacher into the regular curriculum with little changes to schedules and planning. The simplicity of the components utilised (daily self-monitoring of PA with a pedometer, feedback and information) meant no special training, facilities or equipment was necessary (except for the pedometer), and the program focussed on maximising opportunities that were already available within the school environment.

Other interventions involved teachers scheduling short “activity breaks” throughout the school day, or “enhancing” PE classes, both to maximise PA levels accumulated during school hours (Pangrazi et al., 2003; Sallis et al., 1997). Most school-based intervention also aimed to encourage children to become self-directed in increasing their participation in daily physical activity, independent of the teacher. For example, the Promoting Lifestyle Activity for Youth (PLAY) intervention by Pangrazi et al. (2003) did not teach physical skills, nor was it intended to replace a comprehensive PE program, rather it was described as a “process-oriented program” to shift the focus from fitness toward regular participation in daily physical activity. However, not all the interventions reviewed here properly evaluated if increases in PA were indeed self-managed or if they were more the result of the new regulated PA opportunities introduced to the school environment as part of the intervention (Butcher et al., 2007; Pangrazi et al., 2003; Sallis et al., 1997).
2.2.3 Common methodological limitations.

In the context of NCD prevention, it has been established that interventions to increase children’s PA should aim to support children in developing and maintaining a generally active daily life (McMurray & Ondrak, 2013; Ekblom-Bak et al., 2014; Saunders et al., 2014). Early success in a learning experience to increase PA levels bodes well for later efforts to increase PA levels (again in the future) and/or the maintenance of increased PA levels (Kirschenbaum, 1987; Sulzer-Azaroff & Mayer, 1991). The home and school-based behavioural studies reviewed in this section provide good evidence that when taught to use a range of behavioural strategies children can ‘self-manage’ increases in their PA levels. However, the intervention studies included in this critique are also limited in several ways.

2.2.3.1 Inadequate description of experimental procedure; problems implementing the intervention and/or its specific components.

A number of the studies lacked clarity on the type and frequency of the feedback provided to participants (Conwell et al., 2010; Hardman et al., 2009; Horne et al., 2009; Pangrazi et al., 2003; Sallis et al., 1997; Taggart et al., 1986). One study used pedometers to objectively monitor children’s PA levels under free living conditions but chose not to incorporate the pedometer as part of the intervention to increase lifestyle PA, thus it is not clear what awareness children had of their PA levels and if it played a role in changing PA behaviour (Pangrazi et al., 2003). In another study, feedback from the pedometer was almost completely overlooked as a component of their intervention in its own right. Horne et al. (2009) instead attributed the success of their intervention to the specially created Fit n Fun Dudes characters and their accompanying merchandise (CD’s, pens, personal letters), over the effect of accessing immediate feedback on steps counts, which can act as a prompt to be more active and a potential powerful reinforcer of increases in PA.
While the description of Sallis et al.’s (1997) school-based self-management intervention was insufficient and there was ambiguity regarding what the self-monitoring and goal-setting aspects involved and indeed if/how feedback was provided, the authors also explicitly acknowledged that their self-management program was poorly designed. While they did not address specific reasons why, it could be argued that their SPARK program failed because increases in PA levels in school was methodologically emphasised over increases in PA out of school. For example, Sallis et al.’s (1997) SPARK intervention consisted of three SPARK ‘enhanced’ PE classes per week compared to only one self-management class per week. Had this simply been reversed - and children had been exposed to three self-management classes and one ‘enhanced’ PE class per week - perhaps children may have been more focussed on self-managing increases in their PA levels, both in school and out of school.

2.2.3.2 Poorly selected outcome measures and assessment.

In studies where family or parental involvement was welcomed or required (Conwell et al., 2010; Taggart et al., 1986) assessment of the degree to which parents actually participated in activities with their child or where children were left to be active without parental involvement or supervision was overlooked. Additionally, selecting outcome measures that were misaligned with the intended outcomes of the program led to uncertain results and limitations in findings in other studies (Pangrazi et al., 2003; Sallis et al., 1997). For example, Sallis et al.’s (1997) school-based SPARK program aimed to promote generalisation of PA outside of school. Yet, measuring one weekday per semester and one weekend per year with an accelerometer is an inadequate reflection of regular PA. Pangrazi et al.’s school-based PLAY program also aimed to promote an increase in lifestyle PA particularly outside of school, yet pedometers were used to measure mean total steps/per day. The researchers did not attempt to measure weekend steps, steps measured in school only, or steps measured out of school only.
Therefore, it was not possible for Pangrazi et al. (2003) to determine whether additional steps were taken outside of school as had been intended.

Had steps been monitored continuously as well as segregating steps on weekdays (in school and out of school), on weekends and on school holidays, the extent to which generalisation of increases in PA occurs beyond the delivery context of the intervention (i.e., at home or at school) could then be assessed. Studies have found that the school context can have a very different shaping effect on children’s PA behaviour compared to the home or out of school context and it is generally accepted that children accumulate more PA out of school than in school (Tudor-Locke et al., 2009). However, Cox et al. (2006) found these contextual patterns were not consistent among all children. When Cox et al. (2006) divided their sample of primary school-aged children into tertiles of ‘most active’, ‘moderate’ and ‘least active’ children, they found the least active group took significantly fewer steps both ‘in school’ and ‘out of school’ when compared to the most active group. Additionally, the contextual trend had reversed for the least active group – with this group accumulating more steps ‘in school’ than ‘out of school’. This suggests low active children benefit from the structured environment provided at school for eliciting PA behaviours but may also need more structure in the home context. Thus, monitoring the effects of interventions on PA levels at home and at school is necessary for evaluating the overall efficacy of any intervention to increase children’s habitual PA levels.

2.2.3.3 Poorly selected evaluation designs.

Assessment methods and, in some cases, the overall design of the evaluation were common limitations among studies included for review. Physical activity is a complex behaviour with many correlates and determinants, including genetic and biological factors, as well as a range of psycho-social and environmental factors (Bauman, et al., 2012). Many call for an ecological approach to understanding and
intervening to increase PA levels (Bauman, et al., 2012; Kohl, et al., 2012). Cox et al.’s (2006) findings provide evidence of the contextual variations that can exist between “high active” and “low active” children, based on whether steps were measured in school or out of school. Given these contextual patterns in habitual levels of PA can exist between different groups of children attending the same school, perhaps it may incorrect to assume that all (i.e., high active and low active) children will respond to an intervention to increase PA levels in the same way or even in the same context.

Single case experimental designs are well suited to evaluating the outcomes of specific intervention techniques (Kratchowill, 1992). Evaluations of PA trials with children at risk of NCD (i.e., due to being “low active” relative to their peers) could benefit from analysis using single case experimental designs, to appreciate the rich complexities of working with ‘at risk’ and habitually ‘low active’ children, and how a particular cluster of bio-psycho-social factors (which may not be directly addressed by the intervention) may interact to affect outcomes at an individual level. The single case design also provides an opportunity to trial the adaptability of a package of behaviour change techniques, on an individual level before inferring that this approach would work with a broader, larger sample size of all children (i.e., that includes a mix of both typical and “at risk” child populations.

The Shulman et al. (1978) study was the only one to use a single-case design and was the earliest evidence that could be found that successfully modified children’s PA levels using behavioural principles (i.e., incorporation of feedback and tangible rewards). However, it was limited due to being evaluated in an artificial setting and was of a short duration. Other studies (Conwell et al., 2010; Taggart et al., 1986) suffered from small samples, for example with less than 15 participants in the experimental group, and did not have a control group, yet chose to report group summary data. Thus,
it is difficult to appreciate how individuals respond to such an intervention to increase PA.

Regarding the school-based interventions, both Pangrazi et al.’s (2003) evaluation of the PLAY program and Sallis et al.’s (1997) evaluation of the SPARK program did involve much larger samples (ranging from 600 to 955 participants in total), however, they both failed to obtain baseline data. Instead, these studies reported only end-of-intervention group comparisons. However, without baseline data it is impossible to properly compare the level of change within groups as a result of the intervention /condition, and it is inadequate as an evaluation. Only a pre-post controlled group design would allow for a comparison within groups in order to assess the magnitude of change within individuals and cohorts. This would then allow a comparison to be made between groups, the changes they made over the 12 week period, as well as being able to establish if groups were equivalent at baseline.

When studies did obtain baseline data and use comparison groups (Butcher et al., 2007; Hardman et al. 2011; Horne et al., 2009), it was often with samples from different schools. However, with this design it is difficult to know whether increases in steps were due to the intervention or other random factors, unique to their environment. While evaluating a program with an experimental and a comparison group from the same school is not the preferred methodology due to concerns regarding the increased potential for type I error due to clustering and type II error due to potential of contamination between groups, a single school design may also help control for other potential random factors that may influence children’s steps during an intervention. This design would then afford greater confidence in concluding that changes in PA levels observed between groups are more likely to be the result of the different conditions of the experiment.
Changes in physical health and/or psychological well-being were not monitored.

Only two studies reported beneficial changes in secondary outcomes in health and fitness (Conwell et al., 2010; Taggart et al., 1986). Other studies only measured physical health at one time point and therefore were unable to report any changes. For example, Pangrazi et al., (2003) reported a group comparison of BMI, only at the end of the intervention. In some cases, baseline measures of body composition and/or physical health were taken, although changes in these measures were not monitored (Butcher et al., 2007; Hardman et al., 2009; Hardman et al., 2011; Horne et al., 2009). While others did not include any measure of secondary outcomes on health (Sallis et al., 1997; Schulman et al., 1978), despite Sallis et al. (1997) having an extended intervention phase of up to 2 years, a time period over which significant changes in physical health and fitness is more likely to be detected. Notably, no studies included measures of psychological well-being. Changes in measures of health and well-being are important potential side effects of children increasing PA levels, which may have direct implications to the individual as a natural reinforcer for increasing PA in childhood. Had they been included in the evaluations there is the potential that tangible outcomes in health and wellbeing could have been demonstrated and would have progressed the effort to find effective PA approaches to prevent obesity and NCD.

Overall, this critique of home- and school-based PA interventions has identified that a variety of self-management techniques can been used to successfully increase children’s PA levels. Based on the studies included in the present review, it can be argued that an individually adapted behaviour program to increase children’s PA levels would, at the very least, need to educate and assist children with the daily self-monitoring of PA with an objective device, goal setting, feedback, and provide planned positive consequences (e.g., tangible rewards) contingent of achieving goals, as well as
assistance with planning and overcoming barriers. Methodological issues regarding the length of the intervention and the accurate monitoring of PA (particularly at baseline) also need to be addressed in future research. Specifically, the continuous monitoring of PA on a daily basis and in different contexts (such as on weekdays and weekends, as well as ‘in school’ and ‘out of school’) is required. This approach would allow for outcomes to be measured against the recommended guidelines on children’s PA sufficient to receive benefits in health and well-being and to assess the extent to which increases in PA generalise across all contexts. Demonstration of generalised increases in PA across contexts of daily living is necessary if an increase in total energy expenditure is required to keep us healthy.

2.3 Chapter Summary: What PA Children Need to do to Keep Healthy and How They Can Make It a Habit

Reviewing the literature on increasing children’s physical activity levels in two parts served to address the two distinct tasks involved. The first was to know what PA children need to do to keep healthy; the second is to know how children can then make it a habit. However, the review also highlighted how this topic has been precariously straddling two distinct worlds: the biomedical / therapeutic world has been primarily focussed on the first task, and the behavioural world has been primarily focussed on the second.

With regards to the effects of PA on health, vigorous PA and MVPA (typically in the form of specific exercises) have been studied the most, and the current recommendations for children’s PA reflect this (Andersen et al, 2011). However, the generalisability or real world applicability of the findings from prescribed exercise interventions discussed in Part A is limited on several fronts. Firstly, this approach fails to take into account an individual’s total energy expenditure from all types of PA, a new
direction this field has identified as important areas to investigate with relation to NCD prevention (Hamilton et al., 2007; McMurray & Ondrak, 2013; Miller & Dunstan, 2004).

Secondly, it is questionable whether children in the ‘real world’ would typically engage in these types of physical activities without a great deal of extra support (e.g., from a trainer) and reinforcement. It is also doubtful that the financial costs and time commitment required for children to participate in an extra-curricular sports programme that might expose them to the weekly dose of PA necessary for health benefits could be afforded by a majority of families, and particularly those children who may need it the most. With continued cuts to public education funding for specialist sports and Physical Education teachers at the primary school level and changes in curriculum emphasis, it may also be unrealistic to expect that primary schools will be able to provide their students with this kind of exposure to specialised PA programmes either. Thirdly, it has not been adequately addressed whether children’s participation in a specific exercise protocol leads to a potential ‘exercise compensation’, as suggested by Rowland (1998) and King et al. (2007).

In light of these limitations there is still no universal agreement on what type/s of PA will lead to generalised desired outcomes in health and wellbeing and/or specifically related to NCD prevention. Based on the evidence discussed in Part A, it is argued here that if children are to achieve lasting health benefits from increasing PA levels, it is likely they will need a PA diet that goes beyond the prescription of a specific exercise regime, and likely even beyond maintaining the minimum daily levels of recommended MVPA. Rather, it is most likely that the successful maintenance of higher daily levels of NEPA, MVPA, VPA and lower levels and shorter bouts of sedentary behaviours across all areas of daily living (and across the lifespan) will alter one’s risk of NCD later in life (McMurray & Ondrak, 2013). Thus, future PA interventions should
be encouraging children to increase all types of PA across the whole day, particularly those they find enjoyable, as these changes will likely need to be maintained for the rest of their lives.

With regards to the effect of interventions on changing children’s PA behaviours it was surprising to find that many PA interventions have not reported objectively monitored PA behaviour as a primary outcome. With the exception of pedometer-based interventions, PA interventions with children have not typically made use of behavioural self-management strategies (or not explicitly). Although they are in a minority, interventions that explicitly teach children how to use behavioural self-management strategies to increase PA were mostly successful in delivering significant increases in objectively measured children’s PA levels. Most of the studies included in the critique in Part B were successful in exposing children to the use of behavioural self-management strategies to increase PA levels; however most of the studies were limited in their evaluations of their interventions. For example, outcomes were limited to either the school or home context, and the dual problems – that increases in children’s PA needs to generalise across all contexts to affect total daily energy expenditure (i.e., not just PA levels at school or at home) and all types of PA need to be increased to maximise the spread of the benefits to specific health and well-being outcomes as a result of specific types of PA (including NEAT, exercise, MVPA, interrupting prolonged bouts of sedentary time etc.) – have not yet been adequately addressed. PA interventions also need to demonstrate that benefits to health and wellbeing can be obtained as a result of the intervention - this was overlooked by most of the interventions included in the review.

It is clear that a multidisciplinary effort is required to find a viable real world solution to the developing physical inactivity crisis. Intervention research that attempts to synthesise findings directly relevant to both the biomedical and behavioural worlds is
necessary. Additionally, the intervention itself (i.e., how the increases in PA are achieved) needs to be deliverable on a budget that would make application across whole populations feasible, to significantly address the threat that NCD poses on a global scale to human health and economic prosperity. Simply telling children that “PA is good for you” is unlikely to help everyone achieve and maintain a sufficiently active lifestyle. For example, in childhood, the reduced risk of NCD is a very delayed positive consequence of increasing PA levels. Children need to experience that PA is good for them as an individual if increases in PA are to be maintained (unless it is possible to keep providing support to children to continue with their specific exercise regimes indefinitely, likely to be at great financial cost). Thus, improvement in fitness, weight loss, being able to run faster, for longer, develop bigger/stronger muscles to do better in sport, spend more time playing with friends/family and improve positive feelings of self-worth are more immediate – and thus more powerful – positive consequences for children, and may be more important factors in the maintenance of higher PA levels throughout life.

The advancement of the individually-adapted behavioural ‘lifestyle’ intervention applied to the task of increasing children’s daily ‘lifestyle’ PA levels may just be the bridge we have been waiting for. Bridging the gap will require investigating what behavioural intervention strategies are necessary to achieve sufficient behavioural change to lead to the biomedical/therapeutic outcomes hoped for in the context of NCD prevention. For example, to improve our understanding of this important and complex topic, PA interventions with children must first demonstrate objectively that PA – both context specific and total levels across the whole day - have actually increased as a result of the intervention. Ideally, monitoring would be on a continuous daily basis during a baseline, intervention and maintenance phase to demonstrate the extent to which change in PA occurred. Only then can the beneficial (or otherwise) effects of PA
on health and well-being be assessed as a result of the increased PA and total energy expenditure. An expectation that beneficial side effects might be derived from an increase in daily levels of PA and modification of sedentary behaviour patterns not only provides a rationale for intervening with whole populations of children, but is also an important factor related to the maintenance of changes in PA and sedentary behaviours in the long term.

Educating children in the use of behavioural strategies so they can learn the skills to self-manage increases in their ‘lifestyle’ PA behaviour – that is, PA that is part of their everyday lives - shows promise as an important first step. Using this approach, children are supported to increase their PA levels by doing activities they enjoy, and help them meet the recommended PA guidelines for children. This approach can also easily be adapted at a later stage to help individuals maintain healthy levels of PA by supporting them to continue to develop their behavioural self-management skills as they mature over the course of their lives, thus more likely to lead to habit formation. It is anticipated that if individuals can maintain a generally active lifestyle, they will effectively be able to self-manage their risk of developing an NCD later in life.

Accordingly, Section II of this thesis aims to address the need for an effective behavioural intervention that enables children to self-manage increases in all types of PA behaviours across all contexts of daily living, while also observing the extent to which measureable changes in health and wellbeing occur at the same time.

The strengths and limitations of the existing programmes, reviewed here, were taken into account when developing the behavioural interventions evaluated in the present thesis. For example, PA was objectively measured with a pedometer, continuously throughout baseline, intervention and maintenance phases and across all contexts (that is, on weekdays - at home and at school - and on weekends). Based on the
conclusions drawn from the review presented in this current chapter, four important areas of inquiry were the focus of the evaluations:

1. Can children self-manage increases in lifestyle PA (daily step counts) to recommended levels of PA for health?

2. Do self-managed increases in PA generalise across contexts – from weekdays, ‘in school’ to ‘out of school’ and weekends?

3. What behavioural strategies are necessary for children to ‘self-manage’ increases in their daily steps to recommended levels?

4. Are there any measurable effects of the intervention on health and well-being?
Section II:

Study I: Single-Case Experimental Evaluations of the home-based *Movin’ It* Programme (MIP)

and

Study II: Quasi-experimental Evaluations of the school-based *Health and Programmed Physical Education (HAPPE)* Classroom Project
Rationale and research questions for Study I: Single-Case Experimental Evaluations of the *Movin’ It Program (MIP)*

Children have been taught successfully how to use behavioural skills to self-manage a range of different behaviours, in the context of a range of developmental problems associated with childhood (Epstein et al., 2001; Koegel et al., 1992; O'Donohue & Ferguson, 2006; Stahmer & Schreibman, 1992; Sulzer-Azaroff & Mayer, 1991). However, the review in Chapter 2 (Part B) showed that past attempts to teach children to self-manage increases in PA levels in the context of NCD prevention have been limited, either in the application of the specific intervention techniques or in the evaluation of the intervention itself. Thus, intervention development and evaluation in the context of the problem of children’s physical inactivity is an important area in need of improvement, particularly by taking better account the complexity of an individual’s context and response to an intervention to change their PA behaviours.

Thus, the purpose of Study I was to investigate to what extent ‘at risk’ (i.e., overweight/habitually inactive) primary school-aged children can self-manage increases in their PA levels when participating in the *Movin’ It Programme (MIP)* – a home-based, individually-adapted behavioural intervention designed to encourage children to self-manage increases in their habitual physical activity levels. As it was the first time (to our knowledge) that a programme such as the *MIP* had been trialled with this group of children in a home-based setting, a single-case design methodology was chosen to evaluate the programme on an individual level and to gain an in-depth understanding of how overweight and inactive primary school-aged children respond to wearing a
pedometer and the additional behavioural self-management components packaged in the 
*MIP*.

The *MIP* incorporated several behavioural self-management techniques, including self-monitoring and daily feedback of physical activity with the daily use of a pedometer, coupled with planned positive consequences for achieving weekly physical activity targets. The *MIP* program itself was originally inspired by the Behavioural Activation literature, in particular the work of Lejuez, Hopko and Hopko (2001) and Jacobson, Martell and Dimidjian (2001); these authors developed Behavioural Activation for the treatment of depression, which is also based on the principles of operant conditioning (Skinner, 1954). The evaluation methods and selection of the specific behavioural self-management components thought to be necessary for increasing PA behaviours was based on the strengths and limitations of the previous home-based behavioural self-management interventions with children in Chapter 2 (Part B) (i.e., Conwell et al., 2010; Hardman et al., 2009; Shulman et al., 1978; and Taggart et al., 1986) and the work of Sulzer-Azaroff and Mayer (1991).

Based on the evidence of the effects of PA on health in childhood and risk of NCD discussed in Chapter 2 (Part A), the *MIP* encouraged participants to make beneficial changes to all types of PA such as, increasing vigorous PA, MVPA, and specific exercises, as well as increasing lifestyle PA, NEAT or NEPA. The *MIP* required children to wear a pedometer continuously for 20 weeks, monitoring step counts on a daily basis, and was implemented in a naturalistic setting –the family home – with at least one parent involved. A detailed description of the programme and its components are presented in Chapter 4.

Children with an ‘at risk’ health profile (i.e., overweight) and who had low levels of habitual PA were selected for the first evaluation of the MIP. These children were prioritised as they are most likely to benefit from an intervention to increase PA
levels. However, the primary emphasis of this research was on attaining PA behaviour goals rather than weight/adiposity (fat/muscle ratio) goals, and that the attainment of these goals was reached in a naturalistic setting for the child (to maximise the chance that new PA behaviours will be maintained). Although, given that changes in physical health and psychological outcomes can be expected if changes in PA levels are achieved, monitoring for changes in weight (kg), BMI, and skin folds, and mood and self-esteem was deemed relevant and important. Finding beneficial changes in these measures would provide evidence for effective treatment interventions for those children ‘at risk’ due to a diagnosis of overweight and/or obesity. Additionally, if the programme demonstrates success with ‘at risk’ children, then it could be adapted to be applied with whole populations of children - including both overweight children as well as those who may be considered relatively healthy in terms of body composition – so that all children can be taught how to self-manage their PA to achieve sufficient levels (even if they are not obviously ‘at risk’).

Specifically, Study I was designed to investigate to what extent ‘at risk’ primary school-aged children can self-manage increases in their PA levels (as measured by a pedometer) in a home-based, individually-adapted behavioural intervention. In particular, Study I aimed to address the following research questions:

1. To what extent do ‘at risk’ (overweight/low active) children in the home-based MIP increase daily step counts to recommended ‘healthy’ daily targets?
2. Does the effect of increasing steps generalise across steps on weekdays and weekends?
3. To what extent do any changes made in steps maintain, when children (with the assistance of their parents) monitor their own data and are left to fully self-manage the MIP?
4. Are there any measureable effects of increasing steps in the MIP on measures of ‘at risk’ children’s physical health and psychological well-being?
Chapter 4

Study I: Methods for Single-Case Experimental Evaluations of the *Movin’ It Program (MIP)*

4.1 Participants

Four participants were included in the study, of whom two were boys (aged 10- and 12-years) and two were girls (aged 8- and 12-years). A description of the case specifics of each participant is included in the Results in Chapter 5. An additional two participants did not complete the minimum contribution period (i.e., at least 50% of the program) and therefore were not included in the evaluation.

*Inclusion criteria.* For children and their families to be eligible for the MIP evaluation in Study I they had to meet several criteria. Ideally, children were pre-pubertal, aged between 7-12 years old, and met criteria for being overweight or obese based on Cole et al.’s (2000) age related cut-offs for body mass index (BMI). Second, the child was also considered by parents to be predominantly inactive, lethargic and/or generally disinterested in activities other than sit-down types of activities, and their parents were concerned about their child not participating in life as fully as they could be, or were concerned about their child’s weight and healthy development. Third, children had been assessed by a medical practitioner. The presence of medical diagnosed conditions, such as Type I or Type II diabetes, cerebral palsy, clinical depression, endocrine disorders, epilepsy (and so on) did not preclude participation in the program; rather it was deemed the information was relevant for the success of the intervention so that it could be properly tailored to the individual with a condition that may make participation in increased physical activity more difficult. However, it was
necessary to exclude a child who may have previously determined dietary or exercise restrictions, or a diagnosed eating disorder. Fourthly, at least one parent or guardian had to be willing to help their child participate, and sign a consent form. The child (and parent) also needed to be able to a) read the “Movin’ It Program” manual, b) complete the daily self-monitoring of activity levels, and c) take care of the pedometer device and ensure child could wear it every day.

Recruitment methods. The recruitment of overweight/obese children to participate in a behavioural experiment to increase physical activity levels presented challenges, similar to those documented by Korde et al. (2009). For example, despite the widespread media coverage on the problems of childhood overweight and obesity at the time of recruitment, cultural taboos and sensitivities needed to be overcome. Consequently, a number of different avenues were pursued to reach the target population.

In all of the recruitment materials, increasing physical activity to promote healthy child outcomes was a rationale for participants to take part in the program. Information material about the study was sent to General Medical Practitioners (GPs) in the vicinity of the university campus to encourage GPs to refer their patients who met the criteria. Information packs that could be displayed and passed on to parents and children were distributed to child health clinics in the south metropolitan area of Perth, Western Australia and the WA State Child Development Centre. Information posters were displayed in shopping centres, cafés and fast food restaurants in the suburbs surrounding the university. A number of primary schools in the areas surrounding the university gave permission to publish information about the study in their weekly newsletters. Additionally, two community newspapers published short articles describing and promoting participation in the study.
4.2 Materials

Several materials essential to implementing the MIP intervention were provided to participants. These included a pedometer and other materials created by the researcher specifically for the MIP. A variety of measures and equipment also were used in Study I to monitor changes in physical health and psychological well-being.

4.2.1 Pedometers.

Physical activity was defined as any movement which resulted in a count being recorded on the Yamax Digi-Walker Model SW-700 pedometer worn by the participant. The pedometer is an electronic motion sensor that is considered a practical, objective and valid method of assessing children’s physical activity levels (Tudor-Locke et al., 2009; Gao et al., 2010). It is a small device worn on the right hip attached to the waistband of clothing with an internal spring-suspended horizontal lever that counts the number of steps taken by the wearer in response to the hip’s vertical acceleration, experienced as a part of normal walking action.

The Yamax Digi-Walker has 95% accuracy as recorded by factory experimentation, a result which has been replicated in numerous studies by independent researchers (Crouter, et al., 2003; Schneider et al., 2004). It is considered to be the most accurate under both laboratory and free-living conditions with children and youth making it the ideal choice for applied physical activity research (Tudor-Locke et al., 2009; Schneider et al., 2004). For example, in a sample of 11 to 15-year-old boys, Jago et al. (2006) reported the Yamax Digi-Walker was reliable at accurately counting steps across repeated activity bouts when children participated in activities including running and walking.

The pedometer displays activity units as step counts (1 to 99,999 steps) and distance travelled in kilometres (range 0.01 to 1,000 km). An estimate of energy
expended as a result of the number of steps counted is displayed in terms of calories consumed, although for the purposes of this research this function was not used. Step counts were automatically converted to distance (km) by the pedometer using the number of steps recorded multiplied by the participant’s average stride length. Average stride length was determined for individuals by asking participants to walk 10 paces on a flat surface, and then dividing the number of steps by the actual distance covered. Specifically, this was the distance from the heel of the back foot where the participant started, to the toe of the front foot after completing the 10 steps. An average of three stride lengths was programmed into each participant’s pedometer.

4.2.2 Materials created by the researcher specifically for implementation of the MIP.

4.2.2.1 The Intake Interview.

The clinical interview protocol is presented in Appendix A. It involved the researcher providing a full disclosure of the requirements of participation, an explanation of the aims of the program, as well an overview on the procedure and what they could expect over the following 20 weeks was presented. The intake interview obtained information regarding family composition, the home environment, health issues, short medical and developmental history, as well as the participant’s usual activities, hobbies and interests, relationships with family and peers and the family’s weekly and daily routines. The interview provided an opportunity to identify a number of potential reinforcers that might be used as part of each individually tailored MIP intervention and to problem solve should step counts not increase.

4.2.2.2 MIP Manual.

The Movin’ It Program Manual was a 30 page, spiral bound book containing pictures and general background information about physical activity, particularly
regarding energy expenditure, energy balance and child health in relation to PA. All were explained at a level understandable to both child and parent. The MIP Manual stayed with the participants throughout their time in the MIP and included detailed instructions for participants in the Movin’ It Program. Certain specific sections were to be read whilst participating in the baseline phase, intervention phase and maintenance phases. The MIP manual was also the place where participants and parents were to keep a record of the daily pedometer data and a brief description of what activities they had participated in that might account for their pedometer readings. For example, participants were instructed to write down all activities, such as “watched TV” or “rode bike in the street” to provide some qualitative information to describe their pedometer data. A copy of a MIP Manual is included in Appendix B.

4.2.2.3 “My Movin’ IT Chart”

The “My Movin’ It Chart” was provided to participants to provide a visual representation of pedometer data, and to illustrate the participant’s target for each week. The chart was designed to provide systematic visual feedback to the participant and his/her parent on whether PA targets were being met and to show their progress throughout the program. The chart was printed on A3 paper, with time (in units of days and weeks) along the x-axis and physical activity level (in units of steps and km) along the y-axis. Participants decorated and individualised their chart with stickers and glitter, also provided by the researcher. An example of a completed “My Movin’ It Chart” is presented in Appendix C.

4.2.2.4 Behavioural Prompts.

Planning aids and memory cues to prompt more active behaviours were provided on an individual basis, as needed. For example, if making a plan to go for a walk with a family member, it was written down on a calendar. ‘Post-it’ note reminders
were also left in places of the house that they would be seen regularly and were used to prompt behaviours necessary in the MIP; for example, wearing the pedometer, daily monitoring of steps, or going for a walk. An interactive poster ("Things I do after school…"), designed by the researcher for the purposes of the MIP, was introduced to act as a behavioural prompt for participants to engage in physical activities in the afternoon period when they had returned home from school. Use of the poster was introduced to participants if the afternoon period was not being utilised optimally for physical activity participation, or if participants were having trouble achieving consistent physical activity data. Essentially, the “Things I do after school” poster was a timetable printed on an A3 piece of paper. There was space next to each day of the week that could be used to allocate which physical activities the child would participate in, usually in the after school time period, before a preferred or sedentary alternative could be accessed. The poster also included space for weekends. Physical activities on the timetable were selected from a list of activities constructed by the child, and included a range of physical activities that could be participated in independently, with a friend or other family member. A copy of the poster is presented in Appendix D.

4.2.2.5 Positive Consequences: Possible Reinforcement and Tangible Rewards.

Tangible rewards came in the form of a Lucky Dip Prize that could be drawn out of a bag brought by the researcher to each weekly behavioural consultation. Tangible rewards differed slightly for each individual but consisted of small toys and gadgets that had been identified by parents as potentially reinforcing for the participant. For example, girls typically preferred coloured pens and plastic make-up sets. Boys typically chose balls, yo-yo’s and superhero or cartoon figurines. In most cases, the researcher also negotiated with parents to provide surprise rewards for their child. For example, one participant enjoyed playing Lotto ‘scratchies’, while another wanted to go
horse-riding. Special MIP Vouchers for these items or activities were then created by the researcher and put in their lucky dip bag (See Appendix E).

**4.2.2.6 Consultation Protocol Form.**

The researcher devised a single-page *pro-forma* data sheet and checklist to be completed at each weekly behavioural consultation meeting with participants during the intervention phase. The sheet contained space to write down pedometer data for that week, along with anecdotal evidence of what activity behaviours had been engaged in by the participant. An example of a data sheet is presented in Appendix F. The researcher took elaborate notes on occasions when the participant had much to report regarding attempts to be more physically active. Other times, the researcher’s notes were minimal, if the participant had little to report. This information was useful in planning and implementing the MIP intervention, as well as for validating and interpreting the pedometer data, leading to a more rigorous evaluation of participants’ progress in the MIP.

**4.2.3 Measures of health and well-being.**

**4.2.3.1 Psychological Measures.**

Standardised psychological measures were used to quantify psychological variables of depression and self-esteem compared to similar aged peers. For each scale, a description of its purpose, evidence for its reliability and validity, definition’s and sample questions of each sub-scale with the response options and range of scores is presented below.

**The Children’s Depression Inventory (CDI) (Kovacs, 1992).** The CDI assesses the presence and severity of specific depressive symptoms in youth and was chosen to assess the extent to which changes in PA behaviour may have affected mood. The CDI is a 27-item self-rated, symptom scale on which the child chooses one
alternative out of three presented that best described his/her own feelings/ideas for the past two weeks. It is a single, double-sided questionnaire paper that can be completed by the child using only a pencil. It is appropriate for 7 to 17-year-olds and takes approximately 10-15 minutes to complete. The CDI is regarded as adequate for assessing the severity of depressive symptoms and by obtaining a quantitative measurement of such symptoms as, mood disturbances; capacity for enjoyment; depressed self-evaluation; disturbances in behaviour toward other people; and vegetative symptoms (including fatigue, oversleeping, having difficulty with activities requiring effort, and other symptoms of passivity or inactivity) (Kovacs, 1992)

Reliability has been demonstrated by its high internal consistency (Chronbach's alpha > .80) in addition to test-retest reliability, where coefficients in 108 normal 7-12-year-old children ranged from .82 over 2 weeks to .66 for longer intervals (4 and 6 weeks) (Finch et al., 1987). The CDI has been successful in distinguishing clinical and non-clinical groups, and there is evidence for its convergent and discriminant validity (Nelson & Politano, 1990). The CDI yields a total score that can range from 0 to 54, with higher scores indicating increasing symptom severity. The CDI total score is made up of five sub-scale scores which were derived from a factor analysis, and reflect the different symptoms experienced as part of an overall depressive episode. The scales are; ‘Negative Mood’, ‘Interpersonal Problems’, ‘Ineffectiveness’, ‘Anhedonia’ and ‘Negative Self-Esteem’. Table 4.1 provides a description of what each sub-scale is measuring and a sample item. The CDI total and subscale scores were used to monitor whether changes in PA levels affected pre- to post - intervention changes on the CDI.
### Table 4.1

*A description and sample item for each of the five sub-scales that make up the 27-Item Child Depression Inventory.*

<table>
<thead>
<tr>
<th>Scale Name</th>
<th>No. of items</th>
<th>Raw score range</th>
<th>Description</th>
<th>Sample Item and Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDI Total</td>
<td>27</td>
<td>0 – 54</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sub-Scales</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anhedonia</td>
<td>8</td>
<td>0 – 16</td>
<td>The inability or decreased ability to experience joy (also includes analysis of vegetative functions such as sleep quality, appetite and fatigue).</td>
<td>Item 11:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Things bother me all the time. (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Things bother me many times. (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Things bother me once in a while. (0)</td>
</tr>
<tr>
<td>Negative self-esteem</td>
<td>5</td>
<td>0 – 10</td>
<td>The belief that you are not good at anything.</td>
<td>Item 2:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Nothing will ever work out for me. (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- I am not sure if things will work out for me. (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Things will work out for me O.K. (0)</td>
</tr>
<tr>
<td>Ineffectiveness</td>
<td>4</td>
<td>0 - 8</td>
<td>A lack of motivation or inability to complete tasks.</td>
<td>Item 15:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- I have to push myself all the time to do my school work. (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- I have to push myself many times to do my school work. (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Doing schoolwork is not a big problem. (0)</td>
</tr>
<tr>
<td>Interpersonal Problems</td>
<td>4</td>
<td>0 - 8</td>
<td>Difficulty making and keeping close relationships.</td>
<td>Item 12:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- I like being with people. (0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- I do not like being with people many times. (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- I do not want to be with people at all. (2)</td>
</tr>
<tr>
<td>Negative Mood</td>
<td>6</td>
<td>0 - 12</td>
<td>Experience of negative emotions, including irritability or anger.</td>
<td>Item 10:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- I feel like crying every day. (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- I feel like crying many days. (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- I feel like crying once in a while. (0)</td>
</tr>
</tbody>
</table>
Piers-Harris – 2, Children’s Self-Concept Scale (Piers-Harris 2) (Piers, Harris & Herzberg, 2002). The Piers-Harris 2 is designed to assess how children feel about themselves and is a measure of their self-esteem. The measure consists of a double-sided piece of paper that is completed by the child using a pencil. It can be used with children who are at least 7 years old and have at least a second-grade reading ability, and adolescents up to 18 years of age (Piers, Harris & Herzberg, 2002). The Piers-Harris 2 is a 60-item, self-report questionnaire with items that cover six subscales: Physical Appearance and Attributes, Freedom from Anxiety, Intellectual and School Status, Behavioural Adjustment, Happiness and Satisfaction, and Popularity. In addition, two validity scales identify inconsistent responding and a tendency to answer either yes or no without regard to item content.

The Piers-Harris 2 is a standardised and norm referenced assessment instrument and is appropriate for use in any research, educational, or clinical setting that requires efficient quantitative assessment of children’s reported self-concept (Piers, Harris & Herzberg, 2002). A high degree of internal consistency for the Total (TOT) score and the six domain scale scores was obtained from in the Piers-Harris 2 standardisation sample of 1, 387 students recruited from elementary, junior high and high schools throughout the United States, where alpha coefficients ranged from 0.74 to 0.91. Test-retest reliability for the original Piers-Harris over intervals of 2 to 5 months was reported to be moderately strong and ranged from 0.71 to 0.75 (Piers, Harris & Herzberg, 2002). Concurrent validity of the Piers-Harris 2 has been established by examining the instruments relationship to other measures of anger and aggressive attitudes as well as measures of psychological symptoms. The Piers-Harris 2 Total score and four of the six domain scales scores showed significant relationships in the predicted negative direction with the Attitudes Towards Guns and Violence Questionnaire (AGVQ) and the Aggression Questionnaire (AQ) (Piers, Harris &
Herzberg, 2002). In correlations with measures of psychological symptoms, the My Worst Experience Scale (MWES, a measure of post-traumatic stress disorder) and the Overeating Questionnaire (OQ, measuring thoughts and attitudes related to obesity) it was found that both scales correlate relatively strongly in the expected direction at the general level and also in specific scale-to-scale relationships (Piers, Harris & Herzberg, 2002).

Items are presented as descriptive statements, and respondents answer yes or no to indicate whether or not the statement applies to them (Piers, Harris & Herzberg, 2002). Items may be worded where a yes response is in the direction of a negative self-concept (e.g. “It is usually my fault when something goes wrong”). Alternatively, items may be worded so that a yes response is in the direction of a positive self-concept (e.g. “I am well behaved in school”). Items are score with either 1 or 0, so that a higher score indicates a more positive self-evaluation in the domain being measured (Piers, Harris & Herzberg, 2002). The Piers-Harris 2 was chosen to assess the extent to which changes in PA behaviour may affect a child’s reported self-concept, and was used to assess pre to post-intervention changes. Table 4.2 provides a description and sample item from each of the scales.
Table 4.2

A description and sample item for the Total (TOT) scale and the six domain scales that make up the 60-Item Piers-Harris 2, as well as details for the two Validity scales.

<table>
<thead>
<tr>
<th>Scale Name</th>
<th>No. of items (Max. Score)</th>
<th>Description</th>
<th>Sample Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (TOT)</td>
<td>60</td>
<td>Overall level of general self-concept (i.e., degree of self-esteem or self-regard)</td>
<td></td>
</tr>
<tr>
<td><strong>Domain Scales</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavioural Adjustment (BEH)</td>
<td>14</td>
<td>Measures the admission or denial of problematic behaviours. Covers specific behaviours (such as fighting) to more general statements concerning problem situations at home or school.</td>
<td>Item 19. “I do many bad things”</td>
</tr>
<tr>
<td>Intellectual and School Status (INT)</td>
<td>16</td>
<td>Reflects a child’s assessment of his/her abilities with respect to intellectual and academic tasks -covering general satisfaction with school and future expectations about achievement.</td>
<td>Item 5. “I am smart”</td>
</tr>
<tr>
<td>Physical Appearance and Attributes (PHY)</td>
<td>11</td>
<td>Measure’s a young person’s appraisal of his or her physical appearance, as well as attributes such as leadership and the ability to express ideas.</td>
<td>Item 44. “I am good-looking”</td>
</tr>
<tr>
<td>Freedom from Anxiety (FRE)</td>
<td>14</td>
<td>Provides a measure of anxiety and dysphoric mood. Individual items inquire about a number of specific emotions, including worry, nervousness, shyness, sadness, fear, and a general feeling of being left out of things.</td>
<td>Item 29. “I worry a lot”</td>
</tr>
<tr>
<td>Popularity (POP)</td>
<td>12</td>
<td>Represents a child’s evaluation of his or her social functioning. The items cover content such as perceived popularity, ability to make friends, and feelings of inclusion in activities such as games and sports.</td>
<td>Item 32. “I feel left out of things”</td>
</tr>
<tr>
<td>Happiness and Satisfaction (HAP)</td>
<td>10</td>
<td>Reflects feelings of happiness and satisfaction with life. Item content is general and broadly phrased.</td>
<td>Item 40. “I am unhappy”</td>
</tr>
<tr>
<td><strong>Validity Scales</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inconsistent Responding (INC) index</td>
<td>15 pairs</td>
<td>Identifies random response patterns. Compares answers between pairs of items that, if answered consistently, should yield a similar response.</td>
<td>Check box if: Item 1 = 0, and Item 47 = 1</td>
</tr>
<tr>
<td>Response Bias (RES) index</td>
<td>(out of 60)</td>
<td>Measures a child’s tendency to respond yes or no irrespective of item content, by counting the number of times the child has answered “yes” to items.</td>
<td></td>
</tr>
</tbody>
</table>
4.2.3.2 Physical Measures of Body Composition.

Anthropometric measures most widely reported in the literature and recommended by Espinel and King (2009) were used to obtain measures of the child’s adiposity and body composition. Three measurements of each variable were taken in succession, and the average calculated to use as the final figure.

**Weight, Height and Body Mass Index (BMI: kg/m²).** Body Mass Index (BMI = Weight (kg) / Height (m)^2) is indicated in the NHMRC Guidelines (NHMRC, 2003) as one of the standard measures of body composition and for defining general adiposity and overweight based on the criteria of Cole et al. (2000). Children were asked to remove their shoes for the measurements of height and weight. Propert Glass Electronic Scales (3120) were used for weight measurements (to the nearest 100g) and a wall mounted tape measure (a tape measure that descended from the wall to the top of the child’s head) for height measurements (to the nearest millimetre). Both instruments were provided by the Murdoch University Chiropractic Clinic. BMI was then calculated from these measurements using the standardised calculation of BMI=Weight (Kg)/ Height (m)^2. Children were classified as normal, overweight or obese based on BMI using the criteria of Cole et al. (2000).

**Waist and Hip circumference (cm), Waist/Hip Ratio (WHR) and Waist to Height Ratio (WHtR).** Waist circumference (WC), hip circumference, and calculations of waist to hip ratio (WHR) and waist to height ratio (WHtR) are common measures of central (abdominal) body fatness. An increasing prevalence of abdominal obesity, defined by increased waist circumference (WC) or waist-to-height ratio (WHtR) has been identified in children and adolescents in recent decades and associations of CVD risk factors in children have been found with fat patterning parameters such as BMI > 85th percentile, WC > 90th percentile, and WHtR > 90th percentile (Haas, Liepold & Schwandt, 2011). Waist and Hip circumferences (cm) were measured using a compact,
retractable flexible tape measure (MABIS, model no. 35-780-010) also provided by the Murdoch University Chiropractic Clinic. The Waist-Hip ratio, (waist circumference (cm) / hip circumference (cm)), and Waist to Height Ratio (WHtR) was then calculated. Waist circumference percentiles for 7- to 15-year-old Australians published by Eisenmann (2005) were used as well as the cut-off defined by Ashwell (2005) that abdominal fatness is excessive in school-aged children when the ratio of waist girth to height exceeds 50% (cited in (CSIRO, et al., 2008, p.36).

**Sum of Four Skin-folds (mm).** Skin fold measurements estimate body fat with a calliper that pinches a fold of skin and underlying adipose tissue to measure the thickness of large fat stores. By measuring several different sites from the trunk and limbs (common sites include the biceps, triceps, sub-scapular, supra-iliac) total body fat can be estimated using one of the many specific calculations, or can simply be summed together (mm). Skin fold measurements are generally accepted for use in clinical and research work, monitoring for individual change in adiposity (muscle/fat ratio) and body shape over time. However, due to the high degree of measurement error expected from one technician to another, they are not recommended for population monitoring (Espinel & King, 2009). The Saehan Skinfold Calliper was used to measure the thickness of "Skin folds". The Calliper had spring-loaded levers and low-pressure bearings for constant pressure when taking a measurement. Measurements were taken at each of the four selected sites on the body (biceps, triceps, subscapular and suprailiac) according to the instruction manual. Three measures were recoded from each site and an average calculated. The resultant “sum of skin fold thickness” was then calculated.

### 4.3 Procedure

Eligible participants attended a clinical intake interview as part of the ‘pre-’ assessment procedure at the Murdoch University Psychology Clinic. All participants
took part with their mother as the main caregiver responsible for their participation in the MIP. Participants attended an initial intake interview at the School of Psychology Clinic on Campus at Murdoch University, as part of the ‘pre-’ assessment procedure. In the intake interview, the researcher followed the clinical interview protocol described previously and administered the standardised psychological questionnaires. The important individual administration procedures required for accurate and valid assessment as detailed by each of the authors of the instruments in the respective manuals was maintained within the context of the clinical intake interview. Immediately following the interview, physical measures of body composition were obtained at the Murdoch University Chiropractic Clinic. All anthropometric measurements were carried out by the Clinic Co-Director (Dr Lisa Caputo) and a chiropractic clinician specially trained in body composition assessments and experienced in working with overweight children. The same clinician carried out all measures to reduce possible inter-clinician variations. The child’s parent and the researcher were present at these times.

Child participants were also fitted with their pedometers and instructed to wear the pedometer until the end of the day, such as when getting ready for bed in the evening. The pedometer was to be worn by the participant from the time they woke up and dressed in the morning until the time they went to bed in the evening, on a continuous daily basis from the baseline period until the end of the program 20 weeks later. Participants were also instructed that the pedometer was to be removed and kept somewhere safe (e.g., with their parent or teacher) when the child took part in any activities involving water where the pedometer might get wet or sustain damage due to impact in rough play or games such as contact sports, and to make a note of these removals. Participants were also asked to keep a record of time spent in any activities that the participant may have engaged in that the pedometer did not record accurately (e.g., swimming, riding a bike, rollerblading). An equation for converting the time spent
in these activities to steps, originally used by Beighle and Pangrazi (2006, cited by Pangrazi, Beighle & Sidman, 2007) was used by the researcher and the final amount of steps was agreed to by each participant. The equation was \( \text{Converted Steps} = \frac{\text{Time spent in physical activity} - 14.5}{0.01}. \)

There were other potential sources of measurement error that participants needed to be made aware of. Participants were instructed to check regularly throughout the day that the pedometer case cover was closed and that the device was positioned correctly on the waistband such that it was not at an angle, sitting loosely or tilting forward as this could result in less movement being recorded. Participants were instructed to wear the pedometer on a belt or on a suitable waistband. The researcher modelled proper and appropriate use and asked participants to demonstrate the fitting, correct positioning and appropriate care and use of the pedometer. Participants and parents were given feedback and praised verbally by the researcher for correct and acceptable pedometer fitting and use. Training was accomplished at the initial intake interview and during subsequent home consultations until the procedure was demonstrated correctly without prompts and the researcher was satisfied the pedometer was being used appropriately by the participant.

4.3.1 Baseline phase.

The Baseline Phase (A) was a two week period (weeks 1-2) that began the day following the intake interview. Participants and their parents were instructed as follows:

“\( \text{This week and next week is for your child to be able to acclimatise to wearing the pedometer and for you both to practice taking the readings from it on a daily basis. We are also trying to get an idea of your child’s regular level of activity over a typical two-week period} \)” (MIP Manual, page 16).

Pedometers were not concealed during baseline or any part of the monitoring period, and participants were encouraged to check their pedometers regularly
throughout the day. The purpose was to help children establish a habit of self-monitoring PA on a daily basis, develop greater awareness of the link between their behaviour and the pedometer’s output and to make sure their device was being worn correctly and accurately recording their activity behaviour. As a result, all participants had access to immediate, but not moderated or interpreted, feedback of their pedometer data. This ensured that if there were any novelty effects of feedback on activity behaviour via pedometer use, these were controlled for when the intervention phase itself was introduced. However, the baseline phase could be conceptualised as a “pedometer only intervention” and if there were any increases in habitual physical activity levels as a result of reactivity, they were expected to be short lived (Tudor-Locke et al., 2009; Zizzi et al., 2006). It was also considered an important part of the intervention package for individuals to become skilled in collecting and recording their own data at an early stage so that the skills learned in the MIP could eventually become self-managed.

Parents were instructed to record pedometer steps per day and the equivalent distance ‘km’ covered on the recording sheet provided in the MIP Manual at the end of each day, along with any notable details such as the types of activities the participant engaged in that day. Parents were encouraged to find a time that would be suitable for the family at the end of each day and to try to keep the time of day for recording consistent. Once recordings were noted in the program manual the “reset” button on the pedometer was to be pressed to set the readings to zero ready for the next day of recording. Daily phone calls to parents were made to prompt completion of daily data recording in the program manual, obtain the pedometer readings and answer any questions they might have about the measuring system and discuss if any problems had arisen. The phone call aimed to be as brief as possible and to offer some non-contingent words of support and encouragement (such as, “Well done”, “That’s great” and “You
guys seem to be getting the hang of this”) in this early phase of the experiment. At no time during the baseline phase did the researcher provide feedback or enter into conversations about changes in a participant’s actual activity levels. Parents were also instructed not to formally display their child’s pedometer readings, to give any type of reinforcement and to refrain from discussing with their child what could be done to increase activity levels.

Weekly calibration tests to assess accuracy of the pedometer occurred during scheduled face-to-face home visits and on any subsequent request by the participant. The test involved the researcher shaking the pedometer to check internal mechanisms were moving correctly, and a 10 step walking test undertaken by both participant and researcher to compare steps taken with the record of steps on the device’s interface. The qualitative information documented in the MIP Manual about the types of activities the child participated in also provided a daily validity check of the pedometer data for that week. For example, if a child had noted participation in organised sports at school on a given day, then the pedometer data should indicate a spiked increase in habitual physical activity levels. If there was a spiked increase in habitual activity levels and no information had been documented, then a qualitative explanation would be sought after by the researcher from the child and/or parent during the weekly behavioural consultation / home visit. Also noted in this section of the manual were any periods where the pedometer had to be removed, such as for swimming, during the day.

The baseline phase continued until at least 14 days of pedometer recordings had been made. Some participants took longer than others to achieve this as they took some time to adjust to regularly wearing the pedometer as a part of their new daily routine.

4.3.2 Intervention phase.

The intervention phase was a 15 week period (week 3-18) that began immediately following the end of the baseline phase. The main component to be self-
managed by the participant was self-monitoring of PA with the pedometer and was largely established during the baseline phase. The additional intervention components of the MIP (feedback, goal setting, positive consequences and planning) were introduced in this phase. The weekly behavioural consultations with the researcher served as a valuable context to deliver the additional MIP components, which could be individualised within the home-based setting.

The first behavioural consultation was scheduled for the final day of baseline recording, so that the instructions for the intervention phase could be delivered. In this consultation participants were instructed how to incorporate the *My Movin’ It Chart* into their established daily routine of data recording as instructed on page 19 of the *MIP Manual*. The chart, plus stickers, glitter and pens were provided to child participants to decorate and individualise their charts. Activity data recorded in the MIP Manual during the baseline phase was transcribed onto the participant’s *My Movin’ It Chart* and was then hung in a prominent position in the house (see Appendix C). Participants were instructed to add to the chart on a daily basis, at the same time as recording pedometer data in the MIP Manual. The *My Movin’ It Chart* was an essential tool providing a visual record of daily pedometer steps over the entire MIP program. The chart was referenced during each behavioural consultation and could be referenced daily by participants, so they could have access systematic feedback about their daily PA habits, fluctuations and progress in the MIP. Most families, however, were inconsistent in charting pedometer data without help, and helping the child update their *My Movin’ It Chart* became the first task to complete during subsequent weekly behavioural consultations during the intervention phase.

The instructions given to participants were specifically designed to reflect the intention of the MIP program; that is, to emphasise that an increase in the participants’ PA behaviour was more likely to occur when children had support from their parent and
families; to develop skills to self-manage their increases in PA; and that desired, positive consequences followed their increases in PA. Participants were told that their pedometer step count at the end of the day was not a reflection of whether they were ‘good’ or ‘bad’ on any given day, and that the MIP was about a gradual shift in behaviour where they could set their own pace and remain in control of their progress. The story of ‘The Tortoise and the Hare’ was shared with participants to highlight the lesson about sustainable approaches to changes in physical activity behaviour. The instructions that relate to this aspect of the program can be found on pages 20-21 and pages 23-26 of the MIP Manual.

4.3.3 MIP Intervention Components

4.3.3.1 Weekly Behavioural Consultation.

The overall goal of the MIP was targeting daily increases in physical activity levels that could be achieved in small incremental stages relative to the participant’s baseline activity levels. The weekly behavioural consultation was a scheduled meeting between the researcher, the child participant and their participating parent with the purpose to assist with implementing the additional behavioural components of the MIP so that the child participant could achieve small, incremental increases in PA during the intervention phase. Behavioural consultations took place in the participant’s home and the researcher provided systematic feedback, assisted with goal setting, provided positive consequences, and assisted with planning. Examples of how these additional components of the MIP were implemented in the weekly behavioural consultations are discussed.

4.3.3.2 Self-monitoring PA

Parents assisted their child to record pedometer steps per day and the equivalent distance ‘km’ at the end of each day, along with any notable details such as the types of
activities the participant engaged in that day. This component was first established during the baseline phase and continued throughout the monitoring period.

**4.3.3.3 Feedback.**

Providing feedback involved analysing activity behaviour via the *My Movin’ It Chart* by counting data points above and below the target step count line, paying attention to the slope of the line, discussing any trends in the data and any differences between school days and weekend days, and discussing with participants and their parents/guardians how activity levels reflected the events of the week. If the chart had not been completed by the parent/guardian on a daily basis throughout the week, the researcher completed it with the parent/guardian and the child participant at the start of the consultation.

**4.3.3.4 Goal Setting.**

Setting personal step targets / goals for increasing more active behaviours in small increments was a weekly activity. For example, an easy method that most participants were willing to agree to on a weekly basis involved setting their step target for the forthcoming week based on their previous week’s performance. This was first established by averaging the participant’s baseline activity and drawing a line on their “My Movin It Chart”.

Step targets changed each week by averaging the participant’s activity from the previous seven day period. On a weekly basis, the goal was to “aim to achieve three days or more at the same level or above your average daily activity level from last week, to see the slope on your graph increase”. Further specific instructions given can be found on pages 20-21 and pages 23-26 of the MIP Manual.
4.3.3.5 Positive Consequences.

Achievement of daily step totals on or exceeding the daily step target was reinforced with specific verbal praise. In addition, a criterion for a tangible reward (a Lucky Dip Prize) was made contingent on the participant achieving their weekly activity goal. Participants had the opportunity to earn the right to draw up to two Lucky Dip Prizes at the next behavioural consultation. Further specific instructions given can be found on pages 20-21 and pages 23-26 of the MIP Manual.

The criterion for rewards could also be changed by the researcher or participant, depending on past performance and upcoming family schedules, and were agreed at the start of the week. Additionally, if a child had a particularly difficult week and had consistently not met the contingency for reward, then the researcher would find something new in the participant’s pedometer data to reward such as, an increasing trend, increase activity levels on weekends, even if particular PA levels were not high. Positive consequences in these situations included lots of verbal praise and in some cases a ‘surprise lucky dip’.

4.3.3.6 Planning.

A functional analysis of participants’ personal contextual factors was considered including discriminative stimuli (DS), consequences, and establishing operations that could be arranged to support more active alternative behaviours. For example, asking questions about how participants could make the most of the readily available opportunities to participate in PA arranged at school or with peers during lunch breaks, and at home after school.

Contingencies such that least preferred and more effortful activities were engaged in first before the more preferred and less effortful activities were identified. Examples included, going for a walk after school before sitting down to play games on
the computer, or organising to ride a bike to a friend’s house instead of playing with them at home.

Alternative behaviours that could accumulate more steps and that could increase contact with a greater variety and density of potential natural reinforcers in participants’ personal contexts were discussed. Examples discussed included, going to the shopping mall with their mother instead of waiting at home for mother to return with items from the shops, or creating a new game or obstacle course in the backyard from old toys that had not been used for some time.

Planning aids and memory cues to prompt more active behaviours were given. For example, making a plan to go for a walk with a family member and writing it down on a calendar, leaving ‘post-it note’ reminders in places of the house that they will be seen regularly, or creating a chart or timetable that specified what activities as selected from a list of activities on the “Things I do after school” poster would be completed in the after school time period.

Parents were responsible for supporting all components of the intervention by encouraging their child to achieve their daily targets, providing reinforcement on a daily basis contingent on chart success (e.g., by giving stickers and verbal praise), and talking to their child about how they might increase activity levels, and helping the child to actively problem solve if they were not increasing activity levels. Parents were encouraged to stick to plans where they had agreed to help the child be active, such as going for walks together, or driving their child to a place where they had planned to engage in PA behaviour. Instructions contained in the program MIP manual (see pages 20 to 21, and 24 to 25 in Appendix B) were referred to throughout consultations, as necessary, to reinforce both the roles of the parent and child, what to expect from the intervention, and to encourage an open and inquisitive stance throughout the program.
Following the mid-way point successful efforts made to individualise the application of the MIP informed planning for the second half of the intervention. Physical measures of body composition were repeated mid-way through the intervention, at the end of week 10. These measures took place in a clinic room at the Murdoch University Chiropractic Clinic and were carried out by the same chiropractic clinician who obtained the baseline measurements, and is specially trained in body composition assessments and experienced in working with overweight children. The child’s parent and the researcher were also present.

In the final week of the intervention phase, a review of program performance, planning for maintenance and relapse prevention took place during the behavioural consultation for that week. The researcher gave verbal instructions to continue everything they were doing and to stay as close as possible to the program. They were specifically asked as a minimum to continue self-monitoring and charting pedometer data, but additionally were encouraged to continue to set goals, establish a system of reinforcement and reward, and plan ahead how to achieve their PA goals.

Physical measures of body composition were repeated at the conclusion of the intervention phase again in a clinic room at the Murdoch University Chiropractic Clinic and were carried out by the same chiropractic clinician who obtained the baseline and mid-intervention measurements, with the child’s parent and the researcher also present. Post- intervention psychological measures were obtained by remote administration, whereby the questionnaire was completed by the child with the assistance of their parent, and returned to the researcher by mail.

4.3.4 Maintenance phase.

The maintenance phase was a two week period (weeks 19-20) that began immediately following the final week of the intervention phase. The conditions established in the baseline phase (habitual pedometer wearing, daily self-monitoring and
charting) and in the intervention phase (exemplified in points 1-4 outlined above) were encouraged to be self-managed by the family, but without the direct weekly support from the researcher (i.e., without the weekly behavioural consultation). Written instructions given to participants regarding the maintenance phase can be found on page 43 of the *MIP Manual* in Appendix B. Data were collected only at the end of the phase in a final home consultation.

Participants had the option to continue longer in the MIP under maintenance conditions if they wished. However, none accepted this offer. Two participants continued monitoring PA levels until the end of the program, one participant terminated their participation in the MIP during the intervention phase, and one participant stopped monitoring their PA levels after only one week in the maintenance phase.

### 4.4 Design and Analysis

Four single-case experimental evaluations were carried out. Data collected in the form of continuous pedometer readings (daily step totals on weekdays and weekends), and assessments of accepted physical measures and standardised psychological questionnaires thought to be sensitive to changes in PA levels were the dependent variables. The independent variable was time, where the MIP utilised a design that included a baseline, intervention and maintenance phase. Daily step totals were charted across the three phases of the MIP to provide a visual representation of change over time between each phase of the MIP. Physical measures were administered at pre-, mid- and post-intervention points and psychological measures were administered at pre- and post-intervention time periods.
Chapter 5

Study I: Results and Discussions for Single-Case Experimental Evaluations of the MIP

Results from the four participants who remained in the study for at least 50% of the program were included in the analysis and are reported separately as single cases. Descriptive data and relevant background information pertaining to the situation of the participant at the time of measurement are provided for each single case to capture a rich snapshot of the constellation of specific factors that may be relevant to the participant’s physical inactivity problem and their response to the MIP.

Pedometer data are reported here as the primary indication of behaviour change, with regards to increasing physical activity levels. Pedometer data were removed if a child had only worn the pedometer for half the day, or the pedometer was not counting steps properly due poor positioning on clothing, and also in instances when a participant reported that he/she had been sick. As a result, the line representing activity data in the graphs may appear to be broken due to this data cleaning process. A visual analysis of the graphs of pedometer data proposed by Parsonson and Baer (1978) is made to analyse activity data during each phase of the study.

Results of physical and psychological measures are monitored as secondary outcomes of the MIP. These are reported predominantly as raw scores and percentile rankings pre- and post-intervention. Notable changes are defined as greater than or equal to 10% change and/or a clinically meaningful shift in diagnostic classification. Thus, for example, shifts in BMI classification might be recorded as from “obese” to “overweight” or on psychological measures from “clinical” to “normal”. The time between pre- and post-intervention assessments differed slightly for each participant but
typically occurred 4 ½ months following the initiation of the MIP. One participant’s
(Anna) post-physical measurements took place prior to her completion of the MIP, 3
months following the commencement of monitoring.

5.1 Daniel

5.1.1 Case background.

Daniel, a 10-year-old Caucasian boy, began participation in the MIP after his
mother read a promotional poster for the study displayed in the family’s local fast food
restaurant. Daniel lived with his mother (45 years), father (47 years) and younger sister
(8 years) in a four bedroom single-level house. They lived in a southern coastal suburb
of Perth, Western Australia, considered to be of a median (i.e. neither particularly
disadvantaged nor advantaged) socio-economic status (SES) (ABS, 2011). There was a
large open playing field with cricket nets two streets away from the family home, and
the street they lived in was a cul-de-sac. Daniel was in Year 5 at the local government
primary school. Daniel’s mother reported that he had a history of taking many days off
school, and last semester he had a total of 19 days away from school. Daniel’s mother
worked in the school canteen managing the preparation of school lunches, while
Daniel’s father was a plant operator.

Daniel’s mother reported that she first noticed Daniel had an “inactivity
problem” when he was seven years old and in Year 2 at school. She believed it had to
do with his poor co-ordination and that he “couldn’t run properly”. Daniel’s mother also
reported an incident that occurred 2 years ago when Daniel was aged 8 years, competing
in a running race at school. Everybody else finished before him while he had only
completed half of the race, and he came last in a particularly humiliating way. Daniel
has also had problems sleeping alone since he played a “scary” Xbox game two years
ago. Daniel’s mother reported that recently he started going to sleep in his own room
(previously he was co-sleeping with his parents) and his mother reported that he watches television in his bedroom when he has difficulty falling asleep. Daniel’s mother reported she also suffers from insomnia.

Three months prior to starting the MIP a General Practitioner (GP) assessed Daniel as being overweight and having “borderline” Type 2 diabetes. The GP recommended that Daniel’s mother should monitor his diet and recommended one hour of activity each day. Daniel’s mother reported that they have found the activity component to be the “hardest part”. Daniel’s mother reported several character traits of Daniel that have made improvement difficult: Daniel does not like change and typically has a low mood. Daniel’s mother felt that he had not engaged in resolving his inactivity problem and said that he had “dug himself in a hole and is scared to come out”. Daniel’s mother reported that she often argued with Daniel to “get him to go outside” and “then he’ll go and sulk and start to cry”. Recently Daniel’s mother enrolled him in tennis lessons and she “made him go until the end”, attending 10 lessons in total. She had also said she “made” Daniel accompany her on shopping errands.

Daniel’s favourite activities included playing computer games on the PC or Xbox, and watching TV and/or movies with his mother. When Daniel came home from school he spent up to three to four hours a night on the computer. He also liked to help in the kitchen with preparing food. Daniel’s least favourite activities were anything physically demanding and going to school. Daniel did not have many friends and spent most of his free time with his 12-year-old cousin who also enjoys playing computer and Xbox with Daniel, his younger sister or his parents. When asked to rate how active she considered her child on a scale of 1 (= inactive) to 10 (= very active), Daniel’s mother rated Daniel as 1.

There was a complex mix of several salient factors contributing to Daniel’s physical inactivity problem. While there was plenty of opportunity in Daniel’s
environments (both at school and at home) to be more physically active, the social family dynamic may have subtly reinforced patterns of inactivity. For example, being older parents, it may have been easier for Daniel’s Mother and Father to have a child with low energy levels and thus may not have encouraged or modelled physical activity behaviours nor limited Daniel’s inactive behaviours strictly enough. Daniel also seemed to have some untreated emotional sensitivity / anxiety problems, particularly in social situations with peers. In response, Daniel appears to have developed a habit of avoiding situations and/or things that are difficult or that produce anxiety, and prefers to withdraw into a world of computer games and television.

5.1.2 Daniel’s pedometer readings.

5.1.2.1 Overall steps

Daniel’s baseline consisted of 11 days of activity monitoring with three days where he forgot to wear his pedometer, and was considered sufficiently representative for baseline measurement of Daniel’s activity levels. Daniel’s activity levels showed considerable variability during this baseline period and ranged from 2,000 steps a day to almost 10,000 steps a day. Wearing a pedometer and filling in the MIP Manual alone (phase A) lead to a small upward trend in Daniel’s daily activity as measured by the pedometer, and a 36.98% (or 1487 more steps per day) average increase in steps from week 1 to week 2 of baseline. Compared to other children his age, Daniel’s average physical activity levels during baseline were very low. The mean daily step count for 10 year-old Western Australian boys ($n=181$) is 12,303 on weekdays, and 11,434 at weekends. Overall, he was in the bottom 10% of his age group for pedometer measured daily steps (Hands et al., 2004b). Daniel’s baseline average also fell short of some of Tudor-Locke et al.’s (2011) guidelines for ideal daily pedometer step counts for boys aged 12 years and under of 15,000 steps per day.
Compared to the baseline holiday period the introduction of the intervention phase corresponded with an immediate increase in Daniel’s daily activity levels which maintained for several consecutive days. An increasing trend developed which led to an average increase of 49.01% (or 2302 more steps per day) above mean baseline steps by the conclusion of week seven. This was followed by a slight decrease in trend, yet by the conclusion of week 10 activity levels had rebounded to where he was maintaining an average increase in physical activity of 47.19%, or 2217 more steps per day over baseline at the end of week 10.

Daniel’s daily activity levels as measured by the pedometer during each phase of the experiment can be seen in Figure 5.1.
Figure 5.1: Daniel's total daily steps during the experimental phases of the MIP: A = baseline; B = intervention; C = maintenance. Black angled lines indicate the general trend in steps during each phase. Grey shaded areas indicate school holiday periods. Grey line at top represents Tudor-Locke et al.’s (2011) daily pedometer step threshold for males equivalent to PA recommendations for ‘sufficient activity’ for health.
Towards the end of the 12th week of monitoring (and 10 weeks of intervention), Daniel’s physical activity levels began to show a decreasing trend, and at the conclusion of week 14, Daniel was maintaining an average increase of only 38.54% (or 1811 more steps per day) above the baseline mean, which is a 5.87% decrease (or 406 less steps per day) in activity levels from the end of week nine. Table 5.1 shows the mean daily steps achieved in each phase of the experiment and also the percentage increase in activity level achieved in each phase compared to the baseline.

Table 5.1

Daniel’s mean daily steps for each phase of the intervention and the percentage increase in activity levels (steps) achieved compared to baseline.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Mean steps/day</th>
<th>Percentile Rank‡</th>
<th>% increase</th>
<th>Steps/day increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>4,697</td>
<td>&lt;10th</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>7,327</td>
<td>10th</td>
<td>+56%</td>
<td>+2630*</td>
</tr>
<tr>
<td>Maintenance</td>
<td>9,232</td>
<td>20th</td>
<td>+97%</td>
<td>+4535*</td>
</tr>
</tbody>
</table>

* Indicates an increase of >10% from baseline steps.
‡Percentile rankings refer are based on results from the Western Australian 2003 Child and Adolescent Physical Activity and Nutrition Survey (CAPANS) (Hands et al., 2004b).

However, at the start of week 15, Daniel’s activity levels recovered and began the steepest increasing trend in activity levels for the whole monitoring period. Between weeks 15 to 18, Daniel achieved an average increase in physical activity of 79.64% (or 3741 more steps per day) above his mean baseline level. Daniel’s range between highest and lowest steps on any given day in the latter half of the intervention period was also narrower and more stable than in other sections of the monitoring period, where a high degree of variability is evident.

When the MIP entered the maintenance phase (C) and weekly consultations with the researcher ceased, Daniel’s activity levels continued to increase, although not quite
at the same pace that was achieved during the intervention phase, with activity levels appearing to stabilise as evidenced by the trend in the data flattening out.

5.1.2.2 Steps on weekdays and weekends

At baseline, Daniel’s physical activity levels on weekends and weekdays showed almost no difference; however, as Daniel progressed though the MIP intervention phase a discernible difference appeared. Differences between steps walked on weekdays and steps walked on weekends can be seen in Figure 5.2. Trends in steps walked on weekdays and weekends typically mirrored each other during the intervention phase from week five onwards.

However, during the intervention phase, Daniel achieved a considerable increase in mean steps on weekdays compared to the increase he achieved in mean steps on weekends, relative to baseline levels. While he continued to show increases in steps on both weekdays and weekends during the maintenance phase, his weekday physical activity levels continued to exceed his weekend physical activity levels.
**Figure 5.2:** Daily total steps walked on weekdays and on weekends, during each phase of the MIP: A = Baseline, B = Intervention, C = Maintenance. Black angled lines indicate the general trend in steps during each phase. Grey shaded areas indicate school holiday periods. Grey line at top represents Tudor-Locke et al.’s (2011) daily pedometer step threshold for males equivalent to PA recommendations for ‘sufficient activity’ for health.
Daniel’s mean steps per day on weekdays and weekends and their variation from the baseline mean during the intervention and maintenance phases can be seen in Table 5.2.

**Table 5.2**

_Daniel’s mean steps per day on weekdays and weekends and their variation from the baseline mean during the intervention and maintenance phases._

<table>
<thead>
<tr>
<th>Phase</th>
<th>Weekdays</th>
<th></th>
<th>Weekends</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean steps/day</td>
<td>% increase</td>
<td>Steps/day increase</td>
<td>Mean steps/day</td>
</tr>
<tr>
<td>Baseline</td>
<td>4,765</td>
<td></td>
<td></td>
<td>4,579</td>
</tr>
<tr>
<td>Intervention</td>
<td>8,129 +71%</td>
<td>+3364*</td>
<td>5,446 +19%</td>
<td>867*</td>
</tr>
<tr>
<td>Maintenance</td>
<td>9,882 +107%</td>
<td>+5117*</td>
<td>7,608 +66%</td>
<td>3029*</td>
</tr>
</tbody>
</table>

* Indicates an increase of >10% from mean baseline steps.

### 5.1.3 Daniel’s physical and psychological measures.

The results of Daniels’s physical assessments are presented as raw scores, whereas raw scores and percentile rankings are displayed for the standardised psychological measures. Changes in all measures from pre- to post- assessment points are also presented. The time between pre and post measurement periods was approximately 4 ½ months (19 weeks), with the mid intervention measures taking place at 14 weeks. Notable changes were defined as greater than or equal to 10% change and/or a clinically meaningful shift in diagnostic classification and are indicated.

#### 5.1.3.1 Physical measures

Changes in Daniel’s measures of body composition can be seen in Table 5.3. An increase in Daniel’s height, weight, and a change in BMI classification from “overweight” to “obese” was observed from pre-post measurements. Increases in waist
and hip circumferences and the bicep skin fold measurement suggest an overall increase in Daniel’s body size at the conclusion of the MIP. Changes in the desired direction were seen on measures of waist/hip ratio and the sum of skin folds. A notable change in a desired direction was seen in the sub-scapular skin fold measurement, with an almost notable decrease in the sum of skin folds.

Table 5.3.

Daniels’s body composition measures prior to baseline (pre), during the intervention (mid) and at follow-up (post-maintenance).

<table>
<thead>
<tr>
<th>Physical Measure</th>
<th>Pre</th>
<th>Mid</th>
<th>Post</th>
<th>Change from Pre-Post</th>
<th>Change in desired direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Mass Index (BMI)</td>
<td>24.12</td>
<td>24.48</td>
<td>25.44</td>
<td>+1.32*</td>
<td></td>
</tr>
<tr>
<td>BMI Classification‡</td>
<td>overweight</td>
<td>overweight</td>
<td>obese</td>
<td>+ *</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>54.27 kg</td>
<td>56.53 kg</td>
<td>58.40 kg</td>
<td>+4.13 kg*</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>1.50 m</td>
<td>1.51 m</td>
<td>1.515 m</td>
<td>+0.015 m</td>
<td>√</td>
</tr>
<tr>
<td>Waist to Height Ratio (WHtR)</td>
<td>62.35</td>
<td>63.03</td>
<td>63.72</td>
<td>+1.37</td>
<td></td>
</tr>
<tr>
<td>Waist/Hip ratio (WHR)</td>
<td>1.057</td>
<td>1.058</td>
<td>1.05</td>
<td>-0.007</td>
<td>√</td>
</tr>
<tr>
<td>Waist circum. (WC)</td>
<td>93.53 cm</td>
<td>95.17 cm</td>
<td>96.53 cm</td>
<td>+3.00 cm</td>
<td>√</td>
</tr>
<tr>
<td>WC &gt;90th%ile</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip circum. (HC)</td>
<td>88.5 cm</td>
<td>89.9 cm</td>
<td>91.9 cm</td>
<td>+3.40 cm</td>
<td>√</td>
</tr>
<tr>
<td>Sum of 4 Skin Folds</td>
<td>138.6 mm</td>
<td>131.97 mm</td>
<td>127.01 mm</td>
<td>-11.59 mm</td>
<td>√</td>
</tr>
<tr>
<td>Sum of 3 Skin Folds</td>
<td>99.3 mm</td>
<td>96.3 mm</td>
<td>91.4 mm</td>
<td>-7.9 mm</td>
<td>√</td>
</tr>
<tr>
<td>Triceps Skin Fold</td>
<td>32.7 mm</td>
<td>32.2 mm</td>
<td>30.7 mm</td>
<td>-2 mm</td>
<td>√</td>
</tr>
<tr>
<td>Biceps Skin Fold</td>
<td>24.3 mm</td>
<td>29.0 mm</td>
<td>29.0 mm</td>
<td>+4.7 mm*</td>
<td>√</td>
</tr>
<tr>
<td>Subscapular Skin Fold</td>
<td>42.3 mm</td>
<td>35.3 mm</td>
<td>31.7 mm</td>
<td>-10.6 mm*</td>
<td>√</td>
</tr>
<tr>
<td>Suprailiac Skin Fold*</td>
<td>39.3 mm</td>
<td>35.7 mm</td>
<td>35.7 mm</td>
<td>-3.6 mm</td>
<td>√</td>
</tr>
</tbody>
</table>

‡Body Mass Index (BMI) classification based on Cole et al. (2000).

+ Suprailiac skin fold was a difficult area to measure due to Daniel’s sensitivity (ticklish), and it was not possible to obtain a reliable reading at the post-intervention assessment. The value is substituted from Mid-intervention assessment in order to obtain a “Sum of Four Skin Folds” value. This area is also usually a very large skin fold, so more difficult to grasp between callipers.

*Indicates a change of >10% and/or a clinically meaningful shift in diagnostic classification.
5.1.3.2 Psychological measures

Daniel’s responses on the Child Depression Inventory (CDI) showed a notable change in the desired direction from pre- post- measurement points. Daniels Total score reduced considerably, indicating a clinically significant shift from the clinical range to the normal range. The biggest shift was on the Anhedonia sub-scale with smaller changes on the Negative mood and Interpersonal problems sub-scales, although all three showed a clinically significant shift from the clinical range to the normal range from the pre-post intervention assessment points.

Results from the Piers-Harris Self-Concept Scale also reflect positive changes in the desired direction. A clinically significant increase in Daniel’s Total self-concept score places him within the normal range at the post measurement point. The greatest increase was seen on the Physical Appearance and Attributes sub-scale. Relevant items on this scale which Daniel had initially responded to negatively had positive responses following his participation in the MIP, on items such as, “I am good looking”, “I have a pleasant face” and “I am strong”. Table 5.4 shows Daniel’s raw scores and percentile rankings from standardised psychological assessments at baseline (pre), and at the end of the maintenance phase (post).
Table 5.4.

Daniel’s raw scores and percentile rankings from standardised psychological assessments at baseline (pre), and at the end of the maintenance phase (post).

<table>
<thead>
<tr>
<th>Psychological Measure</th>
<th>Pre</th>
<th>Post</th>
<th>Change from Pre-Post</th>
<th>Change in desired direction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Raw Score</td>
<td>Percentile Rank</td>
<td>Raw Score</td>
<td>Percentile Rank</td>
</tr>
<tr>
<td>Child Depression Inventory (CDI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>29‡</td>
<td>75&lt;sup&gt;th&lt;/sup&gt;</td>
<td>15</td>
<td>56&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Negative mood</td>
<td>6‡</td>
<td>70&lt;sup&gt;th&lt;/sup&gt;</td>
<td>2</td>
<td>49&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Interpersonal problems</td>
<td>3‡</td>
<td>64&lt;sup&gt;th&lt;/sup&gt;</td>
<td>2</td>
<td>57&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Ineffectiveness</td>
<td>4</td>
<td>59&lt;sup&gt;th&lt;/sup&gt;</td>
<td>4</td>
<td>59&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Anhedonia</td>
<td>13‡</td>
<td>86&lt;sup&gt;th&lt;/sup&gt;</td>
<td>5</td>
<td>56&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Negative self-esteem</td>
<td>3</td>
<td>56&lt;sup&gt;th&lt;/sup&gt;</td>
<td>2</td>
<td>51&lt;sup&gt;st&lt;/sup&gt;</td>
</tr>
<tr>
<td>Piers-Harris 2, Self-Concept Scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25‡</td>
<td>&lt;5&lt;sup&gt;th&lt;/sup&gt;</td>
<td>35</td>
<td>16&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Behavioural adjustment</td>
<td>9</td>
<td>18&lt;sup&gt;th&lt;/sup&gt;</td>
<td>11</td>
<td>34&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Intellectual and school status</td>
<td>5‡</td>
<td>5&lt;sup&gt;th&lt;/sup&gt;</td>
<td>7‡</td>
<td>12&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Physical appearance and attributes</td>
<td>3‡</td>
<td>7&lt;sup&gt;th&lt;/sup&gt;</td>
<td>7</td>
<td>31&lt;sup&gt;st&lt;/sup&gt;</td>
</tr>
<tr>
<td>Freedom from anxiety</td>
<td>8</td>
<td>24&lt;sup&gt;th&lt;/sup&gt;</td>
<td>10</td>
<td>42&lt;sup&gt;nd&lt;/sup&gt;</td>
</tr>
<tr>
<td>Popularity</td>
<td>2‡</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt;</td>
<td>4‡</td>
<td>8&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Happiness and satisfaction</td>
<td>5‡</td>
<td>10&lt;sup&gt;th&lt;/sup&gt;</td>
<td>7</td>
<td>24&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Note. On the CDI, higher scores indicate greater clinical concern. On the Piers-Harris lower scores indicate greater clinical concern.
‡ indicates a score in the clinical range
*Indicates a change of >10% and/or a clinically meaningful shift in diagnostic classification

5.1.4 Discussion of Daniel’s response to the MIP.

The effect of the MIP on Daniel’s physical activity is best demonstrated in relation to his baseline levels. Daniel was maintaining a very low level of PA compared to his same age peers at baseline, and his mother noted on weekends he can spend up to 6 hours or more on the computer, mostly playing internet games with other ‘online’ playmates. However, baseline data also showed Daniel was capable of achieving higher activity levels given certain conditions. For example, on the Saturday of week two, Daniel obtained a relatively high step count. It was noted that Daniel had been taken out

135
of the house all day by his family and accompanied them on an all-day shopping trip visiting two large shopping malls and as a consequence he did lots of walking.

The extent to which the home-based MIP helped Daniel increase his daily step counts to recommended ‘healthy’ daily targets can be seen with a steadily increasing trend in daily steps across the intervention phase. However, his levels did not reach Tudor-Locke et al.’s (2011) recommended pedometer step thresholds for health. Daniel’s overall mean PA levels increased from being below the 10th percentile during baseline to being on the 10th percentile during the intervention phase, compared to other Western Australian boys his age. Early on during the intervention phase, there were periods of variability and periods of stability with regards to activity levels. Based on the anecdotal evidence from the behavioural consultations, the variability of this particular section of the data appears to reflect the typical occurrences of childhood, and included days when Daniel was feeling sick and was absent from school (thus there are some days with missing data) and days when increased activity on school days was seen due to the commencement of athletics training during school hours. Early on in the intervention phase, Daniel experienced recurrent headaches and had a total of nine days off school in 10 weeks.

The day of the week had a significant relationship with Daniel’s activity levels, where weekends and days when Daniel was absent from school were usually days when pedometer counts were much lower than on school days. On days when Daniel had increased interaction with peers and other family members, his activity levels also seemed to increase. This suggested that for Daniel, attendance at school, and peer and family interaction, were powerful variables that affected his daily physical activity levels. The figures show there were differences in the pattern of steps on weekdays compared to weekends. At the outset of the MIP intervention phase a period of increased stability and increased activity levels is evident in steps on weekdays, while
levels on weekends remain very low, suggesting the MIP was not immediately effective at increasing Daniel’s steps on weekends. This was highlighted to Daniel and his family when providing feedback on PA levels in a behavioural consultation. Daniel’s PA levels on weekends then showed a substantial increase, which was then maintained throughout the intervention phase. This was highlighted in a subsequent behavioural consultation and Daniel’s mother reported that the family had changed from typically being “couch potatoes” on weekends, to where Daniel’s parents were engaging the whole family in fun activities on the weekends. Beginning in week five, each weekend was occupied with a family outing (e.g., museums, the zoo). Daniel’s mother reported that they never used to do that before and this change was likely due to the systematic feedback provided during the behavioural consultation, based on data obtained from daily self-monitoring with the pedometer.

A change in Daniel’s approach to physical activity was also observed around this time. For example, in week seven Daniel was allowed to take the day off school (at his request) to avoid participating in the school ‘cross country’ run. However, in week eight Daniel chose to attend school on the day of the school ‘fun run’ (where children run a considerable distance, comparable to a ‘cross country’), and managed to achieve his highest step count for the entire monitoring period. Instead of habitually avoiding such activities, it appeared as though Daniel was now willing to approach situations at school where he could participate in physical activity.

During the middle part of the intervention phase, around the time when school holidays began, Daniel was continuing to struggle to achieve his daily step targets until he reached another low point in week 13. Target setting was altered as Daniel found it punishing when his target activity level was reduced to a number below the previous week, as happened following his setback in week 8 when he did not maintain his activity levels. Thus, while Daniel struggled in the middle part of the intervention phase
to achieve his targets, the targets were allowed to plateau until his activity levels came
more under control. Modifying target setting reflects good clinical practice, where a
client can take time to demonstrate mastery over one stage, before progressing to the
next (Sulzer-Azaroff & Mayer, 1991). From week 14 onwards, Daniel’s activity levels
began to recover and his daily step target began to increase again, in a more paced
fashion. Additionally, towards the end of the MIP, Daniel’s mother began taking him on
errands when he was absent from school, thus exposing him to situations involving
physical activity even if he was absent from school.

The MIP approach remained effective even when Daniel and his mother were
left to continue monitoring his activity data and fully self-manage PA increases using
the additional components of the MIP through the maintenance phase. The increasing
trend in daily steps in the intervention phase can be seen to cross over to the
maintenance phase, during which overall mean PA levels increased again compared to
levels in the intervention phase. Though these levels did not reach Tudor-Locke et al.’s
(2011) recommended pedometer step thresholds for health, Daniel’s overall mean PA
levels increased from being on the 10th percentile during the intervention phase to being
on the 20th percentile during the maintenance phase, compared to other Western
Australian boys his age (Hands et al., 2004b).

While Daniel demonstrated significant increases in his activity levels during the
MIP, it is unclear what effect this had on his measures of physical health. Beneficial
changes to Daniel’s measures of physical health included a slight reduction in the
waist/hip ratio, as well as notable reductions in the sub-scapular skin fold measure
resulting in a reduction in the sum of skin folds. However, his body mass continued to
increase throughout the MIP and his BMI crossed the classification threshold from
‘overweight’ to ‘obese’. This would typically be seen as unfavourable. However, in
light of the changes to skin folds, there may have been slight changes to his body
composition. Thus, while Daniel’s body size increased overall it could be hypothesised
that this was due to an increase in bone and muscle mass as opposed to adipose tissue.

With regards to Daniel’s psychological well-being, there were measureable,
beneficial changes observed alongside Daniel’s increase in PA levels during the MIP.
At baseline Daniel’s psychological well-being was considered poor, with high scores on
the Child Depression Inventory (CDI) and low scores on the Piers-Harris (P-H) Self-
Concept Scale. When retested following the MIP, his depression score had reduced
significantly shifting from the clinical range to the normal range. The biggest shift on
the ‘Anhedonia’ scale of the CDI suggests that at the conclusion of the MIP, Daniel’s
ability to enjoy life increased significantly. Daniel’s Self-Concept score had also
increased significantly, and was now within the normal range. The greatest increase was
on the ‘Physical Appearance and Attributes’ scale of the P-H and indicated that Daniel
was feeling more positive about his appearance and his physical strength following his
participation in the MIP.

In behavioural consultations with Daniel and his mother, several significant
barriers to further increasing PA levels were highlighted. Daniel’s father was unable to
spend much time with Daniel during the MIP, nor was he able to get involved in any
physically active outings specially with his son, and this was highlighted as significant
barrier to further PA increases. For this family in particular, it might have helped to
ensure there was more direct involvement of Daniel’s father in the MIP. For example,
this could have been made contingent on Daniel’s PA increases, where family outings
and special “father and son time” could have been included as lucky dip prizes.

Daniel also reported that when he experienced difficulty in interacting with
peers; for example, during recess and lunch break he would often withdraw from the
playground and spend time around the school canteen where his mother worked.
Daniel’s mother also confirmed this. Daniel’s results might have shown improvement
had he been able to overcome the difficulty he experiences in social situations, particularly when interacting with peers at school. Daniel’s mother attempted to help by being less available to him at school. Daniel reported sometimes he was quite distressed, particularly if he felt rejected by his peers after attempting to “join in” with play. Some efforts were made to coach Daniel in behavioural consultations about what activity options he had in the playground and what he could do to manage his feelings. However, it was acknowledged that overcoming this particular barrier may take some time. It is likely that Daniel’s excessive sedentary behaviour, particularly the time he spent playing internet games with ‘online’ friends had a distinctly social function, and was probably maintained by the lack of more socially rewarding experiences with his peers at school.

Overall, it can be concluded that the MIP had a beneficial effect on Daniel’s daily PA as indicated by increased mean steps, and compared to other Western Australian boys his age Daniel’s PA levels shifted from below the 10th percentile at baseline to the 20th percentile at maintenance. Beneficial effects on health and well-being were also observed, with changes in the desired direction on WHR and skin folds as well as a decrease in his depression score and an increase in his self-concept score. However, this case study also identified some complexities (such as dynamics within the family and Daniel’s ability (or lack thereof) to interact socially with his peers) which were not addressed by the intervention but are likely to have affected the outcome measures.

5.2 Anna

5.2.1 Case background.

Anna, an 8-year-old Caucasian girl, came to participate in the MIP after her mother read about the program in her primary school newsletter. Anna was in Year 3 at
the local government primary school. Anna lived in a large four-bedroom, two-storey house with her twin brother, mother and father. The house took up most of the approximately 500sqm block, though the back yard did have room for an outdoor spa, and both covered and uncovered areas including a small grassed area. The house was situated in a quiet, relatively newly built neighbourhood considered to be of median SES, where the houses are constructed around a private golf course. Anna’s mother (42 years old) worked from home as a beauty and nail therapist, while Anna’s Father (43 years old) was currently working in car sales. Anna’s mother and father originated from England, settling in Australia before the birth of their children. Their extended family lives in England.

Anna’s mother reported that she first noticed Anna’s weight and inactivity problem when she was about 6 years old, believing the problem was caused by Anna’s preference for “sit-down types” of activities and predominantly feeling tired. When Anna was 5 to 6 years of age she suffered recurrent ear infections related to problems with her adenoids and tonsils, which resulted in sleep apnoea. Anna’s mother also reported that at this time Anna was “not sporty”. The family consulted with a dietician one year ago on the recommendation of their General Practitioner; however, the mother reported that the dietician “felt Anna’s diet was fine”. The family also tried a ‘skipping chart’, which was successful in increasing Anna’s activity levels. However, the intervention trailed off as the family became inconsistent with completing the chart.

Anna’s father was reportedly “a bit strict about eating, but tried not to make a big deal of it”, and said all members of his family are “overweight and overeat”. Anna’s brother has been known to occasionally tease his sister about her body. Anna’s mother reported that Anna was unhappy about her weight and body shape and has been bullied at school because of it. Anna’s mother reported that she tried to initiate sport with Anna, but thought that Anna not participating in any structured activities after school is not
helping the situation. Anna wanted to take part in more activity programs after school, but reported she felt uncomfortable in those situations, especially when she can be compared to other girls.

Anna enjoyed craft activities, playing with her dolls, cooking, skipping and dancing. The family had a large pet dog, and Anna spent most of her free time around the house or in the backyard playing with the dog. Other favourite activities of Anna’s included playing in the backyard with her with brother and watching DVD’s with her parents. Anna has been avoiding competitive sports, particularly running. Anna’s mother reported being very enthusiastic about helping Anna incorporate more physical activities into her daily life, but did not want to push her to participate in competitive sport at this time as she has been bullied by her peers in the past for a lack of physical ability. Anna also has a history of being bullied at her previous school, and her parents decided to change schools when Anna was in preschool. Anna’s mother reported that Anna had “a few nice friends” from school and she regularly encourages after-school play dates.

Anna’s mother reported that Anna is typically a “good sleeper” but is slow to get out of bed in the morning, and needs significant prompting to get ready for school in the mornings, as she often complains about being tired. Anna’s mother drives both children to and from school as it is not close enough to walk. Anna’s mother reports that she has observed Anna seems to be “a bit of a loner at school, and doesn’t walk into the classroom confidently”. After school, Anna’s mother picks the children up from school and they spend some time together at home having a snack before Anna goes to play with her dog. If she is tired in the afternoon she watches TV. When asked how physically active she would rate herself on a scale she felt she was a 3 out of 10, where a rating of 10 is extremely physically active. Anna reported enjoying being physically
active and associated feelings such as “fun” and “happy”. She also said, “I want to do some more of it and get whoever is playing with me to keep playing with me”.

The salient factors in Anna’s case contributing to her physical inactivity problem are similar to those identified in Daniel’s case. For example, Anna also has an unresolved social anxiety problem, particularly in situations involving competition with peers. In response, the family continue to avoid these situations, and they have not found suitable replacement activities that can meet Anna’s need for stimulating social relationships without the emphasis on competition. Additionally, despite their home environment being surrounded by plenty of opportunity to be more physically active (e.g., on the golf course), the social family dynamic and family routines may have subtly reinforced Anna’s inactivity behaviours. For example, being older parents, Anna’s mother and father may not have modelled physical activity behaviours sufficiently enough to encourage Anna to be more physically active or willing to participate in competitive sports. The house was also in a newer housing development - typically developed around a reliance on the car for transport – and few amenities were within walking distance.

5.2.2 Anna’s pedometer readings.

5.2.2.1 Overall steps

Anna terminated her participation in the program prematurely, and activity monitoring ceased before the planned maintenance phase could begin. However, it was decided Anna’s activity data was still of value to report and that enough data were gathered in order to adequately evaluate the effect of the MIP with this participant. Anna’s baseline data is based on 14 days of continuous activity monitoring. Anna’s baseline shows some variability, with total daily steps ranging between 12,254 and 2,794 steps a day. Wearing a pedometer and filling in the MIP Manual alone (phase A)
did not lead to any increases in Anna’s daily activity as measured by the pedometer, in fact activity levels appear to decline in the second week of the baseline phase.

The mean daily step count for 8 year-old Western Australian girls is 9,989 steps per day. In comparison, Anna’s average baseline activity level is not far below this level and her mean steps during the baseline phase would be considered to fall above the 30% percentile (Hands et al., 2004). However, Anna’s baseline activity levels still fall short of current pedometer recommendations of 12,000 steps per day for children under 12 years of age (Adams et al., 2009; Tudor-Locke et al., 2011).

With the introduction of the additional components of the MIP during the intervention phase, Anna’s daily activity levels begin to trend upwards in a relatively steep and stable fashion. The variability of Anna’s daily activity levels reduced considerably, with a range of only 1,588 steps between her lowest and highest steps counts during the 5th week of monitoring which was the third week of the intervention. At this point, Anna was walking an average +2,593 steps more per day, which was a 31.98% increase from her baseline activity level. Anna’s daily activity levels as measured by the pedometer during the MIP can be seen in Figure 5.3. At the beginning of the 5th week of the intervention (7th week of monitoring) Anna’s increasing trend in activity levels begins to flatten, and activity levels stabilise around 11,000 steps per day. Variability in activity levels returns in week 8 and this continues to increase until the end of the monitoring period, ranging from a daily maximum of 15,714 steps to a daily minimum of 8,571. Her lowest data point was still
Figure 5.3. Anna’s total daily steps during the experimental phases of the MIP: A = baseline; B = intervention; C = final week of intervention*. Angled solid black lines indicate the overall trend during each phase. Grey shaded area indicates the school holiday period. Grey horizontal line represents Tudor-Locke et al.’s (2011) daily pedometer equivalent cut off for ‘sufficient activity’ for health. *Note: data from the final week of intervention is presented instead of maintenance data as Anna withdrew prior to entering the maintenance phase.
above her baseline average. Another steep increasing trend developed mid-way through week eight which continued until mid-way through week 10, when activity levels begin to stabilise/plateau again. From week 10 until the end of the monitoring period Anna’s activity levels appear to stabilise at an average increase of 46.73% above baseline levels, which was equivalent to Anna walking an average of +3,790 more steps per day. Table 5.5 shows the mean daily steps achieved in each phase of the experiment and also the percentage increase in activity level achieved in each phase compared to the baseline.

**Table 5.5**

*Anna’s mean daily steps for each phase of the intervention, percentile ranking and the percentage increase in mean steps achieved compared to baseline.*

<table>
<thead>
<tr>
<th>Phase</th>
<th>Mean steps/day</th>
<th>Percentile Rank‡</th>
<th>% increase</th>
<th>Steps/day increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>8,110</td>
<td>&lt;40&lt;sup&gt;th&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>11,068</td>
<td>&lt;70&lt;sup&gt;th&lt;/sup&gt;</td>
<td>36%</td>
<td>+2,958*</td>
</tr>
<tr>
<td>Final Week of Intervention</td>
<td>12,358</td>
<td>&lt;80&lt;sup&gt;th&lt;/sup&gt;</td>
<td>52%</td>
<td>+4,248*</td>
</tr>
</tbody>
</table>

* Indicates an increase of >10% from baseline steps.
‡Percentile rankings refer to “overall steps” are based on results from the Western Australian 2003 Child and Adolescent Physical Activity and Nutrition Survey (CAPANS) (Hands et al., 2004b).

### 5.2.2.2 Steps on weekdays and weekends

While the difference is small, activity levels on weekends are lower than Anna’s activity levels on weekdays, as shown in Table 5.6. The greatest difference is observed during the baseline period, where mean weekend steps deviate negatively from weekday steps and the overall step mean by an average difference of approximately 2,000 steps.
Table 5.6

Anna’s mean steps per day on weekdays and weekends and their variation from the baseline mean during the intervention phase.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Weekdays</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>% increase</td>
<td>Steps/day increase</td>
<td>Mean</td>
<td>% increase</td>
<td>Steps/day increase</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>steps/day</td>
<td></td>
<td></td>
<td>steps/day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>8,788</td>
<td></td>
<td></td>
<td>6,414</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>11,295</td>
<td>29%</td>
<td>+2507*</td>
<td>10,514</td>
<td>64%</td>
<td>+4100*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final Week of Intervention</td>
<td>12,952</td>
<td>47%</td>
<td>+4,164*</td>
<td>10,873</td>
<td>70%</td>
<td>+4,459*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Indicates an increase of >10% from baseline steps.

Differences between steps walked on weekdays and steps walked on weekends can be seen in Figure 5.4. During the intervention phase, Anna’s steps on weekends increased at a greater pace compared to increases in steps on weekdays, relative to baseline levels.
Figure 5.4: Anna’s total daily steps walked on weekdays and weekends during the MIP: A = baseline; B = intervention; C = final week of intervention*. Angled solid black lines indicate the overall trend during each phase. Grey shaded area indicates the school holiday period. Grey horizontal line represents Tudor-Locke et al.’s (2011) daily pedometer equivalent cut off for ‘sufficient activity’ for health. *Note: data from the final week of intervention is presented instead of maintenance data as Anna withdrew prior to entering the maintenance phase.
5.2.3 Anna’s physical and psychological measures.

The results of Anna’s physical assessments are presented as raw scores, while raw scores and percentile rankings are displayed for the standardised psychological measures. Changes in all measures from pre- to post- assessment points are also presented. Notable changes were defined as greater than or equal to 10% change and/or a clinically meaningful shift in diagnostic classification and are indicated.

The time between Anna’s pre- and post- measurement period is different to the length of the physical activity monitoring period. Anna’s post- measures, originally collected as the mid-intervention measures, were taken almost 3 months following pre-intervention measures. It was decided that these measurements would suffice as post-measures due to Anna’s later decision to terminate her participation in the MIP prematurely. Activity monitoring continued for another month following the date that these measurements were taken. For the standardised psychological measures, the time between pre-post measurements coincides with the start and end of the activity monitoring period and was approximately 4 ½ months. Post measures for the CDI and Piers Harris were collected via remote administration.

5.2.3.1 Physical measures

The physical measures did not show any notable changes in the desired direction. Results showed increases in Anna’s weight, BMI, hip circumference as well as notable increases in Anna’s skin fold measurements. Results from Anna’s physical measures are shown in Table 5.7.
Table 5.7

Anna’s physical measures of body composition prior to baseline (pre) and during the intervention (mid).

<table>
<thead>
<tr>
<th>Physical Measure</th>
<th>Pre</th>
<th>Mid</th>
<th>Change from Pre-Mid</th>
<th>Change in desired direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Mass Index (BMI)</td>
<td>19.49</td>
<td>20.17</td>
<td>+ 0.68</td>
<td></td>
</tr>
<tr>
<td>BMI Classification*</td>
<td>overweight</td>
<td>overweight</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>41.2 kg</td>
<td>43.2 kg</td>
<td>+ 2 kg</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>1.45 m</td>
<td>1.46 m</td>
<td>+ 0.01 m</td>
<td>√</td>
</tr>
<tr>
<td>Waist to Height Ratio (WHR)</td>
<td>50.54</td>
<td>50.29</td>
<td>- 0.25</td>
<td>√</td>
</tr>
<tr>
<td>Waist/hip ratio (WHR)</td>
<td>0.938</td>
<td>0.921</td>
<td>- 0.017</td>
<td>√</td>
</tr>
<tr>
<td>Waist circum. (WC)</td>
<td>73.46 cm</td>
<td>73.60 cm</td>
<td>+ 0.14 cm</td>
<td></td>
</tr>
<tr>
<td>WC &gt;90th%ile</td>
<td>Yes</td>
<td>Yes</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Hip circum. (HC)</td>
<td>78.31 cm</td>
<td>79.91 cm</td>
<td>+ 1.60 cm</td>
<td></td>
</tr>
<tr>
<td>Sum of 4 Skin Folds</td>
<td>108.5 mm</td>
<td>125.3 mm</td>
<td>+ 16.8 mm*</td>
<td></td>
</tr>
<tr>
<td>Triceps Skin Fold</td>
<td>27.6 mm</td>
<td>27 mm</td>
<td>- 0.6 mm</td>
<td>√</td>
</tr>
<tr>
<td>Biceps Skin Fold</td>
<td>18.3 mm</td>
<td>24 mm</td>
<td>+ 5.7 mm*</td>
<td></td>
</tr>
<tr>
<td>Subscapular Skin Fold</td>
<td>25.3 mm</td>
<td>30.7 mm</td>
<td>+ 5.4 mm*</td>
<td></td>
</tr>
<tr>
<td>Suprailiac Skin Fold</td>
<td>37.3 mm</td>
<td>43.7 mm</td>
<td>+ 6.4 mm*</td>
<td></td>
</tr>
</tbody>
</table>

*Indicates a change of >10% and/or a clinically meaningful shift in diagnostic classification

5.2.3.2 Psychological measures

While Anna’s scores from pre-post assessments were all within the normal range, Anna’s self-esteem as indicated by her responses on both the Piers-Harris and the Negative Self-Esteem sub-scale on the CDI still saw a change in the desired direction at the conclusion of her participation in the MIP. However, scores on the CDI subscales of Ineffectiveness and Anhedonia had increased in the post-assessment.

On the Piers-Harris Self-Concept Scale a notable change in the total score was found from pre-post comparisons. Items previously rated unfavourably, such as “I am often sad”, “My looks bother me”, “I give up easily”, “I am good looking” and “I like being the way I am” were rated favourably in the post-measurements. Results from Anna’s psychological assessments and notable changes are shown in Table 5.8.
Table 5.8

Anna’s raw scores and percentile rankings from standardised psychological assessments at baseline (pre) and at the end of the intervention phase (post).

<table>
<thead>
<tr>
<th>Psychological Measure</th>
<th>Pre</th>
<th>Post</th>
<th>Change from Pre-Post</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Raw Score</td>
<td>Percentile Rank</td>
<td>Raw Score</td>
</tr>
<tr>
<td>Child Depression Inventory (CDI)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>29\textsuperscript{th}</td>
<td>5</td>
</tr>
<tr>
<td>Negative mood</td>
<td>0</td>
<td>21\textsuperscript{st}</td>
<td>0</td>
</tr>
<tr>
<td>Interpersonal problems</td>
<td>0</td>
<td>69\textsuperscript{th}</td>
<td>0</td>
</tr>
<tr>
<td>Ineffectiveness</td>
<td>0</td>
<td>34\textsuperscript{th}</td>
<td>3</td>
</tr>
<tr>
<td>Anhedonia</td>
<td>1</td>
<td>35\textsuperscript{th}</td>
<td>2</td>
</tr>
<tr>
<td>Negative self-esteem</td>
<td>3</td>
<td>86\textsuperscript{th}</td>
<td>0</td>
</tr>
</tbody>
</table>

Piers-Harris 2, Self-Concept Scale

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Behavioural adjustment</th>
<th>Intellectual and school status</th>
<th>Physical appearance and attributes</th>
<th>Freedom from anxiety</th>
<th>Popularity</th>
<th>Happiness and satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Score</td>
<td>45</td>
<td>14</td>
<td>14</td>
<td>7</td>
<td>8</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Percentile Rank</td>
<td>42\textsuperscript{nd}</td>
<td>88\textsuperscript{th}</td>
<td>66\textsuperscript{th}</td>
<td>31\textsuperscript{st}</td>
<td>24\textsuperscript{th}</td>
<td>18\textsuperscript{th}</td>
<td></td>
</tr>
<tr>
<td>Raw Score</td>
<td>52</td>
<td>13</td>
<td>16</td>
<td>9</td>
<td>13</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Percentile Rank</td>
<td>73\textsuperscript{rd}</td>
<td>66\textsuperscript{th}</td>
<td>95\textsuperscript{th}</td>
<td>58\textsuperscript{th}</td>
<td>79\textsuperscript{th}</td>
<td>27\textsuperscript{th}</td>
<td></td>
</tr>
<tr>
<td>Change</td>
<td>+ 7* \checkmark</td>
<td>- 1</td>
<td>+ 2 \checkmark</td>
<td>+ 2* \checkmark</td>
<td>+ 5* \checkmark</td>
<td>+ 1 \checkmark</td>
<td></td>
</tr>
</tbody>
</table>

Note. On the CDI, higher scores indicate greater clinical concern. On the Piers-Harris lower scores indicate greater clinical concern. \(\dagger\) indicates a score in the clinical range. *Indicates a change of >10% and/or a clinically meaningful shift in diagnostic classification.

5.2.4 Discussion of Anna’s response to the MIP.

Anna’s baseline recordings indicated that she was maintaining an overall level of PA that was below most of her same age peers, and also below Tudor-Locke et al.’s (2011) recommended step counts for girls ‘sufficient activity’ for health. However, an increasing trend in PA developed with the introduction of the additional components of the MIP and half way through the intervention phase Anna’s daily pedometer step totals began to regularly exceed the 12,000 steps per day recommendation (Tudor-Locke et
al., 2011). Her mean overall activity level during the intervention phase also increased so that she could be considered more active than the majority of her same age peers, sitting on the 70th percentile (Hands et al., 2004b).

Anna had her greatest successes early on in the MIP, achieving large activity level increases in the first three weeks of the intervention phase. At the time, her mother had reported that Anna was “so excited, she’s already increased her activity level”. Anna was advised during early behavioural consultations to start off slowly, as her rapid pace of improvement was likely to make it harder for her to achieve rewards later.

It was noted that Anna sought to keep active mostly at home in the afterschool period, by inventing games and obstacle courses in the back yard, playing actively with the family dog and arranging “play-dates” with friends from school on a more regular basis. Anna kept moving in a variety of ways inside the house too, by running up and down the stairs, for example, as a way to meet her step target.

During baseline, Anna obtained higher steps counts on weekdays than weekends. When the MIP intervention began, Anna was able to increase her steps on weekends by a greater proportion than the increase seen in her weekday steps, when compared to baseline levels of each. This suggests the effect of the MIP generalised to increasing steps on both weekdays and weekends, and increases to weekend steps were greater. Additionally, greater increases in Anna’s steps on weekdays and weekends were associated with school attendance. School holidays began mid-way through week 6, which corresponded to the same point where Anna’s increasing trend in steps per day began to plateau. When the school term resumed at the start of week 9, a new upward trend appeared in Anna’s activity levels.

The advice given to slow her progress in increasing her steps did not deter Anna and it only became clear later on that she did not want to slow her pace as it would mean that she would “only get one lucky dip reward instead of two”. Anna reported
later that only being eligible for one lucky dip was like a “fail”. Perhaps due to this, Anna withdrew her participation prior to completion of the full MIP procedure, and as a result she did not reach the maintenance phase.

There were no measurable, beneficial changes in Anna’s physical health during her participation in the MIP. Instead, increases in weight, BMI, hip circumference as well as notable increases in skin fold measurements were observed. With regards to Anna’s psychological well-being, however, measurable, beneficial changes were observed alongside the increases she achieved in her PA levels during the MIP. While her baseline scores were all within the normal range, Anna reported a notable improvement in her self-esteem at the conclusion of her participation in the MIP. Specifically, her results indicated that she felt more positively about her looks, her mood, and her ability to persevere.

A slight increase in her total depression score revealed there was a notable increase in her scores on the Ineffectiveness and Anhedonia subscales, and may provide more evidence for why Anna discontinued her participation in the MIP prior to completion. The items on these scales refer to school work and experiences at school and with her peers. For example, following participation in the MIP the items on the Anhedonia scale that showed an unfavourable change included, “I have fun at school only once in a while”, “I have some friends but I wish I had more”. Items on the Ineffectiveness scale that showed an unfavourable change included, “I have to push myself all the time to do my school work”, “I can be as good as other kids if I want to”. There is a possibility that Anna’s responses on these items may have been influenced by her participation in the MIP. At one point during the intervention phase Anna had reported that she had received some negative attention from her peers at school for wearing a pedometer. She reported that while she enjoyed wearing the pedometer, there were times at school where she felt uncomfortable being the only one wearing a
pedometer. Thus, wearing the pedometer may have exacerbated the already tentative relationships she had with some of her peers in her class, and made it more difficult for her to avoid receiving negative attention.

Anna’s avoidance of “failing” acted as a negative reinforcer of immediate and increasing behaviour changes; however, it appears she did eventually learn that her increasing targets were unsustainable for the duration of the program. It suggests that while she was working very hard to avoid failing to reach her target, perhaps at some point she felt it was becoming too hard and was beyond her ability. In hindsight, modification to the initial goals and contingencies for Anna could have led to a more sustainable level of increased physical activity and over a longer period. For example, maintaining a minimum weekly average - such as 10,000 steps - might have led to sustainable PA levels and feeling success instead of “failure”.

Tudor-Locke and Chan (2006) observed in their exploratory analysis of adherence patterns and program completion when participating in pedometer-based physical activity programmes that attrition was characterised by lower initial incremental changes in steps/day and subsequent regression towards baseline values. This was not the case for Anna, as she experienced a large increase early on in the program, and she is an example of why all programs seeking to enhance physical activity levels and well-being need to be able to quickly respond to each individual’s unique capabilities. In future, it would be wise to take note of the advice from Sulzer-Azaroff and Mayer (1991) that “successful programs of behaviour change depend on the manner in which contingencies are arranged. Although principles of behaviour can guide the arrangement of contingencies in general, at the individual level we need to find the most ideal ways to manage contingencies for each person” (p.99).
5.3  Elsie

5.3.1  Case background.

Elsie was a 12-year-old Caucasian girl who came to be in the program after her mother saw promotional material about the MIP circulated by her work colleagues. Elsie lived in a large detached single level home with her younger brother (8 years), two older sisters (15 and 17 years), and mother (42 years) and father (44 years) in a neighbourhood rated with a median SES. Elsie was in Year 7 at a local Catholic primary school. Elsie’s father worked full-time as the principal of a regional country school. He travelled weekly for his work and could be away for up to five days at a time. Elsie’s mother was a social worker, who worked full-time at a major metropolitan hospital. The family had a medium-sized back yard and lived in a street with parks, bicycle paths and lakes nearby. The family also had a large dog, which Elsie enjoyed playing with.

Elsie was overweight, at risk for Type II Diabetes and already had insulin resistance. Elsie’s mother reported that she had put on 1 kg a month over the 9 months prior to her participation in the MIP. Elsie had also been diagnosed with childhood epilepsy, and was managed with Lomotragine. She often had migraine headaches, which usually required her to take days off school. Elsie’s mother reported that she had always been a “chubby kid” since she was a toddler. She believed the epilepsy medication may have played a role in stimulating appetite and may explain Elsie’s overeating. It was noted that Elsie’s older sister had a history of anorexia, for which she had been hospitalised in the past but who is currently well, and some of Elsie’s family on her paternal side have also had overweight problems.

Elsie was bullied at the local government primary school from Years 1 to 4 for being “the fat kid”, and would be distressed when she came home at the end of school. It was decided by the family that it would be best to change Elsie’s school. Elsie’s mother reported that Elsie did not appear to be worried by her body composition
problems. They consulted with Elsie’s GP about her weight problem and had tried to help Elsie lose weight by modifying her diet and exercise. However, so far it has not been successful in bringing any changes to Elsie’s body composition. Her mother responded to the situation by trying to keep Elsie active, though she also confessed that it had been a challenge being a mother of four children and working full-time to be able to properly regulate Elsie’s diet and physical activity problems. Elsie had just started a new “low GI” diet (suggested by her G.P.) to reduce the amount of sugar in her diet in an effort to lose weight and prevent diabetes.

Elsie’s activity levels were described by her mother as “inconsistent” and she reported that she finds it “harder to enforce things”. She also reported that Elsie likes to spend time “lounging about in the lounge room”, or playing with the family dog. She was enrolled in a swimming club which meets three times a week and also played for a hockey team. Elsie described many ways that she enjoys being physically active, including swimming, running, skipping, volleyball, soccer, hockey, jumping on the trampoline, walking the dog, riding, climbing, running in the park and doing a variety of chores to help around the house. However, Elsie also reported that every now and then she can feel like a “lazy bones” and does not feel like being active.

Elsie was described by her mother as friendly, vibrant and resilient, and good at helping around the house with gardening and cooking. Elsie reported that she had many friends at her current school, and is looking forward to starting high school next year. While her older sisters do not like to spend time with Elsie, she does interact well with her younger brother. Elsie’s favourite activities are horse riding, going to the beach and socialising with her friends. When alone, she likes to play the keyboard or just “veg-out”. Elsie is known for coming home from school feeling tired in the afternoon. At these times she dislikes doing anything active such as taking the dog for a walk. The family is busy on the weekends when the father comes home and most of the children
have individual sporting commitments to attend. Elsie also reported that she disliked going for walks with her father as he tended to “push her to walk further and faster” than she prefers.

In summary, it seems a mix of biological and social factors and the family routine contribute to Elsie being less active than she could be. Elsie’s keenness to participate in physical activity appears to fluctuate between extremes of immense enthusiasm when in social situations with peers to overwhelming fatigue when arriving home at the end of the school day. This may be part of her complicated medical profile, and dynamics within the family and everyday family routines may also have reinforced and maintained Elsie’s pattern of inactivity at home or when in the company of her family.

5.3.2 Elsie’s pedometer readings.

5.3.2.1 Overall steps

Elsie had some initial problems with remembering to wear the pedometer consistently during the baseline monitoring period, often as a result of “forgetting” where she had left her pedometer. As a consequence, Elsie’s baseline data is based on 15 days of monitoring spanned across a three week period. During this period Elsie’s highest total daily step count was 19,074 on day 20, with her lowest total daily step count of 4,444 on day 18. Compared to other girls her age, Elsie’s average baseline activity level was on par with the WA State average of 11,621 steps per day, and was in the 60th percentile of girls her age (Hands et al., 2004b). However, Elsie’s baseline activity level was just short of meeting the current pedometer recommendations of 12,000 steps per day, for girls (Tudor-Locke et al., 2011). Elsie’s daily activity levels as measured by the pedometer during each phase of the experiment can be seen in Figure 5.5.
Figure 5.5: Elsie’s total daily steps during the experimental phases of the MIP: A = baseline; B = intervention; C = maintenance. Black angled lines indicate the general trend in steps during each phase. Grey shaded areas indicate school holiday periods. Grey line at top represents Tudor-Locke et al.’s (2011) daily pedometer step threshold for males equivalent to PA recommendations for ‘sufficient activity’ for health for females.
With the introduction of the MIP Elsie’s activity levels increased noticeably with a 63% average increase by the end of week six (i.e., during the 3rd week of the intervention), which equates to Elsie walking 7,504 more steps per day compared to her baseline level. Elsie may have reached a ceiling level for physical activity as levels began to plateau at this point, with a downward trend developing during week 11. Elsie managed to reverse this trend in week 13, and maintained a steady increasing trend in her activity levels until the end of the intervention phase. Table 5.9 shows the mean daily steps achieved in each phase of the experiment and also the percentage increase in activity level achieved in each phase compared to the baseline.

Table 5.9

_Elsie’s mean daily steps for each phase of the intervention and the percentage increase in activity levels (steps) achieved compared to baseline._

<table>
<thead>
<tr>
<th>Phase</th>
<th>Mean steps/day</th>
<th>Percentile Rank‡</th>
<th>% increase</th>
<th>Steps/day increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>11,822</td>
<td>&lt;60th</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>16,957</td>
<td>&gt;90th</td>
<td>+43%</td>
<td>+5135*</td>
</tr>
<tr>
<td>Maintenance</td>
<td>8,783</td>
<td>20th</td>
<td>-26%</td>
<td>-3,039*</td>
</tr>
</tbody>
</table>

* Indicates an increase or decrease of >10% from baseline steps.
‡Percentile rankings refer to “overall steps” are based on Results of Western Australian Child and Adolescent Physical Activity and Nutrition Survey 2003 (CAPANS) (Hands et al., 2004b).

Overall, Elsie’s activity levels during the intervention period remained highly variable, with large daily variations. Despite this variability Elsie performed very well during the intervention phase of the program, achieving an average of 84% of days during the intervention where she walked above her baseline mean. This increase did not carry over to the maintenance phase, where a sharp drop in activity levels to lower than baseline levels can be observed.
5.3.2.2 Steps on weekdays and weekends

Elsie’s mean steps per day on weekdays and weekends and their variation from the baseline mean during the intervention and maintenance phases can be seen in Table 5.10. While there is a noticeable increase in weekday steps from the baseline to intervention phase, mean steps on weekends during the intervention phase remained stable relative to mean steps on weekends at baseline.

Table 5.10

<table>
<thead>
<tr>
<th>Phase</th>
<th>Weekdays</th>
<th>Weekends</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean steps/day</td>
<td>% increase</td>
</tr>
<tr>
<td>Baseline</td>
<td>10,604</td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>17,410*</td>
<td>+64%</td>
</tr>
<tr>
<td>Maintenance</td>
<td>8,572</td>
<td>-19%</td>
</tr>
</tbody>
</table>

* Indicates an increase or decrease of >10% from baseline steps.

An increasing trend in weekend steps developed in the latter half of the intervention phase. Spring school holidays were from week 2 until week 4, and summer school holidays were from week 12 until week 19 and these do not show systematic influence of school non-attendance on Elsie’s overall physical activity levels. There may be a weak association between school holidays and weekend data, where activity levels on weekends during school holidays appears to be higher than weekend activity levels during school term. During the maintenance phase, both weekend and weekday data show a substantial decrease in activity level. Differences between steps walked on weekdays and steps walked on weekends can be seen in Figure 5.6.
Figure 5.6: Daily total steps walked on weekdays and on weekends, during each phase of the MIP (A= Baseline, B= Intervention, C= Maintenance). Shaded areas indicate school holiday periods. Black angled lines represent the overall trend in daily steps during each phase. Solid grey horizontal line represents Tudor-Locke et al.’s (2011) daily pedometer equivalent cut off for ‘sufficient activity’ for health for females.
5.3.3 Elsie’s physical and psychological measures.

The results of Elsie’s physical assessments are presented as raw scores, whereas raw scores and percentile rankings are displayed for the standardised psychological measures. Changes in all measures from pre- to post- assessment points are also presented. The time between pre and post measurement periods for both physical and psychological measurements was 4 ½ months, with the mid - intervention physical measures taking place at 11 weeks. Notable changes were defined as greater than or equal to 10% change and/or a clinically meaningful shift in diagnostic classification and are indicated.

5.3.3.1 Physical measures

Following her participation in the MIP, changes in the desired direction were seen in Elsie’s BMI, height and weight. A slight decreasing trend in BMI values over the course of the intervention was detected, which is in the opposite direction to the developmental trend one would expect for children of Elsie’s age. There is also a notable decrease in Elsie’s skin folds’ measurement, including the sum of skin folds and the triceps, subscapular and suprailiac skin fold measures. Changes in Elsie’s measures of body composition can be seen in Table 5.11.
Table 5.11

_Elsie’s body composition measures prior to baseline (pre), during the intervention (mid) and at follow-up (post-maintenance)._  

<table>
<thead>
<tr>
<th>Physical Measure</th>
<th>Pre</th>
<th>Mid</th>
<th>Post</th>
<th>Change from Pre-Post</th>
<th>Change in desired direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>30.87kg/m²</td>
<td>30.38kg/m²</td>
<td>29.55kg/m²</td>
<td>-1.32kg/m²</td>
<td>√</td>
</tr>
<tr>
<td>BMI Classification†</td>
<td>obese</td>
<td>obese</td>
<td>obese</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>77.06 kg</td>
<td>77.6 kg</td>
<td>76.06 kg</td>
<td>-1 kg</td>
<td>√</td>
</tr>
<tr>
<td>Height</td>
<td>1.582 m</td>
<td>1.598 m</td>
<td>1.604 m</td>
<td>+0.022m</td>
<td>√</td>
</tr>
<tr>
<td>WHtR</td>
<td>61.16</td>
<td>59.49</td>
<td>60.90</td>
<td>-0.26</td>
<td>√</td>
</tr>
<tr>
<td>WHR</td>
<td>0.88</td>
<td>0.86</td>
<td>0.91</td>
<td>+0.03</td>
<td></td>
</tr>
<tr>
<td>WC</td>
<td>96.76 cm</td>
<td>95.06 cm</td>
<td>97.7 cm</td>
<td>+0.94 cm</td>
<td></td>
</tr>
<tr>
<td>WC &gt;90th%ile</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HC</td>
<td>109.66 cm</td>
<td>111.6 cm</td>
<td>107.26 cm</td>
<td>-2.4 cm</td>
<td>√</td>
</tr>
<tr>
<td>Sum of 4 Skin Folds</td>
<td>158.2 mm</td>
<td>156.9 mm</td>
<td>132.6 mm</td>
<td>-25.6mm*</td>
<td>√</td>
</tr>
<tr>
<td>Triceps Skin Fold</td>
<td>41 mm</td>
<td>43.3 mm</td>
<td>35.5 mm</td>
<td>-5.5mm*</td>
<td>√</td>
</tr>
<tr>
<td>Biceps Skin Fold</td>
<td>30.3 mm</td>
<td>29.0 mm</td>
<td>27.6 mm</td>
<td>-2.7mm</td>
<td>√</td>
</tr>
<tr>
<td>Subscapular Skin Fold</td>
<td>47.3 mm</td>
<td>43.0 mm</td>
<td>36.0 mm</td>
<td>-11.3mm*</td>
<td>√</td>
</tr>
<tr>
<td>Suprailiac Skin Fold</td>
<td>39.6 mm</td>
<td>41.6 mm</td>
<td>33.5mm</td>
<td>-6.1mm*</td>
<td>√</td>
</tr>
</tbody>
</table>

†Body Mass Index (BMI) classification based on Cole et al. (2000).  
*Indicates a change of >10% and/or a clinically meaningful shift in diagnostic classification

5.3.3.2 Psychological measures

Overall, Elsie’s responses to the CDI and the Piers-Harris represent a complex clinical picture of depression and low self-esteem, with high percentile rankings on the CDI and low percentile rankings on the Piers-Harris. Following her participation in the MIP, improvements in responses to items on the CDI _Anhedonia_ sub scale and on the Piers-Harris _Behavioural adjustment_ subscale, though decreases across all other subscales on these measures were observed. She remained in the clinical range on both the CDI and the Piers-Harris at the end of the monitoring period. Results from Elsie’s psychological assessments and changes from pre-post are shown in Table 5.12.
Table 5.12

Elsie’s raw scores and percentile rankings on the standardised psychological assessments at baseline (pre) and at the end of the intervention phase (post).

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
<th>Change from Pre-Post</th>
<th>Change in desired direction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Raw Score</td>
<td>Percentile Rank</td>
<td>Raw Score</td>
<td>Percentile Rank</td>
</tr>
<tr>
<td>Child Depression Inventory (CDI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>27†</td>
<td>97&lt;sup&gt;th&lt;/sup&gt;</td>
<td>25†</td>
<td>96&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Negative mood</td>
<td>4</td>
<td>88&lt;sup&gt;th&lt;/sup&gt;</td>
<td>4</td>
<td>88&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Interpersonal problems</td>
<td>0</td>
<td>69&lt;sup&gt;th&lt;/sup&gt;</td>
<td>0</td>
<td>69&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Ineffectiveness</td>
<td>7†</td>
<td>&gt;96&lt;sup&gt;th&lt;/sup&gt;</td>
<td>6†</td>
<td>&gt;96&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Anhedonia</td>
<td>8</td>
<td>96&lt;sup&gt;th&lt;/sup&gt;</td>
<td>9†</td>
<td>98&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Negative self-esteem</td>
<td>8†</td>
<td>&gt;97&lt;sup&gt;th&lt;/sup&gt;</td>
<td>6†</td>
<td>97&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Piers-Harris 2, Self-Concept Scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>21†</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt;</td>
<td>17†</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
</tr>
<tr>
<td>Behavioural adjustment</td>
<td>8†</td>
<td>14&lt;sup&gt;th&lt;/sup&gt;</td>
<td>11</td>
<td>34&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Intellectual and school status</td>
<td>1†</td>
<td>&lt;1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>2†</td>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
</tr>
<tr>
<td>Physical appearance and attributes</td>
<td>3†</td>
<td>7&lt;sup&gt;th&lt;/sup&gt;</td>
<td>1†</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
</tr>
<tr>
<td>Freedom from anxiety</td>
<td>5†</td>
<td>10&lt;sup&gt;th&lt;/sup&gt;</td>
<td>3†</td>
<td>4&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Popularity</td>
<td>3†</td>
<td>4&lt;sup&gt;th&lt;/sup&gt;</td>
<td>1†</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
</tr>
<tr>
<td>Happiness and satisfaction</td>
<td>6</td>
<td>16&lt;sup&gt;th&lt;/sup&gt;</td>
<td>2†</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Note. On the CDI, higher scores indicate greater clinical concern. On the Piers-Harris lower scores indicate greater clinical concern.
† indicates a score in the clinical range
*Indicates a change of >10% and/or a clinically meaningful shift in diagnostic classification

5.3.4 Discussion of Elsie’s response to the MIP.

Elsie’s baseline recordings indicated she was maintaining an overall level of PA that was in fact above most of her same age peers; however, it was still below Tudor-Locke et al.’s (2011) recommended step counts for girls ‘sufficient activity’ for health. With the introduction of the additional components of the MIP, Elsie’s daily pedometer step totals began to regularly exceed the 12,000 steps per day recommendation (Tudor-Locke et al., 2011) almost immediately and this was maintained throughout the intervention phase. Despite continued daily variability in Elsie’s PA habits, she
maintained an average of 16,828 steps per day during the intervention phase, which is well above her baseline level and above Tudor-Locke et al.’s (2011) recommendation for girls pedometer steps per day for ‘sufficient activity’ for health. Her mean overall activity level during the intervention phase increased where she was considered more active than the majority of her same age peers, sitting above the 90th percentile.

During Baseline, Elsie was more active on weekends compared to weekdays, opposite to the typical pattern observed in children who are generally more active on school days compared to weekends. During the intervention phase there was an immediate and noticeable increase in weekday steps from the baseline to intervention phase. Steps on weekends tended to remain stable between Baseline and Intervention, though a delayed increasing trend can be seen in steps on weekends in the latter half of the intervention phase, while weekday steps seem to show a slight downward trend at this time.

The school holidays that occurred during the baseline and the intervention phases may interact with Elsie’s pattern of activity and affect steps on weekdays and weekends in different ways. While there does not appear to be an immediate or systematic influence of school non-attendance on Elsie’s overall physical activity levels, there may be a weak association between school holidays and weekday and weekend data separately. Activity levels on weekends during school holidays appeared to be higher than weekend activity levels during school term, while activity levels on weekdays during school holidays appeared to be lower than weekday activity levels during school term. However, this can only be said in relation to activity levels observed during the intervention phase.

When Elsie and her mother were left to monitor PA levels on their own and self-manage the MIP components during the maintenance phase, both weekend and weekday data show a substantial decrease in activity level from the intervention to maintenance
phase. Elsie’s PA during the maintenance phase reverted to levels lower than those recorded during Baseline, and her overall activity level had dropped down to the 20th percentile compared to other Western Australian girls her age. Thus, the generalised improvement in steps on weekdays and weekends achieved in the intervention phase did not maintain when the MIP was to be self-managed by Elise and her mother.

Measureable, beneficial changes in Elsie’s physical health were observed alongside her increase in PA levels in the MIP. Elsie’s weight and BMI decreased, reversing the trend of weight gain her mother had reported at the beginning of the MIP. Favourable reductions in waist to height ratio, hip circumference, and all skin fold measures suggests Elsie’s overall body composition was showing improvement in terms of a potential reduction in the amount of adipose tissue. It should be highlighted that Elsie had begun a new Low GI diet shortly before her participation in the MIP. Thus, the beneficial changes observed in her body mass and composition might be interpreted as result of the combination of changes to both diet and physical activity.

With regards to Elsie’s psychological well-being, the complex picture of depression and low self-esteem at baseline did not shift significantly in a favourable direction when retested again following the maintenance phase. However, the post-measures took place at a time when Elsie was at her most inactive relative to other phases of the MIP. Perhaps Elsie’s responses to these questionnaires would be different had they been administered when she was more active, during the intervention phase.

Elsie did not seem to have any problems increasing her PA levels initially. She participated in PA at every opportunity, particularly those available as part of the school day such as, sports and games during the lunch time break and during PE classes including, basketball and dance, as well as volleyball after school. Once it was assumed Elsie’s ceiling for physical activity as measured by the pedometer had been reached, the MIP aimed to achieve consistency and reduce the large fluctuations in step totals from
one day to the next. There was some success with this as variability in the second half of the intervention reduced compared to the first half of the intervention, although levels dropped and there were still days that differed greatly compared to other days even in the second half of the intervention.

Maintaining increases in PA levels during the long summer school holiday period was more challenging for Elsie, particularly on weekdays as her parents were at work during the days and her participation in PA was less structured compared to school days. Time during behavioural consultations was spent helping Elsie to plan how to spend her free time in a way that could increase her PA and could also be easily accommodated by the availability of her parents. However, on weekends when her parents were more available, Elsie obtained higher steps counts compared to weekdays.

Several reasons could explain why Elsie’s PA levels during the maintenance phase were so low compared to intervention and baseline levels. Firstly, it is well known that PA levels decline with age (Allison, et al., 2007; Kin-Isler et al., 2009; Telford et al., 2005; Trost et al., 2002), particularly for females during the adolescent years (Eisenmann & Wickel, 2009; Sherar, et al., 2007), and Elsie celebrated her 13th birthday during the maintenance phase. Secondly, following a long period of summer holidays Elsie had just started high school when she entered the maintenance phase of the MIP. Entering high school is likely to have been the more powerful and immediate causal factor in the sudden drop in Elsie’s PA levels, rather than any specific biological effects of maturation. In high school there is typically greater emphasis placed on achievement in academic studies, and the structure of the school day is very different to a primary school environment, particularly as children are less likely to “play” during the recess and lunch breaks. Uniforms for private schools such as the one Elsie attended are not designed for participating in PA and a change of uniform is required for PE classes. Opportunities for PA become more restricted to formal participation in sport,
and there was less free time for children to be naturally active in their leisure.

Considering how important PA accrued during the school day was for Elsie during the intervention phase, it makes sense that such a drastic change in context from school holidays to a new school environment would impact her PA levels.

Thirdly, however, as PA levels on weekends also showed a decline, individual factors to do with Elsie’s PA preferences may have also led to the eventual overall decline in PA levels observed. In a follow-up phone call with Elsie’s mother following the maintenance phase it was reported that the last couple of weeks had been a struggle for Elsie in adapting to the new school routines. Her mother also suspected that Elsie had “run out of steam with the lucky dip – graph system”, and it is likely that a change in reinforcers was needed. It was reported that Elsie’s “self-motivation” had improved as a result of participating in the MIP but “it was still a struggle for her,” and her mother wanted to keep monitoring. It was also revealed that Elsie had originally envisaged that participation in the MIP was going to involve participating in regular structured physical activities with other children similar to her, and she was very much looking forward to a programme that would provide this. Thus, while willing to give it a try, Elsie experienced some disappointment with regards to the actual procedures of the MIP. While Elsie persevered with the MIP and managed to achieve a considerable increase in her steps, she confessed at the end that she did not enjoy the recording of steps and graphing as much as she would have enjoyed a more socially-based intervention programme, and Elsie reported herself that “recording and graphing is a drag”.

In conclusion, the MIP was beneficial for Elsie and encouraged her to increase her PA levels well-above that recommended for positive health and wellbeing outcomes. The significant clinically relevant changes in her body composition may in part reflect the changes she made in her PA behaviours. However, her effort to maintain her increase in PA levels was impeded by several factors. In hindsight, perhaps simply
creating a system of positive consequences contingent on Elsie’s accurate self-
monitoring of her PA with a pedometer would have been sufficient as an intervention to
increase her PA levels. Also, socialising with others, particularly her friends, was an
early positive consequence that reinforced Elsie’s PA behaviours. Helping her to
arrange to participate in more physical activities where she could derive such social
rewards, and making this contingent on accurate self-monitoring would likely have been
sufficient for Elsie to maintain higher levels of PA.

5.4  Josh

5.4.1  Case background.

Josh, a 12-year-old Caucasian boy, was referred to the MIP by his G.P. due to
health concerns about his excess weight and increased risk of developing Type II
diabetes. Josh lived with his mother and two older brothers (aged 17 and 20 years) in a
detached, single level home. The house had a small back yard with a small in-ground
pool which Josh has always enjoyed using. Josh also liked to play games on the
computer in the lounge room. He was in Year 7 at the local government primary school,
only a short walking distance away at the end of his street. Josh’s parents had separated
12 months prior, and their divorce was nearly finalised. Prior to the separation, Josh’s
father was frequently absent from the home due to work demands, but had later
arranged to live in his own house. Josh’s mother worked full time as an administrator
and Josh’s father ran his own business. Josh’s father had a leg amputated above the knee
some years ago. At the time of Josh’s participation in the MIP, Josh’s father and his
eldest brother were in training to walk the full length of the Bibbulmun track (a bush
walking track in the South West of Western Australia) a distance of approximately
800km.
Josh’s physical appearance immediately suggested he had a problem with his weight, which was first identified when he was in Year 3, aged 8 years. He was also assessed by his doctor six months prior to his participation in the MIP as being clinically overweight. It was Josh’s GP that suggested he take part in the MIP due to concerns regarding his risk of developing early onset Type II Diabetes and other associated health problems of paediatric obesity and overweight. Josh’s mother believed his weight problem was predominantly a result of over-eating and she had found it difficult to properly supervise his eating behaviour. Josh’s mother also reported that when given a choice he would always opt for sedentary activities over more physically active pursuits.

Josh’s medical history was mostly unremarkable, although there was still the occasional occurrence of nocturnal enuresis. Josh’s mother reported it typically occurred once every four months, usually after there had been an argument between them. Josh’s mother described her son as a little shy, where he tended to “wait on the sidelines” before initiating interaction with others. Josh liked to play computer games and watch TV. On a typical day, Josh watched TV while he got ready for school, and when he came home from school and also after the evening meal before bed time. Josh participated in two structured group physical activities a week, including a swimming class (squad training) and a Tae Kwon Do class. Josh reported his favourite activities were swimming and playing computer games. He also liked to ride his bike. However, Josh’s mother restricts Josh from riding his bike alone in the street. When Josh had time alone to himself, he reported that he liked to “do nothing”, or play computer games. Josh reported he had many friends from school and also had a best friend. Josh related well to his brothers, and enjoyed playing computer games with them and attending their soccer matches. Josh’s mother reported that she and Josh also relate well together and Josh has usually helped her out at home with chores and meal preparation when she
asked him to. Josh also had regular visits with his father, where they typically went for walks together or to the movies.

Josh comes from a family where several members have struggled with their weight and are presently overweight or obese, including both his mother and father, and his two maternal aunts. Neither of Josh’s older brothers appeared to have any problems maintaining a healthy weight. Josh’s mother reported that she had tried to manage Josh’s weight problem by limiting his food intake. For example, she would not allow Josh to eat more food when he asks for it. Josh’s mother reported that he was aware he had a problem, but that he was “ok about himself”. Josh’s mother also reported that there was a general acceptance of weight problems amongst other family members.

Over the last 1 to 2 years, Josh and his mother had tried to manage their weight problem together. They attended several appointments with a dietician and attempted to follow the diets prescribed. However, they ceased continuing with the consultations as they were becoming financially too prohibitive. Josh’s mother also reported she had increased her walking, and would take Josh with her on walks. However, when Josh’s mother’s motivation would drop so would Josh’s and both their activity levels decreased. Josh’s mother reported that she had found it difficult to cope with her own emotional problems and at the same time be able to manage Josh’s weight problem. Josh’s mother reported that she was “very motivated” to support Josh to take part in the MIP and had decided that she would offer Josh regular pocket money in return for his continued participation. Josh was interested in trying it out.

Again in Josh’s case, despite exposure to many opportunities in his environment to be physically active on a daily basis, a complex mix of bio-psycho-social factors seems to be contributing to his physical inactivity problem. Josh’s personality, family dynamics and biological factors have all contributed to a long learning history - where Josh’s exposure to positive consequences in response to activities involving sedentary
behaviour or low levels of physical exertion – and created his current habitual PA levels.

5.4.2 Josh’s pedometer readings.

5.4.2.1 Overall steps

Josh’s baseline consisted of 14 days of continuous monitoring. He had a slight decreasing trend during the baseline period. Compared to other children his age, Josh’s average physical activity levels during baseline were very low. The mean daily step count for Western Australian 12-year-old boys is 13,793 steps per day (Hands, et al., 2004b). Josh’s baseline average fell short of some of the most current guidelines for ideal daily pedometer steps counts for children aged 12 years and under, which range from 12,000 to 16,000 steps per day (Adams, et al., 2009; Tudor-Locke et al., 2011).

Table 5.13 shows the mean daily steps achieved in each phase of the experiment and also the percentage increase in activity level achieved in each phase compared to the baseline.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Mean steps/day</th>
<th>Percentile Rank‡</th>
<th>% increase</th>
<th>Steps/day increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>9,885</td>
<td>&lt;20&lt;sup&gt;th&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>12,209</td>
<td>&lt;40&lt;sup&gt;th&lt;/sup&gt;</td>
<td>+24%</td>
<td>+2,324*</td>
</tr>
<tr>
<td>Maintenance</td>
<td>9,332</td>
<td>&lt;20&lt;sup&gt;th&lt;/sup&gt;</td>
<td>-6%</td>
<td>-553</td>
</tr>
</tbody>
</table>

* Indicates an increase of >10% from baseline steps.
‡Percentile rankings refer to “overall steps” are based on Results of the Western Australian Child and Adolescent Physical Activity and Nutrition Survey 2003 (CAPANS) (Hands et al., 2004b).

Josh’s daily activity levels as measured by the pedometer during the MIP can be seen in Figure 5.7.
Figure 5.7. Josh’s total daily steps during the experimental phases of the MIP: A = baseline; B = intervention; C = maintenance. Black angled lines indicate the general trend in steps during each phase. Grey shaded areas indicate school holiday periods. Grey horizontal line represents Tudor-Locke et al.’s (2011) daily pedometer step threshold for males equivalent to PA recommendations for ‘sufficient activity’ for health for males.
With the introduction of the *MIP*, a gentle increasing trend in Josh’s activity level developed over the first weeks of the intervention phase that maintained until the 10th week of monitoring. During this period, Josh achieved an average increase of 22% (or 2,145 more steps per day) above baseline levels. In the ninth week of monitoring, he was averaging 15,218 steps per day, which is 54% (or 5,333 more steps per day) above his baseline levels.

Following this achievement in increasing physical activity Josh’s activity levels began to plateau from week 10 onwards but there was decreased variability in steps per day during weeks 11 to 13. A new increasing trend developed in week 14, leading to a maximum average increase of 57% (or 5,641 more steps per day) above baseline in week 15. After week 18 they began to decline rapidly.

Overall, Josh performed well during the intervention phase of the MIP, achieving an average of 70% of days during the intervention where he walked above his baseline mean. This increase did not carry over to the maintenance phase, where a sharp drop in activity levels to lower than baseline levels can be observed.

### 5.4.2.2 Steps on weekdays and weekends

Differences between pedometer data on weekdays and weekends were evident in Josh’s results, with mean steps on weekdays and mean steps on weekends both deviating from the mean for overall steps, particularly during the baseline phase. Trends in steps walked on weekdays and weekends typically mirrored each other with a gradual increasing trend observed in each data set during the first half of intervention phase (i.e. from week 3 to week 10). From this point forward, increased variability was observed in Josh’s steps on weekends with an inconsistent trend (i.e., both increases and decreases); though a slight increasing trend in weekend steps can be seen in the final weeks of the intervention that also continues during the maintenance phase. Differences between steps walked on weekdays and weekends can be seen in Figure 5.8.
Josh’s Weekday Steps (Monday to Friday)  
Josh’s Weekend Steps (Saturday and Sunday)

**Figure 5.8:** Daily total steps walked on weekdays and on weekends, during each phase of the MIP: A= Baseline, B= Intervention, C= Maintenance. Black angled lines indicate the general trend in steps during each phase. Grey shaded areas indicate school holiday periods. Grey horizontal line represents Tudor-Locke et al.’s (2011) daily pedometer step threshold for males, equivalent to PA recommendations for ‘sufficient activity’ for health.
The mean daily step count for 12-year-old, Western Australian boys is 13,424 on weekdays and 11,585 steps per day on weekends (Hands, et al., 2004b). Josh’s steps on weekdays and weekends were approaching both of these levels during the intervention phase of the MIP. Josh’s mean steps per day on weekdays and weekends during the intervention and maintenance phases relative to their mean values at baseline can be seen in Table 5.14.

Table 5.14

Josh’s mean steps per day on weekdays and weekends and their variation from the baseline mean during the intervention and maintenance phases.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Weekdays</th>
<th></th>
<th></th>
<th>Weekends</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>% increase</td>
<td>Steps/day increase</td>
<td>Mean</td>
<td>% increase</td>
<td>Steps/day increase</td>
</tr>
<tr>
<td>Baseline</td>
<td>11,616</td>
<td></td>
<td></td>
<td>5,557</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>12,552</td>
<td>+8%</td>
<td>+936</td>
<td>11,401</td>
<td>+105%</td>
<td>+5844*</td>
</tr>
<tr>
<td>Maintenance</td>
<td>9,119</td>
<td>-21%</td>
<td>-2,497*</td>
<td>9,865</td>
<td>+78%</td>
<td>+4308*</td>
</tr>
</tbody>
</table>

* Indicates an increase of >10% from baseline steps.

However, when looking exclusively at mean steps during each phase, there is no notable increase in mean steps per day on weekdays between the baseline and intervention phases. This is then followed by a notable decrease in weekday steps during the maintenance phase. Conversely, the mean for steps on weekends during the intervention phase increases notably, relative to baseline levels, which is also largely maintained during the maintenance phase. This suggests that the changes Josh’s made to his physical activity levels seemed to occur mainly as a result of increased participation in physical activity on the weekends.
5.4.3 Josh's physical and psychological measures.

The results of Josh’s physical assessments are presented as raw scores, whereas raw scores and percentile rankings are displayed for the standardised psychological measures. Changes in all measures from pre- to post-assessment points are also presented. The time between pre- and post-intervention measurement periods was approximately 5 months (20 weeks exactly), with the mid-intervention physical measures taking place at 12 weeks. Notable changes were defined as greater than or equal to 10% change and/or a clinically meaningful shift in diagnostic classification and are indicated.

5.4.3.1 Physical measures

Changes in the desired direction were only seen in height and on the sub-scapular and supra-iliac skin fold measurements, with the latter being notable (>10%). All other physical changes were in a positive direction, with a notable increase in the bicep skin fold measure. These changes show there was a general increase in Josh’s overall body mass following participation in the MIP. However, the reduction in the skin fold measures of the central body suggests there may have been change in body composition, with a decrease in fat mass and an increase in muscle mass, which may partly explain the increase in weight. Changes in Josh’s measures of body composition can be seen in Table 5.15.
Table 5.15

Josh’s body composition measures prior to baseline (pre), during the intervention (mid) and at follow-up (post-maintenance).

<table>
<thead>
<tr>
<th>Physical Measure</th>
<th>Pre</th>
<th>Mid</th>
<th>Post</th>
<th>Change from Pre-Post</th>
<th>Change in desired direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>26.62</td>
<td>26.95</td>
<td>28.18</td>
<td>+1.52 kg/m²</td>
<td></td>
</tr>
<tr>
<td>BMI Classification†</td>
<td>obese</td>
<td>obese</td>
<td>obese</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>57.6 kg</td>
<td>58.7 kg</td>
<td>61.4 kg</td>
<td>+3.8 kg</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>1.471 m</td>
<td>1.476 m</td>
<td>1.476 m</td>
<td>+0.005 m</td>
<td>√</td>
</tr>
<tr>
<td>WHtR</td>
<td>61.05</td>
<td>61.86</td>
<td>64.70</td>
<td>+3.65 kg/m²</td>
<td></td>
</tr>
<tr>
<td>WHR</td>
<td>0.955</td>
<td>0.974</td>
<td>0.987</td>
<td>+0.032 kg/m²</td>
<td></td>
</tr>
<tr>
<td>WC &gt;90th%ile</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>WC</td>
<td>89.8 cm</td>
<td>91.3 cm</td>
<td>95.5 cm</td>
<td>+5.7 cm</td>
<td></td>
</tr>
<tr>
<td>HC</td>
<td>94 cm</td>
<td>93.7 cm</td>
<td>96.7 cm</td>
<td>+2.7 cm</td>
<td></td>
</tr>
<tr>
<td>Sum of 4 Skin Folds</td>
<td>127.3 mm</td>
<td>135.94 mm</td>
<td>127.7 mm</td>
<td>+0.4 mm</td>
<td></td>
</tr>
<tr>
<td>Triceps Skin Fold</td>
<td>27.0 mm</td>
<td>35.7 mm</td>
<td>27.7 mm</td>
<td>+0.7 mm</td>
<td></td>
</tr>
<tr>
<td>Biceps Skin Fold</td>
<td>17.0 mm</td>
<td>27.7 mm</td>
<td>25.3 mm</td>
<td>+8.3 mm*</td>
<td>√</td>
</tr>
<tr>
<td>Subscapular Skin Fold</td>
<td>37.0 mm</td>
<td>34.7 mm</td>
<td>34.0 mm</td>
<td>-3.0 mm*</td>
<td>√</td>
</tr>
<tr>
<td>Suprailiac Skin Fold</td>
<td>46.3 mm</td>
<td>38.0 mm</td>
<td>40.7 mm</td>
<td>-5.6 mm*</td>
<td>√</td>
</tr>
</tbody>
</table>

†Body Mass Index (BMI) classification based on Cole et al. (2000).
*Indicates a change of >10% and/or a clinically meaningful shift in diagnostic classification

5.4.3.2 Psychological measures

Josh’s responses to the standardised psychological measures show him to be within the normal range for both depression and self-esteem at the baseline measurement period. Calculation of pre-post changes show further improvements in these scores – with increases in self-esteem scores on the Piers-Harris and reductions in Negative mood, Ineffectiveness and Negative self-esteem on the CDI following participation in the MIP. However, these improvements cannot be defined as clinically significant, as Josh’s scores were already in the normal range. Josh’s results from the standardised psychological assessments at baseline (pre), and at the end of the maintenance phase (post) can be seen in Table 5.16.
Table 5.16

Josh’s raw scores and percentile rankings from standardised psychological assessments at baseline (pre), and at the end of the maintenance phase (post).

<table>
<thead>
<tr>
<th>Psychological Measure</th>
<th>Pre</th>
<th>Post</th>
<th>Change from Pre-Post</th>
<th>Change in desired direction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Raw Score</td>
<td>Percentile Rank</td>
<td>Raw Score</td>
<td>Percentile Rank</td>
</tr>
<tr>
<td><strong>Child Depression Inventory (CDI)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>32nd</td>
<td>1</td>
<td>5th</td>
</tr>
<tr>
<td>Negative mood</td>
<td>2</td>
<td>65th</td>
<td>1</td>
<td>40th</td>
</tr>
<tr>
<td>Interpersonal problems</td>
<td>0</td>
<td>48th</td>
<td>0</td>
<td>48th</td>
</tr>
<tr>
<td>Ineffectiveness</td>
<td>2</td>
<td>63rd</td>
<td>0</td>
<td>20th</td>
</tr>
<tr>
<td>Anhedonia</td>
<td>0</td>
<td>12th</td>
<td>0</td>
<td>12th</td>
</tr>
<tr>
<td>Negative self-esteem</td>
<td>2</td>
<td>75th</td>
<td>0</td>
<td>25th</td>
</tr>
<tr>
<td><strong>Piers-Harris 2, Self-Concept Scale</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>49</td>
<td>58th</td>
<td>53</td>
<td>79th</td>
</tr>
<tr>
<td>Behavioural adjustment</td>
<td>12</td>
<td>46th</td>
<td>14</td>
<td>88th</td>
</tr>
<tr>
<td>Intellectual and school status</td>
<td>11</td>
<td>34th</td>
<td>11</td>
<td>34th</td>
</tr>
<tr>
<td>Physical appearance and attributes</td>
<td>8</td>
<td>42nd</td>
<td>9</td>
<td>58th</td>
</tr>
<tr>
<td>Freedom from anxiety</td>
<td>13</td>
<td>79th</td>
<td>14</td>
<td>93rd</td>
</tr>
<tr>
<td>Popularity</td>
<td>10</td>
<td>66th</td>
<td>11</td>
<td>84th</td>
</tr>
<tr>
<td>Happiness and satisfaction</td>
<td>9</td>
<td>54th</td>
<td>10</td>
<td>82nd</td>
</tr>
</tbody>
</table>

Note. On the CDI, higher scores indicate greater clinical concern. On the Piers-Harris lower scores indicate greater clinical concern.

‡ indicates a score in the clinical range

*Indicates a change of >10% and/or a clinically meaningful shift in diagnostic classification

5.4.4 Discussion of Josh’s response to the MIP.

Josh’s Baseline phase occurred during a period that covered both school term and school holidays. His baseline recording showed he was maintaining an overall level of PA in the bottom 20th percentile compared to other Western Australian boys his age, and well below Tudor-Locke et al.’s (2011) recommended step counts for boys ‘sufficient activity’ for health. With the introduction of the additional components of the MIP, Josh’s daily pedometer step totals began to increase with days on or exceeding the 15,000 steps per day recommendation (Tudor-Locke et al., 2011) occurring more
regularly from week 5 onwards in the intervention phase. Mean overall activity levels during the intervention phase increased by 24% compared to Baseline. His overall PA level ranking also increased to the 40th percentile compared other Western Australian boys his age (Hands et al., 2004b).

It was still school holidays when the intervention phase began and the additional components of the MIP were introduced. During this time Josh’s activity levels only increased on weekends, as his mother was more available to take him on outings where they “did lots of walking”. Josh’s mother predicted that his activity levels would probably show a sharp decline when he went back to school. However, this did not occur. School athletics and cross country training had commenced at school and Josh was keen to take part in all the activities he could. Josh also increased his PA behaviours during lunch and recess at school by playing soccer with his friends. In his second week of the intervention phase Josh discovered there was a casual indoor soccer practice session at his local recreation centre that he could take part in after school. He was very keen to commit to this being a regular weekly activity. Josh’s mother supported this new activity by encouraging them to walk together to the recreation centre. Josh’s mother also came up with the idea that if they were watching TV as a family, Josh could get up during each advertisement break and do three laps indoors around the house, from 6pm to 6.30pm.

There were some problems with accurately monitoring Josh’s activity as he liked to ride his bike and participated in Tae Kwon Doh lessons, both of which are PA’s that the pedometer was unable to record accurately. While an equation was used to convert the time he had spent in these activities to steps, additional time in behavioural consultations was also spent thinking of activities that Josh would enjoy participating in that would also record steps accurately on the pedometer.
In the first half of the intervention phase, Josh’s mother continued to take him on walks with her and steps on weekends can be seen to show a consistently increasing trend as a result. Also, on the days when steps peaked above the 15,000 step recommendation, Josh had been playing soccer after school with group of his friends at the neighbourhood recreation centre; this is notable as it was something he never used to do before the MIP. Josh also reported an instance where his mother had allowed him to go to the soccer practice session after school at the recreation centre with his friend by himself (i.e., without her). Josh reported that he felt very happy to be granted greater independence as a consequence of participating in increased PA, serving as an additional reinforcer. Additionally, this enabled the effect of the MIP to generalise, increasing steps on both weekdays and weekends.

However, by the time Josh entered the MIP’s maintenance phase, where he and his mother were left to self-manage the monitoring of PA and the additional behavioural components, Josh’s PA levels had already begun to decline. He did not achieve his step target on any day during the maintenance phase and, when his overall PA levels were compared with other Western Australian boys, his percentile ranking had returned back to the 20th percentile (Hands et al., 2004b). PA levels on both weekdays and weekends declined from those achieved during the intervention phase. However, when compared to baseline levels, PA levels on weekends had at least maintained above baseline levels, while PA on weekdays returned to baseline levels.

With regards to the effect of the MIP on measures of physical health and psychological well-being, beneficial changes to Josh’s measures of physical health included a notable decrease in the supra-iliac skin fold and a decrease in the sub-scapular skin fold measure suggesting there may have been changes in body composition. While overall body mass increased it could be hypothesised (as in the case of Daniel) that this was due to an increase in muscle mass as opposed to adipose tissue.
Measureable, beneficial changes in Josh’s psychological well-being were also observed during the MIP. Even though Josh’s baseline scores for depression and self-esteem were within the normal range, all scores had improved when he was retested again following the MIP. In particular, Josh’s self-esteem improved where he was feeling more positive about school, his relationships with peers, and was happier with “who he was”.

Based on notes taken during behavioural consultations with Josh and his mother, several reasons could be identified that may have contributed to Josh’s decline in PA levels which seemed to affect steps walked on both weekdays and weekends equally. One could be that the increasingly hot weather (with many days over 34°C) became too much of a barrier for him to participate in PA outside the home and school buildings. Josh himself had complained to the researcher about the heat, and it was reported that Josh was typically averse to going outside in the back yard to play. Secondly, Josh found the activities he was participating in to specifically increase steps less enjoyable compared his more preferred ways of being physically active - bike riding, scootering – which unfortunately the pedometer cannot accurately monitor.

However, the most powerful reason for the decrease in PA was Josh’s mother’s behaviour. She was most able to participate in PA with Josh on weekends, and in the first half of the intervention, steps on weekends showed a consistent increasing trend. However, weekend levels developed a decreasing trend during week 11, and at the time Josh’s mother had reported to the researcher that Josh was “losing energy” to keep maintaining a higher level of regular PA, and that she herself did not have the energy to take herself for a walk let alone “try to get him moving” and participate with him in other PA’s. Initially, it was thought items in the Lucky Dip bag may not have acted as reinforcers of his new activities. From week 12 onwards new items were discussed and specially made “MIP money cheques” were put into the Lucky Dip bag. From then on Josh had the opportunity to earn up to $20 a week if he could achieve his target of
maintaining his higher PA levels. This was successful and led to a new increasing trend on both weekends and weekdays. However, the effect was short lived and PA levels on both weekdays and weekends declined systematically from week 16 onwards. It was noted that on days when Josh’s mother worked, Josh was more likely to choose to “do nothing” at home after school, and Josh’s mother remained reluctant to allow Josh to leave the house unsupervised. As PA levels continued to decline, monitoring results may have become less reinforcing. By the maintenance phase, Josh was requesting to “take a week break” from the MIP entirely.

In sum, the effect of the MIP on Josh’s PA levels was beneficial, and particularly for PA levels on weekends. Notable decreases were observed in two skin fold measures and improved scores on both the depression and self-concept questionnaires. However, by the end of the MIP PA levels on both weekdays and weekends had declined. His response to the MIP highlight the psycho-social factors that maintained his physical inactivity (lack of independence), and while these were overcome temporarily during the intervention, it did not last. It may also have been that for Josh when he could not access the natural rewards that he wanted (greater independence), the positive consequences that were planned as part of the MIP were unable to compete with more powerful reinforcers of avoiding feedback on PA levels and “doing nothing”.
5.5 Summary of the Results from the Single-case MIP Evaluations

Large differences in the mean daily physical activity levels were observed across the four participants during baseline. While the degree of individual daily variation in baseline data showed all participants they were capable of being more active (as indicated by the range in daily steps during baseline), none of the MIP participants could be considered ‘sufficiently active’ for health according to pedometer step recommendations by Tudor-Locke et al. (2011). Table 5.17 presents a summary each participant’s pedometer data (overall) from the baseline, intervention and maintenance phases in the MIP.
Table 5.17

*Summary of pedometer data (overall) from baseline, intervention and maintenance phases in the MIP*

<table>
<thead>
<tr>
<th>Age</th>
<th>Gender</th>
<th>Daniel</th>
<th>Anna</th>
<th>Elsie</th>
<th>Josh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 Years</td>
<td>8 Years</td>
<td>12 Years</td>
<td>12 Years</td>
<td></td>
</tr>
<tr>
<td>Mean Daily Steps</td>
<td>4,697</td>
<td>8,110</td>
<td>11,822</td>
<td>9,885</td>
<td></td>
</tr>
<tr>
<td>%ile ranking*</td>
<td>&lt;10&lt;sup&gt;th&lt;/sup&gt;</td>
<td>39&lt;sup&gt;th&lt;/sup&gt;</td>
<td>60&lt;sup&gt;th&lt;/sup&gt;</td>
<td>20&lt;sup&gt;th&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Min-Max</td>
<td>1,971 – 9,745</td>
<td>2,794 – 12,254</td>
<td>4,444 – 19,074</td>
<td>3,192 – 15,400</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>7,773</td>
<td>9,460</td>
<td>14,630</td>
<td>12,208</td>
<td></td>
</tr>
<tr>
<td>% of days on/above Baseline mean</td>
<td>45%</td>
<td>43%</td>
<td>53%</td>
<td>50%</td>
<td></td>
</tr>
</tbody>
</table>

**Baseline Phase (A)**

| Mean Daily Steps | 7,327 | 11,068 | 16,828 | 12,209 |
| %ile ranking* | 10<sup>th</sup> | 70<sup>th</sup> | >90<sup>th</sup> | 40<sup>th</sup> |
| Min-Max | 950 – 14,875 | 6,508 – 15,714 | 4,444 – 27,407 | 5,212 – 23,342 |
| Range | 13,925 | 9,202 | 15,759 | 18,131 |
| % of days on/above Baseline mean | 86% | 96% | 84% | 70% |

**Intervention Phase (B)**

| Mean increase: | % | 56% | 36% | 42% | 24% |
| steps | +2,630 | +2,958 | +5,006 | +2,324 |
| % of days on/above daily step target | 55% | 68% | 67% | 63% |
| Overall Success Rate | 75% | 86% | 81% | 88% |
| Maximum increase: | % | 98.96% | 53.50% | 78.60% | 57.06% |
| Steps | +4,649 | +4,339 | +9,292 | +5,641 |

**Maintenance Phase (C)**

| Mean Daily Steps | 9,232 | 8,783 | 9,332 |
| %ile ranking* | 20<sup>th</sup> | 20<sup>th</sup> | 20<sup>th</sup> |
| Min-Max | 5,486 – 11,213 | 3,704 – 15,759 | 6,442 – 12,577 |
| Range | 5,725 | 12,056 | 6,135 |
| % of days on/above Baseline mean | 100% | 43% | 43% |

**Mean increase:**

| % | 97% | -26% | -6% |
| steps | 4535 | -3,039 | -553 |
| % of days on/above Target | 86% | 0% | 0% |

*Percentile rankings are based on results from the Western Australian 2003 Child and Adolescent Physical Activity and Nutrition Survey (CAPANS) (Hands et al., 2004b).*

**Note:** The week in which maximum increases occurred was obtained by counting from the beginning of the monitoring period, i.e., including baseline monitoring.

**Note:** The ‘overall success rate’ is defined as the % of weeks during the intervention phase where the participant was eligible for a lucky dip reward (i.e., they had achieved their daily steps target on three or more days during the week). The ‘mean increase’ and ‘maximum increase’ are calculated relative to the baseline mean.
5.5.1 To what extent do ‘at risk’ children in the home-based MIP increase daily step counts to recommended ‘healthy daily targets?’

In three of the four cases, activity levels appeared to trend upwards in a consistent manner during the intervention phase. Three of the four participants were able to increase their mean weekly steps to a level that exceeded the pedometer steps per day recommendations by Tudor-Locke et al. (2011). Elsie also achieved a mean daily step count throughout the entire intervention period that was above the 12,000 pedometer steps per day recommendation by Tudor-Locke et al. (2011) for girls ‘sufficient activity’ for health. The weekly average of daily steps for each participant can be seen in Figure 5.9, relative to the steps per day recommendation by Tudor-Locke et al. (2011).
Figure 5.9 The weekly average of daily steps for each participant during baseline, intervention and maintenance phases in the Moving It Program. Grey horizontal line represents Tudor-Locke et al.’s (2011) recommended daily pedometer cut-off for ‘sufficient activity’ for health.
5.5.2 Does the effect of increasing steps generalise across steps on weekdays and weekends?

During baseline, most participants had large differences between weekday and weekend activity levels, and for three of the four participants’ weekend levels were lower than weekday levels. For most participants, as they progressed through the MIP, variability between the weekday and weekend physical activity levels tended to decrease, where steps walked on weekends were at a similar level to steps walked on weekdays.

Excellent generalisation of the effect of the MIP on increasing steps on both weekdays and weekends was seen in two participants, Daniel and Anna. While Elsie made large gains to steps on weekdays, steps on weekends showed a delayed increase during the MIP intervention and her overall mean for weekend steps did not differ greatly from her baseline levels. However, the reverse was true for Josh, who made relatively large gains to steps on weekends though overall change in mean weekday steps from baseline to intervention showed a relatively small increase.

The variability between physical activity levels on weekdays and weekends across each phase of the MIP can be seen in Figure 5.10 for each participant.
Figure 5.10 Mean steps/day on weekdays and weekends during each phase of the MIP
5.5.3 What is the effect of the MIP on measures of ‘at risk’ children’s physical health and psychological well-being?

The extent to which notable increases in activity levels of participants related to improvements in measures of physical health and psychological well-being at the end of the Moving It Program is summarised in Table 5.18. Due to the associated health benefits of relatively minor changes in measures such as weight/BMI, waist circumference and waist to hip ratio, improvements of <10% are also included.
Table 5.18

Summary of physical and psychological improvements following participation in the Moving It Program.

<table>
<thead>
<tr>
<th>Participant:</th>
<th>Daniel</th>
<th>Anna</th>
<th>Elsie</th>
<th>Josh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>10 Years</td>
<td>8 Years</td>
<td>12 Years</td>
<td>12 Years</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Female</td>
<td>Female</td>
<td>Male</td>
</tr>
</tbody>
</table>

**Physical Measures:**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Daniel</th>
<th>Anna</th>
<th>Elsie</th>
<th>Josh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time between pre-post</td>
<td>19 weeks</td>
<td>11 weeks, 5 days</td>
<td>18 weeks</td>
<td>20 weeks</td>
</tr>
<tr>
<td>Body Mass Index (BMI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waist to Height Ratio (WHtR)</td>
<td></td>
<td>Improved</td>
<td>Improved</td>
<td></td>
</tr>
<tr>
<td>Waist / Hip Ratio (WHR)</td>
<td></td>
<td>Improved</td>
<td>Improved</td>
<td></td>
</tr>
<tr>
<td>Waist circumference</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hip circumference</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum of Four Skin Folds</td>
<td>Improved</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triceps Skinfold</td>
<td>Improved</td>
<td>Improved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biceps Skinfold</td>
<td></td>
<td></td>
<td>Notable</td>
<td></td>
</tr>
<tr>
<td>Subscapular Skinfold</td>
<td>Notable</td>
<td>Notable</td>
<td></td>
<td>Improved</td>
</tr>
<tr>
<td>Suprailliac Skinfold</td>
<td>Improved</td>
<td></td>
<td>Notable</td>
<td></td>
</tr>
</tbody>
</table>

**Psychological Measures:**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Daniel</th>
<th>Anna</th>
<th>Elsie</th>
<th>Josh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time between pre-post</td>
<td>19 weeks</td>
<td>17 weeks, 3 days</td>
<td>18 weeks</td>
<td>20 weeks</td>
</tr>
<tr>
<td>Child Depression Inventory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Total</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Negative self-esteem</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piers-Harris Self Concept Scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Total</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Physical appearance and attributes</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Happiness and satisfaction</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** A ‘notable improvement’ refers to a change in the desired direction >10%, and ‘improved’ refers to a change in the desired direction that is <10%.
Chapter 6

Study I: Overall Discussion of the Single-Case *MIP* Evaluations

The purpose of Study I was to investigate to what extent ‘at risk’ primary school-aged children are able to self-manage increases in their PA levels (as measured by a pedometer) in a home-based, individually-adapted behavioural intervention. The extent to which participants self-managed increases in daily step counts to recommended ‘healthy’ daily targets was examined. Additionally, it was also examined whether the effect of increasing steps generalised across steps on weekdays and weekends. The extent to which changes made in steps were maintained when children (with the assistance of their parents) monitored their own data and were left to fully self-manage the MIP, was also of interest. With regards to the effects of lifestyle PA on health and well-being, Study I also investigated whether increases in PA during the MIP led to any beneficial effects on measures of ‘at risk’ children’s physical health and psychological well-being.

### 6.1 Changes to Children’s ‘Steps’ During the *MIP*

The single-case evaluations presented in Study I demonstrated that the home-based, individually-adapted ‘Moving It Programme’ was successful in encouraging overweight and obese children to increase their daily, lifestyle physical activity levels as measured with a pedometer. When the additional components of the MIP were introduced in the intervention phase the day to day variability in steps remained, however increasing trends were observed in all participants’ data and all 4 single-cases
made notable changes (>10% increase relative to baseline) in their daily activity levels across the intervention period.

During the MIP intervention phase, three out of the four single-cases were able to self-manage increases in their PA levels, with the assistance of a parent, to eventually reach a consistent level of PA equivalent to the daily recommended PA levels for health and well-being (Tudor-Locke et al., 2011). All participants were able to increase their mean daily steps enough to see an improvement in their percentile ranking when compared to other children their age and gender in Western Australia (Hands et al., 2004b). A pattern in the data often emerged where periods of upward trend were followed by increased variability and/or a decrease in levels which was then followed by an upward trend. This pattern of increase and the relative magnitudes observed in the MIP is similar to that reported in the pedometer-measured, home-based intervention by Conwell et al. (2010), although absolute steps increases in the MIP exceeded those reported by Conwell et al. For example, PA levels during Conwell et al.’s (2010) intervention also showed varying increasing and decreasing trends at times throughout the intervention phase, although overall maintaining an increase above baseline levels. They reported a mean peak increase among their group of 8- to 18-year-old obese children and adolescents of +3320 more mean steps per day during the 6th week of their 10 week intervention, and participants finished the intervention program walking a mean of +2867 more steps per day in the final week. Whereas, at individual points throughout the intervention phase, peak increases in mean steps achieved among the four MIP participants were +9,292 steps (Elsie, during week 16), +5,641 steps (Josh, during week 15), +4,649 steps (Daniel, during week 7) and +4,339 steps (Anna, during week 13).

Beyond the net gains in steps that were achieved in the MIP, the effect of increasing steps generalised across steps on weekdays and weekends. Mean step
increases over the entire 16 week MIP intervention phase ranged between MIP participants from +936 and up to +6,806 more steps per day on weekdays and from +122 and up to +5,844 more steps per day on weekends. These results are comparable to those obtained in Hardman, Horne and Lowe’s (2009) home-based intervention with 10-year-old girls. Their experimental group achieved a mean increase of +4,112 more steps per day on weekdays and +5,318 more steps per day on weekends, during their 8 day intervention.

Duncan et al. (2012) has shown that children are more likely to take more steps on weekdays compared to weekend days, and this was also the case for the low active MIP participants Daniel, Anna and Josh at baseline and throughout the intervention. However, when weekend and weekday data was compared to each participant’s overall mean, different patterns began to emerge which highlighted areas where each individual was able or less able to increase their physical activity levels. For example, while the MIP resulted in all participants increasing their steps on weekdays and weekends during the intervention period, the increase was not by the same amount across contexts. Some children (Daniel and Elsie), made greater gains in their mean steps/day on weekdays relative to their increase in weekend steps, while others (Josh and Anna) made greater improvements to their weekend steps relative to their increase in weekday steps. This pattern might have been overlooked if the MIP had not been evaluated as single-cases. It provides valuable individual level detail about which context supported increased activity levels for that child, and signified where they required extra support. This result demonstrates the importance of monitoring and evaluating changes in PA accrued on weekdays and weekends separately as well as demonstrating the value of individually adapted programmes when working with children to increase everyday PA levels, as not all children show the same pattern across each context. Efforts to increase PA behaviours had to target both weekend and weekday (school-day) contexts in the MIP,
where routines on each day exposed participants to different variables that controlled their PA behaviour. While it was possible to obtain data from the school holiday period, it was difficult to see any clear effects of these times on PA levels in MIP participants. For some, activity levels increased during holiday periods, while for others activity levels decreased. It was generally observed that weekday steps decreased during the school holidays. Also, in the cases of Elsie and Josh, steps on weekends during school holidays continued to increase in spite of decreases to steps on weekdays. However, it was difficult to pinpoint variables that could be affecting participant’s PA levels during the school holiday periods.

It was generally accepted that behaviours that add steps to the pedometer were desirable (i.e. physical activities) and behaviours that did not add steps to the pedometer were less desirable (i.e., sedentary activities). However, parents and children agreeing on what specific behaviours were acceptable and what behaviours were unacceptable was also an important aspect of the MIP and was individual for each family. During the initial interview and during subsequent behavioural consultations, hypotheses as to the function of sedentary behaviours and inactivity were generated and tested for each single case. Functions differed depending on the context of the behaviour. Functional assessments identified several hypothesized functions for MIP participants’ excessive/inappropriate sedentary behaviours in the home context as, for example, to escape or avoid negative feeling states (physiological or emotional), escape or avoid family members, escape or avoid activities, and obtain adult attention or self-stimulation. In the school context it was hypothesized that sedentary or low levels of PA were maintained by the function to escape or avoid negative feeling states (physiological or emotional), to escape or avoid peers, escape or avoid activities, and obtain adult attention. For example, Daniel’s physical inactivity at school was often negatively reinforced by escaping from the social demands and frequent negative
consequences of interacting with his peers. Whereas, at home Daniel’s preferred sedentary behaviour - playing internet games on the computer – was positively reinforcing as it provided the much needed rewarding social contact with peers (be they ‘online’) that he could not obtain from peers at school. Thus, to maximise opportunities for success in reaching step goals the MIP attempted to teach participants new behaviours that could replace their preferred sedentary behaviours and would allow him or her to obtain the same type of consequence as the ‘problem behaviour’ – that is, excessive/inappropriate sedentary behaviours. In the case of Daniel, this meant coming up with physical activities that were also socially rewarding in the after school and home context.

However, achieving this was not always possible. MIP participants often found themselves in environments where sedentary behaviours were predominantly more rewarding than active behaviours, which maintained their preference for sedentary behaviours. In the case of Daniel, finding socially rewarding physically active alternatives to replace computer games with his internet friends was difficult. An interaction between factors in the school context and the physical activity behaviours in the home context was also observed. For example, all MIP participants had complained to their parents at some point throughout the monitoring period of feeling “tired” after school. For some children this was a very common experience, as was the experience of headaches. The notes from behavioural consultations showed that these experiences often led to the afterschool period being a time of very low activity levels. The MIP intervention was designed to encourage children and families to change the child’s environment so that active behaviours are rewarded more than sedentary behaviours, while realizing that it is unrealistic to completely eliminate sedentary behaviours. Typically, the MIP relied on helping participants make specific plans / contracts where obtaining the negatively reinforcing avoidance/escape function of inactivity was made
contingent on participating in more active behaviours. For example, “you can play on the computer after you have done ten laps of the driveway/ridden your bike around the block/walked the dog”. While it was not possible to obtain separate data for steps during school and steps after school in these single-case evaluations, this would be of great value for future evaluations. Monitoring of steps ‘out of school’ in comparison to steps ‘in school’ and the overall daily total would allow a more focused approach and might suggest ways of overcoming the different variables that control PA behaviour in these specific contexts, such as feeling “tired” after school.

The weekly home consultations were an opportunity to explore what factors may have played a role in the intervention’s success or failure for that individual, and was typically related to the degree of parental involvement in the child’s everyday PA behaviours and/or the barriers encountered to being more physically active. Parents supported their children to increase their steps in different ways. Some examples include joint participation in PA and role modelling (e.g., going for a walk or a bike ride together; active commuting; ensuring child accompanied them on while running errands), enrolling the child in structured exercise classes (e.g., tennis, judo, soccer), providing transport to places where the child could be physically active (such as a friend’s house), making transport an opportunity for activity (e.g., walking to the destination), providing infrastructure and/or giving permission for the child to be active in various contexts when at home (e.g. scooter, active computer gaming, balls, or creating an obstacle course in backyard or indoors).

The more direct and continuous involvement the parent had in their child’s PA behaviours facilitated greater and more sustainable gains, as for example in the case of Daniel, whose mother frequently took him on outings and errands and eventually they joined a gym together. However, when the parent’s support was withdrawn, there was evidence that it led to a decrease in PA, as for example with Josh, whose mother tired of
joining him for bike rides and walks but would not let Josh go out by himself. These findings support those by Fogelholm et al. (1999) who found that parent inactivity (particularly that of the mother) was a strong and positive predictor of child inactivity. Additionally, Wen et al. (2009) investigated the role of a child’s independent mobility on PA levels and reported that children who were allowed to walk on their own, near where they lived, were significantly more likely to spend more than half an hour a day outdoors after school compared with children who were never allowed to walk on their own near where they lived. Thus, how active parents are, and the decisions they make regarding what their children can do, may determine the success of overweight children who are trying to increase their PA levels. This also concurs with findings from Crawford et al. (2010) who found that among boys, the degree to which their mothers were role models for MVPA was positively associated with their son’s MVPA, and father’s role modelling MVPA and parental co-participation in PA were significant positive predictors of MVPA in daughters.

When participants were left to self-manage during the maintenance phase MIP results showed that two out of the three cases with maintenance data were able to maintain their step increases on weekend days, while only one of the three cases maintained their step increase on weekdays, above baseline levels. This result is in contrast with those of Hardman, Horne and Lowe’s (2009) home-based intervention with 10-year-old girls, which reported a lack of significant difference between baseline and follow-up for steps on both weekdays and weekends. Hardman et al. (2009) speculated that as their control group showed an overall decreasing trend from baseline to follow-up, that the decrease in their experimental group might have been due to a time-of-year effect as whether conditions had progressed from summer during baseline to colder autumn weather at follow-up. They speculated their intervention had been effective by preventing the significant decrease in PA that was observed in their control
group, potentially due to the colder weather. While the weather conditions in Western Australia are characteristically mild, there are many days during the summer months that can be uncomfortably hot. Very hot weather conditions may be even more uncomfortable for those who are overweight, and often prohibitive of non-essential physical activity. These weather conditions coincided with when MIP participants were completing the final half of their intervention phase and/or had entered the maintenance phase. Thus, in this instance the weather conditions could also be considered a contributing factor affecting results during the maintenance phase. However, there were other factors that also appeared to have a large effect on PA levels during the maintenance phase.

Factors relating to attrition and the extent to which parents were able to maintain treatment fidelity to the MIP may have also played a role in determining PA levels during maintenance. Following the maintenance phase participants were offered the opportunity to continue to use the pedometer and adopt the MIP approach, self-monitoring of PA on a daily basis and adjusting contingencies, stimulus controls and reinforcers accordingly to achieve their own activity goals, as part of living a healthy active lifestyle. However, no MIP participants took up this offer. Thus, the lack of more positive results during the maintenance phase may be signifying more a problem of attrition than a systematic failure of the MIP’s additional components to affect an increase in steps per se. For example, decreasing trends in steps were observed prior to the maintenance phase. Each participant showed signs of wavering commitment at different times throughout the MIP. While attempts to address these issues were made during behavioural consultations, success was variable, as evidenced by the wave-like trends observed in daily steps.

The eventual unwillingness to continue to adopt the MIP approach as part of a long term lifestyle change may have been due to the design of the MIP. A slow pace of
increase was planned by selecting a design with a long intervention phase and weekly behavioural consultations. This design was chosen as it was thought a slower increase was more likely to generalise and maintain over the long term, rather than achieving a rapid increase that may be unsustainable over the longer term. This approach is also in line with the WHO’s (2010) global PA recommendations when intervening with inactive children. However, with this design it also meant that it was slower at responding to and effectively dealing with problems of attrition. Thus, when participants had decided they had had enough, it was difficult to encourage a child to continue for another whole week or two or three before things improved. It is likely to be easier to encourage a child to persevere for one or two more days, whereby if a turnaround can be achieved their participation was likely to continue.

Thus, while the MIP was intended to be an individually adapted programme, its design of weekly home consultations and a long intervention phase meant it was unable to adapt in a timely manner. When it was most critical to the participant that elements of the MIP were adapted to their changing circumstances, the MIP was only able to respond on a weekly basis. It would then take longer again to gather evidence to suggest if the adaptations had been beneficial or otherwise. Anna’s early withdrawal could be taken to signify the failure of the MIP to adequately respond and adapt to her individual needs in the programme in a timely manner.

6.2 Changes to Physical Health and Psychological Well-Being during the MIP Evaluations

Participants’ physical health and psychological well-being were monitored as secondary outcomes, to assess to what extent measureable, beneficial changes might be observed alongside participants increasing their everyday, lifestyle PA levels in the MIP. However, changes in these measures were not directly targeted in the MIP per se.
For example, it was not anticipated that significant weight reduction would occur as a result of increases in steps in the MIP, particularly as there was a deliberate lack of prescription for specific types of physical activity or ‘exercise’ that are common in weight loss oriented programmes. Therefore, monitoring was to ascertain if any secondary, beneficial side-effects are experienced as a result of MIP participation.

With the typical time between pre- and post-intervention assessments of 4 ½ months, it was surprising to find that all four of the MIP participants had shown some improvement in their measures of physical health following an increase in walking behaviours during the MIP. Anna showed the least improvement in body composition relative to other MIP participants. While she had achieved a notable increase in PA during her time in the programme she did not remain in the MIP until the end of the intervention phase. The reduced time between pre- post measurements (of less than 3 months) was a disadvantage to detecting further potential improvements to body composition that she may have attained had she remained in the programme until the end. Anna, Daniel and Josh all showed increases in weight and BMI during their time in the MIP. However, Daniel and Josh each showed notable reductions in central body skin fold measures suggesting both may have attained beneficial changes in their body composition, with a decrease in fat mass. The results obtained by Daniel and Josh support the findings from McGovern et al.’s (2008) review of ‘physical activity / exercise only’ treatments for paediatric obesity, who reported evidence for a moderate treatment effect of physical activity on adiposity (i.e., body fat), but not for BMI.

The MIP results are also similar to the findings from Conwell et al.’s (2010) 10-week pedometer-based intervention, who reported a significant increase in weight with non-significant increases in BMI and waist circumference amongst their group of 15 overweight children and adolescents. However, Conwell et al. had included additional measures of metabolic health. They found that in the absence of any significant changes
in dietary intake their participants also showed a significant increase in insulin sensitivity following their behavioural home-based intervention to increase PA, which was maintained at follow-up. Given the similarity in findings from the MIP with Conwell et al.’s evaluation, it could be argued that similar beneficial changes to metabolic health are also likely to have occurred in the MIP participants, as a result of their increased physical activity.

Elsie’s results were different from other MIP participants, and also different from other short-term physical activity intervention studies. Elsie showed a notable improvement in her BMI, with a reduction in weight alongside increases in height and physical activity levels. She also showed notable improvements in all skin fold measures including those from the central body and the extremities. Overall, Elsie’s results showed a reversal of the trend in weight gain her mother had reported at the beginning of the MIP. Elsie’s results are comparable to those reported by Epstein et al. (1982) in their landmark evaluation comparing the effects of a ‘lifestyle exercise’ intervention with a ‘programmed exercise’ intervention, both with and without dietary intervention. Epstein et al.’s ‘lifestyle exercise’ programme, with and without dietary intervention showed mean BMI’s had decreased by 2.97 and 1.95 (respectively) after six months from the start of treatment. Elsie’s BMI had decreased by 1.32, 4 months after the MIP had begun. While Elsie showed considerably variable increasing and decreasing trends in PA throughout the MIP monitoring period, she consistently exceeded Tudor-Locke et al.’s (2011) recommended pedometer step cut-offs for ‘sufficient activity’ for health throughout the intervention phase. Coincidentally, Elsie’s mother reported that they had begun trialling a “low GI” diet (on recommendation from her G.P.) in the weeks prior to the MIP and throughout the MIP, to help manage Elsie’s risk of Type II Diabetes. Thus, Elsie’s weight loss and improvement in body
composition might be due to a combination of changes to both diet and PA as a result of participation in the MIP.

Considering the MIP was a lifestyle PA intervention, which did not prescribe hours of vigorous physical activity/exercise per day, nor directly target outcomes in body composition, it was surprising to find beneficial, measureable improvements in body composition in participants (particularly to the extent shown in the case of Elsie). The MIP results show that cumulative increases in daily, lifestyle physical activities over several months can lead to additional benefits to measures of physical health in overweight and obese children.

The extent to which measureable, beneficial changes in participants’ psychological well-being can be observed as a result of participation in the MIP was also of interest. The patterns of change on the measures of depression and self-esteem suggest there were psychological benefits to increasing children’s physical activity levels using the MIP approach, with increases in self-esteem in particular. Daniel showed the greatest significant improvements in scores on both depression and self-esteem measures; although, this was likely due to his scores being in the clinical range at baseline, thus he had room for improvement. Daniel’s results directly support the evidence reported by Livingstone et al. (2003). They reviewed studies that showed increased levels of physical activity reduced behaviours typical of depression and anxiety, and offered opportunities for promoting self-esteem, particularly in children who were disadvantaged and with low initial self-regard. While Anna and Josh had scores in the normal range at baseline, both showed improvements at follow-up on the psychological scales, particularly on those measuring self-esteem. Thus, even ‘normal’ children can still benefit psychologically from participating in a programme like the MIP to increase physical activity. When participants were retested following the MIP, they reported feeling more positive about a range of areas in their life including; for
example, their appearance and physical strength, school attendance, relationships with peers, ‘who they were’ as a person, their mood, and their ability to persevere. While it cannot be completely ruled out that these improvements might have simply been due to a response bias since, although standardised, these psych measures are nevertheless self-report. However, the fact that Elsie did not show the same degree (if any) improvement in psychological well-being indicates not all participants were affected by a positive response bias.

The MIP results from the single cases also suggest that the positive effects of increasing PA on psychological well-being may be independent of the positive effects of increasing PA on physical health. For example, Anna showed notable improvement on measures of self-esteem in the MIP, in the absence of any notable improvements in physical health. In the case of Elsie, however, the reverse pattern was seen. Elsie showed many improvements in the measures of physical health relative to other MIP participants; however, she only showed limited improvements in measures of psychological well-being relative to the other MIP participants. Elsie’s complex picture of depression and low self-esteem noted at baseline maintained despite the significant improvements made to her PA levels and physical health. It was noted that re-testing Elsie’s psychological measures took place at a time when Elsie was at her most inactive relative to other phases of the MIP. Perhaps Elsie’s responses to these questionnaires would be different had they been administered when she was more active, during the intervention phase. This would corroborate with Parfit and Eston’s (2005) findings on PA and self-esteem in children who found that children walking more than 12,000 steps per day had more positive ‘psychological profiles’ than children walking less than 9,200 steps per day. Thus, it may be that these positive effects of PA on self-esteem might only occur while the children engaged in PA, and if PA then reduces, this may affect the extent to which positive effects on well-being is maintained. That is, the increased
levels of PA need to be maintained in order for the benefits to self-esteem to be maintained.

6.3 Limitations and Future Directions

Overall, the MIP was successful in increasing overweight/obese children’s everyday walking behaviour on weekdays and weekends. While improvements in both physical health and psychological well-being were also observed over the same time period, some caution should be applied when interpreting the secondary outcomes of health. For example, despite reductions in skin fold measurements, (including reductions in the suprailiac skin fold measurement from the abdominal/central body) observed in three of the four participants, all showed increases in waist circumference. These anthropometric measurements are known to have a relatively high margin for error even with very experienced anthropometrists. Despite the advanced training of the anthropometrist in this study, technical errors of measurement were not collected during data collection. Thus, the lack of concordance between changes in the measures of body composition over time indicate a level of uncertainty in the waist and hip girth and skin fold measures that should be acknowledged as a limitation of this study.

Additionally, while notable increases in steps per day were observed in each of the single cases, there were several limitations to increasing children’s PA with the MIP approach. Firstly, the use of the pedometer caused some problems when the types of activities that it could reliably count ‘steps’ for did not match with the types of activities the participants preferred to spend time doing (e.g., riding a bike, Tai Kwon Doh, swimming). Although, an equation was used to convert the time participants had spent in their preferred types of PA (that the pedometer was unable to monitor) and participants agreed to the calculated equivalent steps amounts. It is likely that the lack
of access to immediate, individually adapted feedback via the pedometer for these types of activities may also have reduced their naturally reinforcing properties.

Secondly, while the MIP aimed to teach participants new behaviours that could replace their preferred sedentary behaviours and would allow him or her to obtain the same type of consequence as the ‘problem behaviour’ – that is, excessive/inappropriate sedentary behaviours - achieving this was not always possible. The MIP more often relied on participants making specific plans / contracts where obtaining the negatively reinforcing avoidance/escape function of inactivity was made contingent on participating in more active behaviours. For example, “you can rest and watch TV after you have done ten laps of the driveway / ridden your bike around the block / walked the dog”. Thus, while all participants achieved notable increases in steps and showed improvements in relation to pedometer step guidelines for health, it appeared that most still participated in sedentary behaviours and some still to problematic levels (although this was not objectively monitored). Additionally, goal setting was a difficult process and led to unexpected outcomes, particularly in the case of Anna, who withdrew her participation perhaps due to being unable to sustain her increased PA levels. Future research should focus on finding out how best to use the recommended pedometer guidelines to teach children not only what is ‘sufficient’, but also what is acceptable and realistically achievable for each individual when aiming to achieve and maintain healthy activity levels.

Thirdly, as identified previously with regards to maintenance, the weekly schedule of home consultations was a limitation. For example, consultations on a weekly basis were more than adequate when the program was going well; however, when participants found the MIP particularly challenging, the weekly consultation schedule may not have been intensive enough to identify and resolve problems in a timely manner. Instead, small problems often got worse due to the length of time
participants had to wait until their next home consultation. For example, if the weekly step target set was too difficult, perhaps due to a misjudgement of the child’s upcoming activities, then each day the child failed to achieve their target was often a negatively punishing experience (as it meant they would be ineligible for their lucky dip reward).

Ideally, parents would have become reasonably proficient at managing the behavioural techniques of the MIP, so they could eventually take over the role as programme administrator. Parents would then have been better placed to be responsive on a daily basis to deal with issue of decreased motivation, lapses and so forth.

Treatment fidelity to the program as outlined in the MIP manual was monitored during each home consultation with the researcher. However, it was overestimated the degree to which parents could take on this ‘new’ role in the time available for weekly home consultations. For example, the content covered in the home consultation by the researcher was gauged on how successful the child had been at engaging in physical activity behaviours and achieving goals and to a degree on how successful the parent had been in delivering/completing the components of the intervention that week.

It was found that some parents were barely able to participate in PA with their children let alone manage the positive consequences and contingencies which increased and maintained their child’s PA behaviour. With some participants there was often not enough time in the weekly consultation to address the needs of the child participant as well as those of the parents. For example, Daniel and Josh’s families often required consultations of 1 hour, whereas Anna’s family (when no issues were identified or seemed apparent) some home consultations lasted only 20 minutes. In hindsight, it was critical that more time should have been allocated to focussing on transferring behavioural management skills to the parents as well. Unfortunately, when extra time was available in consultations it was due to the parent and child’s success with monitoring, charting and achieving steps goals, and it was assumed (perhaps
incorrectly) that using the extra time to focus on directly evaluating and building the parent’s skills was unnecessary.

Thus, in its present form there is evidence that the MIP was effective as a home-based intervention to increase PA levels on both weekdays and weekends. However, unless parents have assumed the role of programme administrator by the time of the maintenance phase, then it is unlikely the increases will be maintained. Also, while in its present form, it would not be feasible to increase the frequency of home behavioural consultations. The transfer of behavioural self-management skills needs to take place at some point and, ideally, both the parent and the child would learn these skills. Future developments of the MIP might include a separate course for parents, with a focus on the direct transfer of behavioural self-management skills, and positive consequences for the parents on providing accurate self-monitoring of both their child and their own PA levels. Unfortunately, such programs rarely have a broad appeal to parents, who often prefer trained professionals to work directly with their child to achieve the desired behavioural changes. Such is the reason why summer camps for overweight children, or so called ‘fat camps’ (Ellin, 2005), are so popular in the United States.

Fundamentally, however, the single case design was unable to detect to what extent children increased activity levels as a result of the various self-management strategies used or if increases were predominantly the result of possible reactivity effects from increased attention on activity levels due to wearing a pedometer, daily self-monitoring of steps and attention and interest from the researcher. While the baseline phase was meant to overcome this limitation to some extent, future evaluations of a MIP-like intervention should use an alternative alternating experimental design or with a control group.

Most of the participants in the MIP had reported some difficulties interacting with peers, either due to past bullying or a lack of acceptance by the peer group. For
example, it is likely Daniel would have met criteria for a social anxiety disorder, and both Anna and Elsie had been bullied in the past due to their being overweight and low physical abilities. For many children being physically active is rarely a solo pursuit, and is almost exclusively carried out in a social or group setting whether playing for a team in a structured sport setting or in playgrounds with family members and other children from the neighbourhood. Perhaps it is no surprise then, if a child has difficulty being socially accepted by their peers that they will also have trouble meeting the normative requirements for physical activity. Future MIP interventions should include methods to increase popularity and positive social experiences with peers. Additionally, by including a measure of ‘peer friendship / acceptance’ as a part of outcome measures future research could also investigate whether increasing PA leads to greater peer acceptance.

Perhaps due to their fragile relationships with peers, it was unfortunate that at times throughout the MIP Daniel, Anna and, to a lesser extent, Elsie all reported experiencing some form of verbal teasing or unwanted attention from their classmates for wearing their pedometers at school. Perhaps this could be avoided if the intervention was delivered from within the school setting with the whole peer group invited to wear pedometers to increase active behaviours. Overweight and ‘at risk’ children already have trouble being accepted by their peers due to the physical differences and so perhaps these children might be better supported in an intervention to increase PA if it were school-based. In this setting, all children would be treated inclusively, thus reducing the likelihood that the ‘at risk’ children will be further rejected for being separately targeted in interventions to increase their PA levels. The single case analysis of low active children in the MIP also showed that the school environment enabled some of them to participate at a higher level of PA during the intervention than on weekends. Perhaps if the intervention was school-based it might lead to more
generalised, long-lasting effects both in and out of school. Additionally, a school-based intervention using a MIP-like approach could then also address the broader issue of the large numbers of ‘typical’ children who also fail to meet current recommendations for daily PA, where the latest survey data suggest that the majority of children are falling short of ideal recommendations for daily PA.

6.4 Conclusions

It can be concluded from the single-case evaluations that children with an ‘at risk’ body composition and PA profile are certainly capable of increasing their PA levels with an individually adapted behavioural programme such as the MIP, and these increases in PA can lead to positive changes in physical health and psychological wellbeing. Each single case presented in the MIP evaluation reminds us of the individual complexity, with differing constellations of factors involved in the regulation of energy balance. Yet from these evaluations it appears there may also be some common barriers to these children participating in more PA. For example, participants often complained of “feeling tired”, particularly after school, and had difficulty initiating and/or maintaining rewarding social relationships with their peers. Their parents also needed hours of professional help to appropriately set goals and arrange reinforcing consequences for their children to increase their active behaviours. The MIP helped parents do this to some extent.

Perhaps what we have learnt most from the MIP single case evaluations is that there is considerable variability in children’s everyday PA levels, not just between children but within each child from one day to the next, and from weekdays (school days) to weekends. While this has already been established by previous research, the findings from Study I highlighted that this characteristic variability remained in each individual’s performance in the MIP programme, though it did not seem to prevent
children from increasing their PA to ‘sufficient’ levels. However, further investigation is required. The results from these single-cases highlighted there were individual patterns in the variation in PA levels between weekday and weekend data during school term and an interaction may also exist with the effect of school holidays. This suggests there may be differences in PA behaviour accrued during school and outside school and these need to be better understood. Future research needs to analyse ‘in school’ and ‘out of school’ steps separately and to evaluate whether intervention programs are increasing steps ‘in school’ or if they can have an effect on steps ‘out of school’, where it is most needed, or both.

Additionally, parents needed significant support from the researcher. Rather than learning as they progressed through the programme it would have been better to involve parents in a separate consultation “training phase” where they could have learnt more in depth about the programme before it being implemented with their children. Even then, while weekly behavioural consultations were effective to some extent, results could have been enhanced if their frequency were increased particularly during their more challenging times – to be more responsive and individually adapted at the critical time and to then more closely monitor the effectiveness of changes to contingencies. It is unlikely to be feasible to commit to meet with children in the home setting on a daily basis – unless parents can be trained to become effective programme administrators. Thus, when balancing the need for frequency with feasibility, the most obvious solution is to adapt the programme to be delivered in a location where it is feasible to meet with participants on a daily basis - such as at school. At school, it would also be possible to meet with many children to discuss their PA levels, on a daily basis, while simultaneously overcoming the limitations of the MIP that were a result of implementation in the home context. Given that the MIP has been demonstrated to effectively help some of the most ‘at risk’ and who are presumably more difficult to
treat, a behavioural MIP-like intervention for use in schools could have a broader reach to children both typical and ‘at risk’. School based interventions also provide the opportunity to work with larger numbers of children, and permit an experimental group design, where the intervention can be evaluated against similar children at the same school as a comparison. Accordingly, an evaluation of a specially designed MIP-like programme for application in regular schools was carried out in Study II.
Rationale and Research Questions for Study II: Quasi-experimental evaluations of the *Health and Programmed Physical Education (HAPPE)* Classroom Project

The single-case evaluations of the MIP demonstrated that, with the assistance of their families, ‘at risk’ children can develop behavioural skills to self-manage notable and clinically relevant increases in daily physical activity levels. Although, the single-cases also highlighted that increases in mean steps on weekdays and weekends, and the extent to which these maintained, differed on an individual basis. Despite this, in most cases the mean increases in PA observed during the MIP intervention led to notable and clinically relevant improvements in body composition and psychological well-being. Thus, an individually adapted, home-based behavioural self-management intervention approach can lead to beneficial outcomes to PA, health and well-being in ‘at risk’ primary school-aged children.

However, in the context of NCD prevention in childhood, the single-case evaluations of the MIP also highlighted a number of limitations of intervening with overweight primary school-aged children in the home context. For example, while there is a pressing need to attract greater numbers of ‘at risk’ children to participate in a program such as the MIP, so they can develop skills to self-manage increases in their PA, the financial costs of the MIP would be prohibitive for its widespread use. While parents were relied on to help administer the programme, the MIP evaluations demonstrated that none of the parents were able to take over full responsibility of programme administrator as they also required a great deal of extra support. The child
participants also experienced social isolation from their peers at school - and in some cases were further outcasts from social interactions in the playground - as a result of being the only child in their class regularly wearing a pedometer and their solo attempt to increase PA levels. The home setting also made it difficult for the researcher to feasibly increase the frequency of home consultations (e.g., to bi-weekly meetings or more) when it may have been needed to increase the intensity of the program and reinforcement schedule. Thus, to address these issues, developing and evaluating a MIP-like intervention which can be implemented in a school-based setting is the most apt solution.

Schools are often seen as an ideal setting for interventions to increase children’s PA levels. Stone et al. (1998) and van Sluijs, Kriemler and McMinn (2007) identified schools as the preferred settings not just because they are places where children spend a significant proportion of their daily life, but because they provide unique existing community infrastructures that have facilities, equipment and expert staff or staff who could be trained to teach the skills and benefits of lifelong physical activity. Goran, Reynolds and Lindquist (1999) described another advantage of schools as places where traditionally hard-to-reach populations can benefit from receiving health information and interventions, particularly if it is unlikely they would be exposed to such information in other settings. For example, within many families with overweight and/or ‘at risk’ children there may be a reluctance to acknowledge or change the established patterns of behaviour that may be contributing to the child’s health problems. This can be more so when other family members also display the same health risks and behaviour problems, such as obesity and a habitually sedentary lifestyle.

Thus, existing cultures within families, social networks and broader communities can normalise such health problems that not only stall changing PA behaviours but also inhibit seeking help to change problematic PA behaviours in the
first place (Goran et al., 1999). Schools provide access not only to participating children but also to their families, potentially influencing a home environment that can be supportive of the change being produced in the recruited child as well as possibly reducing the disease risk of his/her parents and siblings (Goran et al., 1999). However, it is also necessary to evaluate the effect of a MIP-like intervention on children who are not obviously ‘at risk’ (i.e., due to their overweight status) yet could also benefit from intervention to increase PA levels. In a school-based PA intervention all children can be treated inclusively and the broader issue of the large numbers of ‘typical’ children who also fail to meet current recommendations for daily PA can be addressed.

Understanding the effect of interventions on children’s PA levels measured on weekdays, during school hours and out of school, as well as on weekends is also important as it is not known to what extent a school-based program can lead to increases in steps generalising from ‘in school’ to ‘out of school’ on weekdays and on weekends. In the past, school-based interventions have traditionally only targeted increasing PA levels ‘in school’ by offering additional PE classes or ‘activity beaks’ – however, PA levels accrued during school hours’ accounts for a relatively small proportion of a child’s total daily PA, and often children will accrue the majority of their daily PA ‘out of school’ hours (Cox et al., 2006; Tudor-Locke et al., 2009). Study I showed the home-based MIP intervention led to increases in mean steps on weekdays and weekends; however, the extent to which increases in steps occurred in each context differed between individuals, and seemed to be determined by baseline levels. Arranging for PA data to be collected at school could allow for measures of daily steps walked ‘in school’ and ‘out of school’ to be gathered in addition to total daily steps on weekdays and weekends, to further investigate the effects of different contexts (such as school attendance) on children’s PA levels and assess the extent to which increases in PA generalise across these contexts.
Although, perhaps more fundamentally, it still needs to be evaluated if all the behavioural components packaged in the MIP are actually necessary for children to learn to self-manage increases in PA levels. Consequently, the behavioural components of the MIP were shaped into a school-based package that could be incorporated into the curriculum and be implemented with a group, including all children from the same classroom. An important aspect of the programme was that it could be flexible, naturalistic, easily adapted to any classroom setting and able to fit in with the school’s structure, timetabling, availability of teachers and resources with minimal extra costs for the school. Originally, the school-based programme continued to be referred to as the ‘Moving It Project’ as in Study I. However, in subsequent trials it was later renamed the Health and Programmed Physical Education (HAPPE) Classroom Project to better reflect the utility of the programme for teachers in a school setting as part of their usual curriculum. In line with the MIP, the intervention package in the HAPPE Classroom Project was also designed to support beneficial changes to all types of PA and sedentary behaviours such as, increasing vigorous PA, MVPA, and specific exercises; increasing lifestyle PA, NEAT or NEPA; reducing excessive participation in sedentary behaviours; and frequently interrupting prolonged bouts of sedentary time.

Study II was devised to evaluate The HAPPE Classroom project with multiple classrooms of primary school-aged children, involving an experimental group and a comparison group from within the same school. Children in the comparison classroom were asked to wear a pedometer and monitor steps on a continuous daily basis for the duration of one school Term (approximately nine weeks). The experimental group also wore a pedometer and monitored steps on a continuous daily basis, but were also exposed to the additional behavioural self-management strategies (such as, goal setting, feedback, planned positive consequences) packaged in the three-week HAPPE Classroom ‘Climb Mt Fuji Challenge’. A series of four separate trials were conducted to
evaluate the HAPPE Classroom program. Following the Pilot trial with children aged 7-9 years, a search for a new school was initiated to carry out further trials with older groups of primary-aged children, aged 8-10 years and 11-12 years. Some minor revisions were made to improve the data collection process (such as introducing a self-monitoring diary) and delivery of pedometer feedback during the intervention (such as using a laptop computer to provide individually-adapted systematic feedback on pedometer steps). It was important for participants in the experimental and comparison conditions to come from the same school and be monitored simultaneously to minimise any potential random effects (such as, school attendance or time of year sampling) differentially affecting PA levels. These trials specifically addressed the following research questions:

1. What is the effect of the school-based HAPPE classroom project (a self-management behavioural programme) on primary school-aged children’s pedometer measured steps, when monitored on a daily basis in one school term (approximately 8 weeks)?

   a. To what extent do mean daily steps increase in the comparison ‘Ped only’ group and in the experimental ‘Ped + HAPPE’ group, relative to recommended levels for health and well-being for children of the same age?

   b. To what extent do increases in daily steps on weekdays ‘in school’ generalise to ‘out of school’ steps and weekend steps?

   c. To what extent does the increase in daily steps in the experimental ‘Ped + HAPPE’ condition exceed the increase in daily steps in the Comparison ‘Ped Only’ condition?

   i. Specifically, it is hypothesised that participants in the experimental ‘Ped + HAPPE’ group exposed to the additional components of the
HAPPE Classroom ‘Climb Mt Fuji Challenge’ will show a statistically significant increase in mean steps during the intervention phase compared to the baseline phase, and that this increase would be greater than any increases observed in the comparison group at a similar time.

2. What is the effect of the HAPPE classroom program on measures of physical health and psychological well-being?
   a. To what extent are measurable, beneficial changes in participants’ physical health and psychological well-being also observed during the HAPPE classroom program, and to what extent are these changes related to changes in steps?
Chapter 8

Study II: Methods for quasi-experimental evaluations of the HAPPE Classroom Project

Many of the materials and procedures were designed and created by the author specifically for use in Study II, and evolved over time from the originals first used in the pilot programme at School A to those used in the three subsequent trials at School B. There were also inevitably some differences between the trials in the timing and delivery of group and individual behavioural consultations and the type and frequency of the delivery of planned group and individual positive consequences. However, the main components did not change and changes made were superficial, aesthetic or were made to enhance the organisation of the information or data collection process. The programme was adapted to the available resources, local surroundings and culture of particular classrooms without changing the fundamental theoretical or experimental aspects of the project. Due to the considerable overlap in the method from the first pilot trial at School A with subsequent trials at School B, the description of the methods will mostly make reference the methods described for the Pilot trial at School A. Any departures in the use of materials or procedures will be acknowledged in the relevant sections. All versions of materials are available in the relevant Appendices.

8.1 Participants

In total, 138 children from two schools were assessed for eligibility in the HAPPE trials. The pilot evaluation involved two regular classrooms from School A, comprised of children \((N=41)\) in Year 2 or Year 3 and aged 7-9 years. Each class was
randomly selected to the experimental or comparison condition. The experimental group (n=23) included 11 males and 12 females, and the comparison group (n=18) included 10 males and eight females.

The second, third and fourth trials of the HAPPE were conducted with older primary-school-age children at School B. The second trial of the HAPPE Classroom programme involved 53 participants aged 8-10 years. The experimental group (n= 27) was a classroom of Year 5 students that consisted of 17 males and 10 females. The comparison group (n = 26) was a classroom of combined Year 4 and Year 5’s, consisting of 15 males and 11 females. The third trial involved 44 children aged 10-12 years. The experimental group (n=22) comprised of 12 males and 10 females and consisted of a class of exclusively Year 7 students. The comparison group (n=22) comprised of 12 males and 10 females consisted of a combined class of Year 6 and Year 7 students.

The fourth trial of the HAPPE was conducted with the same children aged 8-10 years from Trial 2 however, participants from the experimental group in Trial 2 crossed over to the comparison group in Trial 4, while participants from the comparison condition in Trial 2 participated in the experimental condition in Trial 4. Most of the participants in the fourth trial of the HAPPE classroom project (N=53) were the same as those in the second trial, with the exception of a small group of children who had left the school, were new to the school between trials, thereby causing the composition of unique participants to fluctuate. The experimental group (n= 26) was the split class of Year 4/5’s comprised of 15 males and 11 females, and the comparison group (n=27) was the class of Year 5 students, comprised of 17 males and 10 females.

The only eligibility criterion for participants was their parents’ and own consent. Copies of information and consent forms for parents and participants are presented in Appendix G. Participants were aware that they could withdraw from the
study at any time. Even if children were no longer able to provide physical activity data from the pedometer, they were invited to continue to take part in all other aspects of the programme.

## 8.2 Setting

The HAPPE programme was originally piloted at School A, a primary school situated in a northern coastal suburb of Perth, Western Australia, in a median SES area for the metro area. The trial took place in Term 3, 2007 across the months of August and September. This is Winter/Spring in the southern hemisphere, when the weather is considered to be mostly mild, with average daily maximums ranging from 18°C to 21°C. Ethics approval was provided by Murdoch University Research Ethics Committee and the State Department of Education and Training in Western Australia.

School B became the site of three further trials of the HAPPE Classroom Project. Over 50 primary schools from both metropolitan and regional areas of Western Australia registered their interest to participate in the project in response to an internal Department of Education advertisement about the HAPPE Classroom Project (see Appendix R for a copy of the email advertisement). However, School B was selected based on the availability of age-matched classrooms that could be allocated to the experimental and comparison conditions, and its location near the university. The school offered the same hours of P.E. per week as the pilot School A. It was also in an area rated as a median SES area by the Department, in a small south western suburb of Perth, Western Australia.

The second trial of the HAPPE took place during Term 2, 2008 where physical activity was monitored with pedometers continuously across the late autumn and early winter months of April, May and June, when the weather is mostly mild, with an average daily maximum ranging from 19°C to 24°C, and gradually increasing rainfall.
Trial three took place in Term 3, 2008 across the months of August and September. This is Winter/Spring in the southern hemisphere, when the weather is considered to be mostly mild, with average daily maximums ranging from 18°C to 21°C. In the fourth trial, data was collected during Term 4, 2008 across the months of October, November and December. This is Spring/Summer in the southern hemisphere when the weather is considered to be mostly mild, with average daily maximums ranging from 23°C to 29°C.

Two other primary schools were selected for the same reasons and were scheduled to participate in the program the following year. However constraints on resources and the researcher’s time meant that further data collection for the project had to cease after the School B study. Ethics approval was provided by the Murdoch University Research Ethics Committee and the State Department of Education and Training in Western Australia.

8.3 Materials

A variety of measures and equipment were designed and created by the author specifically for use in Study II, evolving from those used for Study I. For example, materials used for the pilot trial were originally labelled for the ‘Movin it Project’ and have been left this way in the relevant Appendices. However, in this section all materials will be referred to as the HAPPE Classroom Project.

Materials that were essential in delivering the necessary components of the HAPPE Classroom Project and collecting data were provided to individual participants. These were a YAMAX CW 701 pedometer, the ‘My HAPPE Activity Book’ (used only in Trial’s 3 and 4), the “My Climb to Mt Fuji Chart” and items to be used as tangible rewards. Materials used with the whole group included a ‘Climb Mt Fuji’ Classroom Poster. Other Materials used in Study II included a “HAPPE Teachers Manual”
provided to the teachers and a Group Behavioural Consultation Pro Forma, used to standardise delivery of the intervention.

**8.3.1 Pedometers.**

As in Study I, movement resulting in a count being recorded on a pedometer was used as the measure for monitoring physical activity levels. A different type of pedometer had become available since the first study and, as Study II was an evaluation of a school-based intervention, the new pedometer was chosen as it meant that parents would not be required to assist with monitoring activity levels in the home environment. The Yamax Digi-walker CW-701 (Yamax Corp., Kumamoto, Japan) was chosen for its seven day memory function and its ability to automatically reset to ‘zero’ at midnight. This allowed the researcher to have more control over the data collection process where pedometer totals could be obtained the following day at school without having to rely on participants to self-monitor in the home environment, and the researcher and the classroom teacher shared responsibility for writing down all participants’ pedometer data on a twice daily basis in the morning and afternoon. Yamax Digi-walker pedometers (e.g., CW-701, SW-200) are valid and reliable for measuring steps in children (as previously discussed in Chapter 4). While the CW-701 improves over previous Digi-walker models by including the multi-day-memory function, the mechanical properties of these units are otherwise identical to earlier models.

**8.3.2 “My Climb to Mt Fuji” chart and “My Activity Levels” chart.**

In the experimental classroom a chart for each individual was created to plot the participant’s total daily steps, as recorded by their pedometer through all phases of the intervention (See Appendix I). The chart was titled “My Climb to Mt Fuji” where each point on the x-axis represented a day of the week and the number of total daily steps
was on the y-axis, scaled individually for each participant. For participants in the experimental group the “My Climb to Mt Fuji” chart provided information about daily steps totals, trend lines and pedometer step targets all relating to the individual. The “My Climb to Mt Fuji” chart was referenced during individual behavioural consultations as part of delivering the feedback and goal setting components of the HAPPE Classroom intervention. During the pilot trial, the chart was constructed by the researcher on A4 paper and updated throughout the intervention. A photocopy of printout of the finished chart was given to participants at the end of the trial.

In the subsequent trials at School B, participants were able to view their chart on the researcher’s laptop computer. Information included daily step totals, as well as trend lines and individual daily pedometer step targets. The chart also displayed other information to participants in separate text boxes around the chart. A list of activity ideas including ‘pro social’, ‘fun’ and ‘everyday’ types of activities that could be engaged in at school, at home and on the weekend were generated through an initial session with the group and were summarised and displayed on individual charts. Another text box contained percentages of increased steps to signify the progress the individual participant was making during the Climb Mt Fuji Challenge. Later in HAPPE Trial’s 3 and 4, participants could view their daily step total data, as well as the total number of steps they had accrued while in-school and out of school. This allowed participants to have a visual representation of their activity behaviour patterns in different contexts across the day and from day to day. A printed copy was given to participants at the end of the trial. (See Appendix I for versions of the feedback charts used in School A and School B).

For participants in the comparison group, a chart titled “My Activity Levels” was provided to participants, only at the end of the data collection period. The chart made no reference to Mt Fuji and provided information on daily steps totals and trends
over the monitoring period. The x-axis represented days of the week and the y-axis showed the number of total daily steps, scaled individually for each participant. The chart was constructed using Excel computer software and printed on A4 paper (see Appendix J).

8.3.3 “My HAPPE Activity Book”.

In HAPPE Trial’s 3 and 4 The “My HAPPE Activity Book” was introduced as a self-monitoring manual designed by the author to help participants monitor and record their pedometer data on a daily basis. With the 11-12-year-old students in Trial 3, the page layout of the book was on A5 paper, with a table where participants could write down their pedometer data in the morning and afternoon. It also contained instructions on participation in the HAPPE classroom project and how to monitor physical activity levels. After several days of training and ongoing support, the My HAPPE Activity Books were considered to be a valid and reliable method of collecting pedometer data. An example of the book used in this trial can be seen in Appendix T (Figure T.1).

Following the success with the older children, a modified version was introduced with the 8-10 year-olds in Trial 4. The page layout of the book was on A4 paper, used a larger font size and provided more space for the younger children’s hand writing. After several days of training and ongoing support, the participants were able to demonstrate they could accurately record their activity data for the researcher, and the ‘My HAPPE Activity Book’ was considered to be a valid and reliable method of collecting pedometer data with this group of children. An example of the book used in this trial can be seen in Appendix T (Figure T.2).
8.3.4 Positive consequences: possible reinforcement and tangible rewards.

In the experimental group, reinforcement and tangible rewards were provided to individual participants who increased their physical activity behaviour contingent on achieving individualised step targets. Positive reinforcement consisted of verbal praise from the teacher and the researcher when acknowledging an individual’s physical activity achievements in front of their peers, which also lead to participants gaining recognition and distinction. Tangible rewards were also delivered and consisted of small badges designed by the researcher that could be worn by eligible participants. Badges, designed by the researcher, had a written phrase with a small graphic (e.g., “I’m a Moving It king/queen”; “I’m a HAPPE kid”).

In the comparison group, reinforcement and tangible rewards were provided to individual participants when they had remembered to wear their pedometer each day. Participants could earn the chance to wear a badge, designed by the researcher specifically for the comparison group, which included a written phrase with a small graphic, for example, “I’m a star at wearing my pedometer”, and “I’m a step counting King/Queen”). This system was introduced to reduce possible attrition in the comparison group. Delivering the badges also provided an opportunity for the teacher and the researcher to give verbal praise to individuals remembering to wear the pedometer and providing step data on a daily basis. Comparison participants also gained distinction and recognition amongst their peers when wearing their badge. In subsequent trials at School B, a greater variety of tangible rewards were on offer to the comparison participants. For example, participants could earn the privilege of designing their own badges or take a Lucky Dip prize choosing an item from a box of prizes, if they remembered to wear their pedometer and had provided accurate data on a minimum of five days out of seven days in the week. The contents of the Lucky Dip box included
stationary items that could be useful in the classroom, such as coloured pens and pencils, stickers, erasers, sharpeners and highlighters, as well as some badges that the researcher had made.

8.3.5 ‘Climb Mt Fuji’ classroom poster.

The ‘Climb Mt Fuji’ Classroom Poster (see Appendix K) was used with the experimental group to assist with goal setting to increase steps throughout the intervention. The poster was printed on large A1 cardboard, with a background illustration of a fictionalised Mt Fuji with three small houses that could be seen along a dotted line, representing the climbing trail. The first house signalled ‘base camp’ with two more houses along the trail each representing the end point of climbing stage 1 and climbing stage 2. Following this, the trail continued to the summit, or peak of the mountain. Each short term activity goal (set weekly) during the intervention phase was made analogous to the stages of climbing the mountain, where the summit indicated the final goal. Mt Fuji was intentionally selected as its classic mountainous shape and even slope resembled the type of goal setting strategy that the HAPPE project wanted to use that is, demonstrating an evenly paced and realistically achievable slope, where progression to the final goal cannot occur until previous stages have been achieved. The poster was displayed prominently in the classroom and acted as a visual aid to provide feedback on the group’s total increases in everyday activity levels during the intervention phase. Appendix K shows an example of the Climb Mt Fuji Classroom Poster half way through the intervention phase, with daily class step totals and other feedback to illustrate the class group’s progression towards their agreed goal.

In all trials of the HAPPE project at School B, the comparison group were also provided with a Wearing my Pedometer poster. This was displayed in a prominent position in the classroom and was introduced at the same time the experimental group entered the intervention phase. The poster was to help maintain the collection of quality
pedometer data from the comparison group. The poster (which can be seen in Appendix S) consisted of a list of the names of all participants in the class, with tick boxes next to their names. Boxes were ticked by the teacher or researcher each day participants wore their pedometer. No details of any individual’s pedometer data was displayed or discussed publicly.

8.3.6 HAPPE teacher’s manual.

The original version of the Teacher’s Manual was written for the pilot project in 2007. It contained a brief outline of the project and a more detailed section devoted to the nature and aims of the Study II. It included details of the procedure, instructions for the teacher and information about the pedometers. The manual was designed to be a comprehensive reference document to prepare teachers for participation and provide guidance while in the program. The manual was given to teachers in the experimental group and the comparison group two weeks before the HAPPE Classroom Project was to begin in their classroom to allow them time to read and prepare. When designing the HAPPE Classroom Project, it was intended that any teacher would be able to read the manual and have enough information to run the program successfully with their classroom. However, given that the project was still in an experimental phase of design, the researcher was available to offer whatever level of support was necessary so that teachers did not feel over worked with the requirements of participating in the project on top of the requirements of their usual teaching schedules.

In Trial 2, the teachers’ manual was updated based on the feedback from the teachers in the pilot school. The format was simplified so that it could be read as a quick reference guide, using dot points and brief instructions. The manual did not include the detailed background information and rationale provided in the original version. It contained procedural information detailing the task for the teacher on a week by week basis. Different content was created for the teacher in the experimental group and the
teacher in the comparison group. In Trial’s 3 and 4, a third version of the Teacher’s Manual was used. It was a combination of the first and second versions and included only limited background information. It also contained an overall project outline and week by week procedural details of the important components in the HAPPE Classroom Project. It was partially re-written and reformatted to be more engaging and legible. All versions of the HAPPE Teachers’ Manual can be seen in Appendix L.

8.3.7 Group behavioural consultation pro forma.

The researcher also designed a group behavioural consultation *pro forma* in order to standardise the delivery of the additional behavioural components packaged in the ‘Climb Mt Fuji Challenge’ during the intervention phase across trials. The *pro forma* itemised the tasks to be carried out during group behavioural consultations with participants in the experimental group, such as providing activity feedback to the group and monitoring progress, discussing class goals, delivering reinforcement and tangible rewards and planning and problem solving. It was written to enable teachers to co-facilitate class consultations if needed. A copy of the *pro forma* is presented in Appendix M.

8.3.8 Measures of health and well-being.

The measures and materials in Study II also assessed if children increasing lifestyle physical activity levels had a measurable effect on their physical health and psychological well-being. These consisted of the same standardised psychological questionnaires and physical measures as used in Study I - the Child Depression Inventory (CDI) and the Piers-Harris Children’s Self Concept Scale - and the details regarding these measures have been provided in Chapter Four. Only the additional measures and materials that were used in Study II are described in this section in detail.
8.3.8.1 Measures of psychological well-being.

The three psychological scales used in Study II were administered in a group setting in the classroom. A general set of instructions was read to all participants at the start of their administration (see Appendix N). Approximately 40 -50 minutes (or one lesson time) was required to allow participants to complete all questionnaires. Conducting the battery of psychological measures in this way maintained the procedures required for accurate and valid assessment as detailed by the respective manuals of each scale. For the purpose of Study II, only data from the three psychological scales that assessed global self-concept/esteem, total anxiety and total depression are reported as they form the apex of the hierarchical structure of the self-concept, depression and anxiety measure employed and are in line with previous research (Parfitt & Eston, 2005).

Revised Children’s Manifest Anxiety Scale (RCMAS). The RCMAS, subtitled 'What I Think and Feel' is a brief self-report questionnaire designed to assess the level and nature of anxiety in children and adolescents aged 6-19 years. In Study II, the RCMAS was chosen to assess the extent to which self-reported anxiety levels may change in response to increasing PA levels in the HAPPE Classroom Project. The RCMAS was specifically designed for group or individual administration to children and adolescents by a teacher, clinician, psychologist or researcher (Reynolds & Richmond, 1985). The RCMAS consists of 37 statements which embody a feeling or action that reflects an aspect of anxiety. The participant is required to respond to each statement by circling either ‘yes’ or ‘no’ with a pencil to indicate whether or not the item is descriptive of the child’s own feelings or actions. Scores are derived from affirmative responses, so that a high score indicates a high level of anxiety.

The RCMAS guidelines on scoring Total Anxiety were followed. The Total Anxiety score is based upon the sum of ‘yes’ answers to 28 of the 37 items. There is
also a Lie (social desirability) Scale which consists of the remaining nine items, and is used to determine if the child was making a valid attempt to respond. Scores are also provided for 3 additional sub-scales which, when totalled constitute the 28 items comprising the total score, and provide more clinical insight into the individual’s responses. A description and sample item for each of the sub-scales, *Worry/Oversensitivity, Physiological Anxiety* and *Social Concerns/Concentration* that make up the 37-Item Revised Children’s Manifest Anxiety Scale are displayed in Table 8.1.
Table 8.1

A description and sample item for each of the sub-scales that make up the 37-Item Revised Children’s Manifest Anxiety Scale

<table>
<thead>
<tr>
<th>Scale Name</th>
<th>No. of items (Max. Score)</th>
<th>Description</th>
<th>Sample Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Anxiety</td>
<td>28</td>
<td>Items associated with physiological manifestations of anxiety such as sleep difficulties, nausea and fatigue.</td>
<td>Item 5. “Often I have trouble getting my breath.”</td>
</tr>
<tr>
<td>Physiological Anxiety</td>
<td>10</td>
<td>Items associated with obsessive worrying about a variety of things, most of which are relatively vague and ill-defined in the child’s mind, coupled with fears of being hurt or isolated emotionally.</td>
<td>Item 2. “I get nervous when things do not go the right way for me.”</td>
</tr>
<tr>
<td>Worry / Oversensitivity</td>
<td>11</td>
<td>Items are concerned with distracting thoughts and certain fears, many of a social or interpersonal nature, that lead to difficulties with concentration and attention.</td>
<td>Item 11. “I feel that others do not like the way I do things.”</td>
</tr>
<tr>
<td>Social Concerns / Concentration</td>
<td>7</td>
<td>Scale is designed to detect acquiescence, social desirability, or the deliberate faking of responses. A high score requires the examiner to determine if the child was making a valid response to the scale or simply marking “Yes” to every item or trying to please the examiner.</td>
<td>Item 16. “I am always good.”</td>
</tr>
<tr>
<td>Lie (L)</td>
<td>9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The RCMAS was standardised with a sample of 4,972 children between the ages of 6 and 19 years. Reliability estimates collapsed across the 12 age levels ranged from .79 to .85 (median=.82). The manual reports higher correlations between the RCMAS Total Anxiety score and another measure of trait anxiety ($r=.67$) than between Total Anxiety and a measure of state anxiety ($r=.10$) (Reynolds & Richmond, 1985).
8.3.8.2 Measures of physical health and body composition.

The anthropometric measures described previously for Study I were also used in Study II to obtain measures of the child’s adiposity and body composition. These measures included *Weight, Height and Body Mass Index (BMI: kg/m$^2$)*, where a portable stadiometer - Tanita Leicester Portable Height Measure - was used to measure height without shoes. *Skin-folds (mm)* measurements were taken by a research assistant who was selected due to her qualifications as a post-graduate exercise physiology student trained in anthropometric measurements. *Waist and Hip circumferences (cm)* were obtained by the researcher herself using a compact, retractable flexible tape measure (MABIS, model no. 35-780-010) designed for this use, with the *Waist-Hip ratio (WHR)* and *Waist to Height ratio (WHtR)* were calculated during data entry.

Additionally, measures of blood pressure and heart rate were included as they were thought to be sensitive enough to respond to changes in levels of PA over a short period of time. Details of the instruments used are described below. The Physical Measures Record Form, created by the researcher to record participants’ data, also contained detailed instructions for the measurement procedures followed for each measure, and can be seen in Appendix O.

*Resting Heart Rate and Blood Pressure.* Heart rate and systolic and diastolic blood pressure measures were monitored using a portable Omron Automatic Blood Pressure Monitor (model IA2, Kyoto, Japan). The research assistant selected a child cuff or adult cuff depending on the child’s size and took measurements according to the machine’s instruction manual. Further details of the measurement procedure can be seen in Appendix O, as it is stated on the Physical Measures Record Form, where participant data was also recorded.
8.4 Procedure

The HAPPE classroom intervention was designed to be implemented over the course of one school term of approximately 10 weeks to take measures of the steps accrued both in-school and out-of-school relative to total daily steps on weekdays and weekends. A meeting was arranged for the first week of term to provide an opportunity for the researcher to develop a working rapport with the teachers, provide training in the programme and discuss any questions they may have. The meeting was used to demonstrate the use of the pedometer and provided time for the teachers to familiarise themselves with the Teacher’s Manual and the other materials and procedures that were to be used in the study. Consent forms were sent home with all students in the experimental and comparison classes to be signed by their parents. Once all consent forms had been returned to the researcher, pedometers and instructions were distributed to children on the school day prior to the start of formal baseline recording. Unfortunately, circumstances caused a delay at the start of term in the Pilot trial which shortened the overall monitoring period by approximately two weeks - leading to shorter baseline and maintenances phases relative to the other Trials. Figure 8.1 provides an overview of the general procedure for administering the HAPPE Classroom project.
Figure 8.1 General procedure for the HAPPE Classroom Project.
Table 8.2 provides a summary of the data collection process for the four trials of the HAPPE programme including the sample (n) of those assessed for eligibility to participate.

Table 8.2

Summary of the data collection process for the four trials of the HAPPE programme

<table>
<thead>
<tr>
<th>Trial</th>
<th>Year</th>
<th>Age Range</th>
<th>School</th>
<th>Start Date</th>
<th>Season</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Pilot)</td>
<td>2-3’s</td>
<td>7-9 years</td>
<td>A</td>
<td>July 2007</td>
<td>Winter/Spring</td>
<td>41</td>
</tr>
<tr>
<td>2</td>
<td>4-5’s</td>
<td>8–10 years</td>
<td>B</td>
<td>April 2008</td>
<td>Autumn/Winter</td>
<td>53</td>
</tr>
<tr>
<td>3</td>
<td>6-7’s</td>
<td>11-12 years</td>
<td>B</td>
<td>July 2008</td>
<td>Winter/Spring</td>
<td>44</td>
</tr>
<tr>
<td>4*</td>
<td>4-5’s</td>
<td>8-10 years</td>
<td>B</td>
<td>Oct. 2008</td>
<td>Spring/Summer</td>
<td>53*</td>
</tr>
</tbody>
</table>

*Most of the participants in Trial 4 were the same as those in Trial 2, with the exception of a small group of children who had left the school or were new to the school between trials.

Activity measurement with the pedometer was on a continuous daily basis from the start of the baseline phase until the end of the maintenance phase, and pedometers were returned to the researcher at school on the final day of the programme. The procedure for introducing pedometers to the classroom situation was adapted from the recommendations set out by Morgan, Pangrazzi and Beighle (2003). A handout with written instructions (see Appendix H) regarding the pedometer and its safe keeping was read aloud to the class and participants were asked to take it home to show their parents. As a class, the children were allowed to familiarise themselves with their pedometer and its functions, were taught how to wear it, and were given responsibilities for ensuring it was not damaged or lost. Participants met individually with the researcher to check their own pedometer was fitted properly, enter their individual weight information and stride length into the pedometer and conduct a step-test. The step test involved participants manually counting while they walked 20 steps and checking afterwards that the...
A pedometer had recorded the steps to within $\pm$ two steps. If the pedometer was out by more than two steps, the step test would be repeated with the position of the pedometer altered each time until a more accurate position was found on the child’s body.

Participants were instructed to establish a routine of wearing their pedometer every day from the time they woke up and dressed themselves in the morning until the time they went to bed in the evening. Participants were instructed that the pedometer was to be removed for safe keeping with the parent when the child took part in any activities involving water where the pedometer might get wet (such as swimming), or sustain damage due to impact in rough play or games, such as contact sports. Participants were also informed by the researcher, their teacher and the school Vice-Principal about the moral and ethical consequences of intentionally shaking their pedometers and how it would jeopardise the validity of the whole research project. They were told, “You shake it, we take it”, and were encouraged to take responsibility for providing accurate data about their activity levels. Participants were instructed to tell the researcher or their teacher if they saw someone else shaking their pedometer.

To maintain quality data throughout the activity monitoring period, the researcher routinely asked participants questions during data collection points such as, “Are you wearing your pedometer in the right place?”, “And on the weekend?”, “Where do you leave your pedometer at night?” and “Are there any problems with wearing your pedometer?” The researcher would attempt to help problem solve situations when a participant was forgetting to wear the pedometer and to offer praise when they did. Regular reliability checks for each pedometer were carried out during all phases of the study. On randomly selected days at least twice a week, the researcher would collect all pedometers from the participants when a scheduled sit-down class activity was planned to avoid missing out on the opportunity for steps to be recorded on the pedometer. In an
office at the school the researcher conducted ‘shake tests’ with each pedometer to check the pendulum mechanism was in working order and sufficiently sensitive, and also checked the clock was reading the right time and had the same time as all other pedometers. The researcher would ask participants to repeat a ‘step test’, to check the accuracy of the pedometer whilst being worn by the participant on random days with each participant throughout the monitoring period.

8.4.1 Baseline phase.

The baseline phase of the experiment established the first behavioural self-management component of the HAPPE Classroom Programme- daily monitoring of physical activity levels with the pedometer. Once physical activity monitoring was underway, baseline measures of physical health psychological well-being were obtained. Participants in the experimental and comparison groups were treated exactly the same throughout the baseline phase. Due to an unforeseen delay at the start of the pilot trial the project could not begin until the fourth week of term, and the length of the baseline phase could only continue for 12 days.

8.4.1.1 Daily monitoring of physical activity levels with the pedometer.

In both experimental and comparison conditions the procedure for activity data collection was the same. To capture the total steps taken in-school, out-of-school and across the whole day, physical activity data were collected at two points during the school day, at approximately 8.30am and 3pm close to the time the school bell rung to start and end school for the day. At the morning data collection point, the number of steps that had been walked in the morning thus far as well as the total step count from the previous day was recorded by the researcher, along with any qualitative details about types of physical activities the participant had engaged in. On Monday mornings, the total step count from the previous three days was also recorded so that step data
from Fridays, Saturdays and Sundays could also be included. The afternoon data collection point simply recorded the total number of steps that had been walked that day during school. This allowed the researcher to obtain pedometer data for steps walked ‘in school’ and steps walked ‘out of school’, as well as total daily steps on both weekdays and weekends. Detailed monitoring such as this was the basis for assessing the degree to which the effect of increasing PA levels with a school-based intervention programme might generalise to other contexts where children are active, such as afterschool and on weekends.

Data collection times were meant to be as brief as possible. They provided an opportunity for the researcher to answer any questions participants might have about the measuring system and offer some words of support and encouragement (such as, “Well done”, “That’s great” and “You guys are really good at this”) with regards to wearing the pedometer in this early phase of the study. At no time during the baseline phase was feedback given, nor comments made, about changes in a participant’s activity levels. Participants also engaged in the monitoring and recording process from the start of the project and helped the researcher monitor their data by reading aloud the number on the pedometer screen for the researcher to hear and record which could then be verified visually by the researcher.

Step counts were used as the primary dependent variable, however, data on activity time (hours and minutes), distance (km), caloric expenditure (kcal) and a brief written account of the activities the child participated in were also noted in the pedometer records. If step counts and distance figures did not match, then the researcher could check for errors in the recording process. Similarly, if children had a very high step count but had noted they had been watching television for a large portion of the day, this would prompt further investigation by the research into the validity of the step count figure and questions were asked about how they had spent their time, and how
they achieved a higher step count. If it was determined the step figure was a recording error or inaccurate the data point was not included in analyses.

Data were collected in a confidential manner so that participants could not see (or hear) the data of others and the researcher never discussed an individual’s pedometer data with other participants. In order to minimise comparison and competition among individuals the researcher highlighted to the class at every opportunity that it would be very unlikely for any participant to have the same number of steps as another participant, and that each individual would have their own unique number at each recording period from day to day. Teachers were also instructed not to display pedometer readings to the class, avoid providing feedback or reinforcement regarding changes in their PA levels and to refrain from discussing with the children what they might do to increase activity levels.

In trial’s 3 and 4, that incorporated the “My HAPPE Activity Book” in daily activity data collection, the procedure was the same in both experimental and comparison conditions. For example, the researcher would be present in the classroom, prior to the morning school bell, to assist with the class self-monitoring their activity levels and collect each participant’s HAPPE activity book for data entry. Books were returned later in the day, often before the morning break or the lunch break. The researcher would also be present with the class at the end of the school day, prior to the school bell, to assist with activity monitoring if the teacher required it, or if the class was outside their normal classroom environment and did not have access to their My HAPPE Activity Books (such as on days when an art class or PE class was scheduled for the final lesson of the day). Data recorded in the books was transcribed by the researcher into electronic data to compute means, daily totals, and other information about activity levels that the researcher might provide as feedback, individually or to the class during the intervention period. All data were collected in a confidential manner, so
that participants could not see the data of others and the researcher never discussed an individual’s specific pedometer data with other participants.

Pedometers were not concealed during baseline or any part of the monitoring period, and participants were encouraged to check their pedometers regularly throughout the day. The purpose was to help children develop greater awareness of the link between their behaviour and the pedometer’s output and to make sure their device was being worn correctly and accurately recording their activity behaviour. As a result, all participants had access to immediate, but not moderated or interpreted, feedback of their pedometer data. This ensured that if there were any novelty effects of feedback on activity behaviour via pedometer use, these were controlled for when the intervention phase itself was introduced. It was considered an important part of the intervention package for individuals to become skilled in collecting and recording their own data at an early stage so that the skills learned in the HAPPE Classroom Project could eventually become self-managed. However, the baseline phase and the comparison group could be conceptualised as a “pedometer only intervention” and if there were any increases in habitual physical activity levels as a result of reactivity, they were expected to be short lived (Tudor-Locke et al., 2009; Zizzi et al., 2006).

8.4.1.2 Measures of physical health and psychological well-being.

Separate batteries of physical and psychological assessments were arranged to take place on two different days during the baseline phase. Measures of physical health were carried out by a team of volunteer research assistants each responsible for a different measurement “station”. The same research assistants responsible for each measurement were employed for all pre- and post- assessments in the pilot and subsequent replication trials of the intervention. The assistants were all final year university students from a range of disciplines including exercise physiology, medicine and psychology who had a valid “working with children” check and had been trained to
carry out the physical assessments with children. The assessments took place on a nominated data collection day during the baseline phase in a room at the school that could provide adequate privacy, particularly for the skin fold measurements. Sections of the room were cordoned off with barriers to provide a privacy screen for each measurement station and discretion was used when recording each individual’s anthropometric measurements. Participants were assessed in groups of six and would rotate between the research assistants measuring height and weight, waist and hip circumferences, and skin fold thicknesses, while two students were asked to sit calmly and quietly for two minutes to wait for their turn to have their blood pressure and heart rate monitored. Three measurements were taken in succession for each measure, and the average was calculated to use as the final figure. Individual participant data was recorded on their Physical Measures Record Form (see Appendix O).

A battery of psychological questionnaires was administered on a single day during the baseline phase of the study. The researcher read out a general set of instructions to all participants at the start of administering the battery of psychological questionnaires (see Appendix N) and remained in the classroom to answer any questions the children had about the questionnaires. The teacher then facilitated the rest of the administration procedure for each questionnaire, first by reading the specific instructions and then reading each item aloud. The children followed along with the teacher and responded to each item. Children were told that if they did not understand any of the words, they should raise their hands and the researcher would come over to assist them. If students required extra support with reading or comprehension, the questionnaires were administered to the children in a small group by the researcher, while the teacher continued the administration procedure with the remainder of the class. In the subsequent trials at School B (where children were typically aged nine years and above) the measures were administered in a group format with the entire
classroom completing the questionnaires silently by themselves and at their own pace as opposed to being read by the teacher. At all times the researcher was present to answer any questions and all children were told that if they did not understand any of the words in the tests, they may raise their hands and the researcher would come to them to assist.

**8.4.2 Intervention phase.**

A three week intervention phase began immediately following the final day of the baseline phase. From this point on, conditions in the comparison group and experimental group differed significantly. During the intervention phase only the experimental group were exposed to the additional components of the HAPPE Classroom Project - goal setting, systematic feedback, planning and positive consequences. These components were implemented by the classroom teacher with assistance from the researcher as necessary (to maintain fidelity of the programme), for children to learn how to self-manage increases in their daily steps as part of the Climb Mt Fuji Challenge. The comparison group continued to be exposed to activity monitoring conditions established in the baseline phase, with the addition of a rewards program for wearing the pedometer and providing accurate activity data.

**8.4.2.1 The experimental ‘Ped + HAPPE’ condition.**

The HAPPE classroom project invited all participants in the experimental group to participate in The Climb Mt Fuji Challenge during the three week intervention phase. An imaginary climbing expedition to the summit of Mt Fuji provided the context for educating children in the use of behavioural self-management techniques to increase physical activity behaviours –specifically ‘walking behaviour’ as measured by the pedometer. The Climb Mt Fuji Challenge encouraged group cooperation to achieve a shared goal, while minimizing the potentially discouraging aspects of individual competition between peers. Peer modelling and peer reinforcement were considered
important components of the program. Behavioural self-management techniques, including goal setting, feedback, planning and positive consequences were considered the necessary components of the intervention. Participants were encouraged to self-manage increases in their physical activity levels throughout the intervention phase as the behavioural self-management techniques were implemented on a group level within the classroom, as well as being individually adapted. Details of these components and how they were implemented at the group and individual level are described in Table 8.2.
Table 8.2

Procedures in the HAPPE for increasing physical activity behaviour (i.e. steps) during the intervention phase.

<table>
<thead>
<tr>
<th>Behavioural component</th>
<th>Intervention Procedure with the individual participant</th>
<th>Intervention Procedure with the Group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Provide a clear rationale for increasing steps in HAPPE:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explanation</td>
<td>Discuss at an individual level if they think they could be more active on daily basis. Discuss the potential positive consequences of being more active on a daily basis, specific to the individual participant’s circumstances.</td>
<td>Provide general information about children’s current physical activity levels, the concerns with regards to current levels being inadequate and its impact on health and well-being. Raise the question “Is it possible for children to do more PA than what they typically do?”</td>
</tr>
<tr>
<td>Example</td>
<td>“It might be fun to see if you can control your PA levels, and see if you can get more steps this term.” “Making an effort to increase your steps this term might lead to having more time playing with your friends or family outdoors,” or “It might lead to you feeling stronger and fitter so you can play longer with your friends”.</td>
<td>Discuss broadly general findings from the literature: Typical PA levels of children; PA decreases as children get older; types of activities children do; the immediate impacts of childhood obesity its relation to being inactive/sedentary and its increasing prevalence; How PA can make children feel good.</td>
</tr>
<tr>
<td><strong>2. Monitoring steps on a daily basis:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explanation</td>
<td>Observe and record steps on a daily basis for the entire monitoring period.</td>
<td>Observe and record class’ total daily steps on a daily basis during the intervention phase only.</td>
</tr>
<tr>
<td>Example</td>
<td>The participant wore their pedometer each day (including weekends) Pedometer steps were recorded each morning and afternoon on school days, by the researcher (or in revised HAPPE trials 3 and 4, by the participant in their ‘My HAPPE Activity Book’).</td>
<td>The researcher compiled ‘step statistics’ for the group, including the group’s total steps per day, based on the usable data provided by each individual participant. If participants had missing data, the mean was substituted so that the “total” was based a constant number of participants each time.</td>
</tr>
</tbody>
</table>
### Table 8.2 cont.d

*Procedures in the HAPPE for increasing physical activity behaviour (i.e. steps) during the intervention phase.*

<table>
<thead>
<tr>
<th>Behavioural component</th>
<th>Intervention Procedure with the individual participant</th>
<th>Intervention Procedure with the Group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3. Goal setting:</strong></td>
<td>Specific explanation specifically targeting individual daily step target, relative to their individual baseline levels and relative to the group’s ‘total steps’ goal.</td>
<td>Specifically targeting the amount by which the group’s ‘total steps’ will be cumulatively increased above the groups baseline levels over a seven day period.</td>
</tr>
<tr>
<td><strong>Explanation</strong></td>
<td>You can help ensure the class will achieve its goal in seven days, if you can maintain a daily step count of ___ each day this week. Write down on a piece of paper the individual participant’s daily step target that they need to strive to achieve or exceed each day for the coming week, to help contribute to the class achieving the goal.</td>
<td>The goal to increase steps this week is for a total increase of 25% above the class’s baseline weekly total. In order to achieve this goal in seven days, the group needs to achieve a total daily step count of ___. Mark on the ‘Climb Mt Fuji’ Poster the Group Weekly Step Goal (and percentage increase) for reaching climbing Stage 1 and the mean Total Daily Steps required to achieve the goal.</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>Using the ‘Climb Mt Fuji’ Poster to mark the daily class total on the path to the next climbing stage. Providing ‘step statistics’ information on how much of the goal they have achieved already, and how much more they need to do.</td>
<td></td>
</tr>
</tbody>
</table>

| **4. Systematic Feedback:** | Provide feedback on performance across contexts and progression towards the goal. Taught pedometer literacy, such as to “read” their pedometer output in different ways, by comparing how one activity yielded more or less steps compared to another, seeing how step counts vary from day to day, from in-school to out of school. | Provide feedback on performance across contexts and progression towards the goal. Encouraged group to be pedometer literate, to “read” their pedometer output across the day an reflect on how one activity yielded more or less steps compared to another, how step counts vary from day to day, from in-school to out of school. |
| **Explanation**        | Providing verbal and visual feedback of activity behaviour via the “My Climb Mt Fuji Chart” and in reference to their ‘My HAPPE Activity Book’. Feedback involved analysing the chart and counting data points above and below the target step count line, paying attention to the slope of the line, discussing any trends in the data and any differences between steps on school days and weekends, in school steps and out of school steps and discussing with participants how activity levels reflected the events of the previous few days. | Using the ‘Climb Mt Fuji’ Poster to mark the daily class total on the path to the next climbing stage. Providing ‘step statistics’ information on how much of the goal they have achieved already, and how much more they need to do. |
| **Example**            |                                                                           |

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Table 8.2 cont.d

Procedures in the HAPPE for increasing physical activity behaviour (i.e. steps) during the intervention phase.

<table>
<thead>
<tr>
<th>Behavioural component</th>
<th>Intervention Procedure with the individual participant</th>
<th>Intervention Procedure with the Group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5. Planning and Arranging Contingencies:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Explanation</strong></td>
<td>A functional analysis of participants’ personal contextual factors was considered including discriminative stimuli (SD), consequences, and establishing operations that could be arranged to support more active alternative behaviours.</td>
<td>A functional analysis of the class’s shared contextual factors was considered including discriminative stimuli (SD), consequences, and establishing operations that could be arranged to support more active alternative behaviours.</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>Asking questions about how participants could make the most of the readily available opportunities to participate in PA arranged at school or with peers during lunch breaks, and at home after school. Going for a walk after school before sitting down to play games on the computer, or organising to ride a bike to a friend’s house instead of playing with them at home.</td>
<td>Asking questions about how the class as a group could make the most of the readily available opportunities to participate in PA arranged at school or with peers during lunch breaks, and at home after school. Completing school lesson and school work in class before having free time to play active games, either in class or outdoors.</td>
</tr>
<tr>
<td><strong>6. Planned Positive Consequences:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Explanation</strong></td>
<td>Provide encouragement for increases in steps using verbalisations and providing tangible rewards for achieving daily steps targets.</td>
<td>Provide encouragement for increases in steps using verbalisations and providing access to group rewards for achieving weekly step goal.</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>“Wow. Look at how much you did yesterday! Your steps out of school are much higher than your steps in school. You must have found some great ways to get more steps.” HAPPE Badges were awarded to participants if they had achieved their daily step target the previous day. The names of successful participants were called out to the class so individuals could come to collect their badge.</td>
<td>“Wow. Look at the way the Class is going! At this rate you might get there before the end of the week! You guys working well as a team to get your steps up. Good job.” At the end of each climbing stage, if the group’s goal was achieved the group reward would be delivered, such as where the class had organised to play their favourite group games on the school oval.</td>
</tr>
</tbody>
</table>
The procedure for introducing the Climb Mt Fuji Challenge on the first day of the intervention phase involved five major tasks: Provide a rationale, provide baseline feedback, set goals to increase activity levels, assist individuals and the group in planning to achieve activity goals, and identify rewards for achieving goals. A script containing the detailed information delivered to participants during the introduction procedure is presented in Appendix P. Essentially, the researcher and teacher co-facilitated a discussion about the current state of children’s activity levels to help “set the scene”, proposing that modern day lifestyles have meant children are not as active as they should be, and perhaps children could be more physically active. This served to provide a rationale for participants and to seek their consent to increase their physical activity levels as a group. The ‘Climb Mt Fuji’ Classroom Poster was introduced to the class to assist with the goal setting process.

In making use of the analogy of climbing a mountain, participants had many questions about what it might be like to climb a mountain, how many steps would it take to climb Mt Fuji, and what Mt Fuji is really like. Participants were invited to imagine a story involving an epic climb: setting off from the ‘Base Camp’ that day (symbolising the baseline phase) and proceeding over the course of three weeks to reach the summit of Mt Fuji. The climb was broken up into three stages, each seven days long; their challenge in the first week was to complete the first stage of the climb. If the climb to the first stage was achieved within the one week time limit they would celebrate their achievement as a group with a class reward. A reward that could be shared by all members of the class was discussed and agreed on. A final shared reward for the class was also discussed, that would be delivered at the end of the intervention phase if they were successful reaching the summit of Mt Fuji within the three week time limit. Specific goals to increase the group’s total step counts were negotiated during the
group consultations at the beginning of each climbing stage. Thus a final goal for the 
summit was not discussed until previous climbing stages had been reached.

The teacher in the experimental ‘Ped+ HAPPE’ group was responsible for 
supporting the components of the intervention by encouraging children to achieve their 
daily targets, commenting on the groups success on a daily basis, providing contingent 
verbal praise when increases were made, talking to the class about how they might 
increase activity levels, and helping them to problem solve if they were not meeting 
their targets. The teacher was encouraged to help their class think of ways to overcome 
barriers to being more active and, if appropriate, could allow brief ‘activity breaks’ 
during class time. The teacher also encouraged children to walk to and from school if 
they lived nearby.

8.4.2.1.1 Behavioural consultations.

During the intervention phase, the researcher met with the experimental group 
on a daily basis. Group Behavioural Consultations typically took place in the morning 
and were co-facilitated by the researcher and teacher. The purpose was to communicate 
with the whole group to implement the various behavioural components of the Climb 
Mt Fuji Challenge. The content of Group Behavioural Consultations closely followed 
the Group Behavioural Consultation pro forma, discussed in the materials section and 
presented in Appendix M. Content was also determined by what stage the group was at 
in the Challenge. For example, at the start of a new climbing stage, a significant 
proportion of time would be devoted to goal setting and discussion of group rewards. 
Part way through a climbing stage, more time would be allocated to providing feedback, 
planning and delivering individual planned positive consequences. At the end of a 
climbing stage final feedback was provided and it was revealed if the class had been 
successful or not in achieving their goal, and allowed time for either celebration or 
contemplation.
The researcher also met individually with participants in the experimental group a minimum of three times a week during each climbing stage of the Climb Mt Fuji Challenge. Individual behavioural consultations were an opportunity to individually adapt the behavioural components of the intervention and educate children in how to self-manage their PA behaviours. During normal class time the researcher would meet individually with each participant in a corner of the classroom for up to 10 minutes, to discuss their performance in the Mt Fuji Challenge. Individual consultations involved reviewing the participants My Climb to Mt Fuji Chart and providing verbal praise for any improvements in their activity behaviour. Attention was paid to whether they were achieving their individual step goal on a daily basis and what activities they participated in that helped them achieve the goal (i.e. teaching pedometer ‘literacy’). Early on during the intervention phase time during individual behavioural consultations was devoted to planning, and suggestions were made on how the participant could arrange contingencies to increase their activity levels at home and at school. Individual consultations provided a confidential meeting time to problem solve any personal or environmental (at school or at home) obstacles to their behaviour change. A more detailed account of the how the researcher delivered the additional components of the intervention during the individual consultations is provided in Appendix Q.

8.4.2.1.2 Goal setting.

An important aspect in the design of the HAPPE Classroom project was to make it accessible to all children in the classroom, irrespective of their physical ability or baseline activity level. To engage all children in the classroom, collaborative goals were agreed on specifying increases in the experimental group’s weekly total step count. Thus, every participant was responsible for making a contribution to the class’s shared goal of increasing the class weekly total on a cumulative daily basis. This confers with research on goal setting where encouraging cooperation amongst a group can be more
advantageous than either competition or individualisation (Sulzer-Azaroff & Mayer, 1991). Goals to increase activity levels were referred as percentage increases from baseline levels. Goals were suggested by the researcher and negotiated by the group. A final figure was agreed on by a majority of participants in the class with a show of hands. The first stage goal was an increase of 25%. The Second stage goal required participants to build on their achievements in the first stage and the class agreed to an additional increase of 15%, representing a total increase of 40% above baseline levels. For the Summit goal the class agreed to an additional increase of 5%, representing a total increase of 45% above baseline levels.

Individual goals were set relative to the group’s goal. For example, if it was agreed to increase the class’ weekly total steps by 25%, then effectively each participant was aiming to increase his/her activity levels 25% above their individual baseline average. Thus, everyone had the same goal, which could also be individualised based on each participant’s baseline mean steps. Speaking to the group in terms of a percentage increase instead of, for example, aiming for 10,000 steps everyday meant that there was little opportunity for students to feel discouraged if they were not able to achieve the same level of activity as their peers. When speaking individually with participants, the researcher was able to discuss personal goals in terms of a daily total step target, calculated by adding, for example, 25% to the participant’s baseline mean steps. It was also possible to tailor the “climbing” process, and alter daily step targets as necessary to keep all children interested and involved in the challenge.

8.4.2.1.3 Systematic feedback.

Progress towards the group goal was calculated by adding individual participant’s daily step total to obtain a “class daily step total”. This total was calculated each day and written on the Climb Mt Fuji Classroom Poster during group behavioural consultations. Class daily step totals were added to previous daily step
totals to provide a cumulative measure of increased steps, signifying the group’s progression (in actual steps and percentage terms) towards their goal for that climbing stage. At the end of the seven days, there was a discussion and reflection about the group’s achievement (or not) of the goal. The next day, a discussion, facilitated by the researcher and teacher with the class, set a new group goal for the next climbing stage, being sure to take into account whether the previous goal was achieved or not, demonstrating realistic goal setting.

The “My Climb to Mt Fuji” Chart was instrumental in providing systematic, visual feedback of pedometer step counts for individual participants. The chart displayed individual’s daily step data accumulated during the baseline and intervention phase and their daily step target for each climbing stage. The chart provided evidence throughout the intervention of the individual’s ability to meet their target, whether their target needed to be revised to make them more achievable or more challenging. Targets could be individually adapted based on their past performance and what their likely movements would be in the coming days based on school and/or family commitments. Individual activity information was confidential and only shared between the researcher and the participant during the individual behavioural consultation; however, participants were free to discuss their own activity levels with others in the class.

8.4.2.1.4 Planned positive consequences.

Individuals also had the opportunity to receive public recognition, verbal praise and tangible rewards from the researcher and teacher on a daily basis during the intervention phase. During group behavioural consultations, the names of all the participants who had achieved their daily step targets the previous day were called out. The researcher and teacher praised the eligible participants for achieving their step targets and encouraged the class to applaud their classmate’s success, and thank them for their contribution to helping the class achieve their goal. The participant was then
asked to come to the front of the class to collect a badge that they could wear for the day and returned it before they went home.

Appropriate group rewards were arranged for the experimental group if the class had achieved their collective weekly step goal (i.e., reached the climbing stage within the agreed time frame). The group rewards were negotiated with the teacher, class participants and the researcher and had to be agreed on by the majority of the group at the start of the climbing stage. Possible group reinforcement and tangible rewards needed to be feasible and achievable, and delivered at the end of the week if the goal was reached. The group rewards chosen generally involved the class earning free time to participate in a fun group activity which made use of the school’s resources that were readily available. They could, therefore, be considered to have been reinforcers for increases in most of the children’s walking steps. The final group reward celebrated the class completing the Mt Fuji challenge by reaching the summit in the time limit. It was of a much larger value and teachers were willing to invest part of the classroom’s budget to be able to provide for this.

During the group behavioural consultation at the beginning of each climbing stage when a specific activity goal was set, possible group reinforcement and tangible rewards were also discussed. The reward was delivered on the day each climbing stage was due to end, only if the class was successful in achieving its goal. If the group was unsuccessful the reward was not delivered and a class discussion was facilitated to understand possible reasons why and what the group could learn from the experience. In the case of the pilot school, the group was successful in achieving the first stage goal, and their reward (to make popcorn and watch a movie together as a class activity) was arranged. On the following school day, the group goal for the second stage and the group reward was discussed and agreed on. The group reward for the second stage was the opportunity to hold a class singing and performing talent show. However, the class
was unsuccessful in meeting the second stage goal, and so a class discussion took place. 
The class was successful in achieving the Summit goal and the final reward for the 
summit (discussed at the beginning of the intervention phase) was arranged by the 
teacher to take place the following day. Examples of planned positive consequences 
(rewards) made contingent on achieving collaborative steps goals in each HAPPE Trial 
are summarised in Table 8.3.

8.4.2.2 The comparison ‘Ped only’ condition

During the intervention phase, individuals in the comparison ‘Ped only’ group 
had the opportunity to receive badges on a daily basis when they had remembered to 
wear their pedometer. To be eligible to wear a badge - designed specifically for the 
comparison group - participants had to be wearing a pedometer and had provided step 
data from the previous day. Each day the names of all eligible participants were read out 
in front of the class. The researcher and teacher praised the eligible participants for 
wearing their pedometers and providing accurate step data and encouraged the class to 
applaud their classmate’s success. The participant was then asked to come to the front 
of the class to collect a badge that they could wear for the day and returned it before 
they went home. The comparison group did not have weekly group rewards but was 
invited to share in the celebrations arranged for the experimental group. In subsequent 
trials at School B, using the Wearing my Pedometer classroom poster, the researcher 
kept a more public record of pedometer wearing occurrences and could establish 
contingencies for tangible rewards. For example, participants could earn the privilege of 
designing their own badges or take a Lucky Dip prize choosing an item from a box of 
prizes, if they remembered to wear their pedometer and had provided accurate data on a 
minimum of five days out of seven days in the week.
Table 8.2

*Examples of planned positive consequences (rewards) made contingent on achieving collaborative steps goals in each HAPPE Trial.*

<table>
<thead>
<tr>
<th>Trial</th>
<th>1st Stage Goal</th>
<th>2nd stage Goal</th>
<th>Summit Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1 (Pilot) School A</td>
<td>25% increase above baseline</td>
<td>40% increase above baseline</td>
<td>45% increase above baseline</td>
</tr>
<tr>
<td>Outcome</td>
<td>Success</td>
<td>Unsuccessful</td>
<td>Success</td>
</tr>
<tr>
<td>Action</td>
<td>Their reward - to make popcorn and watch a movie together as a class activity - was arranged for the following day.</td>
<td>The class had organised to hold a singing and performing talent show. This was not arranged. The class had a longer brainstorming session about what happened and how they planned to achieve the summit goal.</td>
<td>Reward was arranged for following day, where each participant received an individual gold medal, presented to them by the school’s principal, followed by a class party.</td>
</tr>
<tr>
<td>Trial 2, School B</td>
<td>25% increase above baseline</td>
<td>40% increase above baseline</td>
<td>45% increase above baseline</td>
</tr>
<tr>
<td>Outcome</td>
<td>Success</td>
<td>Unsuccessful</td>
<td>Success</td>
</tr>
<tr>
<td>Action</td>
<td>The reward was delivered that afternoon - the class played games on the school oval.</td>
<td>The reward (an afternoon of free time and playing games in the classroom) was not arranged. The class had a longer brainstorming session about what happened and how they planned to achieve the summit goal.</td>
<td>Arrangements to celebrate were made for participants in both the experimental and comparison groups to go on an excursion to an indoor ‘Jungle Gym’ facility the following week during the maintenance phase.</td>
</tr>
</tbody>
</table>
Table 8.2
Examples of planned positive consequences (rewards), continued…

<table>
<thead>
<tr>
<th>Trial</th>
<th>1st Stage Goal</th>
<th>2nd stage Goal</th>
<th>Summit Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trial 3, School B</strong></td>
<td>25% increase above baseline</td>
<td>45% increase above baseline</td>
<td>42% increase above baseline</td>
</tr>
<tr>
<td>Outcome</td>
<td>Success</td>
<td>Unsuccessful</td>
<td>Success</td>
</tr>
<tr>
<td>Action</td>
<td>The reward - to play a class basketball tournament at school during the lunch break - was delivered that afternoon.</td>
<td>The planned group reward (an afternoon of free time and playing games in the classroom) was not arranged. Instead, the class had a longer group consultation about what happened and how they planned to achieve the summit goal. The summit goal also was revised.</td>
<td>The following week, during the maintenance phase, the experimental and comparison groups both enjoyed a party together in the experimental group’s classroom, where children brought in their favourite foods to share.</td>
</tr>
<tr>
<td><strong>Trial 4, School B</strong></td>
<td>25% increase above baseline</td>
<td>40% increase above baseline</td>
<td>50% increase above baseline</td>
</tr>
<tr>
<td>Outcome</td>
<td>Success</td>
<td>Unsuccessful</td>
<td>Success</td>
</tr>
<tr>
<td>Action</td>
<td>The reward - to watch a movie together in the classroom - was delivered that afternoon.</td>
<td>The planned group reward to spend the afternoon playing organised games on the school oval was not arranged. The class was very close to achieving the second stage goal, and they had a longer brainstorming session during the group behavioural consultation about what happened. The class was determined to continue their pace of change and set a new Summit goal and planned how they were going to achieve it.</td>
<td>The following week, during the maintenance phase the experimental and comparison groups both enjoyed an excursion to an adventure playground with a picnic and games in the park.</td>
</tr>
</tbody>
</table>
8.4.3 Maintenance phase.

Daily monitoring of physical activity levels with the pedometer continued as in previous phases and a repeat administration of the battery of physical and psychological measures was also conducted with both groups (following procedures outlined in the baseline phase). Qualitative data on the feasibility and acceptability of the programme was collected in post-intervention teacher interviews.

8.4.3.1 The experimental ‘Ped + HAPPE’ condition

The experimental group entered the maintenance phase following the final day of their challenge to reach the summit of Mt Fuji. Feedback on whether the class achieved their goal for the summit was provided in a final group behavioural consultation. The researcher summarised the group’s progress over the entire three weeks and each climbing stage. Participants also shared what they had learned from their experience. While there was no longer a systematic attempt to increase steps, participants who wished to keep being active were encouraged to try. Self-management of the additional HAPPE components of goal setting, reinforcement and planning was encouraged but was not formally monitored or implemented by either the teacher of researcher, and thus functioned as an ‘intervention withdrawal’ phase. Arrangements were made for the final class reward to be delivered to the experimental group. The maintenance period continued until a few days before the end of the school term. Due to the unforeseen delay at the start of the pilot trial the length of the maintenance phase could only continue for 7 days. A more detailed account of the teacher’s interaction with the experimental group during this time can be seen in the Teacher’s Manual in Appendix L.
8.4.3.2 The comparison ‘Ped only’ condition.

For the comparison group, the conditions established during the baseline and intervention phases continued until the end of the monitoring period. Individuals were presented with their *My Activity Levels Chart* only at the end of the monitoring period when pedometers had been returned. Brief verbal feedback was provided in a confidential meeting with the researcher to help the child understand the pattern of their activity levels. The comparison group was invited to celebrate the end of the monitoring phase with the experimental group, sharing the experimental group’s final reward. A special mention was made to everyone at the end of the trial to thank the comparison group for supporting the program by wearing their pedometers every day and providing valuable activity information. At the end of the trial, the researcher provided a gift basket and made a special note of thanks to the teachers for their essential support and participation in the program.

8.5 Design, Data Handling, and Overview of Statistical Analysis

Pedometer measured physical activity levels (steps) was the primary dependent variable. Physical activity was monitored on a continuous, daily basis during each of the three experimental phases; these phases constituted the within group independent variable of time (i.e., baseline, intervention and maintenance phases). The between group independent variable was condition, namely the experimental ‘Ped +HAPPE’ condition and the comparison ‘Ped only’ condition. Participant’s daily recorded pedometer data was used to create four data sets: *total daily steps* on weekdays and weekends, with weekday values further subdivided into ‘In School’ and ‘Out of School’ steps. Data for ‘in school’ steps was calculated by subtracting the before-school step figure (recorded at approximately 8.30 am) from the end-of-school step figure (recorded
at approximately 3pm). ‘Out of school’ steps were calculated by subtracting ‘in school’ steps from the daily step total for the corresponding day.

To be included in the analysis of each data set (i.e., weekday steps, in-school steps, out of school steps, and weekend steps), participants were required to have at least 3 data points from each of the baseline, intervention and maintenance phases. For each phase, mean ‘weekday’, ‘in school’, ‘out of school’ and ‘weekend’ step values were calculated for each participant. The final sample sizes in the analysis of each data set differed somewhat from each other as the pattern of missing data differed slightly with each data set (i.e., ‘weekdays’, ‘in school’, ‘out of school’ and ‘weekend’ data). Missing data were due to school absences, withdrawing from the project, losing or forgetting to wear the pedometer, being absent at one of either the morning or afternoon data collection points and children leaving or starting school part way through the term.

8.5.1 Outliers.

Once cases were selected based on the inclusion criteria for sufficient data, the data were checked for outliers where the daily step total was more than three standard deviations above or below the group mean. Only two outliers were detected in the sample (Trials 1-4) of the HAPPE evaluations, and were investigated further to see if they were due to measurement/typographical error. In both cases it was determined that the data were an accurate reflection of the activities of the participant in question, and hence all cases with sufficient data were retained in the data set.

8.5.2 Proportion of children who were ‘sufficiently’ active.

The criteria used to determine whether a child was ‘sufficiently active’ was based on the recommendations by Tudor-Locke et al. (2004) that boys get at least 15,000 steps each day, and girls at least 12,000 steps. These are the same criteria used in the 2007 Australian National Children’s Nutrition and Physical Activity Survey.
(Department of Health and Ageing, 2007), and the Western Australian CAPANS 2008 study (Martin, et al., 2008). The criteria for ‘sufficiently active’ pedometer steps were chosen as they are the upper limit of the threshold that can be equated to the national guidelines that children should accumulate at least 60 minutes of MVPA per day (Tudor-Locke et al., 2011). Any child whose mean steps per day was on or above this threshold was considered to be ‘sufficiently active’. This classification was determined separately for steps on weekdays and steps on weekends.

8.5.3 Body size and shape.

Children’s body mass index (BMI) was classified as overweight or obese according to Cole et al.’s (2000) age related BMI cut-points. Children were also identified if their mean waist circumference exceeded the 90th percentile according to the cut points proposed by Eisenmann (2005) and / or exceeded the 50% cut-off for waist to height ratio (WHtR) as delineated by Ashwell (2005) and similarly reported in the 2003 CAPANS report (Hands et al., 2004a). These cut-off scores provide an estimate of the proportion of the sample who could be considered ‘at risk’ due to the association of fat patterning indicators as predictors of CVD risk.

8.5.4 Addressing the research questions.

8.5.4.1 Effect of the HAPPE on PA.

To evaluate the effectiveness of the HAPPE Classroom Project in increasing PA levels a factorial design was employed to test whether mean activity levels across participants changed over time, whether overall activity levels differed between groups, and whether the way in which activity levels changed over time differed between groups. Initially, results for each condition are reported separately, followed by a comparison of how groups performed across equivalent time points during the monitoring period. Using a quasi -experimental design, the groups were matched for
age, location, school timetable, SES and broader community factors, as they were pre-existing classrooms sampled from the same school and age group at the same time. As a result, a tougher comparison group could not have been used. While this may have made detecting statistically significant changes more difficult (increasing type II error), it also affords greater confidence in concluding that changes in PA levels observed over time are more likely to be the result of the different conditions of the experiment.

Analyses on step data were split by trial (rather than combining unique participants from Trials 1-3) to examine if potential effects of the HAPPE programme on PA levels are replicable with children of different ages, across different school sites, with different teachers and at different times of the year (i.e., during different seasons and climatic conditions). This also eliminates the potential of the different age groups in each trial to confound the results, particularly between the pilot and subsequent trials. Age was not included as an independent variable as samples sizes were not large enough, nor were they equivalent across trials. Splitting the results by trial also allowed for a visual comparison between the participants’ responses from Trial 2 to Trial 4, who were the same participants, however the experimental and comparison groups in Trial 2 were crossed-over to the other condition in Trial 4.

Visual analyses (proposed by Parsonson and Baer (1978)) of charts of mean daily pedometer steps during each phase of the study is presented for each data set (i.e., steps walked on ‘weekdays’, ‘in school’ and ‘out of school’, and on weekends). Each data point in the respective chart represents the ‘mean steps per day’, based on steps data from participants with sufficient data. The charts also highlight trends in mean daily steps across the monitoring period, and in relation to Tudor-Locke et al.’s (2011) daily step thresholds for males and females, equivalent to the accepted child PA recommendations for ‘sufficient’ PA for health. The charts also allow a visual comparison of the trends in daily steps across phases between the groups. Mean
steps/day for participants in the Comparison ‘Ped only’ condition were calculated from the first, middle and final weeks of the monitoring period - equivalent to the Baseline, Intervention and Maintenance Phases in the Experimental condition. Group means and standard deviations for each phase are also presented.

A mixed methods (3x2) ANOVA was also used to examine the effects of phase (baseline, intervention and maintenance) and condition (comparison or experimental) on mean steps over time. Where significant main effects and/or interactions were detected, Post Hoc analyses explored the difference in mean steps walked between baseline and intervention; between intervention and maintenance; and between baseline and maintenance, overall and within the experimental and comparison groups. Modified Bonferroni adjustments to alpha levels (Olejnik, Supattathum, and Huberty, 1997; Holm, 1979) were used to control for Type I error in cases of multiple post hoc comparisons. The same analysis was run to investigate the effect of the HAPPE classroom project on the steps walked on weekdays, ‘In-school’, ‘Out of school’ and on weekends. In analyses where sphericity was violated the Huynh-Feldt epsilon was used. Gender was not included as a factor in the statistical analyses due inadequate numbers in each cell. The number of participants in the analyses was determined by the constraints of the recruitment and data collection processes, rather than statistical power concerns. Effect size estimates are included for all tests, independent of significance, to allow the reader to make a judgement about the magnitude of the effect size.

The proportion of ‘sufficiently active’ children on weekdays and weekends across the monitoring period are also reported for participants in the Comparison ‘Ped only’ condition and the Experimental ‘Ped + HAPPE’ condition in each trial of the HAPPE. Chi-square analyses of this data was used to determine whether the proportion of children considered ‘sufficiently active’ at baseline changed over the course of the monitoring period in each group. Only the unique participants from Trial’s 1-3 were
included in these analyses, and they were conducted separately for steps on weekdays and steps on weekends.

**8.5.4.2 Effect of the HAPPE on health and well-being.**

The second research question was concerned with whether increases in activity levels during the HAPPE classroom program might lead to beneficial side-effects with regards to changes in physical and psychological measures. Results of physical and psychological measures were secondary dependent variables, and are reported predominantly as raw scores pre- and post- intervention. The analysis sought to highlight to what extent measureable, beneficial changes in participants’ physical health and psychological well-being are observed during the HAPPE classroom program and assess to what extent these changes are related to increases in ‘steps’. Due to small sample sizes in each trial, this question was investigated based on the grouped results of unique participants from Trials 1-3. Mean scores for each measure of physical health and psychological well-being were calculated for pre and post measurement points for participants in Trial's 1-3.

It was assumed that a step walked ‘in school’ was likely to have the same effect on measures of health and well-being as a step walked out of school, on weekdays or on weekends. Thus, the average of the increase in steps on weekdays and weekends was calculated for each participant with sufficient step data to determine mean overall steps for each phase. Participants with at least 3 pedometer data points in the baseline and intervention phases were included in the analyses of changes to physical and psychological measures. A series of paired samples t-tests were run for the experimental group and the comparison group. Significant results were investigated further with Bivariate correlation analyses to determine if there was a relationship between increased steps in the HAPPE programme and changes in measures of physical health and / or psychological well-being.
In total, 138 children from two schools were assessed for eligibility in the HAPPE trials. The only eligibility requirement was the participant’s assent and written informed consent from their parents or legal guardians to participate in the study. Based on this criteria, 127 children were then allocated to either the ‘Ped + HAPPE’ experimental condition (n=66) or the ‘Ped only’ comparison condition (n=61). Four children from the ‘Ped+HAPPE’ condition and four children from the ‘Ped only’ did not receive the allocated intervention due to withdrawing their participation, losing their pedometer, or leaving the school part way through the intervention. Calculating overall attrition rates were complicated by the inclusion of the crossover sample as a separate trial and the change in the number of participants excluded from each analysis of steps data based on whether they met criteria for sufficient data, which is defined separately for each particular analysis (refer to ‘Data Handling’ Chapter 8, section 8.5).

Participants were less consistent in providing data for ‘in school’, ‘out of school’ and ‘weekend’ steps, compared to ‘weekday’ steps. Yet, a participant may have been excluded from the analyses of one data set, but could still be included in analyses of other step data, if they had sufficient data. Participants were less consistent in providing data for ‘in school’, ‘out of school’ and ‘weekend’ steps, compared to ‘weekday’ steps. Thus, the number of participants included in a mixed method ANOVA, fluctuated for each type of step data. For example, a total of 95 unique participants (males = 50, females = 45) from Trial’s 1-3 were included in the analysis of weekday steps, yielding an attrition rate of 25%. A diagram showing the flow of all unique participants through

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each stage of their trial (only including data from those who participated in Trials 1 to 3 is presented in Figure 9.1.

Figure 9.1. Diagram showing the flow of all unique participants through each stage of HAPPE Evaluation (i.e., only including participants from Trials 1 to 3).
Diagrams showing the flow of participants through each stage in each trial separately (including data from those who participated in Trials 1 to 4) is presented in Appendix V (Figure’s V.1 to V.4). In the case of weekday steps data, attrition rates varied for each trial ranging from 39% in Trial 1 to 20% in Trial 3.

9.1 Changes to children’s ‘steps’ during the HAPPE evaluations

9.1.1 Can children ‘self-manage’ increases in daily ‘steps’ to recommended levels?

The numbers and proportions of “sufficiently active” children on weekdays and weekends across the baseline, intervention and maintenance phase of the HAPPE programme were calculated based on data from the unique participants in Trials’ 1-3 who had sufficient data in all phases. Within group’s differences between phases were analysed using an exact McNemar’s Chi Square test, for the experimental and the comparison condition and the sample overall. Table 9.2 shows the changes in the numbers and proportions of sufficiently active children based on weekday steps across each phase of the HAPPE programme. Exact McNemar’s Chi Square tests confirmed that in the overall sample, the proportion of “sufficiently active” children on weekdays increased significantly during the intervention phase (p<.001). The proportion of sufficiently active children on weekdays continued to increase during the final weeks, so that by the end of the HAPPE programme, the amount remained significantly greater than baseline (p<.001). Thus, from the overall sample, 23 more children were achieving recommended daily steps on weekdays by the end of the HAPPE trials.
Table 9.2

The numbers and proportions of sufficiently active children on weekdays across the phases of the HAPPE programme.

<table>
<thead>
<tr>
<th>Participants</th>
<th>Baseline</th>
<th>Intervention</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Comparison ‘Ped Only’</td>
<td>42</td>
<td>26.19%</td>
<td>11</td>
</tr>
<tr>
<td>Experimental ‘Ped + HAPPE’</td>
<td>53</td>
<td>32.08%</td>
<td>17</td>
</tr>
<tr>
<td>Overall</td>
<td>95</td>
<td>29.47%</td>
<td>28</td>
</tr>
</tbody>
</table>

Note: Sample (N) is comprised only of unique participants in Trial’s 1 to 3, with sufficient data in all phases. *Indicates a statistically significant increase from Baseline using McNemar Chi-squared test. Criteria for “sufficient activity” based on Tudor-Locke et al. (2011).

Discernable differences between groups can be seen in the tables of the proportions of sufficiently active children and are indicated using an exact McNemar’s Chi square test. The proportion of sufficiently active children on weekdays in the experimental group increased significantly during the intervention phase (p<.001), nearly doubling their baseline amount, while the increase in the comparison ‘Ped only’ group during the equivalent time period was not (p=.453). By the end of the monitoring period though, both the comparison and experimental groups had significantly greater proportions of sufficiently active children on weekdays (p<.001 and p=.001, respectively) compared to baseline levels.

McNemar Chi square test also confirmed the number of sufficiently active children on weekends overall increased significantly during the intervention phase from baseline (p<.001). While the proportion of sufficiently active children on weekends at the end of the HAPPE programme dropped non-significantly, it was still significantly higher than the baseline amount (p=.001), resulting in 15 more children overall achieving daily step totals equivalent to the recommended daily activity levels on weekends. Table 9.3 shows the changes in the numbers and proportions of sufficiently active children based on weekend steps across each phase of the HAPPE programme.
Table 9.3

The numbers and proportions of sufficiently active children on weekends across the phases of the HAPPE programme

<table>
<thead>
<tr>
<th>Participants</th>
<th>Baseline</th>
<th>Intervention</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Comparison ‘Ped Only’</td>
<td>33</td>
<td>9.09%</td>
<td>3</td>
</tr>
<tr>
<td>Experimental ‘Ped + HAPPE’</td>
<td>47</td>
<td>8.51%</td>
<td>4</td>
</tr>
<tr>
<td>Overall</td>
<td>80</td>
<td>8.75%</td>
<td>7</td>
</tr>
</tbody>
</table>

Note: Sample (N) is comprised only of unique participants in Trials 1 to 3, with sufficient data in all phases. *Indicates a statistically significant increase from Baseline using McNemar Chi-squared test. Criteria for “sufficient activity” based on Tudor-Locke et al (2011).

Both the comparison and experimental groups showed a significant increase in the proportion of sufficiently active children on weekends during the intervention phase / middle weeks (p=.039 and p<.001, respectively). By the end of the monitoring phase however, only the experimental group maintained a significantly greater proportion of sufficiently active children on weekends compared to baseline levels (p=.034). While in the comparison group, the difference in the number of “sufficiently active” children in the comparison group between the first and final weeks of monitoring was non-significant (p=.063).

**9.1.2 Do self-managed increases in ‘steps’ generalise across contexts: Changes in steps on weekdays, in school, out of school and on weekends**

**9.1.2.1 Weekday Steps**

Mean steps per weekday during the first, middle and final weeks of the monitoring phase for each of the comparison groups are displayed in Table 9.4.
Table 9.4

Mean (S.D.) ‘Weekday’ steps/day for participants in the Comparison ‘Ped only’ condition from the first, middle and final weeks of monitoring.

<table>
<thead>
<tr>
<th>Trial</th>
<th>n</th>
<th>First weeks</th>
<th></th>
<th>Middle weeks</th>
<th></th>
<th>Final weeks</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>1 (Pilot)</td>
<td>10</td>
<td>10,136</td>
<td>2,670</td>
<td>10,280</td>
<td>2,971</td>
<td>11,838</td>
<td>3,714</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>12,999</td>
<td>3,750</td>
<td>13,045</td>
<td>2,970</td>
<td>14,344</td>
<td>3,746</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>11,360</td>
<td>2,858</td>
<td>13,354</td>
<td>3,381</td>
<td>13,736</td>
<td>2,843</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>12,850</td>
<td>2,937</td>
<td>12,992</td>
<td>3,616</td>
<td>14,120</td>
<td>3,807</td>
</tr>
</tbody>
</table>

The mean daily ‘weekday’ steps for the comparison ‘Ped only’ group participants in each trial are displayed in Figure 9.1, in relation to Tudor-Locke et al.’s (2011) criteria for sufficient PA for health for boys and girls. Upwardly angled trend lines indicate a gradual increase in weekday steps, which can be observed in all trials.
Figure 9.1 Daily mean ‘weekday’ steps for Comparison ‘Pedometer only’ group participants in each trial during the monitoring period. Dashed lines represent recommended levels of “sufficient activity” for health benefits for males (15,000) and females (12,000). Solid angled lines represent the direction of the overall trend in mean steps per day (i.e. increasing or decreasing).
Mean ‘weekday’ steps of the experimental ‘Ped+HAPPE’ participants during baseline, intervention and maintenance phases in each trial are displayed in Table 9.5. During the intervention phase an increase in mean levels of weekday steps can be seen across all trials, relative to baseline levels.

Table 9.5

Mean (S.D.) ‘Weekday’ steps/day during baseline, intervention and maintenance in the Experimental ‘Ped + HAPPE’ condition in each Trial.

<table>
<thead>
<tr>
<th>Trial</th>
<th>n</th>
<th>Baseline</th>
<th>Intervention</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
</tr>
<tr>
<td>1 (Pilot)</td>
<td>15</td>
<td>10,307</td>
<td>2,936</td>
<td>11,807</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>11,161</td>
<td>2,592</td>
<td>14,324</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>13,936</td>
<td>2,441</td>
<td>16,612</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>12,364</td>
<td>4,160</td>
<td>15,189</td>
</tr>
</tbody>
</table>

The mean daily steps on weekdays can be seen for each trial in Figure 9.2. Mean steps per day can be seen during the Baseline, Intervention (where participants were exposed to the additional behavioural strategies package in the HAPPE Programme’s ‘Climb Mt Fuji Challenge’) and Maintenance phases and in relation to Tudor-Locke et al.’s (2011) criteria for sufficient PA for health and well-being for boys and girls.
Figure 9.2 Mean daily Weekday steps for the Experimental ‘Ped + HAPPE’ group participants in each trial during Baseline, Intervention and Maintenance phases. Dashed lines represent recommended cut offs for being “sufficiently active” for males (15,000) and females (12,000). Solid angled lines represent the direction of the overall trend in mean steps per day during each phase (i.e. increasing or decreasing).
Mean changes in ‘Weekday’ steps/day for the comparison and experimental groups in Trial’s 1 – 4 can be seen in Figure 9.3, relative to their baseline levels. In this figure, values during the intervention period for the experimental ‘Ped + HAPPE’ groups in Trial’s 1 to 4 were equivalent to increases of 14.6%, 28.3%, 19.2% and 22.8%, respectively. Values for the comparison ‘Ped only’ groups observed during the equivalent time period - the middle weeks of monitoring in Trial’s 1 to 4 - were equivalent to increases of 1.4%, 0.4%, 17.6% and 1.1% respectively.

The mean increases in ‘Weekday’ steps during the maintenance phase for the experimental ‘Ped + HAPPE’ groups were equivalent to increases of 16.6%, 21.8%, 4.6% and 3.5% in Trial’s 1 to 4 respectively. The values for the comparison ‘Ped only’ groups in Trial’s 1 to 4 observed during the final weeks were equivalent to increases of 16.8%, 10.3%, 20.9% and 9.9% respectively, relative to their baseline levels.
Figure 9.3 Mean ‘Weekday’ steps/day for the Comparison and Experimental groups in each Trial during the intervention / middle weeks and the maintenance phase / final weeks, relative to baseline/first week’s levels. *Indicates a statistically significant increase from Baseline phase. ◄Indicates change in experimental group was not significantly greater than change in Comparison group.
Mixed methods (3x2) ANOVA examined the effects of phase (baseline, intervention and maintenance) and condition (comparison or experimental) on mean weekday steps in each trial. The findings and summary statistics from these analyses are summarized in Table 9.6 for each trial. The analysis revealed a significant main effect of phase in all trials. A main effect of condition was not significant in all trials except in Trial 3, with 11-12 year olds, where the experimental group had a higher mean overall compared to the comparison group.

No significant phase by condition interaction was detected in Trial 1. Though, a significant phase by condition interaction was found in Trial 2. Further analysis revealed a significant simple effect of phase in both the comparison (F (1.538, 24.612) = 5.183, p = .019, ηp² = .245) and experimental (F (2, 34) = 17.960, p < .001, ηp² = .514) conditions. Post hoc testing indicated that while the mean weekday step counts in the comparison condition increased non-significantly from Baseline to Intervention (p=.879, α=.017) and Baseline to Maintenance (p=.032, α=.025), the increase in weekday steps from the Intervention to the Maintenance phase (p=.021, α=.05) was statistically significant. In the experimental condition, mean weekday steps increased significantly from the Baseline to Intervention phases (p<.001, α=.05), then dropped non-significantly during the Maintenance phase (p=.238, α=.017), where mean weekday steps during the Maintenance phase remained significantly higher than that observed during the Baseline phase (p=.002, α=.025).

In Trial 3, with the 11-12 year-olds, a significant phase by condition interaction was also found. Further analysis indicated that phase had a significant simple effect on mean weekday steps in both the comparison (F (2, 28) = 10.886, p <.001, ηp² = .437) and experimental groups (F (1.635, 31.061) = 11.578, p < .001, ηp² = .379). Post-hoc testing
Table 9.6

Summary of mixed method (3x2) ANOVA results for weekday steps in each Trial.

<table>
<thead>
<tr>
<th>Trial 1 (Pilot)</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Trial 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main effect of Phase</strong></td>
<td>F (1.779, 40.916) = 7.729, p = .002, η² = .252</td>
<td>F (1.611, 53.163) = 15.487, p &lt; .001, η² = .319</td>
<td>F (1.837, 60.607) = 16.598, p &lt; .001, η² = .335</td>
</tr>
<tr>
<td><strong>Post Hoc Tests</strong></td>
<td>Mean (SD) steps per day: Baseline=10,239 (2,777); Intervention = 11,944 (3,299); Maintenance = 11,196 (2,552). When groups were combined, overall steps increased significantly from Baseline to Maintenance (p = .004, α = .05). Mean steps during the intervention did not differ significantly from those during either Baseline (p = .026, α = .025) or Maintenance (p = .042, α = .017).</td>
<td>Mean (SD) steps per day: Baseline=12,054 (3,293); Intervention = 13,703 (3,166); Maintenance = 13,959 (3,656). Overall, steps increased significantly from Baseline to Intervention (p &lt; .001, α = .05). Mean activity levels during Maintenance were also significantly higher than baseline levels (p &lt; .001, α = .025), but did not differ significantly from those during the intervention (p = .474, α = .017).</td>
<td>Mean (SD) steps per day: Baseline=12,832 (2,892); Intervention = 15,216 (3,692); Maintenance = 14,214 (3,058). Overall, steps increased significantly from Baseline to Intervention (p &lt; .001, α = .05). Mean steps during Maintenance did not differ significantly from those during either Baseline (p = .41, α = .025) or Intervention (p = .104, α = .017).</td>
</tr>
<tr>
<td><strong>Main effect of Condition</strong></td>
<td>F (1, 23) = .334, p = .569, η² = .014</td>
<td>F (1, 33) = .174, p = .682, η² = .005</td>
<td>F (1, 33) = 5.822, p = .022, η² = .150</td>
</tr>
<tr>
<td><strong>Post Hoc Tests</strong></td>
<td>Higher overall mean steps in Experimental group compared to comparison group</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Phase by Condition Interaction</strong>*</td>
<td>F (1.779, 40.916) = 1.621, p = .212, η² = .066</td>
<td>F (1.611, 53.163) = 9.332, p &lt; .001, η² = .220</td>
<td>F (1.837, 60.607) = 4.611, p = .016, η² = .123</td>
</tr>
</tbody>
</table>

Note: Significant results are indicated in bold type. *Refer to main text for outcomes from further analyses investigating significant phase by condition (3x2) interactions.
indicated mean weekday steps in the comparison group increased significantly between Baseline and Intervention (p=.001, α=.025) phases before showing a further non-significant increase during the Maintenance phase (p=.515, α=.017), where they remained significantly higher than Baseline (p=.001, α=.025). In the experimental group, mean weekday steps increased significantly between Baseline and Intervention (p<.001, α=.05) then decreased significantly during the Maintenance phase (p=.011, α=.025), where mean weekday steps during Maintenance was non-significantly higher than Baseline (p=.250, α=.017). Independent samples T-test compared the magnitude of change in weekday steps from the baseline to the intervention phase between groups. The test found the difference in the increases achieved between the comparison ‘Ped only’ and the experimental ‘Ped + HAPPE’ conditions was not statistically significant (t(33) =-1.014, p=.318).

In Trial 4, with the 8-10-year-old crossover sample from Trial 2, a significant phase by condition interaction was also found. Further analysis indicated that phase had a significant effect on mean weekday step count in the experimental group (F(2, 34) = 19.278, p < .001, ηp²=.531), but not in the comparison group (F(2, 34) = 3.149, p = .056, ηp²=.156). Post-hoc tests indicated mean weekday steps in the experimental group had increased significantly from baseline to intervention (p<.001, α=.025) before dropping significantly between intervention and maintenance phases (p<.001, α=.025), and mean steps on weekdays during the maintenance phase were non-significantly higher than baseline levels (p=.362, α=.017).

9.1.2.2 In school Steps

The daily mean ‘in school’ steps per day for the comparison ‘Ped only’ group participants in each trial are displayed in Figure 9.4. Upwardly angled trend lines observed in all trials indicate a consistent pattern of a delayed, gradual increase in ‘in school’ steps in all trials.
Figure 9.4 Daily mean ‘In school’ steps for Comparison ‘Pedometer only’ group participants in each trial. Solid angled lines represent the direction of the overall trend in mean daily steps (i.e. increasing or decreasing).
Mean ‘in school’ steps per day during the first, middle and final weeks of the monitoring phase for each of the comparison groups are displayed in Table 9.7.

Table 9.7

<table>
<thead>
<tr>
<th>Trial</th>
<th>n</th>
<th>First weeks</th>
<th>Middle weeks</th>
<th>Final weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
</tr>
<tr>
<td>1 (Pilot)</td>
<td>8</td>
<td>5,239</td>
<td>1,033</td>
<td>5,079</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>6,237</td>
<td>1,584</td>
<td>6,591</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>5,270</td>
<td>1,069</td>
<td>6,143</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>5,778</td>
<td>1,516</td>
<td>5,722</td>
</tr>
</tbody>
</table>

Mean steps per day during baseline, intervention and maintenance phases for each of the experimental groups are displayed in Table 9.8.

Table 9.8

<table>
<thead>
<tr>
<th>Trial</th>
<th>n</th>
<th>Baseline</th>
<th>Intervention</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
</tr>
<tr>
<td>1 (Pilot)</td>
<td>16</td>
<td>5,048</td>
<td>970</td>
<td>5,498</td>
</tr>
<tr>
<td>2</td>
<td>19</td>
<td>6,198</td>
<td>1,304</td>
<td>6,770</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>5,443</td>
<td>897</td>
<td>7,998</td>
</tr>
<tr>
<td>4</td>
<td>19</td>
<td>5,491</td>
<td>1,434</td>
<td>5,798</td>
</tr>
</tbody>
</table>

The mean daily ‘in school’ steps of the experimental ‘Ped+HAPPE’ participants can be seen during the Baseline, Intervention (where participants were exposed to the additional behavioural strategies package in the HAPPE Programme’s ‘Climb Mt Fuji Challenge’) and Maintenance phases in each trial in Figure 9.5. A gradual increasing trend in mean ‘in school’ steps per day can be seen in trials 1, 2 and 4. In trial 3, mean ‘in school’ steps per day appear to increase initially in response to the HAPPE ‘Climb Mt Fuji Challenge’ at the start of the intervention phase, followed by a decreasing trend.
Figure 9.5 Mean daily ‘In School’ steps for the Experimental ‘Ped + HAPPE’ group participants in each trial. Solid angled lines represent the direction of the overall trend in mean daily steps (i.e. increasing or decreasing) during each phase.
Mean changes in ‘In School’ steps/day for the comparison and experimental groups in Experiment’s 1 – 4 can be seen in Figure 9.6, relative to their baseline levels. Values during the intervention period for the experimental ‘Ped + HAPPE’ groups in Experiment’s 1 to 4 were equivalent to increases of 8.9%, 9.2%, 47.0% and 5.6%, respectively. Values for the comparison ‘Ped only’ groups observed during the middle weeks in Experiment’s 1 to 4 were equivalent to a changes of -3.1%, 5.7%, 16.6% and -1.0% respectively.

The mean increases in ‘in school’ steps during the maintenance phase for the experimental ‘Ped + HAPPE’ groups were equivalent to increases of 16.0%, 24.9%, 45.9% and 8.6% in experiments 1 to 4 respectively. The values for the comparison ‘Ped only’ groups in experiments 1 to 4 observed during the final weeks were equivalent to increases of 9.1%, 16.1%, 23.6% and 11.4% respectively, relative to their baseline levels.

Mixed methods (3x2) ANOVA examined the effects of phase (baseline, intervention and maintenance) and condition (comparison or experimental) on mean in school steps in each trial. The analyses revealed a significant main effect of phase in all trials. The main effect of condition was not significant in all trials except in Trial 3, with 11-12 year olds, where the experimental group had a higher mean overall compared to the comparison group. No significant phase by condition interactions were detected Trial’s 1, 2 and 4.
Figure 9.6 Mean ‘In school’ steps/day for the Comparison and Experimental groups in each Trial during the intervention / middle weeks and the maintenance phase / final weeks, relative to baseline/first week’s levels. *Indicates a statistically significant increase from Baseline mean. ‡Indicates experimental group’s mean increase is significantly greater from the comparison group’s mean increase at the same time point.
The findings and statistics from the 3x2 mixed methods ANOVA for ‘in school’ steps are summarized in Table 9.9 for each trial.

A significant phase by condition interaction was found in Trial 3, with 11-12 year olds. Further analysis indicated that phase had a significant simple effect on mean in-school steps in both the comparison (F (2, 28) = 20.120, p < .001, ηp²=.590), and experimental groups (F (1.088, 8.705) = 17.924, p = .002, ηp²=.691). Post-hoc tests revealed both the comparison and experimental groups’ mean in-school steps increased significantly from baseline to intervention (p<.001, α=.05 and p<.001, α=.05, respectively), with further non-significant mean increases during the maintenance phase (p=.113, α=.017 and p<.927, α=.017 respectively). Maintenance levels remained significantly higher than baseline in the comparison (p<.001, α=.025) and the experimental (p=.002, α=.025) group.

Further comparisons of mean in-school steps in each condition revealed that at baseline the comparison and experimental groups did not differ significantly (t (22) = .406, p = .689). During the intervention phase, the experimental group’s mean in-school steps were significantly higher than the comparison group’s (t (22) = 4.076, p = .001), during maintenance however, the difference between the groups’ mean in-school steps was non-significant (t (22) = 1.958, p = .063).

Independent samples T-test also compared the magnitude of change in ‘in school’ steps from the baseline to the intervention phase between conditions. The test found mean in school steps in the experimental ‘Ped + HAPPE’ group increased significantly more than the comparison ‘Ped only’ group (t (22) =-8.015, p<.001).
### Table 9.9

**Summary of mixed method (3x2) ANOVA results for in school steps in each Trial.**

<table>
<thead>
<tr>
<th>Trial 1 (Pilot)</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Trial 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main effect of Phase</strong></td>
<td><strong>Main effect of Phase</strong></td>
<td><strong>Main effect of Phase</strong></td>
<td><strong>Main effect of Phase</strong></td>
</tr>
<tr>
<td>$F (2, 44) = 10.514, p &lt; .001, \eta^2_p = .323$</td>
<td>$F (1.703, 59.950) = 30.650, p &lt; .001, \eta^2_p = .467$</td>
<td>$F (1.322, 29.084) = 41.644, p &lt; .001, \eta^2_p = .654$</td>
<td>$F (2, 70) = 11.047, p &lt; .001, \eta^2_p = .240$</td>
</tr>
<tr>
<td><strong>Post Hoc Tests</strong></td>
<td><strong>Mean (SD) steps per day:</strong></td>
<td><strong>Mean (SD) steps per day:</strong></td>
<td><strong>Mean (SD) steps per day:</strong></td>
</tr>
<tr>
<td>Baseline = 5,112 (1,004)</td>
<td>Intervention = 6,217 (1,427)</td>
<td>Maintenance = 7,497 (1,476)</td>
<td>Baseline = 6,335 (1,460)</td>
</tr>
<tr>
<td>Intervention = 5,358 (9,70)</td>
<td>Maintenance = 6,833 (1,436)</td>
<td>Mean steps did not change significantly from baseline to intervention ( (p = .279, \alpha = .017) ) but was significantly higher at maintenance compared to baseline ( (p = .001, \alpha = .05) ) and Intervention levels ( (p = .002, \alpha = .025) ).</td>
<td></td>
</tr>
<tr>
<td>Maintenance = 5,810 (973)</td>
<td>Mean steps increased significantly from Baseline to Intervention ( (p = .001, \alpha = .017) ) and from Intervention to Maintenance ( (p &lt; .001, \alpha = .05) ). Compared to Baseline, mean steps ‘in school’ had increased significantly by the end of Maintenance ( (p &lt; .001, \alpha = .025) ).</td>
<td>Mean steps increased significantly from Baseline to Intervention ( (p &lt; .001, \alpha = .05) ), and remained significantly higher than baseline during Maintenance ( (p &lt; .001, \alpha = .025) ).</td>
<td>Mean steps increased significantly from Baseline to Maintenance ( (p &lt; .001, \alpha = .05) ), and Intervention to Maintenance ( (p = .001, \alpha = .025) ) (though Intervention steps were not significantly higher than Baseline levels ( (p = .273, \alpha = .017) ).</td>
</tr>
</tbody>
</table>

**Main effect of Condition**

<table>
<thead>
<tr>
<th>Trial 1 (Pilot)</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Trial 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$F (1.22) = .084, p = .774, \eta^2_p = .004$</td>
<td>$F (1, 35) = .238, p = .629, \eta^2_p = .007$</td>
<td>$F (1, 22) = 5.579, p = .027, \eta^2_p = .202$</td>
<td>$F (1, 35) = .252, p = .619, \eta^2_p = .007$</td>
</tr>
<tr>
<td><strong>Phase by Condition Interaction</strong></td>
<td></td>
<td></td>
<td>Overall, mean in-school steps significantly higher in the experimental group.</td>
</tr>
<tr>
<td>$F (2.44) = 2.149, p = .129, \eta^2_p = .089$</td>
<td>$F (1.703, 59.950) = 1.377, p = .259, \eta^2_p = .038$</td>
<td>$F (1.322, 29.084) = 7.395, p = .007, \eta^2_p = .252$</td>
<td>$F (2, 70) = 2.469, p = .092, \eta^2_p = .066$</td>
</tr>
</tbody>
</table>

Note: Significant results are indicated in bold type. *Refer to main text for outcomes from further analyses investigating significant phase by condition (3x2) interactions.
9.1.2.3 Out of School Steps

A generalised increase in ‘out of school’ steps in the comparison ‘Ped only’ group is not consistent across trials. Mean daily ‘out of school’ steps in the Comparison ‘Ped only’ group during the first weeks, middle weeks and final weeks for each trial are displayed in Table 9.10.

Table 9.10

Mean (S.D.) ‘out of school’ steps/day for participants in the Comparison ‘Ped only’ condition from the first, middle and final weeks of monitoring.

<table>
<thead>
<tr>
<th>Trial</th>
<th>First weeks</th>
<th>Middle weeks</th>
<th>Final weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>1 (Pilot)</td>
<td>8</td>
<td>5,080</td>
<td>1,589</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td>6,969</td>
<td>3,048</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>6,835</td>
<td>2,357</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>7,146</td>
<td>2,312</td>
</tr>
</tbody>
</table>

The extent to which increases in daily steps in the school-based HAPPE programme generalized can be seen in the analyses of out of school steps. Figure 9.7 shows the mean daily ‘out of school’ steps in Comparison ‘Ped Only’ condition for each trial. A generalised increase in ‘out of school’ steps in the comparison ‘Ped only’ group is not consistent across trials.
Figure 9.7 Daily mean ‘Out of school’ steps for the Comparison ‘Ped only’ group participants in each trial. Solid angled lines represent the direction of the overall trend in mean steps per day (i.e. increasing or decreasing).
The mean ‘out of school’ steps for the experimental ‘Ped + HAPPE’ condition during the baseline, intervention and maintenance phases for each trial are shown in Table 9.11.

Table 9.11

*Mean (S.D.) ‘Out of School’ steps/day for participants in the Experimental ‘Ped + HAPPE’ condition during baseline, intervention and maintenance.*

<table>
<thead>
<tr>
<th>Trial</th>
<th>Baseline</th>
<th></th>
<th>Intervention</th>
<th></th>
<th>Maintenance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
</tr>
<tr>
<td>1 (Pilot)</td>
<td>11</td>
<td>5,685</td>
<td>1,396</td>
<td>6,688</td>
<td>1,478</td>
<td>7,345</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>5,086</td>
<td>2,145</td>
<td>7,710</td>
<td>2,388</td>
<td>6,896</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>8,847</td>
<td>2,161</td>
<td>10,634</td>
<td>2,638</td>
<td>8,863</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>7,003</td>
<td>2,962</td>
<td>9,424</td>
<td>3,201</td>
<td>7,563</td>
</tr>
</tbody>
</table>

The daily mean ‘out of school’ steps for the Experimental ‘Ped + HAPPE’ group participants in each trial is shown in Figure 9.8. An effect of the HAPPE Programme’s ‘Climb Mt Fuji Challenge’ on ‘out of school’ steps can be seen with an increase in the level of mean daily steps the intervention phase across all trials, and an increasing trend during the intervention phase in Trials’ 2-4.
Figure 9.8 Daily mean ‘Out of School’ steps for the Experimental ‘Ped + HAPPE’ group participants in each trial. Black solid angled lines represent the direction of the overall trend in mean steps per day during each phase (i.e. increasing or decreasing).
Mean changes in ‘Out of School’ steps/day for the comparison and experimental groups in Trial’s 1 – 4 can be seen in Figure 9.9 relative to their baseline levels. Values during the intervention period for the experimental ‘Ped + HAPPE’ groups in Experiment’s 1 to 4 were equivalent to increases of 17.6%, 51.6%, 20.2% and 34.6%, respectively. Values for the comparison ‘Ped only’ groups observed during the middle weeks in Experiment’s 1 to 4 were equivalent to changes of 12.8%, 0.9%, 3.2% and 4.7% respectively.

The mean increases in ‘in school’ steps during the maintenance phase for the experimental ‘Ped + HAPPE’ groups were equivalent to increases of 13.8%, 35.6%, 0.2% and 8.0% in experiments 1 to 4 respectively. The values for the comparison ‘Ped only’ groups in experiments 1 to 4 observed during the final weeks were equivalent to increases of 44.6%, 10.7%, 8.6% and 12.3% respectively, relative to their baseline levels.

Mixed methods (3x2) ANOVA examined the effects of phase (baseline, intervention and maintenance) and condition (comparison or experimental) on mean out of school steps in each trial. The analyses revealed a significant main effect of phase in all trials, demonstrating that the effect of increasing steps generalised to ‘out of school’ contexts. The main effect of condition was not significant in all trials, except in Trial 3 with 11-12 year olds, where the experimental condition had a higher mean overall compared to the comparison condition. No significant phase by condition interaction was detected Trial 1. The significant phase by condition interactions were found in Trial 2, Trial 3 and Trial 4.
Figure 9.9 Mean ‘Out of school’ steps/day relative to baseline/first week’s levels for the Comparison and Experimental condition in each Trial during the intervention / middle weeks and the maintenance phase / final weeks. *Indicates a statistically significant increase from Baseline mean.
The findings and summary statistics from the mixed methods 3 (phase) x 2 (condition) ANOVA for out of school steps are summarized in Table 9.12 for each trial. In Trial 2, further analysis of the significant phase by condition interaction revealed significant simple effect of phase on ‘Out of school’ steps in the experimental condition (F (1.515, 25.761) = 23.886, p < .001, $\eta_p^2=.584$) but not in the comparison condition (F (2, 30) = 1.931, p = .162, $\eta_p^2=.114$). Post-hoc testing showed the experimental group’s mean ‘out of school’ steps increased significantly between the Baseline and Intervention phases (p<.001 $\alpha=.05$) before dropping significantly during the Maintenance phase (p=.013, $\alpha=.017$). However, mean steps during the Maintenance phase remained significantly higher than Baseline levels (p=.002, $\alpha=.025$).

In Trial 3, further analysis of the significant interaction revealed a significant simple effect of phase on mean out-of-school step count in the experimental group (F (2, 16) = 8.515, p = .003, $\eta_p^2=.516$) but not in the comparison group (F (2, 26) = .704, p = .504, $\eta_p^2=.051$). Post-hoc tests revealed mean out-of-school steps increased significantly from Baseline to Intervention (p=.005, $\alpha=.05$) before dropping significantly from Intervention to Maintenance (p=.024, $\alpha=.025$), mean out-of-school steps during Maintenance was non-significantly higher than Baseline levels (p=.966, $\alpha=.017$). In Trial 4, further analysis of the interaction revealed that phase had a significant simple effect on mean out-of-school step count in the experimental group F (2, 34) = 10.747, p < .001, $\eta_p^2=.387$), but not in the comparison group (F (2, 28) = 1.017, p = .374, $\eta_p^2=.068$). Post-hoc testing indicated mean ‘out-of-school’ steps in the experimental group increased significantly from baseline to intervention (p<.001, $\alpha=.05$) before dropping significantly from intervention to maintenance (p=.010, $\alpha=.025$). Mean ‘out-of-school’ steps during maintenance in the experimental group was non-significantly higher than baseline levels (p=.326, $\alpha=.017$).
Table 9.12

Summary of mixed method (3x2) ANOVA results for out of school steps in each Trial.

<table>
<thead>
<tr>
<th>Trial 1 (Pilot)</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Trial 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main effect of Phase</strong></td>
<td>F (1.360, 23.113) = 6.046, p=.015, η²=.262</td>
<td>F (1.616, 51.712) = 13.999, p&lt;.001, η²=.304</td>
<td>F (2, 42) = 3.837, p=.029, η²=.154</td>
</tr>
<tr>
<td><strong>Post Hoc Tests</strong></td>
<td>Mean (SD) steps/day: Baseline=5,430 (1,469) Intervention=6,284 (1,663) Maintenance=6,839 (2,614)</td>
<td>Mean (SD) steps per day: Baseline=5,972 (2,739) Intervention=7,391 (2,364) Maintenance=7,283 (2,458)</td>
<td>Mean (SD) steps/day: Baseline=7,623 (2,447) Intervention=8,455 (3,141) Maintenance=7,987 (2,257)</td>
</tr>
<tr>
<td>Mean out of school steps did not increase significantly from Baseline to Intervention or Intervention to Maintenance (p=.038, α=.025 and p=.041, α=.017, respectively). But the overall increase from Baseline to Maintenance was significant (p=.019, α=.05).</td>
<td>Mean out of school steps increased significantly from Baseline to Intervention (p&lt;.001, α=.05) and Baseline to Maintenance (p=.001, α=.025).</td>
<td>Mean out of school steps increased significantly from Baseline to Intervention (p=.007, α=.05), while Maintenance levels did not differ significantly from either Baseline (p=.448, α=.113) or Intervention levels (p=.084, α=.025).</td>
<td>Mean out of school steps increased significantly from Baseline to Intervention (p=.001, α=.05), while Maintenance levels did not differ significantly from those during either Baseline (p=.448, α=.113) or Intervention (p=.140, α=.017)</td>
</tr>
<tr>
<td><strong>Main effect of Condition</strong></td>
<td>F (1, 17) = .088, p=.770, η²=.005</td>
<td>F (1, 32) = .738, p=.397, η²=.023</td>
<td>F (1, 21) = 6.458, p=.019, η²=.235</td>
</tr>
<tr>
<td><strong>Post Hoc Tests</strong></td>
<td>Overall mean out of school steps significantly higher in the experimental group</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Phase by Condition Interaction</strong></td>
<td>F (1.360, 23.113) = 2.452, p=.123, η²=.126</td>
<td>F (1.616, 51.712) = 10.086, p&lt;.001, η²=.240</td>
<td>F (2, 42) = 4.451, p=.018, η²=.175</td>
</tr>
</tbody>
</table>

Note: Significant results are indicated in bold type. *Refer to main text for outcomes from further analyses investigating significant phase by condition (3x2) interactions.
9.1.2.4 Weekend Steps

Mean steps per day on weekends in the Comparison ‘Ped only’ group during the first weeks, middle weeks and final weeks for each trial are displayed in Table 9.13.

Table 9.13

<table>
<thead>
<tr>
<th>Trial</th>
<th>First weeks</th>
<th>Middle weeks</th>
<th>Final weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>1(Pilot)</td>
<td>6</td>
<td>8,253</td>
<td>3,765</td>
</tr>
<tr>
<td>2</td>
<td>13</td>
<td>10,943</td>
<td>4,737</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>8,739</td>
<td>2,795</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>9,669</td>
<td>4,094</td>
</tr>
</tbody>
</table>

The extent to which increases in daily steps in the school-based HAPPE programme generalize can also be seen in Figure 9.10, which displays the mean daily ‘weekend’ steps for the comparison ‘Ped only’ group participants in each trial in relation to Tudor-Locke et al.’s (2011) criteria for sufficient PA for health and well-being. The gradual increases in steps by the Comparison ‘Ped Only’ groups observed in other contexts (on weekdays and ‘in school’) does not appear to have generalised to steps on weekends consistently across trials, as indicated by relatively flat trend lines in all trials.
Figure 9.10 Daily mean ‘weekend’ steps for Comparison ‘Pedometer only’ condition in each trial. Dashed lines represent recommended cut-offs for being “sufficiently active” for males (15,000) and females (12,000). Solid angled lines represent the direction of the overall trend in mean steps per day over time.
Table 9.14 shows the mean ‘weekend’ steps of the experimental group during baseline, intervention and maintenance phases for each trial.

### Table 9.14

Mean (S.D.) ‘Weekend’ steps/day for participants in the Experimental ‘Ped + HAPPE’ condition during baseline, intervention and maintenance.

<table>
<thead>
<tr>
<th>Trial</th>
<th>Baseline</th>
<th>Intervention</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>1(Pilot)</td>
<td>10</td>
<td>6,165</td>
<td>3,822</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>7,147</td>
<td>3,304</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>10,492</td>
<td>2,960</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>10,478</td>
<td>5,998</td>
</tr>
</tbody>
</table>

Figure 9.11 shows the mean daily ‘weekend’ steps for the Experimental ‘Ped + HAPPE’ group participants in each trial in relation to Tudor-Locke et al.’s (2011) criteria for sufficient PA for health and well-being. A pattern of increasing mean steps on weekends (similar to that of out of school steps) was observed consistently in the experimental groups across trials.
Figure 9.11 Daily mean ‘Weekend’ steps for the Experimental ‘Ped + HAPPE’ condition in each trial. Dashed lines represent recommended cut offs for sufficient activity for males (15,000) and females (12,000). Solid angled lines represent the direction of the overall trend in mean steps per day.
Mean changes in ‘Weekend’ steps/day for the comparison and experimental condition in Trial’s 1 to 4 can be seen in Figure 9.12, relative to their baseline levels. Values during the intervention period for the experimental ‘Ped + HAPPE’ condition in Trial’s 1 to 4 were equivalent to increases of 48.9%, 65.5%, 51.8% and 14.4%, respectively. Values for the comparison ‘Ped only’ condition observed during the middle weeks in Trial’s 1 to 4 were equivalent to changes of 13.5%, -1.8%, 42.5% and 4.1% respectively.

The mean increases in ‘Weekend’ steps during the maintenance phase for the experimental ‘Ped + HAPPE’ condition were equivalent to changes of 59.1%, 69.8%, -1.8% and 6.9% in Trial’s 1 to 4 respectively. The values for the comparison ‘Ped only’ condition in Trial’s 1 to 4 observed during the final weeks were equivalent to increases of 26.4%, 9.1%, -7.0% and -7.9% respectively, relative to their baseline levels.
Figure 9.12 Mean ‘Weekend’ steps/day relative to baseline/first week’s levels for the Comparison and Experimental condition in each Trial during the intervention / middle weeks and the maintenance phase / final weeks. *Indicates a statistically significant increase from Baseline phase.
Mixed methods (3x2) ANOVA examined the effects of phase (baseline, intervention and maintenance) and condition (comparison or experimental) on mean weekend steps in each trial. The findings and statistics from the 3x2 mixed methods ANOVA for ‘weekend’ steps are summarized in Table 9.15 for each trial. The analyses revealed a significant main effect of phase in all trials, with the exception of Trial 4. The main effect of condition was non-significant in all trials, except Trial 3, where mean steps on weekends in the experimental condition was significantly higher than mean steps on weekends in the comparison condition across the entire monitoring period.

The phase by condition interactions in Trial’s 1, 3 and 4 were non-significant. A significant phase by condition interaction was found in Trial 2. Further analysis revealed a significant simple effect of phase on mean weekend steps in the experimental condition \( (F (1.555, 24.885) = 15.641, p < .001, \eta_p^2 = .494) \) but not in the comparison condition \( (F (2, 24) = .313, p = .734, \eta_p^2 = .025) \). Post-hoc tests revealed mean weekend steps in the experimental condition increased significantly from Baseline to Intervention \( (p<.001, \alpha=.05) \) with a further non-significant increase between Intervention and Maintenance \( (p=.677, \alpha=.017) \), where steps remained significantly higher than Baseline levels \( (p=.001, \alpha=.025) \).
Table 9.15

Summary of mixed method (3x2) ANOVA results for weekend steps in each Trial.

<table>
<thead>
<tr>
<th>Main effect of Phase</th>
<th>Trial 1(Pilot)</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Trial 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>F (2, 28) = 6.841, p = .004, ( \eta_p^2 = .328 )</strong></td>
<td><strong>F (2, 56) = 5.992, p = .005, ( \eta_p^2 = .175 )</strong></td>
<td><strong>F (2, 64) = 41.282, p &lt; .001, ( \eta_p^2 = .563 )</strong></td>
<td><strong>F (1.631, 30.988) = 1.191, p = .309, ( \eta_p^2 = .059 )</strong></td>
</tr>
<tr>
<td>Post Hoc Tests</td>
<td>Mean (SD) steps per day: Baseline, 6,948 (3,819)</td>
<td>Mean (SD) steps per day: Baseline, 8,792 (4,355)</td>
<td>Mean (SD) steps per day: Baseline, 9,770 (2,981)</td>
<td>Mean (SD) steps per day: Baseline, 9,777 (4,776)</td>
</tr>
<tr>
<td></td>
<td>Intervention, 9,251 (3,188)</td>
<td>Intervention, 11,362 (4480)</td>
<td>Intervention, 14,499 (3,601)</td>
<td>Intervention, 10,800 (5,245)</td>
</tr>
<tr>
<td></td>
<td>Maintenance, 10,043, (3,916)</td>
<td>Maintenance, 12,047 (4,590)</td>
<td>Maintenance, 9,409, (3,692)</td>
<td>Maintenance, 9,777 (4,531)</td>
</tr>
<tr>
<td></td>
<td>Mean steps did not change significantly from Baseline to Intervention (p=.027, ( \alpha = .025 )) and intervention to maintenance (p=.217, ( \alpha = .017 )). The overall increase from Baseline to Maintenance was significant. (p=.007, ( \alpha = .05 ))</td>
<td>Mean steps overall did not change significantly from Baseline to Intervention (p=.013, ( \alpha = .025 ), with a further non-significant increase from Intervention to Maintenance (p=.434, ( \alpha = .017 )). Maintenance step levels were significantly higher than those at baseline (p=.003, ( \alpha = .05 ))</td>
<td>Mean steps overall did not change significantly from Baseline to Intervention (p=.013, ( \alpha = .025 )) and then dropped significantly from Intervention to Maintenance (p&lt;.001, ( \alpha = .025 )), where there was no significant difference between baseline and maintenance levels (p=.560, ( \alpha = .017 ))</td>
<td>Overall mean weekend steps significantly higher in the experimental group.</td>
</tr>
</tbody>
</table>

| Main effect of Condition | F (1, 14) = .331, p = .574, \( \eta_p^2 = .023 \) | F (1, 28) = .457, p = .505, \( \eta_p^2 = .016 \) | F (1, 32) = 7.827, p = .009, \( \eta_p^2 = .197 \) | F (1, 19) = .677, p = .421, \( \eta_p^2 = .034 \) |
| Phase by Condition Interaction* | F (2, 28) = .754, p = .480, \( \eta_p^2 = .051 \) | F (2, 56) = 4.128, p = .021, \( \eta_p^2 = .128 \) | F (2, 65) = 1.086, p = .344, \( \eta_p^2 = .033 \) | F (1.631, 30.988) = .572, p = .536, \( \eta_p^2 = .029 \) |

Note: Significant results are indicated in bold type. *Refer to main text for outcomes from further analyses investigating significant phase by condition (3x2) interactions.
9.2 Changes to physical health and psychological well-being during the HAPPE evaluations

While the primary aim of the HAPPE intervention was to increase ‘steps’, it was also of interest to see if any secondary, beneficial side-effects of increased steps during the HAPPE intervention resulted in measurable improvements in physical health and psychological well-being. For the purposes of this analysis all unique participants from HAPPE Trial’s 1 to 3 were combined to create a larger sample size. Additionally, it was assumed that a step walked ‘in school’ was likely to have the same effect on measures of health and well-being as a step walked out of school, on weekdays and on weekends. Thus, an average of the increase in steps on weekdays and weekends was calculated for each participant with sufficient step data. The experimental group typically showed a maximum increase in steps between the baseline and intervention phase, thus their mean overall step increase was calculated based on data from these time points. However, the comparison group typically showed a maximum increase in steps only at the end of the monitoring period, thus mean overall step increases for the comparison group participants were calculated based on data from the first weeks and the final weeks of the monitoring period (equivalent to the Baseline and Maintenance phases for the experimental group).

As can be seen in Table 9.16, when combining all unique participants from the HAPPE Trials 1-3, paired samples t-tests reveal significant increases in mean overall steps in both the experimental (t (43) = 9.034, p < .001) and the comparison (t (32) = 2.996, p = .002) conditions. Independent samples t-test of overall steps change, found the magnitude of change in mean overall steps in experimental condition was significantly greater when compared to the comparison condition (t (75) = 4.025, p < .001). Exact McNemar Chi-squared tests show the proportion of “sufficiently active”
children increased significantly between measurement points in the experimental group (p<.001) but not in the comparison (p=.125).

Table 9.16

*Overall Physical activity levels of participants’ in HAPPE Trials’ 1-3*

<table>
<thead>
<tr>
<th>Physical Activity</th>
<th>N</th>
<th>Baseline / First weeks</th>
<th>Intervention/ Final weeks</th>
<th>Magnitude of Change</th>
<th>p</th>
<th>α*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Steps†</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comparison Condition</td>
<td>33</td>
<td>10,927</td>
<td>3,193</td>
<td>12,218</td>
<td>3,289</td>
<td>+1,291 2,247</td>
</tr>
<tr>
<td>Experimental Condition</td>
<td>44</td>
<td>10,359</td>
<td>2,943</td>
<td>13,946</td>
<td>3,776</td>
<td>+3,587 2,633</td>
</tr>
<tr>
<td>% “sufficiently active” overall ‡</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comparison Condition</td>
<td>33</td>
<td>15.2%</td>
<td>5</td>
<td>27.3%</td>
<td>9</td>
<td>+12.1% +4</td>
</tr>
<tr>
<td>Experimental Condition</td>
<td>44</td>
<td>15.9%</td>
<td>7</td>
<td>52.3%</td>
<td>23</td>
<td>+36.4% +16</td>
</tr>
</tbody>
</table>

†results from paired samples t-tests. ‡Results from Exact McNemar Chi-square tests.*Indicates corrected alpha level using modified Bonferroni.

Means of the pre and post measurements of physical health variables are displayed in Tables 8.11 for the comparison group and Table 8.12 for the experimental group. These tables include results from either paired samples t-tests or exact McNemar Chi-squared tests, where significant changes are indicated in bold type when reporting significance. Most measures of body composition increased from pre-post measurement as may be expected in the case of normal growth. The measure of resting heart rate showed a significant decrease from pre-post measurement in both groups.

Means of the pre and post measurements of psychological well-being variables are displayed in Table 9.17 for the comparison group and Table 9.18 for the experimental group with the results from either paired samples t-tests or McNemar Chi-squared tests. Measures of psychological well-being show changes in the desired direction, with the exception of a non-significant increase in Total depression in the experimental group. Results from paired samples t-tests show a significant reduction in
raw scores on the Depression Inventory and Anxiety Scale in the comparison group and a significant reduction in raw scores on the Anxiety Scale in the experimental group.
Table 9.17

Measures of physical health and psychological well-being from participants’ in Comparison ‘Ped only’ condition in Trials’ 1-3.

<table>
<thead>
<tr>
<th>Physical Health Measures</th>
<th>N</th>
<th>PRE Mean</th>
<th>PRE S.D.</th>
<th>POST Mean</th>
<th>POST S.D.</th>
<th>Direction of Change</th>
<th>p</th>
<th>α*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paired Samples t-test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>30</td>
<td>19.87</td>
<td>3.29</td>
<td>19.73</td>
<td>3.38</td>
<td>↓</td>
<td>.232</td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>30</td>
<td>42.89</td>
<td>11.75</td>
<td>43.08</td>
<td>12.04</td>
<td>↑</td>
<td>.380</td>
<td></td>
</tr>
<tr>
<td>Height (m)</td>
<td>30</td>
<td>1.45</td>
<td>0.11</td>
<td>1.46</td>
<td>0.11</td>
<td>↑</td>
<td>&lt;.001</td>
<td>.050</td>
</tr>
<tr>
<td>Systolic BP (mmHg)</td>
<td>30</td>
<td>112.23</td>
<td>10.29</td>
<td>111.74</td>
<td>8.42</td>
<td>↓</td>
<td>.737</td>
<td></td>
</tr>
<tr>
<td>Diastolic BP (mmHg)</td>
<td>30</td>
<td>67.13</td>
<td>9.41</td>
<td>66.74</td>
<td>8.20</td>
<td>↓</td>
<td>.821</td>
<td></td>
</tr>
<tr>
<td>Heart Rate (bpm)</td>
<td>30</td>
<td>89.03</td>
<td>13.02</td>
<td>79.56</td>
<td>10.72</td>
<td>↓</td>
<td>.001</td>
<td>.025</td>
</tr>
<tr>
<td>Waist Circ. (cm)</td>
<td>30</td>
<td>69.00</td>
<td>10.49</td>
<td>69.20</td>
<td>9.50</td>
<td>↑</td>
<td>.726</td>
<td></td>
</tr>
<tr>
<td>Hip Cir. (cm)</td>
<td>30</td>
<td>77.29</td>
<td>8.45</td>
<td>76.32</td>
<td>8.83</td>
<td>↓</td>
<td>.024</td>
<td>.013</td>
</tr>
<tr>
<td>WHtR</td>
<td>30</td>
<td>47.32</td>
<td>5.21</td>
<td>47.28</td>
<td>4.81</td>
<td>↓</td>
<td>.929</td>
<td></td>
</tr>
<tr>
<td>WHR</td>
<td>30</td>
<td>0.89</td>
<td>0.05</td>
<td>0.91</td>
<td>0.05</td>
<td>↑</td>
<td>.068</td>
<td></td>
</tr>
<tr>
<td>Skinfold:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triceps (mm)</td>
<td>30</td>
<td>17.63</td>
<td>6.32</td>
<td>17.77</td>
<td>6.57</td>
<td>↑</td>
<td>.666</td>
<td></td>
</tr>
<tr>
<td>Biceps (mm)</td>
<td>30</td>
<td>12.33</td>
<td>6.18</td>
<td>12.04</td>
<td>6.42</td>
<td>↓</td>
<td>.372</td>
<td></td>
</tr>
<tr>
<td>Subscapular (mm)</td>
<td>30</td>
<td>14.22</td>
<td>8.34</td>
<td>12.86</td>
<td>8.57</td>
<td>↓</td>
<td>.011</td>
<td>.017</td>
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<tr>
<td>Suprailiac (mm)</td>
<td>26</td>
<td>15.14</td>
<td>7.10</td>
<td>16.03</td>
<td>9.12</td>
<td>↑</td>
<td>.408</td>
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<tr>
<td>Sum of three (mm)</td>
<td>30</td>
<td>44.18</td>
<td>20.00</td>
<td>42.68</td>
<td>20.82</td>
<td>↓</td>
<td>.063</td>
<td></td>
</tr>
<tr>
<td>Sum of four (mm)</td>
<td>26</td>
<td>54.22</td>
<td>21.14</td>
<td>53.19</td>
<td>23.29</td>
<td>↓</td>
<td>.535</td>
<td></td>
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<tr>
<td>McNemar Chi-squared test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% “Overweight” ^</td>
<td>33</td>
<td>27.3%</td>
<td>9</td>
<td>27.3%</td>
<td>9</td>
<td>--</td>
<td>&gt;.999</td>
<td></td>
</tr>
<tr>
<td>% “Obese” ^</td>
<td>33</td>
<td>6.1%</td>
<td>2</td>
<td>6.1%</td>
<td>2</td>
<td>--</td>
<td>&gt;.999</td>
<td></td>
</tr>
<tr>
<td>% WHtR &gt; 50%</td>
<td>30</td>
<td>33.3%</td>
<td>10</td>
<td>26.7%</td>
<td>8</td>
<td>↓</td>
<td>.625</td>
<td></td>
</tr>
<tr>
<td>% Waist circ. (cm) &gt; 90th Percentile</td>
<td>30</td>
<td>46.7%</td>
<td>14</td>
<td>50%</td>
<td>15</td>
<td>↑</td>
<td>&gt;.999</td>
<td></td>
</tr>
<tr>
<td>Psychological Measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paired Samples t-test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child Depression</td>
<td>27</td>
<td>7.93</td>
<td>8.06</td>
<td>5.74</td>
<td>6.53</td>
<td>↓</td>
<td>.016</td>
<td>.025</td>
</tr>
<tr>
<td>Inventory: Total</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revised Child Manifest Anxiety Scale: Total</td>
<td>27</td>
<td>8.59</td>
<td>6.55</td>
<td>5.33</td>
<td>5.80</td>
<td>↓</td>
<td>.001</td>
<td>.050</td>
</tr>
<tr>
<td>Piers-Harris 2, Self-Esteem Inventory: Total</td>
<td>27</td>
<td>46.81</td>
<td>11.36</td>
<td>49.96</td>
<td>9.43</td>
<td>↑</td>
<td>.041</td>
<td>.017</td>
</tr>
</tbody>
</table>

Table 9.18

*Measures of physical health from participants’ in the Experimental ‘Ped + HAPPE’ condition in HAPPE Trials’ 1-3.*

<table>
<thead>
<tr>
<th>Physical Health Measures</th>
<th>N</th>
<th>PRE Mean</th>
<th>PRE S.D.</th>
<th>POST Mean</th>
<th>POST S.D.</th>
<th>Direction of Change</th>
<th>p</th>
<th>α*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paired Samples t-test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>39</td>
<td>18.46</td>
<td>3.53</td>
<td>18.51</td>
<td>3.46</td>
<td>↑</td>
<td>.667</td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>39</td>
<td>40.10</td>
<td>11.92</td>
<td>40.59</td>
<td>11.77</td>
<td>↑</td>
<td>.053</td>
<td></td>
</tr>
<tr>
<td>Height (m)</td>
<td>39</td>
<td>1.46</td>
<td>0.12</td>
<td>1.47</td>
<td>0.12</td>
<td>↑</td>
<td>&lt;.001</td>
<td>.05</td>
</tr>
<tr>
<td>Systolic BP (mmHg)</td>
<td>39</td>
<td>111.39</td>
<td>8.41</td>
<td>111.50</td>
<td>9.81</td>
<td>↑</td>
<td>.951</td>
<td></td>
</tr>
<tr>
<td>Diastolic BP (mmHg)</td>
<td>39</td>
<td>66.98</td>
<td>8.44</td>
<td>66.85</td>
<td>7.65</td>
<td>↓</td>
<td>.938</td>
<td></td>
</tr>
<tr>
<td>Heart Rate (bpm)</td>
<td>39</td>
<td>87.67</td>
<td>11.42</td>
<td>79.89</td>
<td>15.03</td>
<td>↓</td>
<td>.002</td>
<td>.025</td>
</tr>
<tr>
<td>Waist Circ.(cm)</td>
<td>39</td>
<td>66.06</td>
<td>10.36</td>
<td>66.17</td>
<td>10.10</td>
<td>↑</td>
<td>.812</td>
<td></td>
</tr>
<tr>
<td>Hip Circ. (cm)</td>
<td>39</td>
<td>74.59</td>
<td>8.81</td>
<td>73.49</td>
<td>9.53</td>
<td>↓</td>
<td>.037</td>
<td>.017</td>
</tr>
<tr>
<td>WHtR</td>
<td>39</td>
<td>45.17</td>
<td>5.19</td>
<td>45.07</td>
<td>5.36</td>
<td>↓</td>
<td>.769</td>
<td></td>
</tr>
<tr>
<td>WHR</td>
<td>39</td>
<td>0.88</td>
<td>0.05</td>
<td>0.90</td>
<td>0.08</td>
<td>↑</td>
<td>.150</td>
<td></td>
</tr>
<tr>
<td>Skinfold:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triceps (mm)</td>
<td>39</td>
<td>14.78</td>
<td>5.94</td>
<td>14.81</td>
<td>6.26</td>
<td>↑</td>
<td>.926</td>
<td></td>
</tr>
<tr>
<td>Biceps (mm)</td>
<td>39</td>
<td>10.12</td>
<td>6.03</td>
<td>10.59</td>
<td>6.61</td>
<td>↑</td>
<td>.289</td>
<td></td>
</tr>
<tr>
<td>Subscapular (mm)</td>
<td>39</td>
<td>11.52</td>
<td>7.61</td>
<td>10.99</td>
<td>7.72</td>
<td>↓</td>
<td>.132</td>
<td></td>
</tr>
<tr>
<td>Suprailiac (mm)</td>
<td>34</td>
<td>13.01</td>
<td>8.11</td>
<td>12.57</td>
<td>7.87</td>
<td>↓</td>
<td>.409</td>
<td></td>
</tr>
<tr>
<td>Sum of three (mm)</td>
<td>39</td>
<td>36.42</td>
<td>18.90</td>
<td>36.38</td>
<td>19.78</td>
<td>↓</td>
<td>.958</td>
<td></td>
</tr>
<tr>
<td>Sum of four (mm)</td>
<td>34</td>
<td>44.46</td>
<td>21.90</td>
<td>43.88</td>
<td>21.94</td>
<td>↓</td>
<td>.528</td>
<td></td>
</tr>
<tr>
<td>McNemar Chi-squared test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% “Overweight” ^</td>
<td>40</td>
<td>20%</td>
<td>8</td>
<td>20%</td>
<td>8</td>
<td>--</td>
<td>&gt;.999</td>
<td></td>
</tr>
<tr>
<td>% “Obese” ^</td>
<td>40</td>
<td>5%</td>
<td>2</td>
<td>5%</td>
<td>2</td>
<td>--</td>
<td>&gt;.999</td>
<td></td>
</tr>
<tr>
<td>% WHtR &gt; 50%</td>
<td>39</td>
<td>12.8%</td>
<td>5</td>
<td>17.9%</td>
<td>7</td>
<td>↑</td>
<td>.500</td>
<td></td>
</tr>
<tr>
<td>% Waist circ.(cm) &gt; 90th Percentile</td>
<td>39</td>
<td>33.3%</td>
<td>13</td>
<td>35.9%</td>
<td>14</td>
<td>↑</td>
<td>&gt;.999</td>
<td></td>
</tr>
</tbody>
</table>

Psychological Measures

<table>
<thead>
<tr>
<th>Paired Samples t-test</th>
<th>Mean</th>
<th>S.D.</th>
<th>Mean</th>
<th>S.D.</th>
<th>Direction of Change</th>
<th>p</th>
<th>α*</th>
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</thead>
<tbody>
<tr>
<td>Child Depression Inventory: Total Revised Child Manifest Anxiety Scale: Total</td>
<td>38</td>
<td>7.21</td>
<td>7.19</td>
<td>7.42</td>
<td>9.02</td>
<td>↑</td>
<td>.738</td>
</tr>
<tr>
<td>Piers-Harris 2, Self-Esteem Inventory: Total</td>
<td>37</td>
<td>46.22</td>
<td>11.08</td>
<td>47.54</td>
<td>12.18</td>
<td>↑</td>
<td>.145</td>
</tr>
</tbody>
</table>

Bivariate correlation analyses further investigated the significant paired t-tests from Tables 9.17 and 9.18, to test if the change in these variables was related to the change in mean overall steps during the HAPPE. Due to the similar pattern of results in the comparison and experimental conditions, the outcomes from the bivariate correlation analyses conducted on the entire sample (i.e., with the conditions combined) are reported. A correlation matrix is presented in Appendix U.

Convergent validity of the physical and psychological measures was demonstrated in the overall sample with significant correlations between similar measures. For example, in the measures of change in body composition a strong, positive correlation was found between changes in BMI and weight \((r (67) = .953, p < .001)\), while a weak to moderate, negative correlation was found between changes in BMI and height \((r (67) = -.269, p = .025)\). The sum of four skin folds’ measure was strongly and positively correlated with the subscapular \((r (58) = .602, p < .001)\), suprailiac \((r (58) = .834, p < .001)\) and the sum of three \((r (58) = .807, p < .001)\) skin fold measures. The sum of four skin folds’ measure showed a moderate, positive correlation with the triceps \((r (58) = .476, p < .001)\) and bicep \((r (58) = .464, p < .001)\) skin fold measures.

Significant correlations between the measures of cardiovascular function were also found with moderate, positive correlations between changes in heart rate and Systolic BP \((r (67) = .254, p = .035)\) and changes heart rate and Diastolic BP \((r (67) = .377, p = .001)\), as well as a strong, positive between changes in Systolic BP and Diastolic BP \((r (67) = .592, p < .001)\). Additionally, significant correlations between the measures of psychological well-being were also found. For example, changes in the total score on the Piers-Harris Self-Concept Scale were moderately, and negatively correlated with changes in the total scores on both the CDI \((r (62) = -.581, p < .001)\) and
the RCMAS ($r(62) = -.535, p < .001$), while the changes in the total score on the CDI and RCMAS showed a moderate, positive correlation ($r(62) = .518, p < .001$).

Significant correlations between measures of change in body composition and cardiovascular function also show changes in the physical measures are interrelated. For example, a moderate, negative correlation existed between changes in height and heart rate ($r(67) = -.339, p = .004$) and height and Sub-Scapular skin fold ($r(67) = -.323, p = .007$). A moderate, negative correlation also existed between changes in hip circumference and the sum of four skin folds ($r(67) = -.323, p = .007$) and Systolic blood pressure and the Triceps skin fold ($r(67) = -.287, p = .017$). However, none of the changes in the measures of physical health or psychological well-being, not even those that had shown significant improvement during the HAPPE trials, were significantly correlated with the change in mean overall steps in the entire sample, (nor in the experimental or comparison condition separately).
Chapter 10

Study II: Overall Discussion of the school-based HAPPE evaluations

The purpose of Study II was to evaluate the effectiveness of the school-based, individually-adapted HAPPE Classroom ‘Climb Mt Fuji Challenge’ on increasing children’s daily, lifestyle physical activity levels. The programme utilised the pedometer in combination with additional individually-adapted behavioural techniques of self-monitoring, goal setting, feedback and contingent reinforcement to help children increase their walking behaviours on weekdays, in school, out of school and on weekends. The programme was evaluated at two primary schools in four trials with children ranging in age from seven- to 12-years. Each trial took place during one school term with monitoring periods ranging from seven to nine weeks. Each trial involved an experimental ‘Ped + HAPPE’ group consisting of students in the same class who wore pedometers and were exposed to the additional behavioural techniques packaged in the HAPPE Classroom ‘Climb Mt Fuji Challenge’. A comparison ‘Ped only’ group was monitored at the same time as a comparison, and consisted of students in another class of similar aged children at the same school who wore pedometers and were rewarded for wearing their pedometers and providing accurate physical activity data for the whole term.

The results from the four trials of the HAPPE demonstrated that primary school children aged seven- to 12-years-old in both groups were able to manage their own pedometers to achieve statistically significant, meaningful and generalised increases in steps relevant to the current recommended guidelines for children’s PA. For example,
the proportion of children sufficiently active (i.e., those meeting the recommended step totals equivalent to daily PA recommendations) on weekdays and weekends had nearly doubled by the end of the monitoring period, relative to baseline levels. For a school-based behavioural intervention where children were encouraged to self-manage increases in their PA behaviours, largely independent of adults specially arranging physical activities, requiring trained professionals or specialised sporting equipment or facilities, these results are promising.

The results from Study II are encouraging when evaluated in light of the Western Australian Physical Activity Taskforce’s (WA PATF) original mandate to “increase the proportion of sufficiently active people in the population by 5% over ten years” (Physical Activity Taskforce Communications Working Group, 2002). Time and budget estimations first proposed by the WA PATF to achieve this goal were in the vicinity of approximately $10 million over 10 years (Physical Activity Taskforce Communications Working Group, 2002). It is estimated that if the HAPPE programme was adapted to reach students attending all government and non-government schools in Western Australia, it could be done so on a more favourable budget (approximately $7.9 million over ten years), while also obtaining measurable outcomes in approximately 120,780 primary school-aged children’s habitual PA levels per year, with the potential to increase the proportion of sufficiently active children by approximately 19% in the first year (See Appendix W for a table of the economic analysis, including the assumptions underpinning it and the breakdown of approximate costs). There is also the potential for a beneficial spill over effect, where other children may also increase their PA levels simply as a result of attending a school where children participate the HAPPE intervention, though this requires further investigation.

The HAPPE evaluations sought to test the specific hypothesis that participants in the experimental ‘Ped + HAPPE’ condition who were exposed to the additional
behavioural self-management components in the HAPPE Classroom ‘Climb Mt Fuji Challenge’ would show a statistically significant increase in mean steps during the intervention period compared to their baseline levels, and that this increase would be greater than in the comparison group. This hypothesis was not supported by the results from the Pilot trial conducted at School A with children aged seven–to nine-years-of-age. This was thought to be due mainly to a high degree of variability in the steps data combined with a reduction in sample size (due to attrition and the exclusion of participants with insufficient data) and an increase in the comparison group. The hypothesis was supported in the three subsequent trials of the HAPPE Classroom programme at School B, with classrooms of children aged eight- to 10-years and 11-to 12-years. Additionally, the effect of significantly increased steps in the experimental ‘Ped + HAPPE’ condition generalised across contexts and affected steps walked on weekdays, in school, out of school and on weekends.

A common finding from the HAPPE trials was of participants in the comparison ‘Ped only’ condition also increasing steps across the monitoring period. In some cases, the increase in the comparison group prevented confirmation of the hypothesis, with both groups showing increases in mean daily steps relative to baseline levels, though not always at the same time. Thus, the analyses of Study II sought to determine to what extent each condition increased steps across the different monitoring contexts, and to what extent increasing steps in the HAPPE Classroom evaluations might have led to beneficial side effects on measures of physical health and/or psychological well-being.
10.1 Changes to Children’s ‘Steps’ During the HAPPE Evaluations

10.1.1 The ‘Ped only’ Condition

With regards to the ‘Ped only’ comparison condition, it was not expected that the daily use of a pedometer plus monitoring daily step data at school over a period of one school term could lead to a significant increase in steps. Across all the trials, the proportion of children ‘sufficiently active’ in the comparison ‘Ped only’ condition had increased significantly by the end of the monitoring period, with the amount of children with mean weekday steps meeting Tudor-Locke et al.’s (2011) threshold for recommended pedometer steps more than doubling. However, the extent to which the ‘treatment’ effect of the ‘Ped only’ condition generalized to increases in steps ‘out of school’ and on weekends across trials was limited. Large increases in steps out of school and on weekends in the Pilot Trial suggested there was an intervention effect in the ‘Ped only’ condition separate to any contamination or “spill over” from the experimental group, as this was unexpected in these contexts. However, the patterns of results from the subsequent trials at School B show the change in steps in the out of school and weekend contexts to be smaller and less consistent. Additionally, none of the changes in steps out of school or on weekends were found to be statistically significant in the Comparison ‘Ped Only’ condition. Taken together, the results from School B suggest that relative to the increases to steps in school and on weekday steps overall, it is unlikely there was generalisation of an effect of the ‘Ped only’ comparison condition on steps out of school or on weekends. This was confirmed by finding the increase between the first weeks and final weeks in the proportion of ‘sufficiently active’ children for steps on weekends to be non-significant.

The increasing trend observed in steps on weekdays and ‘in school’ across trials suggests that the specific conditions in the comparison ‘Ped only’ group did in fact lead
to an increase in steps. Pedometers were open and accessible to participants in the comparison group as in the experimental group however, only those in the experimental group were instructed to try to increase their steps, and were exposed to the additional components of the HAPPE Climb Mt Fuji intervention. No instruction was given to participants in the comparison condition to increase their steps, nor was any systematic feedback provided regarding steps. Horne, et al. (2009) also found their comparison group to show a significant increase in weekday steps during their follow-up phase. Although, in their study pedometers were not worn continuously between the baseline and follow-up phases and they attributed the increase to reflect seasonal differences, where warmer temperatures during the follow-up monitoring phase were more conducive to outdoor play. The seasonal differences explanation can be ruled out in the HAPPE evaluations as each trial was conducted at a different time of year, yet the same pattern of results was observed in each trial – a delayed yet gradual increase in steps towards the end of the monitoring period.

While they may not have done as well as the experimental group to increase PA levels during the intervention phase, most comparison ‘Ped only’ groups showed at least a delayed, gradual increase - observed in weekday steps, and ‘in school’ steps - and in some cases the increase was significantly above baseline levels. In fact, it was often due to the parallel increases in steps in the comparison group that prevented finding more statistically significant phase by condition interactions in the experimental group (as was the case in Trial 1). Even in the cases where a significant interaction was found, significant simple effects of phase were also detected in the comparison group. Such was the case in Trial 2 and Trial 3 for weekday steps and in Trial 3 for in-school steps. It has been speculated previously that these increases could in part be due to a spill over or contamination effect caused by the two independent conditions (experimental and comparison) experiencing an overlapping of physical and social conditions to such an
extent that comparison participants may have modelled their peers in the experimental condition by also increasing their steps. While the researcher made every effort to keep the two conditions independent, the experiment was not conducted in a laboratory but in a real life setting where the two groups went to the same school and were also friends with each other. Thus, it could be argued that the increase in steps in the comparison ‘Ped only’ condition is an additional benefit of using the school-based HAPPE Classroom approach, leading to a beneficial spill over effect that could benefit other children in the school not directly involved in the Climb Mt Fuji Challenge.

The question remains, however, if the increase in the comparison ‘Ped only’ condition was due to a spill-over effect, then why were increases in steps not seen more consistently during the intervention phase? Instead, visual analyses of the figures show in most cases when the comparison group’s steps increased, it was delayed and did not appear until towards the end of the monitoring period when the experimental group was entering its maintenance phase (and when PA levels typically began to show a downward trend back to baseline levels). Certainly there may have been other external random factors controlling the amount of PA these children were doing but, perhaps the slow and steady increase in steps in the comparison groups were due to the specific circumstances of their condition – the daily self-monitoring of steps with a pedometer. Under these conditions, there is the possibility that the increases in steps observed in the Comparison ‘Ped only’ group were due to the incidental exposure to raw feedback from wearing the pedometer and monitoring steps twice a day, also known as reactivity. Regardless of whether or not participants can see how many steps they have, simply knowing that steps are being recorded could lead to reactivity (Tudor-Locke et al., 2009). Yet the pedometers in the comparison ‘Ped only’ condition were left accessible (unsealed), and perhaps seeing the increase in their steps over the course of the day
reinforced changes in behaviours to improve their step count leading to a more gradual change in their steps.

Finding a significant treatment reactivity effect from the comparison ‘Ped only’ condition was unexpected. Tudor-Locke et al. (2009) had reviewed studies investigating reactivity effects on children’s physical activity levels from wearing unsealed pedometers and concluded that there was little evidence to support that it could lead to a significant increase in steps. However, the longest monitoring period from the studies Tudor-Locke et al. (2009) reviewed was only 6 days. For example, after only 4 days of monitoring Ozdoba, Corbin and Le Masurier (2004) quite confidently concluded that reactivity did not exist when children wore unsealed pedometers. This is because studies investigating reactivity effects from pedometers on children’s PA levels were based on the hypothesis that “if reactivity occurs, it should be evident in the first day(s) of wear and that a steady decline in steps/day should ensue” (Tudor-Locke et al., 2009, p. 181).

Very little research, however, has attempted to test for reactivity effects on children’s PA levels when pedometers are worn on a daily basis unsealed over a much longer time, such as in the HAPPE evaluations. Labrosse (2008) conducted a study similar to Ozdoba et al.’s (2004), testing for reactivity effects on primary-school-aged children’s PA levels over a longer time period. Children wore sealed pedometers for 2 weeks, followed by another 2 weeks of wearing the pedometer unsealed. Labrosse (2008) then compared the mean steps from the unsealed pedometers with the mean steps from the sealed pedometers and found no significant difference. Labrosse (2008) concluded that wearing a pedometer alone does not result in increased physical activity but when combined with other complementary intervention components, such as goal setting, pedometers could lead to increases in children’s PA levels. The findings from the present HAPPE evaluations demonstrate, on the other hand, that under the conditions of the comparison ‘Ped only’ group, reactivity can occur though it may take
a long time for a significant increase in steps to be achieved. While the effect of the ‘Ped only’ condition did not generalise consistently in all trials to increase steps ‘out of school’ and on weekends, these results suggest that assumptions about the short term and longer term pedometer reactivity effects on children’s PA behaviour’s may be incorrect.

The findings from the HAPPE evaluations imply there is some utility in the conditions of the comparison ‘Ped only’ condition that enabled children to increase their PA levels on weekdays (and to a lesser degree on weekends) simply in a programme that encouraged daily objective self-monitoring of steps and having access to feedback from a pedometer for a period of approximately 8 weeks. While the ‘Ped only’ group’s improvement was not as immediate nor as marked (compared to baseline) as the ‘Ped + HAPPE’ group, perhaps the increase in PA resulted from a proportion of children in the comparison sample learning to use their pedometers to self-manage their PA behaviours independently of any instruction from the researcher.

Schneider (2012) reported that “BF Skinner favoured (and constructed) carefully designed educational materials that provided frequent questioning, individual pacing, and the immediate intrinsic rewards of achievement and progress. He thought these natural rewards would usually be sufficient for normally developing children, and artificial rewards unnecessary, not even praise” (p. 215). Thus, perhaps children in the ‘Ped only’ condition were more sensitive to the reinforcing properties of simply wearing a pedometer and recording its output on a daily basis over a prolonged period (8 weeks) due to the absence of the additional behavioural components and the systematic attempt to increase PA levels.

The pedometer was the central component in both conditions in the HAPPE evaluations. The unsealed pedometer worked by being able to display steps across the whole day, and children developed pedometer literacy, by learning how to read their
pedometer’s output in different ways. For example, the wearer of a pedometer can compare how one activity yields more or less steps compared to another, see how step counts vary from day to day, from in-school to out of school, and so on. Exposure to this feedback can educate the wearer about what conditions are necessary for them if they want to set about to increase their habitual PA level. When feedback is accessed in this systematic way it can be empowering to an individual should they wish to act, and do something with it. For example, it can serve as a cue/prompt to be more active, and can be reinforcing when it elicits a positive emotional response – such as when it signifies that progress has been achieved.

Studies evaluating school-based, self-management interventions with children, targeting other behaviours (such as social skills or inappropriate classroom behaviours) have found that programs that were partly managed by teachers were less effective than a fully self-managed treatment package (Fantuzzo & Polite, 1990). Additionally, Schneider (2010) identified that in the context of interventions designed to manage classroom behaviours “natural rewards often take time to gain value” (p. 210). Sulzer – Azaroff and Mayer (1991) have also stated that “separating self-monitoring from self-reinforcement was not always possible, and the degree to which the two factors interact remains unclear” (p. 185). Thus, findings from Study II suggest that in the context of a school-based PA intervention, children supported to wear pedometers and record step data on a daily basis may only require sufficient time – enough time to adapt to wearing the pedometer and respond to its output, so that ‘steps’ can become something of value – which can then lead to a fully self-managed increase in steps, even without any specific instruction to do so.

If this is the case, then further evaluations of the HAPPE program could evaluate the effects of using a longer measurement period over two consecutive teaching terms, and including the school holiday period in combination with minimal direction from the
researcher/teacher to support accurate daily monitoring of steps on an individual basis, as well as providing a role for participants in self-selecting goals and delivering self-reinforcement. This may lead to more durable improvements in PA levels over time, with the addition of reducing the load on the teacher to deliver the additional aspects of the HAPPE Classroom ‘Climb Mt Fuji Challenge’. However, a generalisation of the effect to increase steps in the critical out of school and home context was inconsistent and limited in the ‘Ped only’ condition. Additionally, not all children in the ‘Ped only’ condition demonstrated the same pattern of increase in steps over time, and a proportion of children in the sample may not have ‘reacted’ to the pedometer in a way that led to an increase in steps. Thus, future research with children wearing unsealed pedometers should aim to support primary school-aged children to identify the events that prompt and reinforce their own PA behaviour, so they can use this information to create self-management programs for themselves (Hansen, 2010).

However, additional consideration needs to be made of those children who, like the overweight MIP participants, do not find the natural consequences associated with a physically active lifestyle a positive experience. For example, lack of success with achieving fitness and mobility and/or lack of positive peer interactions can act as barriers to being more physically active. Such children may require additional support to increase their PA levels to overcome their avoidance behaviours. For example, self-monitoring with a pedometer alone may not be effective enough for ‘at risk’ children and Sulzer –Azaroff and Mayer (1991) suggested that self-reinforcement and self-monitoring be used in combination “when natural reinforcers are delayed or presented infrequently” (p. 185-186). Additionally, Schneider (2010) reported that rewards that emphasize success or competence on a task can enhance the value of reinforcers. These were the fundamental principles underlying the design of the MIP and HAPPE interventions. The reason for developing the school-based HAPPE intervention was to
encourage an entire classroom to consent to increase their steps, so that all children (both typical and overweight / ‘at risk’) may benefit from participating together and helping each other live more active lifestyles.

10.1.2 The HAPPE Classroom ‘Climb Mt Fuji Challenge’

With regards to the performance of the experimental ‘Ped + HAPPE’ condition, the visual analyses showed the additional components packaged in the ‘Climb Mt Fuji Challenge’ led to an immediate increase in weekday steps in all trials, with statistically significant increases in the ‘Ped + HAPPE’ condition’s from Trial’s 2, 3 and 4 when comparing levels from the baseline and intervention phases. Across all the HAPPE trials, the proportion of sufficiently active children in the experimental ‘Ped + HAPPE’ condition also increased significantly during the intervention phase, nearly doubling the baseline amount and nearly doubling the amount seen in the comparison group during the equivalent time period. The gains in weekday steps in the HAPPE trials are on par with those reported in the pedometer-measured, school-based studies by Horne et al. (2009) and Hardman et al. (2011). Hardman et al. (2011) reported a mean increase in weekday steps in their full-intervention condition of +2,456 steps per day during the intervention phase, compared to a mean increase in the no-rewards condition of +1033 steps per day. Horne et al. (2009) reported mean increases in steps made by their experimental girls and boys of +3822 and +2785 steps per day respectively which is equivalent to a 35% and 21% increase over baseline, and was equated as being equivalent to doing an additional 30 minutes of moderate-intensity physical activity per day.

Mean increases in steps in school in the experimental group were modest by comparison to the overall increase observed in weekday steps, and only in Trial 3 was the increase to in school steps found to be statistically significant. This finding makes
sense given that children were restricted during school hours with regards to the amount of time they had to engage in free play. Butcher et al. (2007) reported significant gains to in school steps made by primary school-aged children following their 5 day school-based pedometer intervention. However, this may have been due to teachers being encouraged to facilitate increases in children’s PA by incorporating “activity breaks” during class time. In the HAPPE intervention this was also an option for teachers (typically used as a reward for having the class achieved a steps goal), but it was not done consistently during or across trials, nor did the researcher encourage teachers to facilitate increasing steps in school hours at the expense of sacrificing class time that would otherwise be devoted to school work and learning. Thus, it would seem the additional components of the school-based HAPPE intervention had a significant additional effect on increasing steps on weekdays, although this increase did not come from increasing steps in school hours.

The extent to which the school-based HAPPE Classroom program led to increases in activity behaviours generalising to the home environment is demonstrated by the consistent finding of statistically significant increases in out of school steps in Trials 2, 3 and 4. It was increases in steps in the out of school context that contributed the most to the increase in weekday steps overall, where in all Trials but one, the proportional increase in out of school steps exceeded the increase to steps in school. Steps on weekends, another measure of generalisation to the home, were also found to have increased notably in the experimental ‘Ped + HAPPE’ condition. In three of the four trials, the experimental condition’s mean increase in weekend steps exceeded the mean increase in weekday steps during the intervention phase, equivalent to increases of up to 49.2%, 51.8% and 64.1% above baseline levels. Due to the high individual variance in steps on weekends, only children’s increases in weekend steps in Trial 2 was found to be statistically significant when compared to baseline levels. However, the
significant increase in the proportion of children in the experimental ‘Ped + HAPPE’ condition classified as sufficiently active based on weekend steps during the intervention phase, provides further evidence of a significant effect of the ‘Climb Mt Fuji Challenge’ on weekend PA levels.

Overall, these findings suggest that the effect of the HAPPE intervention of increasing steps had successfully generalised to the critical afterschool / home context. Participants in three of the four ‘Ped + HAPPE’ groups were able to increase their everyday PA levels out of school to a greater extent than in school on weekdays and were able to increase steps on weekends to a greater extent than increases to steps on weekdays. Based on Horne et al.’s (2009) findings it seems reasonable to conclude that the step increases made in the HAPPE intervention could be equated to participants doing an additional 30 minutes or more of moderate-intensity physical activity per day on both weekdays and weekends.

The finding of substantial increases in steps out of school and differential increases across contexts is contrary to the findings from previous reviews of PA interventions by Dobbins et al. (2009) and Kriemler et al. (2011) who reported that school-based interventions had no effect on leisure time PA and that effects out of school were often not observed. In the HAPPE Classroom Programme gains made in steps out of school far exceeded the gains made to in school steps. This was possibly as children had more discretionary time before and after school which they could devote to more active pursuits. It appears that the HAPPE Programme, although implemented as a school-based intervention, also prompted children to work to meet their step targets before and/or after school as well as on weekends.

These findings imply that school-based interventions that only seek to increase PA in school by way of activity breaks during class time, via structured activities during lunch and recess, by increasing the time being active during PE, or by delivering
“enhanced” PE classes, may be limited in achieving a magnitude of change on a level similar to that achieved in a programme such as the HAPPE - which targeted increases in daily lifestyle PA, at school and at home. The WHO (2010) recommendations state that beneficial effects to health can be derived from accumulating PA across the whole day. Thus, school-based interventions that target PA only at school may be short changing children and missing opportunities to help children make greater gains in everyday PA out of school. These types of interventions also risk reinforcing a subtle message that sufficient levels of PA can be accrued in school, and could lead to children being even less active out of school, as they have already been ‘active’ at school, similar to the process of PA compensation highlighted by Rowland (1998) and King et al. (2007). Therefore, even if an intervention is school-based it is important that it aims to increase children’s PA levels in all contexts across the whole day, and the HAPPE programme demonstrates how this can be achieved.

The HAPPE programme was also efficient in the way it only required a minimal amount of time during school hours to implement the components. Each day required one 20-minute group consultation and 5 minutes self-monitoring in a log book, and three 5-minute individual consultations per week. Under these conditions, along with wearing a pedometer daily, children were able to achieve significant increases in out of school PA levels on weekdays and on weekends.

It is difficult to compare the findings of the HAPPE evaluations with other studies, on the grounds of a school-based intervention leading to generalised improvement in steps to the out of school context. Atkin et al. (2011) reviewed interventions promoting physical activity in young people that were conducted in the hours immediately after school. Ten papers, reporting nine studies, were included in their review and of these, three studies reported positive changes in physical activity and six indicated no change. They highlighted that the effectiveness of interventions in the
after-school setting have so far been hindered by limitations in study design, including lack of statistical power and problems with implementation. Atkin et al. (2011) concluded that single-behaviour interventions that only target increases in PA may be most effective during these hours. The HAPPE evaluations presented in this thesis provide evidence to support this.

Only one other study was found that evaluated a school-based programme to increase children’s PA and where PA had been monitored with a pedometer in a range of contexts including weekdays, in school, out of school and weekends. Sigmund, Ansari and Sigmundova (2012) evaluated their school-based physical activity intervention in a two year non-randomized longitudinal study to see if increases in PA would lead to decreases in overweight and obesity in children aged six- to nine-years. Their intervention did not teach children how to self-manage their PA / movement behaviours, rather the intervention involved teachers organising structured exercise games and activities that children took part in during recess, PE, additional activity breaks between lessons, and in an after-school nursery. PA was monitored using semi-sealed pedometers for seven successive days at five different time points over the two year intervention period. Significant increases in steps were achieved by the experimental group in school, as well as out of school and on weekends, when compared to baseline and to a ‘no intervention’ control group at another school. However, the mean increase in steps obtained in their experimental group - of approximately +2,500 more steps per day on weekdays, + 1,500 more in school steps per day, + 1,200 more out of school steps per day, and +1,000 more steps per day on weekends - were only on par with those achieved by the ‘Ped only’ condition in the present HAPPE evaluations.

It was also an unfortunate consequence of the Sigmund et al. (2012) intervention that the experimental group who participated in the organised structured exercise games
did so at the expense of opportunities to participate in activities such as painting, drawing and doing homework as the control school did. It could be argued that these activities are equally important for optimal development, health and well-being. An advantage of the HAPPE programme was that children decided for themselves what activities they would forgo in order to increase their physical activity based on their own individual preferences. For example, in the first week of the Climb Mt Fuji Challenge, participants tended to show increases in steps in school rather than out of school. However, the participants in the experimental group realised early on that changes only to in school steps would not be enough to achieve the increasing step targets. Thus, the HAPPE school-based intervention was most effective in supporting children to make specific changes with regards to how they spend their time out of school in a way that led to increasing steps. While quantitative data on how children spent their time was not gathered in the HAPPE it was noted anecdotally that children preferred to substitute the time they might have spent sitting in a car on the way to school, watching TV or playing other screen based media in order to increase their walking and physical activity levels.

While the results from the present evaluation of the HAPPE programme are promising, the extent to which children participating in the HAPPE are able to maintain generalised improvement in PA over time is yet to be determined. (Laitakari, Vuori and Oja, (1996) questioned whether the long term maintenance (>6 months) of increases in health-related physical activity was even possible. Their review and theoretical analysis echoed the findings from the HAPPE trials and highlighted that “long term maintenance of health related physical activity is clearly a different phenomenon from the initiation and short term maintenance of health related physical activity and involves the automatisation and routinisation of the behaviour and linking it to the social reality” (p 474). Thus, the ultimate test of the potential of the HAPPE intervention on longer term PA outcomes will be in future studies that can incorporate a design with a long-term
follow-up, and at the very least will require better planning and better parent education. Ideally, these future studies should also seek to evaluate how best to encourage the maintenance of increased PA behaviours over time. However, given a school term is 10 weeks the logistics of planning a sufficient maintenance phase under similar conditions as the intervention phase was difficult in the present study. It is not yet known what generalised effects school attendance compared to holiday periods have on children’s lifestyle PA levels. Certainly full parental participation would be a desirable addition to a HAPPE programme, and would likely involve an agreement to join a course of parent training in all aspects of the programme prior to the child’s acceptance.

However, despite what the trends (or lack of trends) during maintenance in the HAPPE trials may indicate, the overall proportion of children in the experimental ‘Ped + HAPPE’ condition with high enough mean steps to be classified as “sufficiently active” during the maintenance phase was significantly higher than the proportion at baseline, for steps walked on both weekdays and weekends. Also, preliminary evidence of longer term maintenance in step increases was observed in the crossover group. This unique group of children in the HAPPE evaluations initially participated in the ‘Ped+ HAPPE’ condition in Trial 2 then participated in ‘Ped only’ condition in Trial 4. During the initial baseline in Trial 2 this group of children had significantly lower mean steps on weekends and ‘out of school’ when compared to their same age peer in the comparison group. They then went on to make significant increases during the ‘Climb Mt Fuji Challenge’ in the intervention phase. While a decreasing trend developed during the maintenance phase, mean weekday steps remained significantly higher than Baseline.

When retested 3 months later, during their second baseline at the start of Trial 4, weekday, out-of-school and weekend steps were at similar levels to those from the previous maintenance phase. Mean step levels were also equivalent with their peers’ in
the comparison group and mean daily weekday and weekend steps were also falling within the ranges of Tudor-Locke et al.’s (2009) recommended pedometer step cut offs for health for males and females. The proportion of “sufficiently active” children in this group has also remained at an increased level, up from 16.7% in Trial 2’s baseline phase to 38.9% in Trial 4’s baseline. As they progressed through the ‘Ped only’ condition, participants also demonstrated gradual increasing trends in steps across the monitoring period. This sustained increase in steps over time could be considered initial evidence for maintenance of the positive effects of the ‘Ped + HAPPE’ condition on PA levels over a longer time frame, in this case 3 months.

10.2 Changes to Physical Health and Psychological Well-Being during the HAPPE Evaluations

The secondary purpose of Study II was to assess what effect increasing steps during one school term in the HAPPE Classroom Program could have on measures of physical health and psychological well-being. The analysis sought to highlight to what extent beneficial changes in measures of participants’ physical health and psychological well-being occurred and assess to what extent these changes were related to increases in ‘steps’. It is important to emphasise that the HAPPE Classroom Programme was a behavioural intervention designed to increase ‘lifestyle’ physical activity, predominantly involving ‘walking’ and measured with a pedometer. It did not require participants to complete a specific programme of ‘exercise’, nor was not designed as a ‘treatment’ to achieve weight loss or specifically reduce risk for NCD’s (although, as presented in the earlier rationale, this is the desired benefit of increasing PA and lifestyle changes in childhood may predict reduced risk for NCD’s in adulthood). Thus, the additional measures of physical health and psychological well-being were analysed based on the assumption that beneficial changes in these variables may be secondary
measurable side-effects. However, it is not possible to determine if any changes in these measures were as a result of participation in a programme that encouraged increases in lifestyle PA measured with a pedometer. Due to the small sample in each trial the analyses involved combining the sample of unique participants from all the HAPPE Trials. It was presumed, for the sake of simplicity, that a ‘step’ walked in school on a weekday could potentially have the same cumulative beneficial effect on health and well-being as a ‘step’ walked on the weekend. Thus, mean ‘overall steps’ was calculated for each participant, averaging steps on weekdays and weekends.

The results from the Ped only and Ped + HAPPE conditions show that some significant changes in measures of health and well-being were detected between the pre-to post-measurements periods. Measures of psychological well-being suggest there were psychological benefits to children increasing their lifestyle PA levels in the HAPPE. Changes in the desired direction were observed with a significant reduction in raw scores on the Depression Inventory and Anxiety Scale in the Ped only condition and a significant reduction in raw scores on the Anxiety Scale in the Ped + HAPPE condition. This is consistent with the reviews by Livingstone et al. (2003) and Strong et al. (2005) which reported experimental studies with children and adolescents with emotional and behavioural problems had showed strong positive influences of PA and improvements on measures of anxiety and depression. This finding suggests increasing typical children’s lifestyle PA, even by the amount seen in the ‘Ped only’ condition, may be sufficient to lead to benefits in children’s self-reported emotions and mood.

However, despite significant increases in mean overall steps in both groups, neither shows a significant change in the measure of self-esteem. Both the experimental and comparison groups show changes in self-esteem scores in the desired direction between pre-post measurements, yet only the change in the comparison group was approaching significance. There is no anecdotal evidence or even any speculative
arguments that can satisfactorily explain this finding. This result contrasts with findings by Parfit and Eston (2005) who reported a significant correlation between increased steps and increased self-esteem. It was also unexpected given the relationship between self-concept, self-esteem and exercise participation seems to have been demonstrated consistently in the reviews by Livingstone et al. (2003), Strong et al. (2005) and Rasmussen and Laumann (2012). Although, all of these reviews were concerned that there is a widespread lack of research in this area and the limited discussion here of the changes in measures of psychological well-being in response to an intervention to increase lifestyle PA behaviours is a reflection of this. Hopefully results from these HAPPE evaluations will help spawn a new effort to examine the under researched area of the potential psychological effects of children’s PA habits and the implications of this when PA levels are increased or decreased. Developing this line of research is imperative as these factors may be particularly important in the maintenance of increases in children’s PA behaviours in the long term.

With regards to measures of physical health and body composition, the significant increase in height in the absence of a significant increase in weight or BMI suggests growth occurred in the short time between pre- post assessments, though it did not result in significant overall weight gain. This could be viewed as an improvement, as it is a trend in the opposite direction to that associated with the development of obesity. The pattern of reductions in the skin fold measures also supports this view, although only the comparison group showed a significant reduction in one of the skin fold measures, and there is no way it can be claimed that these changes were as a result of changes in PA levels between the pre and post measurement period. The lack of significant ‘improvements’ in indicators of overweight (BMI, waist circumference, WHR) among participants is consistent with previous literature which has found little evidence to expect any changes in typical healthy children’s body composition after an
intervention to increase PA levels exclusively (Biddle & Mutrie, 1991). In their review, Dobbins et al. (2009) reported that school-based interventions had no effect on leisure time physical activity rates, systolic and diastolic blood pressure, body mass index, and pulse rate.

Similar results were reported in the intervention studies reviewed earlier in Chapter 2. For example, despite the purported increase in MVPA in their experimental group, Hardman et al. (2011) reported no significant effects of either their ‘full’ intervention or their ‘no-rewards’ intervention on measures of BMI or waist circumference over the 21 week monitoring period. Also, in the 12-week school-based intervention to increase primary-aged children’s PA levels, Pangrazi et al. (2003) found no significant differences between groups for mean BMI despite children in the PLAY, and PLAY + PE intervention conditions having significantly higher steps than children in the PE only and a no treatment control.

In contrast to others’ findings, Sigmund et al. (2012) were able to demonstrate that the proportion of obese and overweight children declined significantly in the experimental group over the course of their two year PA intervention, with rates for obesity dropping to 0% for boys and girls by the end of the two year intervention. Prevalence rates for overweight and obesity in the no treatment control group continued to increase over the two year period. Experimental ‘Ped + HAPPE’ groups achieved significant increases in steps/day that were well over the amounts obtained by the participants in the Sigmund et al.’s (2012) study on weekdays, in school, out of school and on weekends. Perhaps if the HAPPE program was part of an ongoing school initiative, over several years, similar reductions to the proportion of overweight and obese children as reported in Sigmund et al.’s (2012) study might also be observed.

A surprising result from the HAPPE evaluations was the significant reduction in mean resting heart rate from pre- to post-measurement, with significant decreases
observed in both the comparison and experimental groups. Initially, this might be indication of an effect on fitness and cardiovascular efficiency as a result of increased PA in the HAPPE evaluations. However, when determining percentiles for resting heart rate, other factors including height, age and gender often need to be taken into account. In a study by Rabbia et al. (2003) to obtain reference limits, resting pulse rates were found to progressively decrease with age and somatic growth in both genders. Rabbia et al. (2003) showed a maximum mean decrease in pulse rate of -10 bpm that was associated with gender, age and height changes over a period of six years, in children aged from 12- to 18-years. The decrease in pulse rate seen in the HAPPE evaluations was at similar levels to that observed in Rabbia et al.’s (2003) study, with the control and experimental group’s decreases in the order of -9.48 bpm and -7.78 bpm, respectively, however these were obtained in just 7 weeks.

Thus, although it is acknowledged that part of the decrease in resting heart rate observed in the HAPPE evaluations is likely to be due to that expected in the course of normal maturation and development (as indicated by the significant moderate, negative correlation with changes in height), part may also be due to an increase in cardiovascular efficiency as a result of increased physical activity. This is a positive finding, especially when considered in light of findings from a recent study of the trends in a population of British children, where resting heart rates have increased steadily between 1980 and 2008 (Peters, et al., 2013). The authors reported that the trend of increasing resting heart rate over 30 years resulted in a mean increase of +2 bpm and was observed in both boys and girls age 9 to 11 years and could not be explained by increases in BMI. The authors speculated that increased resting heart rates might be due to decreases in habitual lifestyle physical activity. Peters et al. (2013) stated if the increase in childhood resting heart rate carried into adulthood it could result in increased risk of cardiovascular disease. Thus, the HAPPE intervention showing a significant
decrease in children’s resting heart rate is a significant achievement for a pedometer-based lifestyle PA intervention, where children self-managed increases in their PA within one school term.

While some significant changes in measures of health and well-being were detected between the pre- to post-measurements periods, caution must be applied when attributing the changes in physical health and psychological well-being from the pre- to post-measurements to increases in PA in the HAPPE programme. For example, the experimental group showed a significantly greater increase in overall steps, yet both the experimental and comparison groups showed a similar pattern of change from pre-post in health and well-being indicators. This could indicate that even the smaller increase in steps as seen in the comparison ‘Ped only’ condition was sufficient to lead to benefits in the physical health and psychological well-being in a sample of typical children. However, it is unlikely to be so simple and there are a range of other random factors that may have affected these outcomes.

Understanding the changes observed in the measures of health and well-being in the HAPPE evaluations is complicated further by the finding that none of the changes in the physical health or psychological well-being variables, not even those that had shown significant improvement during the HAPPE trials, were significantly correlated with the change in mean overall steps, in either the experimental group or the comparison group, nor in the sample overall. Thus, based on the correlation analysis of change scores, the changes in the measures of physical health and psychological wellbeing was not related to the increase in steps that occurred at the same time during the HAPPE evaluations.

There are two separate factors that may have contributed to the ambiguity caused by these findings. Firstly, it is possible that subsets of individuals in the HAPPE sample may have confounded the results of others and resulted in the non-significant correlations. For example, a fact often referred to in this topic is that “the greatest
improvements in health status are seen when people who are least fit become physically active” (Warburton, Nicol & Bredin, 2006, p. 807). Additionally, it is also becoming more widely appreciated that not all individuals have the same physiological responses to exercise or increases in PA levels and some may not respond at all (Bouchard et al., 1999; Adams, 2007). Thus, it is speculated that four possible participant profiles could confound the correlation of changes in steps with changes in the measures of health and well-being.

The first profile is the participant who may have been highly active at baseline in addition to being typically healthy and happy relative to their peers. While they were also able to self-manage significant increases in steps during the HAPPE evaluation (despite being highly active at baseline), it is unlikely these increases in steps could have much additional (i.e., measureable) benefit to their already positive health status, and in this sense may be categorised as physiological non-responders. The second profile is the participant who may have been considered low active at baseline (and may or may not have been considered ‘at risk’ due to weight) and increased their steps above their baseline levels in the HAPPE evaluation. Though their increase in steps may have been small relative to their highly active peers, the increase above their individual baseline levels may nevertheless have triggered the desirable physiological and/or psychological responses in their body. A third profile may be the participant that successfully self-managed increases in steps above their baseline levels, yet perhaps due to genetic factors, did not show any measurable physiological and/or psychological response to the change in their PA behaviours. Additionally, a fourth profile may be the participant who did not achieve an increase in their steps relative to their baseline levels (although these were very few in number), yet measureable changes in physical health and psychological well-being occurred as a result of normal growth and maturation and other random factors.
A second important factor that may have prevented finding a significant correlation between changes in steps and changes in health and well-being in the HAPPE evaluations, is that steps - as a measure of lifestyle PA - is too general, and as a result does not correlate strongly with changes in specific measures of physical health and psychological well-being. Perhaps, Rasmussen and Laumann (2012) summarized the problem best in their example that “it would not be reasonable to expect to find the same benefits from recreational yoga as you would from professional sprinting,” and despite the contributions from previous research, “there is no single ‘exercise hypothesis’ that can be tested experimentally” (p. 946). Thus, while pedometers may be apt for monitoring PA in interventions where participants use the pedometer to self-manage increases in PA levels, they may not be the best tool for assessing the secondary concern of this thesis – the effect of these increases in PA on health and well-being.

In sum, the school-based HAPPE intervention was able to demonstrate a significant increase in steps in a heterogeneous sample of school children, with increases in PA in the experimental condition also generalising from the school to the home contexts. While some significant changes in the measures of physical health and psychological well-being were also detected between pre- to post- measurement points in both the comparison and experimental conditions, there is no strong evidence that these changes are meaningful in the context of NCD prevention or are in anyway related to the significant increases in steps. The lack of evidence in this case may be due to the short follow-up period and the modest sample size, and given a longer monitoring period, perhaps more reliable measures of health and well-being may detect beneficial changes.

Yet understanding the extent to which the increase in overall steps is related to beneficial outcomes in health and well-being remains unresolved. It was highlighted by McMurray and Ondrak’s review (2013), increasing different types (i.e., intensities) of
PA levels may affect health differently within different homogenous subgroups of children. As there was no objective measure of different types of PA across the energy expenditure spectrum (or the potential changes to the patterns of these), the results from the HAPPE evaluations are consistent with the broader literature in that they do not yet show a clear picture of how increases in objectively measured physical activity affect changes in children’s body composition and other indicators of health and well-being over time.

10.3 Limitations and Future Research

Overall, the HAPPE evaluations presented in Study II have provided a significant contribution to understanding how children’s PA levels respond to a school-based Ped only and a Ped+ HAPPE condition across different contexts (at home and at school). However, there were also several limitations to the present study. Firstly, while significant increases in steps were achieved in the HAPPE trials, the extent to which these increases can be maintained when the additional components of goal setting, systematic feedback and reinforcement are withdrawn was only partially addressed in Study II. While labelled as such, the ‘maintenance’ phase the experimental group were exposed to was not designed to encourage children to develop their new / increased PA behaviours (initiated during the intervention phase) to become habits maintained over the long term. Rather, this phase functioned as an “intervention withdrawal phase” with a return to baseline conditions, designed to demonstrate the effect of the intervention itself. The end of this phase coincided with the end of school term and evaluation of a longer maintenance phase on a continuous daily basis that did encourage habit formation, was not logistically possible in this study.

However, it is fundamentally important that future research does address issues with how to maintain the new, more healthful, PA behaviours developed during an
intervention phase. Perhaps additional involvement of parents and the continued involvement of teachers are what are required for children to benefit from short term increases and long term maintenance of change. That is, the effects of the HAPPE on increased steps as well as beneficial changes in health and well-being could be maximised if it were part of an ongoing school initiative that involved parents as well, in supporting children to increase their steps in all contexts, and maintain those increases over the long term so they become habitual. Younger children in particular may need even more support on weekends and may struggle to maintain higher levels of PA if their parents cannot provide adequate supervision to play outside or take them to a safe location where they can be physically active (Cox et al., 2006; Duncan et al., 2012). If this could be accomplished, it would also increase the likelihood that significant improvements in physical health and psychological well-being would be detected and maintained over the long term.

A second limitation of the HAPPE evaluations was the exclusive use of the pedometer as the primary objective measure of lifestyle PA. It was proposed at the start of this thesis that in the context of health and NCD prevention, the problem of children’s physical inactivity needs to be inclusive of all the problems of 1) insufficient MVPA, vigorous PA and/or specific/organised exercises, 2) insufficient levels of lifestyle PA/ NEAT or NEPA, 3) excessive participation in sedentary activities and, 4) prolonged bouts of sedentary behaviour - none of which are restricted to any single specific location and can occur in all contexts of a child’s daily life. In response, the HAPPE Classroom Climb Mt Fuji Challenge was designed to encourage children to self-manage increases to all types of PA, and encouraged children to experiment with increases in a range of behaviours that could be defined as vigorous PA, MVPA, and specific exercises; increases in lifestyle PA, NEAT or NEPA; reductions in excessive
participation in sedentary behaviours; and interrupting prolonged bouts of sedentary time.

All of these activities accumulate to increase participants’ daily steps. However, even though pedometers can measure a variety of activities performed at all frequencies, intensities and durations and all contribute to total energy expenditure, the pedometer cannot provide an itemised measure of each type of PA on the energy expenditure spectrum. Thus there is no objective evidence in study II indicating change actually occurred in any of these different types of PA. Additionally, not all types of PA have an equal impact on physical and psychological outcomes (Pate, O’Neill & Lobelo, 2008; McMurray & Ondrak, 2013) thus, the assumption - that a ‘step’ is a ‘step’ no matter where it is taken- which was adopted in the present analyses of the extent to which increases in lifestyle PA are related to beneficial changes in health and well-being may have been somewhat naïve.

At the present time, there is a lack of definitive evidence providing a clear understanding of the nature of the relationship between increasing lifestyle PA levels in children and its effects on physical health and well-being in a free-living, heterogeneous sample of primary school-aged children. The HAPPE evaluations have provided an important first step in identifying what outcomes might be expected in the short term. However, it is clear that a study utilising a longitudinal design is the ideal way to evaluate the effects of these behavioural changes that, if maintained, may beneficially reduce later risk for developing NCD.

However, future short term evaluations of the HAPPE could follow Pate et al. (2008) recommendation that PA performed at different intensities should be treated as potential independent influences on health outcomes, because “activity performed within a narrow intensity range (e.g., vigorous) may influence health in ways that are unique from other activity intensities” (p. 178). While the intervention itself could
remain pedometer-based (to support the self-management approach), accelerometer
determined measures of PA at a range of intensities could be added to the battery of pre-
post-assessments to allow for the full range of PA to be observed and used analytically
(including sedentary behaviour and light physical activity as well as moderate and
vigorous physical activity) to evaluate the effectiveness of the intervention at increasing
different types of PA and determine their independent and joint contributions to health
outcomes (Pate et al., 2008). Additionally, while it is expensive monitoring changes to
metabolic health indicators, including triglycerides (i.e., levels of fat) in the blood
stream and insulin resistance, these measures could also be included as they may be
more responsive to changes in an individual’s PA in the short term, and could help
further clarify the impact of children’s lifestyle PA on health and well-being.

Future research could further extend the findings from the HAPPE evaluations
by also identifying specific subgroups (for example, physiological ‘responders’ and
‘non-responders’) to shed more light on the nature of the relationship between increases
in children’s PA and health outcomes (Bouchard et al., 1999; King et al., 2007). For
example, examining how different sub-groups perform in the HAPPE intervention with
regards to step increases and in their response (or non-response) to measures of physical
health and psychological well-being would help to provide a more tailored intervention
with tailored outcome expectations. A profile analysis approach might illustrate how ‘at
risk’ children might have performed compared to typical/healthy children with regards
to step increases and in their response (or non-response) to measures of physical health
and psychological well-being. Similar analyses could also compare boys with girls,
children ‘sufficiently active’ at baseline with ‘inactive’ children at baseline, as well as
identify the intervention responders and comparing them with those who did not
respond to the intervention, or who were not included due to insufficient activity data.
The high standard deviations in the pedometer data indicated there was large individual variance in PA. This is the nature of children’s PA levels and high variance should be expected in heterogeneous groups of children (Ridley et al., 2008). However, this, in combination with the reduction in sample sizes due to attrition and the exclusion of participants with insufficient data is likely to have reduced power in the statistical analyses and prevented finding significant increases in steps when they may have occurred. Future evaluations of pedometer-based PA interventions should allow for adequate sample sizes to be included in the analyses. Consideration of these factors serves to highlight the importance of working with children using individually-adapted programmes. Due to the large individual differences in PA behaviours and habits, and the extent to which children may/may not respond physiologically and psychologically to increases in these levels it is necessary for intervention programmes to be designed with inherent flexibility so they can be tailored to each individual participant and take into account their initial baseline PA levels, their unique circumstances and response to the challenge to increase their PA levels. The experimental ‘Ped + HAPPE’ condition intentionally allowed for this in its design, while the ‘Ped only’ condition unintentionally allowed for this to occur.

10.4 Conclusion

In conclusion, the HAPPE evaluations have demonstrated that primary school-aged children can be taught behavioural skills to self-manage specific increases in PA using a pedometer in a school-based classroom intervention. Significant increases in steps were obtained in the short term, and were observed to generalise across contexts, including out of school on weekdays and on weekends. A significant proportion of children were able to self-manage increases in steps to levels that are currently considered sufficient to receive health benefits (i.e., in line with the current PA
recommendations). However, the findings from this study do not demonstrate that positive outcomes in health and well-being may also be expected as a result of increases in PA in the HAPPE programme, although this may be due to the short time between measurements and a modest sample size.

Significant increases in children’s PA resulted from participation in the Climb Mt Fuji challenge. In most cases these increases were greater than those in the comparison condition, and confirmed the hypothesis that the additional behavioural self-management strategies enable children to self-manage increases in their PA levels. However, some step increases in the Comparison ‘Ped only’ condition were also statistically significant, and both groups saw a significant increase in the proportion of children meeting guidelines for sufficient PA levels for health and well-being by the end of the monitoring period. The increases in PA in the comparison group suggest that some children may only need to wear a pedometer and self-monitor their habitual PA levels over a prolonged time period to achieve a significant increase in PA levels.

The school-based HAPPE classroom program might show some potential for use in the global effort to prevent NCD by supporting groups of primary-school-aged children to increase their habitual PA to sufficient levels for health and well-being. With pedagogical advice, the HAPPE program could be adapted to be integrated into the school curriculum, thus allowing broader implementation for a relatively low cost, while contributing to the achievement of population-based targets to increase the proportion of children meeting guidelines for sufficient PA. However, future research needs to determine the extent to which self-managed increases in children’s PA are maintained and further clarify the extent to which increases in the different types (intensities) of PA (perhaps measured with an accelerometer) are related to changes in measures of health and well-being in childhood.
Section III:

Summary and Conclusions
“Almost all our major problems involve human behaviour, and they cannot be solved by physical and biological technology alone. What is needed is a technology of behaviour” (Skinner, 1971, p. 24).

When it comes to increasing children’s PA behaviour, there is no lack of intervention research (Demetriou & Honer, 2012; Dishman & Buckworth, 1996; Heath, et al, 2012; Kahn, et al, 2002; Kamath, et al, 2008; Kang et al., 2009; Kriemler et al, 2011; Lubans, Morgan & Tudor-Locke, 2009; Meriwether, Lobelo & Pate, 2008; Salmon, et al, 2007; Stone, et al, 1998; Timperio, Salmon & Ball, 2004; van Sluijs, Kriemler & McMinn, 2011; van Sluijs, McMinn & Griffin, 2007). Yet much of it has been non-behavioural, not objectively monitored and/or poorly evaluated. Consequently, from the existing body of literature, it is still unclear what works, for whom, in what context, what gains can be expected or even how much PA in general children need to be doing, particularly for health related benefits. Additionally, there is a lack of research successfully bridging the gap between the behavioural and physiological / biomedical aspects of this important topic. The ‘lifestyle approach’ to increasing PA seems a viable solution applicable in both realms – whereby increasing ‘lifestyle PA’ behaviours (that is, inclusive of PA performed at a range of intensities and in different contexts) is most likely to lead to maximum potential benefits to health and well-being and thus is the prime tool to help individuals manage their risk of developing a lifestyle related NCD.
The studies presented in this thesis attempt to address the biomedical /
behavioural research and practice gap in an applied setting; specifically, designing and
evaluating a home-based and a school-based version of an individually-adapted,
behavioural approach to increasing children’s everyday ‘lifestyle’ PA, and monitoring
its effects on steps in different contexts (on weekdays and weekends, at home and at
school) and on health and well-being. Based on the evidence obtained in Study I and
Study II, a clear direction for future research has been identified; that is, to continue
developing methods for the widespread application of individually-adapted behavioural
interventions that educate participants in the use of behavioural strategies to self-
manage their PA behaviours and monitor the effect on health and well-being outcomes.
If continued, the cumulative evidence will likely demonstrate that humans do indeed
have the capacity to turn round the “slow motion disaster” in response to the
globalisation of unhealthy lifestyle behaviours (Chan, 2012, para 2), through the
widespread dissemination of the technology of behaviour (i.e., self-management skills)
in combination with objective, body worn PA monitoring technology so that individuals
can better self-manage their PA, their risk of premature death due to NCD, and thus
their lives.

11.1 Changing Children’s Physical Activity Behaviours

Children engage in both sedentary behaviours and physical activities as a part of
their typical daily and weekly routines. When given the choice, many of Australia’s
children may ‘prefer’ sedentary behaviours over more physically active pursuits.
Indeed, this is reflected in the national statistics, where a great proportion of Australian
children do not meet recommendations for daily MVPA and many more also exceed the
daily limit on screen time (ABS, 2013). Although, sedentary behaviour in itself is not a
problem behaviour until it has crossed a threshold to become excessive or when

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sedentary behaviour has become more reinforcing than health appropriate replacement behaviours. That is, not all sedentary behaviours / inactivity are inappropriate – unlike some other behaviour in childhood (e.g. hitting or biting others). Rather, the problem is excessive sedentary behaviour or engaging in sedentary behaviours in the absence of any prior physically active behaviours, and these can be altered in an intervention. In a positive behaviour management approach, intervention is more successful when it focuses on increasing positive (i.e. desired) behaviours, rather than focussing on reducing undesirable / problem behaviours (Carr et al., 2002; Sulzer-Azaroff & Mayer, 1991). Thus, the behavioural PA interventions evaluated in this thesis aimed to reward increases in overall levels of everyday lifestyle PA. The findings from both Study I and II provide rich qualitative data and empirical support for the individually-adapted behavioural approach to increasing children’s ‘lifestyle’ PA, where children exposed to the additional behavioural self-management techniques in the MIP and the HAPPE ‘Mt Fuji Challenge’ were able to successfully self-manage increases in PA behaviours measured with the pedometer. Key findings from the individually-adapted behavioural interventions to increase children’s PA evaluated in Study I and Study II are summarised in Table 11.1 and Table 11.2, respectively.
Table 11.1

**Key findings from the individually-adapted behavioural interventions to increase children’s PA evaluated in Study I and its effects on PA behaviours.**

<table>
<thead>
<tr>
<th>Key findings</th>
<th>Individually-Adapted Behavioural Intervention to Change Children’s Physical Activity Levels</th>
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<td><strong>Study I: Overweight/low active ‘at risk’ children in the MIP home-based intervention</strong></td>
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</table>
| 1. Children can self-manage increases in PA to recommended levels for health and well-being | i. During the MIP intervention phase, mean increases in overall steps (i.e., averaged across weekdays and weekends) ranged from +24% to +56%, above baseline levels.  
   ii. Participants achieved mean increases during the MIP intervention phase, that were equivalent to walking between +2324 and +5153 more steps per day.  
   iii. During the MIP intervention phase, three out of the four single-cases were able to self-manage increases in their PA levels, with the assistance of a parent, and eventually achieved a consistent level of PA that was equivalent to the daily recommended PA levels for health and well-being. |
| 2. Increases in PA generalise across different contexts                       | i. When steps were segregated by context (i.e., steps walked on weekends or weekdays), generalised increases in PA were observed during the intervention phase in two participants who achieved similar increases in steps on both weekdays and weekends. However, two participants made notable increases in one context, but relatively little increase in steps was observed in the other context.  
   ii. Thus, when averaging across steps walked on weekdays and weekends it may seem that generalised increases have occurred. However, when increases in steps are examined at the context level, the MIP has shown that some children may only be able to self-manage increases in PA in one context rather than the other.  
   iii. The extent to which increases in steps were made in each context during the MIP intervention seemed to be determined by the individual’s PA level in each context at baseline.  
   iv. The effect of school attendance on PA levels on weekdays (both in school and out of school) and on weekends needs further investigation. |
| 3. Increases in PA did not maintain in all cases or all contexts              | i. Self-managing the behavioural components the MIP (Self-monitoring, feedback, goal setting and planned positive consequences) without the assistance from the researcher may not be enough for these children and their families to maintain the increases in PA achieved in the MIP. |
| 4. Recommended program improvements                                          | i. Participants may have benefited from more intensive support at times throughout the intervention phase (i.e. on a bi-weekly or even daily basis) and to be included in a group with their peers, also sharing the same experience of increasing PA levels.  
   ii. Intervening in the school context may be particularly helpful for low active and/or at risk children.  
   iii. Goal setting was a difficult process and may have led to one participant withdrawing early from the MIP due to being unable to sustain increased PA levels.  
   iv. Future research should focus on examining how best to use the recommended pedometer guidelines to teach children not only what is ‘sufficient’, but also what is acceptable and realistically achievable for each individual when aiming to achieve and maintain healthy activity levels. |
In Study I, the single case evaluations demonstrated that it is possible for ‘at risk’ (overweight / inactive) children to self-manage a general increase in their pedometer measured steps with the assistance of a parent in a home-based intervention. Although, further analyses revealed that individual participants responded differently and the MIP was not effective for all children across all contexts of monitoring. For example, two of the four participants achieved notable increases (>10% from baseline steps) in steps on both weekdays and weekends, whereas one participant only showed notable increases in PA levels on weekdays, while another participant only showed notable increases in PA levels on weekends. Thus, in these cases it seems steps walked on weekdays were under different environment control from steps walked on weekends and, even though they were all ‘at risk’, not all children showed the same pattern of habitual PA across each context. It was also noted that it was difficult for ‘at risk’ children to be participating in an intervention to increase their PA in isolation from their same aged peers. Thus, Study II was devised, and the intervention programme was shaped into a school-based package that could be implemented in a group, with all children in the same classroom – The HAPPE Classroom Project.
Table 11.2

Key findings from the individually-adapted behavioural interventions to increase children’s PA evaluated in Study II, and its effects on PA behaviours.

<table>
<thead>
<tr>
<th>Key findings</th>
<th>Individually-Adapted Behavioural Intervention to Change Children’s Physical Activity Levels</th>
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</thead>
<tbody>
<tr>
<td>Study II: All children in the collaborative, HAPPE ‘Climb Mt Fuji Challenge’ school-based intervention</td>
<td>Study II: All children in the collaborative, HAPPE ‘Climb Mt Fuji Challenge’ school-based intervention</td>
</tr>
</tbody>
</table>
| 1. Children can self-manage increases in PA to recommended levels for health and well-being | i. Significant proportions of children in the experimental group were able to self-manage increases in their daily PA to a level considered to be a sufficient amount of PA for health and wellbeing. The proportion of children considered ‘sufficiently active’ shifted from 32% at baseline, increasing to 62% during the intervention, and settling to 49% during the maintenance phase.  
   ii. For the experimental ‘Ped + HAPPE’ participants, mean increases in weekday steps during the intervention phase ranged from +1500 to +3163 more steps per day between trials, equivalent to increases of 14.6% and 28.3%, respectively. In three of the four HAPPE trials, statistically significant increases relative to baseline levels were achieved in mean weekday steps during the intervention.  
   iii. Statistically significant increases were also made to ‘out of school’ steps (in 3 of the 4 trials). Relatively small changes were observed to ‘in school’ steps, with only 1 of the 4 trials showing a significant increase from baseline levels. |
| 2. Increases in PA generalise across different contexts                      | i. The increases in the proportions of children meeting and exceeding guidelines for sufficient PA for health were also seen in PA levels monitored on weekends. In the experimental group, the proportion of children considered ‘sufficiently active’ shifted from 8.5% at baseline, increasing to 42.5% during the intervention, and settled at 29.8% during the maintenance phase.  
   ii. For the experimental ‘Ped + HAPPE’ participants, mean increases in weekend steps during the intervention phase ranged from +1513 to +5439 more steps per day between trials, equivalent to increases of 65.5% and 14.4% above baseline PA, respectively. In one of the four HAPPE trials, a statistically significant increase from Baseline phase was achieved in mean weekend steps.  
   iii. Statistically significant increases were also made to ‘out of school’ steps (in 3 of the 4 trials). Relatively small changes were observed to ‘in school’ steps, with only 1 of the 4 trials showing a significant increase from baseline levels. |
Table 11.2 cont.

**Key findings from the individually-adapted behavioural interventions to increase children’s PA evaluated in Study II, and its effects on PA behaviours.**

<table>
<thead>
<tr>
<th>Key findings</th>
<th>Individually-Adapted Behavioural Intervention to Change Children’s Physical Activity Levels</th>
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<tr>
<td><strong>Study II: All children in the collaborative, HAPPE ‘Climb Mt Fuji Challenge’ school-based intervention</strong></td>
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<tr>
<td>3. Additional behavioural strategies in the HAPPE ‘Mt Fuji Challenge’ are beneficial - but not all may be necessary - for all children to successfully self-manage increases in PA.</td>
<td>i. The experimental ‘Ped + HAPPE’ group showed significantly greater gains in mean steps during the intervention in comparison to their peers in the comparison ‘Ped only’ group. This occurred for steps on weekdays (in 2 out of 4 trials), steps ‘in school’ (1 out of 4 trials), steps ‘out of school’ (3 out of 4 trials) and steps on weekends (1 out of 4 trials).</td>
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<td></td>
<td>ii. In most of the instances when gains in the experimental group were not significantly greater, it was usually due to the comparison group showing a similar pattern of increase in mean steps over time as the experimental group.</td>
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<td></td>
<td>iii. Thus, the Comparison group also made significant increases in steps on weekdays (in 2 out of 4 trials) and steps ‘in school’ (in 1 out of 4 trials). In one trial, the increase in mean steps on weekdays by the comparison group was not significantly different to the increase in mean steps by the experimental group.</td>
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<td></td>
<td>iv. Significant proportions of children in the comparison group were also able to self-manage increases in their daily PA to a level considered to be a sufficient amount of PA for health and wellbeing. The proportion of children considered ‘sufficiently active’ on weekdays increased significantly from 26% at baseline to 59% by the end of the monitoring period. While on weekends, the proportion of children considered ‘sufficiently active’ also increased from 9% at baseline to 24% by the end of the monitoring period.</td>
</tr>
<tr>
<td>4. Recommended program improvements</td>
<td>i. Self-monitoring of total PA levels at school on a daily basis may be enough for many kids to increase steps (i.e., indicated by improvement in the comparison groups)</td>
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<td></td>
<td>ii. Additional self-management strategies are also very helpful to all children (the experimental groups’ improvements), and led to significant increases in the short term, though the effects of this approach may not lead to lasting changes in all cases.</td>
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<td></td>
<td>iii. Additional consideration of individual situations, perhaps through identification of subgroups, might enable more precise consideration of why there was considerable variation in the extent of improvement that was observed across the sample.</td>
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<tr>
<td></td>
<td>iv. Younger children may need extra involvement from parents in the HAPPE to support them to self-manage increases in PA out of school and on weekends.</td>
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</table>
A significant proportion of the participants in Study II were able to increase their steps enough to be considered “sufficiently active” during and following the intervention. The increase in the proportion of ‘sufficiently active’ children on weekdays by 24.21%, certainly goes well beyond the original goal set by the Western Australian Physical Activity Task Force; namely, to increase the proportion of the population who can be considered “sufficiently active” by 5% over ten years. The result was achieved in only three weeks with the HAPPE classroom project. The findings from the present study are particularly encouraging considering Metcalf et al.’s (2012) meta-analysis found that interventions to increase children’s objectively monitored PA only had a small effect of approximately 4 minutes more of walking or running per day on children’s overall activity levels.

The additional behavioural self-management techniques in the HAPPE ‘Climb Mt Fuji Challenge’ also led to significant self-managed increases in PA behaviours in a range of contexts (e.g., on weekdays, ‘in school’ and ‘out of school’ as well as on weekends) when compared to baseline levels, and when compared to the comparison group. However, the greatest and statistically significant gains in children’s PA were observed to a greater extent in steps ‘out of school’ on weekdays. This is a novel finding for a school-based intervention, and contrasts with findings from previous reviews by Dobbins et al., (2009) and Kriemler et al., (2011).

These findings demonstrate that both schools and parents can have a shared role in helping children live ‘sufficiently active’ lifestyles, and that specially structured or arranged exercise programmes during school hours or out of school may not be necessary— or even sufficient - to obtain significant increases in children’s overall ‘lifestyle’ PA levels. The HAPPE programme also found that children were able to increase their everyday PA levels without any formal or direct involvement of a parent. However, it is a prediction for future research that if parents are involved, children may
show greater increases in steps (particularly the younger children), and these increases may be more likely to maintain.

Another novel and important finding from Study II showed the participants in the comparison ‘Ped only’ group achieving smaller, yet consistent increases in mean steps over the course of the monitoring period, and in some cases these were statistically significant. The findings imply there may be some utility in the conditions of the ‘Ped only’ condition, enabling children to increase their PA levels on weekdays (and to a lesser degree on weekends) simply in a programme that encouraged daily objective self-monitoring of steps and having access to feedback from a pedometer for a period of approximately 8 weeks. This finding also suggests that previous assumptions about the short term and longer term pedometer reactivity effects on children’s PA behaviours may be incorrect. This is an advantage for interventions, as it seems that primary school-age children became increasingly responsive to the intrinsically reinforcing properties of wearing a pedometer and recording its output on a daily basis over a prolonged period (8 weeks) despite the absence of the additional behavioural components and the systematic attempt to increase PA levels, indeed perhaps even due to the absence of these additional components. However, the ‘Ped only’ group’s improvement was not as immediate nor as marked across contexts, compared to baseline and the experimental ‘Ped + HAPPE’ group. This suggests that while the additional behavioural strategies in the HAPPE ‘Mt Fuji Challenge’ were beneficial, not all may be necessary for all children to successfully self-manage increases in PA.

Contextual effects on children’s PA behaviour were observed in both the MIP and HAPPE evaluations, such as steps on weekdays were higher than steps on weekends at baseline, and increases in ‘out of school’ steps were greater than increases in ‘in school’ steps. In need of consideration is what it is about these differing contexts that might account for this variation in response to the interventions. When considering
children’s opportunities to be more active, there can be many barriers to overcome and in particular ones that may seem out of a child’s own control. Simply urging children to “do more” PA is unlikely to be enough of a catalyst to obtain outcomes in PA, health and well-being, in particular those outcomes relevant to preventing NCD risk. For example, participants in the MIP and HAPPE programmes raised issues relating to town planning and traffic management; sporting and open space facility management; safety and security with outside play areas; pollution; reduction of block sizes and higher densities of living areas; as well as the sedentary effects of passive screen “watching”; the diminishing role of PE in the school curriculum; and the effects of maturation, individual interests and habits on PA levels.

There is also another seemingly obvious aspect of child behaviour that often goes unmentioned; that the opportunity for children to make their own decisions about how they would prefer to spend their time is often governed by the overriding needs of the family and caregivers; and other practical, educational and social commitments, as well as the limitations on parents as a result of living in smaller nuclear families. An individual’s early learning experiences from infancy, childhood and through to the formal schooling years also play a large role in shaping habitual patterns of PA, strengthening reinforcers, and establishing operations related to future PA or sedentary behaviour. For example, the degree to which early active ‘seeking’ and ‘exploration’ behaviours in infancy and early childhood is reinforced (by caregivers and/or the environment) may be critical in establishing such patterns (Panksepp, 1998). Certainly, this is corroborated by investigations into the correlates of children’s PA behaviours, which consistently find parental and family support for children’s PA is positively related to PA among young people (Bauman et al., 2012). Additionally, it is a concerning trend that many children now experience much of their early years in a pram, stroller or car seat due to growing up in the predominantly urbanised
environments of Australian cities, where cars dominate the streets. For example, parents’ natural instincts to prevent their children from harm may opt to restrain them in a pram while walking, while also simultaneously restricting opportunities for young children to walk any considerable distance on a regular basis.

With regards to the participants in the MIP and HAPPE programmes, it seemed that the extent to which parents perceived their child to have been active, were able to provide supervision and support for children to be active, and whether PA behaviours or sedentary behaviours were reinforced by their environments were important factors controlling children’s accumulations of overall PA. For example, in the out of school context, children simply had more opportunities to be physically active. However, parents may not know how much physical activity their children have engaged in during the school day and, if their child comes home and wants to be sedentary, then perhaps a parent is more likely to permit this if a) they assume their child has accumulated a ‘sufficient amount’ of PA at school, and b) children’s sedentary behaviours at home/out of school also assist the parent in completing their own tasks at that time of day (e.g., cleaning the house, preparing the evening meal and so on). However, the data suggests that parents would be wrong to assume their child has achieved a ‘sufficient amount’ of PA at school, as the amount of PA a child accumulates at school is at best 50% of their total PA across the whole day (Cox et al., 2006; Tudor-Locke et al., 2009). If more parents were aware of this simple fact, they may be less likely to permit sedentary activities after school on weekdays to dominate their child’s behaviour. In particular, parents should take caution if their child is habitually obtaining a greater proportion of their daily PA in the school context, as the total PA a child can accumulate during school is restricted predominantly to recess and lunch times and occasional PE lessons.

In the short term, the programs evaluated here show that it is possible for children to learn to self-manage significant increases in daily PA levels, particularly in
the critical out of school context. Results demonstrate the overall success and feasibility of implementing programs of this type, as significant gains in steps per day can be expected for relatively little cost, mostly by using resources that are already available, or could be easily acquired by schools and families. These achievements are worth investigating further. Equipping children with the skills to self-manage increases in PA behaviours enabled children to overcome a range of social and environmental barriers that may have previously prevented them being more active prior to the interventions.

It seems that this approach may contribute an important piece of the puzzle of how to increase levels of PA in whole populations. In Australia, many have already been exposed to television advertisements and promotional campaigns urging us to ‘be more active’; many already have easy access to world class sporting and PA infrastructure; and the vast majority of Australians experience a year-round climate that is arguably the most conducive to outdoor activities (much to the envy of our friends in the northern hemisphere). Yet, Australia still ranks as one of the most inactive and overweight countries in the world. As a population, not only are we running out of solutions to address this issue, but we are running out of excuses!

Thus, the need to implement on a wide-scale level the individually-adapted behavioural interventions - like the MIP and HAPPE - that educate children in the use of behavioural strategies so they learn to self-manage increases in their PA behaviours is paramount. Lifestyle behavioural interventions aimed at children that can provide a planned learning experience for individuals to overcome barriers to living a “sufficiently” active lifestyle, tailored to each individual’s specific circumstances. Ideally, an intervention of this sort would first be offered to an individual during their middle-primary school years, with additional exposures to the program (or a similar version) adapted for secondary school years. This might inoculate children with a set of behaviour change skills that they can develop and apply to manage their PA behaviours
throughout their lifespan and in response to the many and varied barriers they may encounter as a result of future innovations in technology, its effects on human behaviour and its effects on health.

11.2 The Effects of Increasing Children’s ‘Lifestyle’ PA on Health and Well-Being

Until recently the main focus of the physical activity and health literature has been on recommending that people attain certain levels and intensities of daily PA in order to achieve the greatest improvements in public health. However, recent evidence is emerging which suggests that exposing the body to prolonged periods of sedentariness (i.e., sitting too much) has its own associated health concerns. These result from biological mechanisms that are independent of the PA behaviours prescribed for health under the current PA recommendations and guidelines, and negative effects on health as a result of excessive sedentariness occur independently of the amount of overall PA or exercise one does (Hamilton, Hamilton & Zderic, 2007). Thus, it may be that the benefits of increasing PA are due to this, in turn, reducing the amount of sedentariness, as opposed to these benefits being the direct result of PA per se.

In reality, such a dichotomous perspective is restrictive, and in all likelihood maintaining a healthy PA ‘diet’ where the body is exposed to the whole range of different PA (types and intensities) on a regular basis across the lifespan will increase the chances of deriving health benefits from PA, particularly in relation to the prevention of NCD’s. Both the MIP and the HAPPE were designed to encourage participants to make beneficial changes to all types of PA and sedentary behaviours, such as increasing vigorous PA, MVPA, and specific exercises; increasing lifestyle PA, NEAT or NEPA; reducing excessive participation in sedentary behaviours; and frequently interrupting prolonged bouts of sedentary time. While direct measures of
these different types of PA were not obtained in the present studies, measures of physical health and psychological well-being were monitored to assess to what extent changes in these variables might occur, potentially as a secondary effects of increasing overall lifestyle PA (steps). Key findings from the individually-adapted behavioural interventions to increase children’s lifestyle PA evaluated in Study I and Study II, and the health and well-being outcomes observed are summarised in Table 11.3 and Table 11.4, respectively.

Table 11.3

*Key findings from the individually-adapted behavioural interventions to increase children’s PA evaluated in Study I and its effects on health and well-being outcomes.*

<table>
<thead>
<tr>
<th>Key findings</th>
<th>Effects of self-managed increases in ‘lifestyle PA’ on Children’s health and well-being</th>
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<tbody>
<tr>
<td><strong>Study I: Overweight/low active ‘at risk’ children in the MIP home-based intervention</strong></td>
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</table>
| 1. Beneficial changes in measures of physical health were observed in overweight/low active children | i. In two cases, an increase in weight and BMI occurred alongside notable reductions in central body skin fold measures, suggesting beneficial changes in their body composition occurred in response to the increased PA, such as a decrease in adiposity (fat mass) and an increase in muscle mass.  
ii. In one case, a notable reduction in BMI and weight occurred alongside notable improvements in all skin fold measures including those from the central body and the extremities. |
| 2. Beneficial changes in participants’ psychological well-being were also observed. | i. One case had depression and self-concept scores in the clinical range at baseline and showed minor improvements in these scores by the end of the MIP.  
ii. One case had depression and self-concept scores in the clinical range at baseline and had made notable improvements following the MIP interventions on both measures.  
iii. Two cases had depression and self-concept scores in the normal range at baseline, yet both showed improvements at follow-up on the psychological scales, particularly on measures of self-esteem.  
iv. Results also suggest that any effect of increasing PA on psychological well-being may be independent of the effect of increasing PA on physical health. For example, one participant showed notable improvements on measures of self-esteem in the MIP, in the absence of any notable improvements in physical health, while another participant showed the reverse pattern. |
Many of the measures of physical health (body composition and CVD risk indicators) and psychological well-being were found to respond in the desired direction over the pre-post monitoring periods in both the home-based MIP and the school-based HAPPE programmes, following increases in PA. Study II found significant decreases in heart rate and mean increases in height without mean increases in weight or BMI. This suggests that significant growth occurred during the monitoring period that was not accompanied by significant increase in weight, and it was tentatively speculated that improvements in cardiovascular efficiency also occurred. Significant psychological benefits included mean decreases in raw scores on measures of depression and anxiety.

Recent findings have indicated that simply helping people shift from a sedentary to an active profile could reap important health benefits (Owen et al., 2010). Similarly, it is speculated here that children self-managing increases in their ‘lifestyle’ PA levels in the MIP and HAPPE programmes may also show some measurable short-term changes in health and well-being, even without attention to diet. Additionally, results from the MIP may suggest that any effect of increasing PA on psychological well-being may be independent of any effect of increasing PA on physical health, whereby it is possible for individuals to show notable improvements in psychological well-being in the absence of any notable improvements in physical health, and vice versa.
Table 11.4

**Key findings from the individually-adapted behavioural interventions to increase children’s PA evaluated in Study II, and its effects on health and well-being outcomes**

<table>
<thead>
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<th>Key findings</th>
<th>Effects of self-managed increases in ‘lifestyle PA’ on Children’s health and well-being</th>
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<tbody>
<tr>
<td>Study II: All children in the collaborative <em>HAPPE Climb Mt Fuji Challenge</em> school-based intervention</td>
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</tbody>
</table>
1. Beneficial changes to physical health were observed in both the comparison and experimental groups  
   i. In both groups, a significant increase in mean height, in the absence of an increase in weight or BMI, indicated growth occurred between the pre-post intervention monitoring points, but in a direction opposite to that associated with overweight/obesity.  
   ii. The Comparison group also showed a significant reduction in mean measures of the subscapular skin-fold.  
   iii. The measure of resting heart rate showed a significant decrease from pre-post measurement in both groups.  
   2. Measures of psychological well-being show changes in the desired direction in both groups  
   i. Measures of psychological well-being show changes in the desired direction from pre-post measurements in both groups.  
   ii. Significant reductions in raw scores on the Depression Inventory and Anxiety Scale were found in the comparison group.  
   iii. A significant reduction in raw scores on the Anxiety Scale was found in the experimental group.  
   i. There was lack of significant correlations between increases in steps and changes in physical health and psychological well-being.  
   ii. Thus, the extent to which changes in health and well-being are actually related to increases in lifestyle PA needs to be further examined.  

Although the observed benefits to health and well-being in the Study II sample did not correlate with their increases in PA levels, it is speculated that these health benefits are likely to have been obtained by participants increasing their level of “active” behaviours (light, moderate and vigorous) as well as decreasing levels of inactivity, and interrupting prolonged bouts of sedentary behaviour. Although future studies will need to examine this using accelerometers, it is speculated that the MIP and HAPPE programme’s effectiveness at increasing PA was due to its ability to target behaviours at both ends of the ‘movement continuum’ to bring about a more healthful activity profile in children and in line with individual preferences.
The MIP found that teaching children what behaviours were acceptable and what behaviours were not acceptable was paramount, and it was individual for each family. However, if children found their environment predominantly rewarded sedentary behaviours over active ones, then children were reluctant to change. The MIP intervention (and the HAPPE to some extent) was designed to help children and families to change their environments (at home and at school) so that active behaviours were rewarded more than sedentary behaviours, while accepting that it is unrealistic to completely eliminate sedentary behaviours.

Certainly, tentative, positive early results were found in the evaluations presented in this thesis. What is needed now is for these programmes to become part of an ongoing project to teach children self-management skills so they can become effective self-managers of their PA over the long term, to achieve and maintain healthy active profiles. Additionally, much more work needs to be done particularly with identifying subgroups of ‘responders’ and ‘non-responders’ to increases in PA levels. It is not yet known if increasing PA (even non-exercise, walking PA) is going to do enough (if anything) to change the future health of Australia’s children and prevent early death from largely preventable, lifestyle based diseases.

11.3 Future Research and Applications

Based on the findings from Study I and Study II, it is clear that future research needs to address the extent to which primary school-aged children can maintain higher levels of self-managed PA behaviours over the long-term. It is important to test what level of support and what conditions children need in order to self-manage PA levels, to at least meet the current PA recommendations for health and well-being. A monitoring period that spans a longer time period, of at least 12 months of continuous daily monitoring (including school and holiday periods), would be necessary to determine this
experimentally. Ideally, children could participate in a HAPPE-like intervention in their early primary school years, and receive top-ups at regular intervals across their primary and secondary schooling. Intervention complexity could alternate between self-monitoring alone or self-monitoring with additional behavioural components (such as goal setting and planned positive consequences) and would be determined by their baseline levels and/or willingness to participate in an intervention involving collaborative goal setting with their peers.

Future research into the health effects of increasing lifestyle PA would benefit from using accelerometers in addition to pedometers to properly ascertain to what extent the different intensities of PA increased (or not) as a result of the lifestyle PA intervention – and in what context (home or school, weekday or weekend) increases occurred. Although evidence from the studies presented here suggest that patterns in PA will be highly individualistic and the extent to which different types of PA increase in response to an individually-adapted behavioural intervention will be determined by an individual’s baseline level of each type of PA in different contexts.

Future interventions to increase PA behaviour are more likely to be effective if they can define individually-based goals for each type of behaviour and provide immediate feedback on an individual’s cumulative PA ‘status’. To achieve this, a ubiquitous, unobtrusive device is needed that has a similar level of reliability in monitoring and providing immediate and systematic feedback to the individual for active behaviours. Mobile smart phones and other wearable technology (for example, Fitbit) are rapidly advancing the field of PA monitoring, as they come with inbuilt accelerometers. A range of software applications (“Apps”) can be easily installed on many smart phones; for example, that can time periods of activity/inactivity and provide daily feedback on the amounts of sleep, as well as light, moderate, MVPA and vigorous
PA a person accumulates over a 24 hour period (e.g., www.Fitbit.com, Fitbit Inc.; Sensorfit Activity Tracker for Android, Sensorfit Ltd, 2011).

It is possible these Apps can be further developed to send a vibration signal or text message to prompt a short burst of activity (at any intensity) in order to prevent a bout of sedentary behaviour from being dangerously prolonged. Indeed, a system similar to the “traffic light” nutrition panel could also be developed to provide systematic feedback regarding an individual’s daily diet of PA, both in real time and as an end of day/week summary, in a way that is coherent with the energy-balance equation. Figure 11.1 below provides an example of the current “traffic light” panel (image A) shown on packaged foods indicating its nutritional content (or lack thereof in many cases) as well as an initial sketch of how this could be adapted to communicate information on physical activity levels (image B).

![Traffic Light Panel Example](imageA.png)

**Figure 11.1** An example of the current “traffic light” panel shown on packaged foods indicating its nutritional content (image A) and an illustration (image B) of how PA recommendations could be adapted in a similar way using metric equivalents for “steps”, “kcal”, and duration in different activity levels (sedentary, light, moderate and vigorous). Epochs for feedback could be adjusted to display PA accumulated for only the morning period, afternoon period, and even entire weeks and months.

Using evidence based guidelines of what is ‘sufficient’ or recommended minimum amounts could be used to provide a coloured warning system with regards to
the levels of PA that had been performed at different intensities as well as time spent in sedentary behaviours. As more evidence becomes available on the effects of PA on health, the guidelines can be updated. With the current, and rapidly increasing, prevalence of smart phone ownership it could be very easily incorporated into a home-based or school-based behavioural intervention program to increase children’s PA behaviours similar to the MIP and the HAPPE. Although, perhaps monitoring ‘steps’ will hold its appeal with many primary school-aged children given their simplicity.

11.4 Final Comments

It is clear that the technology and the tools to change children’s PA behaviours are ripe, having already demonstrated their effectiveness in application to a range of human health and behavioural problems. Increasing children’s PA levels is not, however, just a public health problem. It is a philosophical problem about how we live. The standard of living experienced by those in a developed nation was once assumed to be the ideal way to raise a child, with little to worry about in terms of access to adequate food and nutrition, hygienic conditions, education and time for leisure and play. Currently, this ideal way of life is eagerly sought after by literally billions now entering the middle classes of the world’s developing nations, including China, India and other nations in Asia and South America. It is also a way of life that is desperately being clung to in many of the developed nations in Europe, along with the USA and Australia. However, decreased levels of physical activity, obesity and too much time spent being sedentary in childhood are behaviours and conditions that researchers, health professionals, governments and health agencies have become increasingly concerned about in recent decades. It seems that, somewhere along the way, life in the developed world passed a tipping point, from once being beneficial to child development to now being a breeding ground for the development of NCD’s that include the world’s four

The conditions of our everyday environments create many subtle and not so subtle disincentives to be active, leading many individuals (children and adults alike) to choose behaviours that are sedentary or do not require much physical activity over behaviours that involve more physical activity. Deciding to be sedentary over a more physically active option is almost always rewarded immediately. These decisions accumulate rapidly over the day and thus can easily become habitual behaviours that can lead to a life of habitual sedentariness and insufficient physical activity. This pattern of behaviour is what the WHO has recently started referring to as the fourth leading cause of death (Kohl, 2012).

It’s likely that how individual families and society in general define what acceptable behaviour is and what is inappropriate for children will determine how physically active they are. For example, children are constantly being told to “calm down”, “sit down”, “don’t run”, “sit still”, “stop jumping all over the place.” From an early age, children learn that being still, sedentary and quiet will be rewarded, and are effectively trained out of their natural urges to be active little explorers and, in turn, active adults. Yet, a great deal of beneficial change could occur if the responsibility for children achieving sufficient levels of PA for health and well-being PA was shared across the community, and the role of the individual, their family, schools and the larger built environment were clearly defined and accepted. For example, at a government level, when decisions are made to reduce limits on public open space in favour of developing shopping precincts, not build footpaths in new housing developments, delay building or upgrading necessary bike paths in favour of developing roads, or demolish existing infrastructure (such as community skate parks) in favour of other residents’ request for peace and quiet and not provide a replacement – all of this signifies that our
society does not value children to have an active outdoor lifestyle. Ironically, at the
same time that Kohl et al. (2012) made the call to action for greater coordinated
systemic changes to be made, Western Australian Premier Colin Barnett abolished the
West Australian Physical Activity Taskforce as part of widespread government budget
cuts, in order to save the government a mere $740,000 a year. In the context of the
escalating costs of health care required to manage and treat NCD, this amount is pitiful.
Yet, a modest amount of money allocated to educating children in the use of
behavioural strategies to self-manage increases in PA levels could realistically prevent
exorbitant amounts of money being spent decades later to treat NCD’s as a result of a
lifetime of habitual physical inactivity.

Governments alone are not to blame. Even when world class infrastructure is
available, overall PA levels of children in developed countries still fall well below those
compared to the overall PA levels of children from developing countries, where there is
little infrastructure for safe play (Tremblay et al., 2014). Thus, the developed world
needs to re-evaluate what children are learning about acceptable physical activity and
sedentary behaviours. Whether the aim is to target increases in PA, decreases in
sedentary behaviour, interrupt prolonged bouts of sedentary behaviour, or all of these,
does not really matter. When the medical and physiological scientists get closer to
understanding what behavioural changes are necessary for individuals to make and
maintain to prevent premature death from lifestyle related disease, it is reassuring to
know that how best to make those behavioural changes has already been evaluated.
Psychology already has the behavioural technology to successfully bring about changes
in human behaviour. At the very least, the use of a pedometer to objectively monitor
children’s PA levels in combination with individually-adapted behavioural self-
management strategies such as daily self-monitoring, goal setting, feedback, planning
and reinforcement, can easily be applied to groups of children at a time, to increase
children’s PA behaviours when packaged in programmes such as the MIP and HAPPE. However, the future is looking even brighter, with the rapid development and potential for widespread use of personal wear physical activity self-monitoring devices, particularly when data can be easily transferred to apps within mobile smart phones.

The studies presented in this thesis have been a necessary step (pun coincidental) in the process of understanding this most fundamental of all human behaviours – physical activity. This particular thesis has demonstrated that a minimalist behavioural self-management approach to increasing children’s PA behaviour can be successfully delivered to primary school aged-children in either a home-based parent-assisted program or in a school-based teacher-assisted program. Utilising the pedometer provided an objective, accurate and reliable way of monitoring and giving systematic feedback of PA levels as well as a framework for setting PA goals related to “step counts”. This also allowed for establishing a reinforcement system contingent on achieving step count goals on a daily, weekly and longer term basis. Meetings with the researcher in individual consultations also provided the opportunity to educate participants about pedometer literacy and plan for changes in PA behaviour (e.g., stimulus control, arranging contingencies) that could take into account their unique circumstances and preferences. Individual consultations also provided opportunity and support for participants to develop the skills to become effective self-managers not only of the intervention components, but also of their PA behaviours, and thus, their lives.

Based on the findings from these studies it can be concluded that primary school-aged children can be taught to self-manage increases in lifestyle PA (that is non-prescriptive and encourages increases in all types of PA) equivalent to PA levels recommended to receive health benefits. Increases in PA were also found to generalise from the context of where the intervention was initially delivered (e.g., at home or at school) to other contexts of the child’s daily life. Some significant changes in health
and well-being outcomes were observed in primary school-aged children participating in the interventions (with some indicating a trend in growth opposite to that associated with obesity, reductions in skin folds and resting heart rate, and improvements in depression and anxiety scores) however, there is no strong evidence that these changes were meaningful or were the result of increases in PA.

The school-based HAPPE in Study II demonstrated that the additional behavioural strategies of systematic feedback, goal setting and planned positive consequences packaged in the HAPPE ‘Climb Mt Fuji Challenge’ led to significantly greater increases in PA in the short term relative to gains made by the comparison group. Although, the act of self-monitoring PA on a daily basis and having access to immediate feedback on PA levels (from a pedometer) was sufficient for many children in the comparison group to self-manage significant increases in their PA levels over one school term.

Therein lies the power of the pedometer. When used in the context of behavioural self-management skills, pedometers work not only by drawing attention to an individual’s PA behaviour habits. They work by creating a value for the simple act of taking a step – it counts them and they add up. Very little else is needed. No additional infrastructure needs to be built. Simply, counting steps, setting step goals and making positive consequences dependent on achieving them creates a ‘step economy’. Thus, the increased value of incidental PA that is part of everyday living makes taking *more* steps reinforcing. All of a sudden PA has transformed from something that used to be habitually avoided into something that is valued and reinforcing in and of itself. It then doesn’t take long to become skilled in noticing that opportunities to be more active in the day are everywhere and rearranging other schedules to incorporate even more opportunities for PA made easier. For example, when a child learns how to ride a skateboard, the humble car park or street curb and eventually the whole built
environment is transformed into a playground, with limitless potential for PA and enjoyment.

So far the power of pedometers to increase children’s lifestyle PA levels has been underestimated as it was previously thought that there was little or no sustained, beneficial reactivity effect of pedometers on children’s PA levels (Butcher, et al., 2007; Eastep et al., 2004; Foley, Beets & Cardinal, 2011; Lubans et al., 2009; Tudor-Locke & Lutes, 2009). However, by adding some structure, such as planned positive consequences for the use of the pedometer (rather than its output) and involving peers and parents (with them also wearing pedometers and committing to participating in an ‘active’ life) may be some of the key ingredients in the recipe for success for a minimalist, low cost intervention. Such an approach can gradually equip individuals with the behavioural skills they need to continue self-managing their PA behaviours throughout their lives. This approach also has the potential to reach a broad population of children and modify a range of behaviours along the whole spectrum of PA that are beneficial to the health and well-being of all children.
Appendices

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Appendix A
The MIP intake interview protocol

MIP Intake Interview:
Full disclosure of requirements of participation in MIP

Basic Theory

To help children find the motivation to be more active, we usually find in psychology that it helps to reward good behaviour, or behaviour that you want to see more of. So, the theory behind this program is a basic reward strategy so that when the child increases the amount of physical activity they do, they will be rewarded for it.

We start off first by seeing what the normal level of activity is for the child over a two week period. So nothing changes initially. Then after finding out what your child’s normal level of activity is, we very gradually help them to do more on a daily basis. We encourage the child to try to beat what they did the day before. And as this builds up by the end of the week, if they have improved over more days than not, say 5 out of 7 days, they manage to improve their activity level then they will be rewarded with a prize from the lucky dip back that I’ll bring around to your house.

The Movin’ It program encourages physical activity that is a part of everyday life, and it can be enjoyable –not something that we need to avoid. Exercise and physical activity don’t need to be segregated from the rest of our daily life activities. Sport is obviously an activity that we do largely in isolation from our other activities, but there are so many other ways that we can be physically active in our everyday lives – we just need to look a bit harder to find them. For Example; jobs around the house, walking to school, doing new things in the neighbourhood, taking up a paper round.

In fact, there is no "right" exercise for maintaining a healthy body and encouraging good development. In a randomised, controlled, weight-loss trial of obese women that specifically compared a structured activity regimen (aerobic exercise classes) with a lifestyle activity regimen (focus on increasing time and effort spent in everyday chores), both types of activity led to comparable results after one year.

Over time, we will encourage _____ to try to set a goal or two, of getting to a certain level of activity and they’ll see if they can reach it. So it’s not a race, and it’s not a test. It’s more of a game that they play with themselves -because they are trying to beat what they did the day before. And if they do, then we celebrate it! Because that’s what we want, for them to be more active so they can grow up to be healthy and strong.

Hopefully by the end of the program they will have found participating in physical activities to be naturally reinforcing, and will not require these weekly rewards to continue with their activity goals for the rest of their lives. Because, having a healthy physical activity schedule is something we hope the child will want to continue with for the rest of their lives, so that they can not only grow up to be healthy and strong, but also, live a long and healthy life!
Methods

One thing that people don’t do very well is estimate their activity levels accurately. So, in this program we use the pedometer to help us get an accurate picture of how much activity your child does every day. We will use the pedometer as a way to monitor increases and decreases in activity over time. I’ll also be getting you to record these measures on to a special chart for _____ so that we can see how they are doing over the weeks. On a daily basis, the responsible parent will be required to record the pedometer readings and mark them on the special wall chart provided. The researcher will also make contact with you at a convenient time every day to keep a record of these readings as well.

To help motivate your child to improve their activity levels, the program has a structured reward system in place to help encourage them to try to do just a little more physical activity every day.

To be there as a support for your family while on the program, the researcher will also visit you in your home at a convenient time each week to check activity levels and reward progress.

Data collection

Over the course of the 20 week period there will be 4 interviews held on the Murdoch campus to collect data on the relevant information about your child. This will take the form of interview, questionnaires, and standard body measurements. This one will be the longest, and the other will probably be a bit shorter.

When in a good time to call home?
When is a good time to come over?

Theory and factors affecting childhood overweight

Before, physical activity used to be an acceptable part of our everyday life. But as society has developed, it seems to be developing in a way that sees physical activity as something that we need to avoid, and there are numerous things we use today so that we don’t have to be physically active –

- cars
- home entertainment systems with remote controls!
- computers/internet
- online shopping
- Fast food…..

There are other changes in our culture that over time has played a role in our increasingly sedentary lifestyles, for example;

- Newer houses are built without sufficient outdoor areas/ backyards, there is an increasing sense of insecurity when outdoors (particularly for children) – whether this is valid or not is not evident.
- Acceptable parenting practices have changed and there is a growing insecurity in many parents about how to raise their children. Decades ago, it was acceptable for children to be told to go outside and entertain themselves, but now (and also due to the other lifestyle changes we have made), this is not as common
anymore. The status of the child in the family seems to have changed as well, to
the point where in many families the child is controlling the parent. Many
parents have great difficulty in challenging their children, as children have a
growing attitude of entitlement that is making it very hard for parents to
courage children to do things that are difficult for them.

I’m sure that even you can think of a couple of things that may be different in our
society than before, when you were a child, and have contributed to our increasingly
sedentary lifestyles.

These developments have enabled us to get used things being made instantly for us, and
things that take a bit of hard work, are even harder to engage in. Sport and physical
activity is something that we (society and culture at large) are teaching our children that
you need to work at. It doesn’t just happen as part of a normal way of life, and you need
to make time for it to be healthy. It’s almost as though hard work/physical activity has
become an exception to life, whereas before, it was accepted as the rule! But in fact, the
truth of the matter is that just as we feel that it is important to eat, it is just as important
to be physically active. You can’t have one without the other!

Now days, those children that have become overweight, or are used to being inactive,
find it difficult to get back into a lifestyle of physical activity. So much so that they
don’t even find it rewarding anymore. It is much more fun for them to be inactive. We
see this as a pretty dangerous place for a child to be in, as one of their major tasks is to
grow up to be healthy and strong, and this kind of lifestyle is really getting in the way of
that. Some statistics have even predicted that, should current lifestyle trends continue,
this generation will be the first where parents will outlive their children. We need to find
ways for children to be more physically active in their everyday lives, and provide
opportunities for them so that they actually find it rewarding enough to also want to
continue choosing to be physically active for their rest of their lives.

Well, the Movin’ It program encourages physical activity that is a part of everyday life,
and it can be enjoyable —not something that we need to avoid. Exercise and physical
activity don’t need to be segregated from the rest of our daily life activities. Sport is
obviously an activity that we do largely in isolation from our other activities, but there
are so many other ways that we can be physically active in our everyday lives—we just
need to look a bit harder to find them. For example; jobs around the house, walking to
school, doing new things in the neighbourhood, getting a paper round.

In fact, there is no "right" exercise for maintaining a healthy body and encouraging
good development. In a randomised, controlled, weight-loss trial of obese women that
specifically compared a structured activity regimen (aerobic exercise classes) with a
lifestyle activity regimen (focus on increasing time and effort spent in everyday chores),
both types of activity led to comparable results after one year.

**MIP Intake Interview Protocol**

*(With parent and child initially)*
Assess how much the child and parent know about the program.
Explain theory, method and data collection process in accordance with what they already know
(see document titles “Requirements of Participation, Intake Interview”)

The main aim of today’s meeting is make sure your child meets our basic eligibility criteria for
entering programme and also to be able to get a clear picture of your child and family. Before
we go on, I’d like you both to give your consent to taking part in the interview and the program. Take your time to read this form, and feel free to ask any questions you like. *(Give Information and Consent form, ask for signature)*.

So, this morning/afternoon, in order for me to get a better idea of who you are and what _____ is like, I’ll also be asking you some pretty standardised questions about any health issues, a bit of a history of your child’s development, what are his/her usual activities, and if you think there might be any barriers to extending or replacing these activities. I’ll be taking notes along the way to record all of this accurately. I’ve also got some forms I need _____ to fill out for me, and he/she can do that in the waiting room. Then I’ll check with you if you have any concerns about your child or about the programme and then we’ll be able to run through exactly what will be involved in the programme together with __________. After this, we’ll all go down to the Chiropractic Clinic together and take the first round of measurements *(ask child to fill out questionnaires in waiting room)*.

**Assess Motivation to change**

I just want to say that we really appreciate your willingness to be involved. But I have to say that basically, we anticipate that the Movin’ It! Program will not work, unless either the family is motivated to stick to the program, and/or the child is willing to try out the program.

**Are you planning to go away for more than a week during the next 6 months?**

**Are you planning to have a baby in the next 6 months?**

This is not a treatment program. There may or may not be benefits for you and your child, but that’s what we’re trying to find out. That’s why it’s important that we select really committed families because we want to see if there is an effect of this program to be able to help other families with overweight children. There are no risks, but it does require the parent to do some careful measuring and monitoring and the child also has to wear a pedometer every day.

So I’ll be relying on you, to be a research assistant, and I’ll be meeting with you at the end of each week to see how it’s all going and support you along the program. Because, as the parent, you are really quite central to this research, because we rely on you on the daily basis of recording with your child their activity levels – as this will be our main indication of change and how we will know if there have been any real improvements. Do you think you are prepared to do something like this?

It’s completely normal for your motivation to vary from day to day, week to week, while on the program. So we need to find out now if this is something you really want, so that on those tough days, you’ll have a reason to keep going. Because no change is easy, and for this program we need people who can be relied upon to follow the instructions of the program – till the end of the program. But, without someone being ready to do something different to what you’re used to, then the Movin’ It program will most likely not work for you at the present time. So, before we go any further, I want to ask you to be honest with yourself right now, and ask yourself how willing you are to make some changes with regards to your child’s eating and activity behaviours.

So, on a scale of 1 – 10 (1=not willing, 10= very willing), of how willing are you to try something new, like the Movin It Program to help make sure your child will grow up to be healthy and strong?

**Family Composition**

Child’s Name: ____________________________________________ Today’s Date: __________

Date: __________

Date of Birth: ___________________________ Age: _________

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Sex: Male Female

Home address: _______________________________________________

Phone: _______________ Mobile: _______________

School: __________________ Year: __________________

Interviewee’s relationship to child (if not mother):_________________________

Interviewee’s Name: _________________________________ Age: _________

Education: ___________ Occupation: ___________________________________

Mother’s Name: _______________ Age: _________

Education: ___________ Occupation: ___________________________________

Father’s Name: __________________ Age: _________

Education: ___________ Occupation: ___________________________________

Step Parent’s Name: _________________________________ Age: _________

Education: ___________ Occupation: ___________________________________

Marital Status of parents:_____________________________________________

If parents are separated or divorced, how old was the child when the separation occurred? _____________

List all the people living in the household:

<table>
<thead>
<tr>
<th>Name</th>
<th>Relationship to Child</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

If any brothers or sisters are living outside the home, list their names and ages:

_____________________________________________________________________

Primary and other languages spoken at home:____________________________

**Home environment**

Tell me what your home is like? Does ____ have his/her own room? Where does ____ play?

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

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Health issues

Presenting problem
When did you first notice that ____ had a weight/inactive problem?
____________________________________________________________________

Has ____ been assessed by their GP as being overweight? When?
____________________________________________________________________

What do you believe caused the problem?
____________________________________________________________________

Were there any significant events that occurred at the time of the onset of the problem (for example, separation or divorce, move to another city or school, financial problems, hospitalisation of a family member)?
____________________________________________________________________

If so, what was ____ reaction to the event?
____________________________________________________________________

How does ____ deal with the problem?
____________________________________________________________________

How do you deal with the problem?
____________________________________________________________________

How do family members react to ____'s problem?
____________________________________________________________________

Does anyone else in your family have a weight problem?
____________________________________________________________________

Is there anything you’ve tried before with ____? 
____________________________________________________________________

How did it go? Was any progress made?
____________________________________________________________________

When was the last time ____ received any help for the problem?
____________________________________________________________________

Medical History
Does ____ eat well?
____________________________________________________________________

What does ____ usually eat?
____________________________________________________________________

____________________________________________________________________
Does ____ sleep well?
Does ____ have nightmares or other sleep problems?
Does ____ have any problems with bowel or bladder control?
Does ____ take any medications? Have they in the past?

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

I’m going to read out a list of illnesses and medical problems, could you tell me if ____ has had any of these and approx. when he had it.

Measles ____________ Dizziness ____________
German measles ____________ Mumps ____________
Frequent or severe headaches ____________ Chicken pox ____________
Difficulty concentrating ____________ Whooping cough ____________
Memory problems ____________ Diphtheria ____________
Extreme tiredness or weakness ____________ Scarlet fever ____________
Meningitis ____________ Rheumatic fever ____________
Encephalitis ____________ Epilepsy ____________
High fever ____________ Tuberculosis ____________
Convulsions ____________ Bone / joint disease ____________
Allergy ____________ Gonorrhoea / syphilis ____________
Hay fever ____________ Anemia ____________
Injuries to head ____________ Jaundice / hepatitis ____________
Broken bones ____________ Diabetes ____________
Hospitalisations ____________ Cancer ____________
Operations ____________ High blood pressure ____________
Ear problems ____________ Heart disease ____________
Visual Problems ____________ Asthma ____________
Fainting Spells ____________ Bleeding problems ____________
Loss of consciousness ____________ Eczema ____________
Paralysis ____________ Suicide attempt ____________
Other ____________

Index of things getting better:
In the last 3 months, can you think back to the number of times you child has:

Visits to the doctor? -

______________________________________________________________________

Experienced any illness symptoms (for example, coughs, colds etc.)?

______________________________________________________________________

Number of ½ days off school?

______________________________________________________________________

Taken medication? ________________________________
Short developmental history of child

Tell me about ____’s birth.
Were there any physical complications?
_____________________________________________________

How much did ____ weigh?
_____________________________________________________

Were there any birth defects?
_____________________________________________________

Tell me about how ____ was as an infant

Was ____ satisfied when fed? __________________________________

How well did he/she sleep? _________________________________

Was ____ easily distressed? _________________________________

How readily could ____ be comforted? _______________________

How well did he/she adjust to new things or routines? ________________

Was he/she cuddly or rigid? _________________________________

Overactive or underactive? _________________________________

Did he/she have tantrums? _________________________________

Rocking behaviour? _______________________________________

Head banging? __________________________________________

I’m going to read a list of infant and preschool behaviours can you just try to give your best idea of how old ____ was when they first did these things.

<table>
<thead>
<tr>
<th>Behaviour</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Showed response to mother</td>
<td></td>
</tr>
<tr>
<td>Put several words together</td>
<td></td>
</tr>
<tr>
<td>Rolled over</td>
<td></td>
</tr>
<tr>
<td>Dressed Self</td>
<td></td>
</tr>
<tr>
<td>Sat alone</td>
<td></td>
</tr>
<tr>
<td>Became toilet trained</td>
<td></td>
</tr>
<tr>
<td>Crawled</td>
<td></td>
</tr>
<tr>
<td>Stayed dry at night</td>
<td></td>
</tr>
<tr>
<td>Walked alone</td>
<td></td>
</tr>
<tr>
<td>Fed self</td>
<td></td>
</tr>
<tr>
<td>Babbled</td>
<td></td>
</tr>
<tr>
<td>Rode bike with trainer wheels</td>
<td></td>
</tr>
<tr>
<td>Spoke first word</td>
<td></td>
</tr>
</tbody>
</table>
What was ____ like during his/her second year of life?
Were there any problems during his/her second year of life? ________________
What was ____ like as a toddler? _________________________________
How did he/she get along with other children? __________________________
Was ____ able to be by himself/herself? _____________________________
Do you see anything that stands out in _____ history that may have affected his/her
development? (For example, separation or divorce, move to another city or school,
financial problems, hospitalisation of a family member, illnesses, social problems)? If
so, what was ____ reaction to the event?

Usual Activities and Social background

Interests/ hobbies
What does _____ like to do in his/her spare time? Any special interests, hobbies, skills?

What are your child’s favourite activities?_____________________________
What does ____ like to do alone?_______________________________
With friends?_______________________________________________________
With family members?
What activities does he/she like least?
Do you see any barriers to extending these activities or replacing them with other ones?

Peers relations
Does ____ have friends? How many friends? (age/gender)
How does____ get along with his/her friends? ____________________________
How does he/she get along with peers of the opposite sex? ________________
Does ____ have a best friend? ____________________________
What are ______ strong points, assets or abilities?
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

**Family relations and discipline**

How does _____ get along with you? ________________________________
What does he/she do with you regularly? ________________________________
What are the good times like with you? ________________________________
What are the bad times like with you? ________________________________
Any other adults he/she spends time with? (Ask same questions above)
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

If any brothers or sisters; how does _____ get along with them? ________________
What do you usually do to discipline ____? I’ll read out a list and you can tell me if you ever do these types of things:
Ignore problem behaviour _____________
Tell child to sit on chair _____________
Scold child _____________
Send child to his/her room _____________
Spank child _____________
Take away some activity or food _____________
Threaten child _____________
Other techniques (describe) _____________
Reason with child _____________
Redirect child’s interest _____________
Don’t use any technique _____________

**Family routine –Family / child activity level**

I’d like to get a picture of what a typical day looks like in your family. Can you walk me through a typical day for you and your child from what time they wake up to when they 378
go to sleep? I’m trying to get an idea of the types of activities your child is already involved in, such as their morning routine, self-care, other care (pets, younger sister), jobs around the house, relaxation, diet / eating, exercise, bed time routine, any specially arranged events. *(If parent doesn’t know, ask child)*

______________________________________________________________________
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______________________________________________________________________

Have you changed your routines lately?

How active would you consider your child? *(Also ask child to rate themselves)*
On a scale of 1 (= inactive) to 10 (= active)

How active is your family? On a scale of 1 (= inactive) to 10 (= active)

*(If child is very active, may need to screen out)*
Any Concerns of parents?

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

When is a good time for me to call tomorrow to get the pedometer readings?

______________________________________________________________________

When is a good time to come over next week to see how things are going?

______________________________________________________________________

Assess child’s willingness to wear pedometer
(Ask child to join us in interview room)
Thanks for filling out the questionnaires; did you have any trouble with them? We can go through them together in just a sec.

Now, only a few selected people can be in the program and we want to see if you can be one of them, and it’d be great if you could be. Now, what’s involved is you would wear this pedometer on your belt like this (show how I wear it). These things are really cool. It can tell us how many steps we take each day. And then it can tell us how far that is in meters and kilometres. Take a look.

We want you to wear this every day for a couple of weeks, because we think you’d be good at it, and we also want to see how much you usually do every day.

So why don’t we get one just for you. You need to be careful with it, because this one is especially for you while you’re doing the program. When you finish the program we might need it back again.

It takes a little time to get used to wearing it every day, so for the next two weeks, I don’t want you to do anything different. Just do what you would normally do and we can see how you go wearing it. Then, I’ll come over to your house in a week or so and we can see how you’ve gone and I can show you what else you can do with it.

Now, some days you might not wear a belt or even strong pants that the pedometer can click onto. So we’ve made up some special belts that you can wear under clothes and the pedometer can sit on that and it will be protected. But we need to measure you to make sure we can get the right size for you.

So, every day for this week and next week, I’ve asked your mum to note down how many steps the pedometer recorded at the end of each day. These numbers are really important for us, because then we’ll know just how much physical activity you do every day. It’s pretty exciting to find out just how far we actually go each day. You might be surprised. Maybe mum will want to get one for her so she can find out too! Now, I’ll be calling at the end of every day to see how you’re going, and I’ll come over once a week as well, to see you’re both going at home.
After this first couple of weeks getting used to it, we will then move on to the next part of the program where I’ll ask you to try and beat what you did the day before and slowly, slowly you will be able to improve on how much physical activity you do, and then it’ll get more fun for you, because for those children who do really well, we have special lucky dip prizes at the end of every week.

So, what do you think about that? Did you have any questions?

Ok, now its mums turn to fill out a questionnaire for me, so I’ll get her set up outside, and we can go through your questionnaires together.

**Go through questionnaires with child**

Now we need to program in the pedometer how long your step is so that we can calculate how many meters you walk each day. (Outside clinic, measure 10 steps three times and take an average)

\[
\begin{align*}
10 \text{ steps} &= \underline{} \quad \text{m} \\
10 \text{ steps} &= \underline{} \quad \text{m} \\
10 \text{ steps} &= \underline{} \quad \text{m} \\
10 \text{ steps} &= \underline{} \quad \text{m} \\
\end{align*}
\]

**Average** 10 steps =

**Go to Chiropractic Clinic**
Appendix B
The MIP Manual

The Movin’ It!
Program

Manual for Parents and Children

2006

MURDOCH UNIVERSITY
PERTH, WESTERN AUSTRALIA
School of Psychology
Congratulations!!!
Well done for joining the Movin’ It! Program!

Recent research has shown that the majority of parents underestimate the weight status of their potentially overweight child. So congratulations on not being one of the majority!

It is not generally recommended that children who are at risk of being overweight go on strict diets or reduce their calories to lose weight, because children are still growing.

Instead, maintaining weight allows children to "grow into" a healthy weight as they get taller. Children who are encouraged to develop healthy eating and activity patterns without "dieting" can stop excess weight gain and maintain their weight while growing taller. Compared to adults, children are more successful at using healthy eating and regular activity to keep weight in the healthy range long term.

As a parent you can actually do a lot to help your child maintain a healthy weight. Children thrive on the structure that their parents create. Knowingly or unknowingly, parents are the driving force behind the family’s eating and activity patterns. They decide which foods are available at home, where and when foods can be eaten in the house, and which activities children can participate in.

You have done well to be one of the lucky families to be able to do the Movin’ It! Program at this stage.

And we also want to THANK YOU for wanting to do it!!

We recommend that you read this manual together with your child so that you are both sharing your experience of the program together, like a team. This program is about helping parents and families to help their kid’s grow up to be strong and healthy by supporting and encouraging children to be more physically active in their everyday, natural environments; at school, in the park, and at home.

The Movin’ It! Program runs for 20 weeks. Woah! That’s a long time isn’t it! But really the program is just about doing what you normally do (and maybe some new fun things), but doing a little bit more day by day, week by week, so that you don’t even notice that what you’re doing at the end is actually very different to what you are doing now. It’s clever because you don’t have to work too hard at the beginning, but over the long time it builds up and up to be a BIG difference!

Also, maintaining a healthy body weight is a lifelong mission, and just like anything else in life that you want to be good at, it takes practice!
Program manual:

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First, a little word about our bodies
First, a little word about our bodies

The basics of your body: what goes in must come out!

We all have our own body shapes. Some people are tall and skinny. Some people are shorter and rounded. We usually end up with bodies that look like our parents. But some people push their bodies to the limits of its natural shape. Look at the picture below, these are just a couple of different body shapes people can have, there are many other types. But in general, being at either position 1 or 9 is extreme, not very good for your health and your natural body shape is almost unrecognizable. But being at position 4 or 5 is where your natural shape can be seen. Most people tend to shift through different body shapes depending on what they do, what they eat, and how old they are.

Some people who do a lot of sport have very special bodies that have lots of muscle and very little fat. They train their bodies to be very good at doing special things. Can you think of a famous sports person you know? Their body probably looks very different from their parents, but if they stopped their special training, then their bodies would probably start to go back to a shape similar to their parents.
Then there is the opposite end of the spectrum. Some people who don’t do a lot of sport or physical activity push their body to the limits of its natural shape in a different direction. Because they don’t do much physical activity they do not have much muscle and may be quite overweight too, where most of their body is made up of fat instead.

Being overweight is a situation where your body has too much mass (that is how much you weigh) compared to your height. For children there are different norms for each child depending on their age as children are always growing taller. It usually results, and is maintained when there is an imbalance in energy in our bodies. This happens when there is an imbalance between how much energy we put in – when we eat and drink (usually called calories), and how much energy we put out - which includes the energy the body uses to keep its organs and systems working (metabolism), for daily activities, and for growth and development. Two elements make up "energy out" -- regular physical activity, which burns calories, and screen time, or time spent in front of the TV, which reduces time spent burning calories.

This is the rule for our bodies; the energy we put in must be used or our body will store it up for later. Our bodies will hold on to energy we don’t use (in fat stores), just in case we don’t get any more for a while. Everybody should have some fat in their bodies as it is essential for some of the body systems, but too much is not good.

So it kind of looks like this:

<table>
<thead>
<tr>
<th>Energy = food and drink</th>
</tr>
</thead>
<tbody>
<tr>
<td>We eat food and drink = energy in our body</td>
</tr>
<tr>
<td>We are active, metabolise, and grow = energy out of our body</td>
</tr>
</tbody>
</table>

If we put too much in and not enough out, then we will get too big; if we put too much out and not enough in then we will get too small (remember the picture on the other page). But sometimes it’s hard for us to get it balanced. So just remember that what you put in you must also put out!

So it’s kind of like putting petrol in a car. Cars are designed to burn up petrol so they can zoom all around, just like our bodies are designed to burn up calories (food energy) so that we can zoom around too! When you fill the car’s petrol tank, then you can move around and go all over the place using up the petrol. But you don’t want to fill up a car with petrol and then just keep it in the driveway at home, because the next time you go to fill it up the tank will overflow! And then you’ll have to fill up the back seat with petrol and then the front seat until there is petrol everywhere, and it’s pouring down the street just waiting to be used. Oh no, But then you’ve ruined your car by putting petrol all over it! What a bit mess!

So it’s similar to our bodies. If we keep filling it up and don’t use the energy, our bodies begin to overflow and we begin to put on extra weight. Our food doesn’t just pour out into the street like would happen with the car – our bodies turn it into fat and we just make more and more room for it until we can’t move anymore even if we wanted to! We would have ruined our bodies with all the extra fat everywhere. Everyone has some fat in their body, but we are talking about having too much extra fat – it’s just unused energy.
BUT, don’t worry, because you can get rid of it. Just like you could clean the petrol from your car if you overfill it, we can “clean” the extra fat from our bodies by being active, and then your body will be back to its bouncing, healthy and happy self again!

This is where physical activity and the Movin’ It! Program can play such a big role in maintaining our body weight. Because being active helps to keep our bodies happy and healthy and make us grow up strong.

Some people think that when they are being active, that they shouldn’t be too active because they need to save some energy for later. This is true if you are planning to run a marathon or climb a mountain, because you need to be careful how far you travel each day so that you can get to the top. But in our everyday lives, this sort of thinking can lead to us not being active enough. In fact, the more active you are, and the more you keep going, then the more energy you feel like you have. Because our bodies get fitter and our muscles get stronger, and we want to keep movin’ it to keep usin’ it!

We have this saying that you need to “Use it or Lose it”. That means that if you don’t use your energy, you will just lose it - it will be stored as fat in your body and you will feel like you have less energy. So the rule is, the more you use your energy, the more you feel like you have energy! So, get your body working, and soon you’ll find that you want to do more. And we can always do more! Sure, we also need rest and it is good to relax, but it’s only good if we have been active as well. Remember, our bodies are built for Movin’ It!

**Physical activity and Children**

Being physically active is especially important for good health and development during the growing years. But in fact, it doesn’t matter what age you are, physical activity has many benefits. It helps us feel more energetic, feel better about ourselves, feel more relaxed and, very important, it helps keep us healthy. For children, being involved in physical activity early in life hopefully helps establish healthy long-term behaviours.

Children are growing and developing and should be active every day for a minimum of one hour. This should include physical activity for a range of activities such as transport, play and recreation. A mix of both moderate and vigorous activity is recommended. Some activity is better than none at all, and more is better than a little. The aim of the Movin’ It! program is to increase physical activity levels gradually, and to maintain it for the rest of your life.

**But, is it O.K. to Veg Out?**

Of course! A balanced day, and life, should involve relaxation; putting your feet up, sitting back, chilling out, because that is also good for us and our growing bodies. This is why we
need to sleep at night, because this is when our bodies need to rest. But you need to mix up your life with being active some of the time and relaxing some of the time, too much of just one thing at a time is not good for growing up to be healthy and strong.

**Why do you want to be fit?**

So now is a good time to ask yourself the question, “but why would I want to be fit and healthy anyway?” Well, in our life it is a valid question, especially when we see so many people doing so many things that are bad for their health! It is confusing times! Basically, you need to be fit to be able to do the things you want to do. It’s as simple as that!

Being unfit is a kind of situation that is like what we call “a double-edged sword”, where it cuts you both ways! You see, when you are unfit it is hard to do physical activities (like running) and because it is hard you feel like not doing much at all, and the less physically active you are the more unfit you get!

So if you want to do things in your life, and this means anything – helping mum with the shopping, running around Adventure World for a day, going to school, playing outside with your friends, going on holidays, working in the garden or around the house, going for a bush walk, then you need to be fit and healthy. And if you’re not, then it’s likely that even these simple and fun activities will be very difficult, that’s if you even feel like doing them at all. We need to keep being active so that we can stay fit, healthy and strong so that we can do things that we want to do and have fun too.

Think about some of the big people you know, are they fit and healthy? What sorts of things can they do because they are fit and healthy?

**What do we mean by physical activity?**

Physical activity is any form of bodily movement using large muscle groups. Pretty broad isn’t it. It can be planned or spontaneous, done individually, in groups or in teams. Physical activity is really about moving more. It includes walking, playing games, walking up stairs, walking to school, gardening, playing and practising sport, flying a kite, throwing a Frisbee, riding a bike, skateboarding, rollerblading, swimming and so on.

Physical activity can be fun! Making it fun encourages children to want to participate – being highly skilled doesn’t really matter. It’s not about winning or losing or seeing who is the best – it’s about participation and having fun. The most important thing is for children to be physically active and to enjoy the opportunity to be involved.

But leisure and play is just one aspect of physical activity. Like we said before, it is an important part of our everyday life to be active, just getting out of bed, getting dressed and going to school is physical activity. So, physical activity can also be things that we have to do too. Maybe you already have some special jobs that only you do around your house – like take the rubbish out, or clean your room – well, this is being physically active!! You are also being active when you are helping your mum or dad around the house.
So, I think you are getting it now, *everyday life is active!!* You don’t need to join a fancy gym or sports club, because there are so many ways you can be active in your life that are FREE! There is a list at the back of this manual to help give you some ideas on the different types of physical activity you can do, some will be fun games and other’s will just be everyday ways to *get more steps in your day!* Because, that’s what it’s all about, being more active and Movin’ It!

Part of the Movin’ It! program will involve the researcher coming around to your house every week to help you and your family work out new ways to be active in your everyday life. She will also want to see how strong and healthy you are growing and give you special prizes when you are doing well.

**Tips for Parents when planning children’s games and activities**

*Providing opportunities and choices*

Emphasis should be placed on providing choices for children of all abilities to be involved in planned activities or spontaneous active play.

*Reduce opportunities for inactivity*

Reducing opportunities for inactivity is also important, especially watching television and other screen-based activities. Outside school hours is an opportune time of day for children to participate and enjoy physical activity, so the time they spend sitting and watching TV and other screen time (such as computer games) should be minimised.

*Maximising participation*

Offer a range of activities that can be done either individually, in a group or as part of a team and in which all children can participate.

*Convenient access*

The activities that can be offered to children are sometimes limited due to lack of equipment or space, but the good news is that not all activity requires equipment.

*Maximising creativity*

Children have a great ability to make up fun games that really just take imagination. If you’re stuck for ideas and you’ve tried the activities at the back of this manual, see what your child can come up with.

*Safe and supportive environments*

If physical activity is occurring outdoors during the warmer months, make sure the children wear a hat and apply sun-screen. If it’s a really hot day, it is probably best to keep children indoors.
or in the shade. Drinks of cool water should always be available and encouraged.

_Intensity_

Intensity refers to the amount of energy expended while taking part in a particular activity. High and medium intensity activities should be included regularly.

_Equipment_

Most games in the Eat Smart, Play Smart manual require either very little equipment or items that should be readily available. Some require balls or sporting equipment. Requirements are highlighted at the beginning of each game or activity.

_Location_

Children can be encouraged to be active in both indoor and outdoor environments. Some games and activities can be enjoyed indoors and outdoors, depending on the weather. Everyone can participate in the fun and games! (The Heart Foundation supports Australia's Physical Activity Recommendations for Children and Youth (NB: external link to website of Commonwealth Department of Health and Ageing)).

**What about the food we eat?**

WOW! All this talk about _using_ our energy - isn’t it amazing all the good things that can come of it! But, we shouldn’t forget to talk about where we get our energy from. Remember, that along with plenty of activity, children also need good foods for healthy growth and development including plenty of water. The more healthy foods they eat, the more energy and strength they have to take on their activities.

In the Movin’ It! Program you are being more active than you usually are and you _may_ find that you will be hungrier and want to eat more. This is fine; because that means that you are using lots of energy! But, when you want to eat more, make sure you eat the foods that are good for keeping you healthy and making you strong like the food from the list below. When you hear your tummy grumble, grab for one of these snacks, because they will give you the most energy!

See if you can name the pictures that are on the next couple of pages. These are the foods that you want to eat when you are feeling that extra hungry because of all the activity you are doing.

You might find that there are some foods with more than one picture; this is so that you can get really good at recognizing them!
Seeing how much movin’ you doin’:

Baseline measurements
Week 1

Welcome! So, you have just come back from the University and now you’re home and your child is ready to try out how their new pedometer works! You have just read the information for parents at the start of this manual so you are probably already brimming with ideas on what sorts of things you can do and ideas about what sorts of new and fun activities you might like to introduce to your child.

But WAIT! I know it’s hard to keep all your creativity in (write it down if you want to), but you’ll have to put all the fun to be had on hold for a bit longer, because for the next two weeks, the plan is to just see what your child does already in terms of physical activity.

This week and next week is for your child to be able to acclimatise to wearing the pedometer and for you both to practice taking the readings from it on a daily basis. We are also trying to get an idea of your child’s regular level of activity over a typical two-week period.

Wearing the pedometer

Make sure every morning that your child has remembered to fasten the pedometer to their clothing at a waist/hip level above the left or right leg. In the picture, you can see the pedometer is fastened around the hips along the top line of underwear.

Perhaps putting a picture or a note in your child’s bedroom will help them to remember when they are getting dressed to also wear their pedometer. You can use the picture on page 52 in this manual if you like!

It’s really important that while your child is in the Movin’ It! Program, that they remember to wear the pedometer everyday, all-day. Because if they forget, then they might miss out on getting enough steps on their charts and aren’t as likely to be able to get the prizes.
“Oooh! Prizes?,” you say.

Yes, there will be prizes and you will get to read more about them later in the manual.

So, even if your child has done lots of physical activity in a day, it can’t be counted without the pedometer on and so it won’t count on the chart. This is why it’s really important in this early stage of the program to get you and your child into the right habit of wearing the pedometer every day.

Because we want you to get the prizes too!

**Taking the pedometer readings**

It is your job as the parent to be responsible for taking the end of day pedometer readings. While your child might be interested to learn how to use the device for themselves, it is best if this is kept as your role. The accuracy of the pedometer readings are one of the most important aspects of this program, because this is how we will know whether your child is benefiting from the program.

If they demonstrate a curiosity with the device you can encourage you child to help with this task by allowing them to very carefully, open the pedometer case and see their step count (as a surprise), handing it back to you straight away so that you can transfer the number to the chart. As a special treat for your child you can allow them to press the “reset” button after you have taken the readings. And then re-fasten the pedometer safely to their clothing.

Taking the readings should be done at a routine time everyday – perhaps before bed time, before bath time, or after dinner time. You may like to experiment with this to find what the most convenient time is for you and your family. As a general rule it is a good idea to take the end of day readings when your child is less likely to be active later on.

For this week, simply take the reading at the regular time that you find is most suitable for you and your family, and note it down in this elegant table we have created for you. It may help to write the names of the days of the week, to help keep you on track with your recordings.
We’ll teach you how you can make these numbers look really cool, by putting them in a chart a bit later on!

The researcher will also call you everyday to obtain the pedometer readings, so that we can keep a record of the steps in our books too. The phone call is also a chance for you to voice any concerns or problems you may be having, as the researcher is also here to support and encourage you while you and your child are on the program.
**Week 2**

Well done for reaching the end of the first week!

We hope that it went well for you, and that any bumps you came across along the way have been smoothed out. You may find this week a little bumpy too, but that’s ok. That’s why we wanted to take the time to help you and your child get used to wearing the pedometer, taking the readings and recording the steps in this book. So, hopefully this week, things will begin to feel like it’s all part of your normal routine.

For this week, again, all you have to do is take the reading at the regular time that you found to be most suitable for you and your family last week, and note it down in another elegant table we have created for you.

<table>
<thead>
<tr>
<th>WEEK 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Days Of The Week</strong></td>
</tr>
<tr>
<td>Day 1:</td>
</tr>
<tr>
<td>Day 2:</td>
</tr>
<tr>
<td>Day 3:</td>
</tr>
<tr>
<td>Day 4:</td>
</tr>
<tr>
<td>Day 5:</td>
</tr>
<tr>
<td>Day 6:</td>
</tr>
<tr>
<td>Day 7:</td>
</tr>
</tbody>
</table>

**Making the numbers look cool in your pedometer chart**

Remember we said we’d teach you how you can make these numbers look really cool in a groovy chart? Well, now is the time. You may have had some experience doing something like this before (probably in your high school maths class), and it’s as easy as a-b-c once you get the hang of it! The chart will be helpful for you and your child because it will make the numbers look more meaningful, and help us all to understand what kind of activity habits your child has.

Firstly, we recommend that you spend some time with your child decorating the chart as it is going to be hanging on the wall for a while and you want it to look cool and funky. This also gives you a chance to explain to your child a little of what the chart is about.
and how it is going to work (which will be explained in a jiffy!). You can use the stickers we have given you to decorate the chart or you can make up your own funky decorations if you like. Most importantly, have fun!

Now, all you need to do is find a place in your house to hang your beautiful chart! It’s best to hang it somewhere in the house in a prominent position. Maybe in your child’s bedroom, or maybe somewhere in the kitchen where everyone can see, and be proud of the progress your child is making!

As you can see, along the right side of the chart is the label for the Y-axis, “How Much Movin’ You Doin’!” This axis represents the number of steps that the pedometer records on a daily basis letting us know how active your child has been.

You will also have noticed the line along the bottom of the chart. This is the X-axis and it represents the number of days you are on the program. This has also been subdivided up into how many weeks that involves.

Ok! So, now you know what some of the bits and pieces are on the chart, let’s start to make some meaning out of all your excellent work you’ve been doing for the last two weeks! The idea now is to plot the points from your elegant tables from the last two weeks onto the chart. For example, if on day 1 in week 1, your child clocked up 5,000 steps, then you would put a red spot on the grid point that lines up with Day 1 on the X-axis and the number 5,000 on the Y-axis. So, it should look something like the picture on the left.

And, if on day 2 your child did 5,040 steps, you would put a red spot on the grid that lines up with day 2 on the X-axis and 5,040 on the Y-axis. Are you getting the hang of it yet? That’s the way! Now you can go ahead and plot all the points from your tables for week 1 and week 2. You might like to get your child to help you with this so they understand what the chart represents too.

Great! We hope you guys had fun with that. And now your numbers have been transformed into what may look like a line. Sure, maybe it’s a bit of a wobbly line, but that’s ok. That’s what we expect to see at this stage. See if you can see the line going in a direction, is it going up, or is it going down? Maybe it goes up and then down, and then up again! That’s great too! What you are starting to see here is a pattern of your child’s activity levels, with all the ups and downs like most people have in their lives. Some days are very active and some days are not very active at all.

You can also see how the X-axis (and this manual) is divided into three more sections; “Seeing How Much Movin’ You Doin’”, “Now You’re Movin’ It!” and, “You Gotta Keep On Keep On Movin’ It”. These titles help you know what part of the program you are in. In the first part (which is what you have just been doing) you didn’t do anything different and just monitored your child’s activity levels (which you can now see on your beautiful chart!).

**Getting ready for the next stage**
In the next part, “Now You’re Movin’ It!” things will be a little different and you will be encouraging your child to get movin’ more and more. In this section, we will calculate an average of how much your child has been movin’ it in the previous week and use that average (indicated by a big line on that section of the graph) as a guide on how much they will aim to ‘move it’ in the next week.

If your child can *beat* their own average from the week before, then you can mark the daily record with a red dot on their graph. If they didn’t manage to get over their average then mark the daily record with a blue dot.

Take a look at the grid below. This is an example of what yours will look like with the red and blue dot system and the average line that is the line to beat! This system will be a useful way for you and your child to know when they have moved more or less than the week before.

![Grid Example]

This is important because in this part of the program, the idea is for your child to find ways in their day to try and move more and more than the week before! And, if they have been able to improve on most days during the week, then they will receive a prize from the Lucky Dip!!

Yes, this is where the prizes come in!! The researcher will visit your house at a time that is suitable for you and your family, and spend some time talking with you and your child about how they have been Movin’ It! during the week. The researcher will then get to see how many red dots are on the chart and if there are three or more, then your child will be able to have a grab from the bag of goodies in the Lucky Dip! If there are six or more then your child will get to have **two** lucky dip prizes!

If there are more blue spots than red spots on the chart then the researcher will spend some time with you and your child in a **Movin’ It Meeting**, and try to help you find ways for your child to be more active, and maybe find out some of the reasons why they are not getting more red spots.

In the last part of the program, “You Gotta Keep On Keep On Movin’ It!” things will be the same as the middle part but we will give you the chance to find out how you can do that part by yourself, so we can all see how much you and your child would have learned from being on the program. We’ll tell you more about this part later on in this manual.

Ok now you are out of the “Seeing How Much Movin’ You Doin’!” part of the program and are about to start the “Now You’re Movin’ It!” part.

Yeeehaa!

It’s time to start Movin’ It!
Yeehaa......

Now You’re Movin’ It!: Intervention Period
Yeehaa......

Now You’re Movin’ It!

Intervention Period

Week 3

Now you are an expert on charting your child’s activity levels, you don’t need to worry about using the elegant tables anymore. At the end of the day when you would usually take the pedometer readings, you can simply put either a blue or a red spot on the grid that lines up with the corresponding steps that your child had accumulated for that day. This makes the process more transparent for you and your child and can be a fun little activity that need not take more than a couple of minutes each day. YAY!

Remember to always reset the pedometer after each reading and keep it fastened securely to your child’s clothing.

How to encourage my child to move it more and more

Now, just if you thought you’d smoothed out all the bumps from the last two weeks, we are going to make things a little different again. It’s a bit sad if your child keeps getting blue dots on their chart, instead of red dots. Because;

Red dots = good

Blue dots= not so good.

Because the more red dots on your chart at the end of the week, then the more chance your child has of taking a grab from the Lucky Dip! And the only way to get more red dots on the chart is by – yep, you guessed it – Movin’ It!

So how do you get your child to get Movin’? Well it’s not easy. And it’s not really something you can bug them about either. This is an opportunity for your child to decide to get movin’ for themselves, and if they do, then they will get rewarded for it. Because you want your child to be able to get movin’ more and more, without you having to nag them to do it, don’t you? Well, then this is your chance.
There are lots of things parents can do, to help their child to be more active in their everyday lives. There are probably many things you are doing already, and we also told you about some of things parents can do at the beginning of this manual. But because your child is overweight for their age and height, we want to help get your child movin’ more and more, to help your child grow up strong and healthy.

We will be encouraging you to ask your child, in a positive and curious way, “What can you do in your day to get your steps up?” By encouraging your child to look for opportunities in their day to be more active, we and you are encouraging them to take responsibility for their lifestyle, and to choose times and places that suit them, when they want to be active.

This is a very important process for all children as they grow up, and especially for children who are overweight. Because it is NOW, that we can build a good foundation for them to develop healthy lifestyle habits, like being more active in their everyday routine. By asking your child what they can do for themselves, we are also giving them the opportunity to find out what works for them in their environment and find out what is naturally reinforcing for them. And once they’ve found that natural reinforcing activity, then they never look back!

Obviously, as you would know if you have ever tried to do something different, it takes some time to get used to doing more and more every day. And some days we just don’t feel like doing ANYTHING! But that’s Ok; we are only human after all! It is in these moments when you as the parent can step in and help them when their motivation is lagging. You can help them figure out what they want and try to help them see it through to happening. Because like all of us, a little support and encouragement can go a long way.

It is also very important to remember that we are encouraging children that it only takes small changes each day, to aim for big improvement at the end. It’s like someone who wants to me an expert athlete high jumper. You can’t jump over the highest pole at the start. You need to practice at lower levels until you get good at it and it becomes easy. Then after all that practice, you are ready to move on to something higher. So this is what we are trying to encourage in the Movin’ It! Program. Tiny changes each day. That’s not too hard is it? Naaaah!

Maybe you can help your child by being active with them. And maybe it will be the extra time they spend with you doing something fun that becomes the natural reinforcer! Or maybe they find that being in the outdoors is naturally reinforcing for them, but they needed some help to find that out, by being taken to a beautiful place that you know about to go and play and run about!
The possibilities are endless really. Perth is an amazing place for participating in leisure activities! There is so much on offer right in our back yards.

And being active doesn’t always have to be about leisure. We can make it just part of our regular habits. The things that we just have to do anyway - like going to school – can be great opportunities for being more active. May children have bikes or are good walkers, and can use the time to travel to school as a perfect opportunity to get more steps in their day. Walking to and from school is fun and safe and also helps kids have energy for the rest of the day!

And the more you ask your child,

“**What can you do in your day to get your steps up?**”

- in a supportive and curious way, well, you just never know what genius little things their highly adaptive minds will come up with!

It’s important to ask this question in a positive way, so that your child knows that you are being supportive towards them and that you understand the challenge they are faced with.

Sometimes it’s easy to say it in a way that tells them that you just don’t want to help them. So, when you ask them, make sure you can give them some time to help them figure out what they can do to be more active. So they know that you are actually being supportive. You don’t have to give them the answers (in fact it’s much better if they figure it out themselves), but they may just need you to sit with them so they can talk about it and share their ideas with you.

A little support and encouragement can go a long way!

So, now you got the idea?

That’s right! You got to keep movin’ it to get red dots!

If there are less than three red dots on your chart then the researcher will need to have a Movin’ It! meeting with you and your parent to help you figure out what’s going on and why there aren’t more red dots on your chart. If there are three or more red dots on your chart then the researcher will want to have a Movin’It! Prize time! So that she can give you a chance at the Lucky Dip to reward you for being so BRILLIANT at movin’ it more and more!
See how many red dots you can get for this week and the researcher will come to your house to check your progress.

Remember:

3 or more red dots = Movin’It! Prize time!

6 or more red dots = A Double Movin’It! Prize time!

**How do I to get more red dots?**

Well, it’s just like a compass reading…

If you make a small difference at one point, then it can lead to a big difference later on. And it’s the same when we get Movin’! If we do just one more thing everyday and keep on doing it, then it can lead to bigger and better things later on. Each week we will help you think of little things you can do to get more red dots. Because we know that movin’ it is good for us, now all we have to do is just keep on, keeping on Movin’ it! It’ll only take small changes each day and you can keep on getting red dots.
## WEEK 3

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<th>Days Of The Week</th>
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<td><strong>Things I could do to Move It more…….</strong></td>
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</table>
Ok. Well done! So, you’ve made it to the fourth week! And last week was when the real work began. I hope you’ve been able to get lots of red dots on your chart! Because remember, the more red dots you get each week, then the more prizes you get each week. We hope you got a prize! If you didn’t get a prize, we hope you got a chance to have a Movin’ It Meeting with your researcher to try to figure out more ways you can move it, and get more red dots!

So, what things have you been doing to get your body Movin’ It! more? Maybe it’d be helpful to write some of them down in the elegant table we have created for you, below. Writing them down, will help you and the researcher know what things you did, if you liked or didn’t like them, and if you want to keep doing them. You can also write down ideas that you might like to try, but don’t know how to organise it by yourself. Then, when the researcher comes over each week, we can all sit down and try to find out how to do the things you want to do.

Things you can write in your table could be as simple as “I walked up the stairs twice – going up and then down again and then up again!”

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<td><strong>Things I could do to Move It more…..</strong></td>
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</table>
Ok. Another big Clap for you!

You’ve made it to the fifth week now!
We knew you could do it!
So, how is your chart looking?
Lots and lots of red dots I bet!

We hope you got a prize for your efforts last week! If you didn’t get a prize, we hope you got a chance to have a Movin’ It Meeting with your researcher to try to figure out more ways you can move it, and get more red dots!

So, what things have you been doing to get your body Movin’ It! more? Don’t forget to write them down in the table below. You can also write down ideas that you might like to try, but don’t know how to organise it by yourself. Then, when the researcher comes over each week, we can all sit down and try to find out how to do the things you want to do. Things you can write in your table could be as simple as, “I took the rubbish bin to the curb, and then I took it back to the house and did it again, just to get my steps up!”

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<td><strong>Things I could do to Move It more</strong></td>
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</table>
Week 6

Yeahaaa!
I bet you’re really starting to get your body movin’ it now!

You’ve made it to the sixth week! That is super dooper amazing, and you should give yourself a pat on the back! We knew you could do it!

So, how is your chart looking?
We hope you got a prize for your efforts last week! If you didn’t get a prize, then you may know what’s happening and we hope you got a chance to have a Movin’ It Meeting with your researcher to try to figure out more ways you can move it, and get more red dots!

So, what things have you been doing to get your body Movin’ It! more? Don’t forget to write them down in the table below. You can also write down ideas that you might like to try, but don’t know how to organise it by yourself. Things you can write in your table could be as simple as, “When I was not busy doing anything active, I jumped up to help my parents when they asked me to help them”

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<td>Things I could do to Move It more......</td>
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Week 7

Giddy-up!
I bet you’re really starting to get your body movin’ it now!
You’ve made it to the seventh week!

That is Ecstatic Fantastic!!

You should be really proud of yourself for all the work you have been doing.
May you are noticing you feel different. That’s fine if you do. Remember we are making some little changes, in little steps day by day. And now it’s been seven weeks, you may be just starting to notice these. You can talk to your researcher and family about these changes if you notice any.

So, how is your chart looking?
We hope you got a prize for your efforts last week!
Don’t forget to write down what you’ve been doin’. Remember, things you can write in your table could be as simple as, “I went to the park and played with my friends after school.”

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<td><strong>Things I could do to Move It more......</strong></td>
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Week 8

Yo! Bag of beans!
You must be really starting to get your body movin’ it now!
You’ve made it to the eighth week already!

That is Thrillin’ Incredible!!

You should be really proud of yourself for all the work you have been doing.

So, how is your chart looking?
We hope you got a prize for your efforts last week!
Don’t forget to write down what you’ve been doin’. Remember, things you can write in your table could be as simple as, “I tried to see how fast I could clean up my room. And then the next time I tried to do it faster”

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<th>WEEK 8</th>
<th>Days Of The Week</th>
<th>What you doin’ to get your body Movin’ more?</th>
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<td>Things I could do to Move It more......</td>
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Yo!
How’s it going Movin’ It Master?!
You’ve made it to the ninth week already!

That is Tremendous Movin’endus!!

Make sure you give yourself a pat on the back for all the work you have been doing.

So, how is your chart looking?
We hope you got a prize for your efforts last week!
Don’t forget to write down what you’ve been doin’.
Remember, things you can write in your table could be as simple as, “I offered to help mum around the house just to get my steps up!”

| WEEK 9 |
|-----------------|----------------------------------|
| **Days Of The Week** | **What you doin’ to get your body Movin’ more?** |
| Day 1: | |
| Day 2: | |
| Day 3: | |
| Day 4: | |
| Day 5: | |
| Day 6: | |
| Day 7: | |
| **Things I could do to Move It more…….** | |
Week 10

YAY! YAY! You Super Dooper, tremendous Movin’endus! You are now half way through the program! So how do you feel? Do you notice any changes in your body? Maybe you don’t see anything different, but maybe you feel different. Well, we think there might be some changes going on so we want to check them out and see how you are doing on the program. It’s time to come and visit us at the university. See you soon!

How is your chart looking? We hope you got a prize for your efforts last week! Don’t forget to write down what you’ve been doin’. Remember, things you can write in your table could be as simple as, “I chose not to use the remote control when watching TV, so every time I changed the channel I had to get up off the couch and move to the TV!”

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<th>WEEK 10</th>
<th>Days Of The Week</th>
<th>What you doin’ to get your body Movin’ more?</th>
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Yo!
How’s it going Movin’ It Master?!
You’ve made it to the eleventh week! That’s more than half way!

That is Fabulously Fantastic!!

Make sure you give yourself a pat on the back for all the work you have been doing.

So, how is your chart looking?
We hope you got a prize for your efforts last week!
Don’t forget to write down what you’ve been doin’ to get movin’.
Remember, things you can write in your table could be as simple as, “I made up a game I can play by myself in my backyard”

| WEEK 11 |
|------------------|--------------------------------------------------|
| **Days Of The Week** | **What you doin’ to get your body Movin’ more?** |
| Day 1:              |                                                   |
| Day 2:              |                                                   |
| Day 3:              |                                                   |
| Day 4:              |                                                   |
| Day 5:              |                                                   |
| Day 6:              |                                                   |
| Day 7:              |                                                   |
| **Things I could do to Move It more**** |   |
Week 12

Yo! Bag of beans!
You must be movin’ it without even noticing it!
This is now the twelfth week!

You are marvellous at Movin’ It!

You should be really proud of yourself for all the work you have been doing.

How is your chart looking?
We hope you got a prize for your efforts last week!
Don’t forget to write down what you’ve been doin’ to get movin’.

Remember, things you can write in your table could be as simple as, “I helped my parents around the house to get my steps up”

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<td>Things I could do to Move It more......</td>
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Week 13

Yeahaaa!
How’s it going Master Mover?

You’ve made it to the thirteenth week!
That is super dooper amazing, and you should give yourself
a pat on the back!
We knew you could do it!

So, how is your chart looking?
We hope you got a prize for your efforts last week!
If you didn’t get a prize, then we hope you figured out some things at the Movin’ It
Meeting with your researcher to try to get more red dots!

So, what things have you been doing to get your body Movin’ It! more? Don’t forget to
write them down in the table below. You can also write down ideas that you might like
to try, but don’t know how to organise it by yourself. Things you can write in your table
could be as simple as, “I took the rubbish bin to the curb, and then I took it back to the
house and I did it again three times just to get my steps up!”

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<td>Things I could do to Move It more......</td>
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</table>
Hey, Hey, Giddy-up there!
You must be movin’ it without even noticing it!

You’ve already made it to the fourteenth week!
That is Ecstatic Fantastic!!

You should be really proud of yourself for all the work you have been doing.
Remember we are making just small changes every day to be better little by little. I wonder if you are feeling strong and healthy. Maybe you can do things now that you didn’t use to do before.

So, how is your chart looking?
We hope you got a prize for your efforts last week!
Don’t forget to write down what you’ve been doin’. Remember, things you can write in your table could be as simple as, “I went to the park and played with my friends after school.”

| **WEEK 14** |
|---|---|
| **Days Of The Week** | **What you doin’ to get your body Movin’ more?** |
| Day 1: | |
| Day 2: | |
| Day 3: | |
| Day 4: | |
| Day 5: | |
| Day 6: | |
| Day 7: | |
| **Things I could do to Move It more......** | |
Week 15

Ok. Another big Clap for you!

You’ve made it to the fifteenth week now!
We knew you could do it!
So, how is your chart looking?
Lots and lots of red dots I bet!

We hope you got a prize for your efforts last week! If you didn’t get a prize, we hope you figure out more ways you can move it in your Movin’ It Meeting with your researcher.

So, what things have you been doing to get your body Movin’ It! more? Don’t forget to write them down in the table below. Things you can write in your table could be as simple as Things you can write in your table could be as simple as, “I made a game that every time someone in my family said someone’s name I would walk up to them and give them a big hug!”

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Week 16

Yeahaaa!

How’s it going Movin’ It Master?
Now it’s the sixteenth week! That is tremendously wicked!

You must have lots and lots of red dots on your chart now. We knew you could do it!

We hope you got a prize for your efforts last week! If you didn’t get a prize, then we hope you figured out some things at the Movin’ It Meeting with your researcher to try to get more red dots!

So, what things have you been doing to get your body Movin’ It! more? Don’t forget to write them down in the table below. Maybe you’re doing new things that you never did before. Well done!
You can also write down ideas that you might like to try, but don’t know how to organise it by yourself. Things you can write in your table could be as simple as, “I took the rubbish bin to the curb, and then I took it back to the house and I did it again three times just to get my steps up!”

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Week 17

Yo there Movin’ It Master?! You’ve made it to the seventeenth week! You must be movin’ it without even noticing it.

That is Tremendous Movin’endus!!

Make sure you give yourself a pat on the back for all the work you have been doing.

So, how is your chart looking? We hope you got a prize for your efforts last week! Don’t forget to write down what you’ve been doin’ to get movin’. Remember, things you can write in your table could be as simple as, “I did twenty star jumps on the spot to get my steps up!”

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<td>Day 6:</td>
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<td>Day 7:</td>
<td></td>
</tr>
<tr>
<td><strong>Things I could do to Move It more......</strong></td>
<td></td>
</tr>
</tbody>
</table>
We 18

YAY! YAY! You Super Dooper, tremendous Movin’endus! You have made it almost all the way through the program! So how do you feel? Do you notice any changes in your body? Maybe you don’t see anything different, but maybe you feel different. Well, we think there might be some changes going on so we want to check them out and see how you are doing on the program. It’s time to come and visit us at the university at the end of this week. See you soon!

How is your chart looking? We hope you got a prize for your efforts last week! Don’t forget to write down what you’ve been doin’ to keep movin’. Remember, things you can write in your table could be as simple as, “I chose not to use the remote control when watching TV, so every time I changed the channel I had to get up off the couch and MOVE to the TV!”

| WEEK 18 | |
| Days Of The Week | What you doin’ to get your body Movin’ more? |
| Day 1: | |
| Day 2: | |
| Day 3: | |
| Day 4: | |
| Day 5: | |
| Day 6: | |
| Day 7: | |
| Things I could do to Move It more...... | |
You Gotta Keep on, Keep on Movin’ It!:

Maintenance Period
You Gotta Keep on, Keep on Movin’ It!

Maintenance Period

**Week 19**

Well done!! You have made it all the way through the Movin’ It! Intervention period!! That is something superb!!

But now something is going to change. You would have said all your “goodbyes” to your researcher at the University, because now she is not coming over to your house anymore. But that’s not because she doesn’t care any more!! In fact she cares SO much about seeing you grow up to be fit, healthy and strong that she wants to see if you can do it like the bigger kids now, and do it by yourself. So now there won’t be anymore Movin’ It Meetings and you will will need to ask your self:

“What am I gonna do to keep on Movin’ It?”

Of course, if you have problems you can always ask your parents for help and ideas - because they will always be there for you.

It’s important to keep on movin’ it because this is what we do – our bodies are built for movin’ it! And we do it because we want to do things! Try to think of all the things you want to do with your body. May be you want to be an athlete, or a mountain climber, or a fire-fighter, or an astronaut or a you want to do a Bungee jump, or

Make sure you still use your chart because this is how you will know whether you are Movin’ It more and more. Also, don’t forget to write down what you’ve been doin’ to keep movin’. This can be helpful for remembering new ideas you might get, and also to help you know what things you can do, and what things you want to do in the future.
Also, remember that:

“...it only takes small changes each day...to

<table>
<thead>
<tr>
<th>WEEK 19</th>
<th>Days Of The Week</th>
<th>What you doin’ to get your body Movin’ more?</th>
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<td>Day 1:</td>
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<td>Day 2:</td>
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<td>Day 7:</td>
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</tr>
<tr>
<td>Things I could do to Move It more......</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

424
Week 20

YAY! YAY! You Super Dooper, tremendous Movin’endus!
By the end of this week, you will have finished the program! Well done!
So how do you feel?
Do you notice any changes in your body?
Maybe you don’t see anything different, but maybe you feel different.
Well, we think there might be some changes going on so we want to check them out and see how you are doing on the program. It’s time to come and visit us at the university at the end of this week. See you soon!

How is your chart looking? Are you still keepin’ on with more that what you did before?
Don’t forget to write down what you’ve been doin’ to keep movin’.
Remember, things you can write in your table could be as simple as “I chose not to use the remote control when watching TV, so every time I changed the channel I had to get up off the couch and MOVE to the TV!”

<table>
<thead>
<tr>
<th>Days Of The Week</th>
<th>What you doin’ to get your body Movin’ more?</th>
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</thead>
<tbody>
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<td>Day 1:</td>
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<td>Day 7:</td>
<td></td>
</tr>
<tr>
<td>Things I could do to Move It more......</td>
<td></td>
</tr>
</tbody>
</table>
Week 21

Well, technically there is no formal week 21 in the Movin’ It! program, but there is in your life. Your Movin’ It! career doesn’t have to stop here. In fact everyone has to keep on keepin’ on movin’ for the rest of their lives. Remember, that’s what our bodies are designed to do. If you like, you can do more everyday, because we can always do more. Isn’t it great!

You can get yourself your own chart and keep it going for the rest of the year, and maybe start a new one next year!

The point is, now that you are movin’ it more than you were before, why stop now. I think you’ve become so excellent at getting yourself going and movin’ that it would be a shame to see all that talent disappear!

Maybe now that you are so good at movin’ you might like to join a team where you can really move it more with other people. Sometimes it’s really fun to move it with other people. Or maybe you like to move it by yourself too, so there’s nothing stopping you there, except you. So if you want to do it –all you have to do is just choose to do it!

Yeahaa, you’re now a Movin’ It superstar!

Just remember what Yoda says….

(Take out the poster on the next page and stick it on your wall so that you never forget)
“Do or do not.
There is no try.”
Fun and mundane activities
to keep you keepin’ on and Movin’ It!
Fun and Mundane activities to keep you keepin’ on and Movin’ It!

- I did twenty star jumps on the spot to get my steps up!
- I took the rubbish bin to the curb, and then I took it back to the house and I did it again three times just to get my steps up!
- I made a game that every time someone in my family said someone’s name I would walk up to them and give them a big hug!
- I went to the park and played with my friends after school.
- **I took the rubbish bin to the curb, and then I took it back to the house and I did it again three times just to get my steps up!**
- I helped my parents around the house to get my steps up
- I made up a game I can play by myself in my backyard
- I chose not to use the remote control when watching TV, so every time I changed the channel I had to get up off the couch and move to the TV!
- I offered to help mum around the house just to get my steps up!
- **I tried to see how fast I could clean up my room. And then the next time I tried to do it faster**
- I went to the park and played with my friends after school.
- I walked up the stairs twice – going up and then down again and then up again!
- I took the rubbish bin to the curb, and then I took it back to the house and did it again, just to get my steps up!
- When I was not busy doing anything active, I jumped up to help my parents when they asked me to help them

See what you can add to the list…..it may change as you grow more and more…
You can write down some ideas you have in this book……

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

Also, check out more ideas from the National Heart Foundation of Australia.
Don’t forget
To wear your
pedometer
Today!
Appendix C

The MIP “My Movin’ It Chart”; Example of a completed “My Movin’ It Chart”

The MIP “My Movin’ It Chart”: Activity data recorded in the MIP Manual was transcribed onto the participant’s “My Movin’ It Chart” which showed a graphical representation of the activity data that had to be displayed in a prominent position in the house. Baseline values for steps were different for each child, thus the scale of the Y axis was left blank until a better idea of the habitual level of PA the participant was capable of. Charts were decorated individually by each participant.

Figure C.1 “My Movin it! Chart” used from week 10 to 18 of the intervention phase. Example of a completed “My Movin’ It Chart”:  

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Figure C.2. Example of a completed “My Movin it! Chart” used for baseline phase and up to week nine of monitoring.

Figure C.3. Example of a completed “My Movin it! Chart” used from week 10 to 18 of the intervention phase.
Appendix D
The MIP “Things I do after school...” poster

Figure D.1. An example of the “Things I do after school...” Poster (and its components) created by the researcher. Participants could select from a list of activities (that they helped to create) what they would agree to do each afternoon. They could also select how they would reward themselves when they had completed their selected activities.
Appendix E
Special MIP Vouchers to be offered in Lucky Dip bag

**Figure E.1** Example of a special MIP voucher created by the researcher for an item or activity preferred by the participant was put in their lucky dip bag.
Appendix F
The MIP weekly behavioural consultation protocol form

The MIP behavioural consultation protocol form - a single-page pro-forma data sheet and checklist to be completed at each weekly behavioural consultation meeting with participants during the intervention phase. The sheet contained space to write down pedometer data for that week, along with anecdotal evidence of what activity behaviours had been engaged in by the participant.
The Movin’ It! Program: Behavioural Consultation

Week Beginning (Date): ________________ Home Visit Day, time: ____________

Participant’s Name: _________________________ Parent’s Name: _______

<table>
<thead>
<tr>
<th>WEEK</th>
<th>Days Of The Week</th>
<th>How much movin’ you doin’</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Steps/ km</td>
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<td>Day 1:</td>
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<tr>
<td>Day 7:</td>
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</tbody>
</table>

Step Goal / Average to maintain: ______________________________________

Is there anything that happened that may account for any spikes or dips in activity levels?
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

This week has your child:
Had any visits to the doctor? ______ Why? ________________________________
Experienced any illness symptoms (for example, coughs, colds, rashes etc.)? -
________________________________

Taken any ½ days off school? ________________ Taken any medications?
________________________________

Any Other Problems?
______________________________________________________________________
______________________________________________________________________
Appendix G
Information and consent forms for parent and participants in the HAPPE

Information letter for experimental ‘Ped + HAPPE’ group participants:

The H.A.P.P.E. Classroom Project
Health and Programmed Physical Education (H.A.P.P.E.) in the Classroom

What’s it all about?
In June 2001, the Premier of Western Australia announced a target of raising the level of physical activity in the state by 5 percent over 10 years. The Physical Activity Taskforce was introduced to develop a strategy to fulfil this goal, which was intended - as part of a combined effort- to address the declining level of physical activity in Western Australia.

Researchers at Murdoch University’s School of Psychology are currently evaluating a new physical activity program aimed at monitoring and increasing the physical activity levels of children. Our research hopes to find out more about typical children’s daily physical activity requirements and how this relates to their healthy development and wellbeing. Research so far has found there is a wide range of activity levels among children, and those who do more seem generally healthier. Yet, there is much more we need to know if we are to achieve the Premier’s goal. To help find answers we are inviting schools to take part in The H.A.P.P.E. Classroom Project – a development project aimed at understanding more about the current everyday activity levels of typical children and its relation to healthy weight, development and wellbeing.

Your child’s school would like to be involved in this research and is giving your child the opportunity to take part with other children in his or her class. If you consent to your child taking part, he/she will be given a pedometer (a small device worn on the waistband that is used to measure your child’s steps) that he/she will wear every day for 8 weeks in Term 3. Your child (along with the other children in his/her class) will also be given a brief fitness and body composition assessment (including weight, height and waist/hip measurements, skin fold measures, and a heart rate and blood pressure check).

These measures will take place at school in Term 3. Children will be asked to wear shirt and shorts or shirt and skirts so that the pedometer can be fastened appropriately to his/her waistband. Also, the child’s shirt will be raised slightly (no more than two inches) to take a skin fold measure just above the belt. If children are wearing a jacket or overcoat on the day of measurement, they will be asked to remove these during time they will have their measures taken. All physical measures will be taken in private with two researchers present in the room. You and your child will also be asked to fill out some questionnaires related to your child’s health and well-being and general lifestyle. Your child will complete his/hers at school while yours will be sent home shortly.
Your child’s class will also take part in The H.A.P.P.E. Classroom Project – Class Challenge to increase activity levels. The class challenge involves each child being given systematic feedback about his/her activity levels from the pedometer (in the form of a graph), to encourage the class to see how much they can increase their activity levels together as a whole group. Your child will be rewarded, along with other children in his/her class, for wearing his/her pedometer every day for the duration of the project and for trying to increase his/her activity levels during the class challenge. Feedback about your child can be provided on your request, otherwise all information relating to you and your child will be kept strictly confidential, and only group data will be reported. Feedback about the overall results of the project will be available later in 2009 when data collection has been completed.

If you and your child are willing to participate in this study, please complete the details on the next page, and return the form to school with your child by the date shown. Participation can only be accepted if children have returned their signed consent forms. My supervisor and I are more than happy to discuss with you any concerns you may have about how this study is being conducted. Alternatively, you can contact Murdoch University’s Human Research Ethics Committee on 9360 6677.

Cath Price, Co-Investigator
School of Psychology
Murdoch University
Email: C.Price@murdoch.edu.au
Mobile: ++ 61 (0)424 611 715
Information letter for control ‘Ped Only’ group participants:

Do you know if your child is doing enough physical activity each day? Take part in…

The HAPPE Project
from Murdoch University
...and find out!

In order to learn more about children’s daily physical activity requirements we are looking for children to take part in The HAPPE Project – a development project aimed at understanding more about the current everyday activity levels of typical children and its relation to healthy weight, development and wellbeing.

Your child has the opportunity to take part in this research with other children in his or her class. If you consent to your child taking part, they will be given a brief fitness and body composition assessment (including weight, height and waist/hip measurements, skin fold measures, and a heart rate and blood pressure check). These will take place at school during Term 3, 2007.

You and your child will also be asked to fill out some questionnaires related to your child’s health and well-being and general lifestyle. (These will be sent home shortly). Feedback about your child can be provided on your request, otherwise all information relating to your child will be kept strictly confidential, and only group data will be reported.

If you and your child are willing to participate in this study, please complete the details on the next page, and return the form to school with your child by …...

If you have any questions about this project, please feel free to contact either myself, Cath Price, by email or on 0424 611 715, or my supervisor, Assoc. Prof. David Leach, on 9360 2703. My supervisor and I are more than happy to discuss with you any concerns you may have about how this study is being conducted. Alternatively, you can contact Murdoch University's Human Research Ethics Committee on 9360 6677.

Cath Price
The Movin’ It! Project
School of Psychology
Murdoch University
Email: C.Price@murdoch.edu.au
Mobile: ++ 61 (0)424 611 715
Consent form:

**The HAPPE Project** Parent Consent form:

I have read the information on the previous page and any questions I have asked have been answered to my satisfaction.

I agree for my child, ________________________,

and myself ____________________,

to take part in The HAPPE Project,

however, I know that I may change my mind and stop at any time.

I understand that all information provided is treated as confidential and will not be released by the investigator unless required to do so by law.

I agree that research data gathered for this study may be published provided my name or other information which might identify me is not used.

Name of Parent/Legal Guardian:

____________________________________

Signature: _______________ Date: _______

Name of Child: ___________________

Signature: _______________________

Please have your child return the signed form to his/her class teacher at school by ..............................

Thank You!

Cath Price

The Movin’ It! Project
School of Psychology
Murdoch University
Email: C.Price@murdoch.edu.au
Mobile: ++ 61 (0)424 611 715
A handout with written instructions regarding the pedometer and its safe keeping was read aloud to the class and participants were asked to take it home to show their parents.
Dear Parent,

Thank you for consenting to your child taking part in the H.A.P.P.-E. Classroom Project with his/her school mates. As part of the project, your child has been given a pedometer that will measure his/her steps, to help us understand his/her typical, daily physical activity levels over the course of 7-8 weeks.

To get the most out of your child wearing the pedometer it helps to follow some simple instructions, as outlined below. By following these instructions, you are helping us make sure we are getting an accurate reading of your child’s typical activity levels.

**How to wear the pedometer**

- The pedometer can be clipped to any waistband on clothes. For example; a skirt, trousers, track pants, tights, jeans, and even on a belt.
- Make sure your pedometer sits directly on the front of the right hipbone, and in line with the right kneecap. In this position the pedometer will give the most accurate reading. The pedometer must stay upright to work correctly.
- If wearing a dress or other clothing that doesn't have a waistband, clip the pedometer to the waistband of the underwear.
- Take care that your pedometer does not slip around on the waist band (e.g., around the side or back of your waistband), as the pedometer will not count all the steps you take.
- Clip the safety strap to a part of your clothing (e.g., the waistband) to ensure the pedometer is not lost if it comes away from your waistband.

**How not to wear the pedometer (or it won’t count properly!)**

- Do not put the pedometer in the pocket of your clothes.
- Do not attach the pedometer via the security strap only.
- Do not wear the pedometer on a slanted pocket.
- Do not attach the pedometer near the belly button. Position it closer to the hip.
- Do not attach the pedometer where the tummy causes it to tip over (out of the vertical position). If your tummy protrudes, position the pedometer on the side of the hip where it will remain upright.

Remember, ensure the pedometer is vertical and not angled sideways or forwards, otherwise it will not accurately record your child’s step count.
When to wear the pedometer

- Every day!
- Even on the weekend!
- Put it on in the morning as soon as you are dressed and take it off in the evening when you get undressed and ready for bed.
- It is very important that only the child who has been selected to take part in the H.A.P.P-E. Project is the only person who wears the pedometer.

When not to wear the pedometer

- In bed
- When playing very “rough and tumble” sports like wrestling or judo
- In the pool
- In the shower

Taking Care of the Pedometer:

- Report to the teacher or the researcher when you think something is wrong with the pedometer, or if it gets lost - we don’t have many spare but we will try to replace it.
- Don’t get it wet!
  - Make sure it is not attached to clothes that are going in the washing machine.
  - Do not swim with it.
  - Also, take care in the rain and that it is not getting too soaked (it can handle a few drops).
- If you are interested to see what the step count is, it is OK to look inside the pedometer. Take care when opening and closing the pedometer cover.
- Don’t press any of the buttons inside the pedometer. Some of the buttons, when pressed, will reset the pedometer counter and will go back to zero! and we will lose all the activity that has been counted previously.

<table>
<thead>
<tr>
<th>Activities that will count lots of steps on the pedometer:</th>
<th>Activities that don’t count many steps on the pedometer (unfortunately):</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Walking</td>
<td>- Swimming (!)</td>
</tr>
<tr>
<td>- Jumping</td>
<td>- Riding a bike</td>
</tr>
<tr>
<td>- Skipping</td>
<td>- Riding a scooter</td>
</tr>
<tr>
<td>- Hopping</td>
<td>- Skateboarding</td>
</tr>
<tr>
<td>- Running</td>
<td>- Rollerblading (this may work, but not as accurately)</td>
</tr>
<tr>
<td>- Jogging</td>
<td>- Any kind of physical activity that involves sitting, or where the feet are not touching the ground.</td>
</tr>
<tr>
<td>- Dancing</td>
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<tr>
<td>- Sports – athletics, netball, basketball, football, tennis, soccer, etc.</td>
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<tr>
<td>- Basically, anything you do with your two feet on the ground.</td>
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</table>
If you shake it, we have to take it!
Shaking the pedometer on purpose severely affects the accuracy of our data. We will not be able to use data from pedometers that have been shaken on purpose and we will have to ask for the pedometer to be returned if we find this to be the case. This is simply because we are trying to get a measure of typical daily activity levels of Australian children, and including data from pedometers that have been purposely shaken will provide misleading results. Please ensure that only the child who has been selected to take part is the only person who wears the pedometer.

Best of Luck, and Thank you!
If you have any comments, questions or problems, please contact:

Cath Price, Co-Investigator
School of Psychology Email: C.Price@murdoch.edu.au
Murdoch University Mobile: ++ 61 (0)424 611 715
Appendix I

“My Climb to Mt Fuji” Chart (experimental condition)

Figure I.1. Example of a “My Climb to Mt Fuji” Chart used in School A, Trial 1 (Pilot).

Figure I.2. Example of a “My Climb to Mt Fuji” Chart used in School B, Trial 2.
Figure I.3. Example of a “My Climb to Mt Fuji” Chart used in School B, Trial 3.

Figure I.4. Example of a “My Climb to Mt Fuji” Chart used in School B, Trial 4.
Appendix J

“My Activity Levels” Chart (comparison condition)

NOTE: ‘My Activity Levels’ Charts were only provided to participants in the comparison group at the end of the monitoring phase (i.e., at the end of term).

Figure J.1. “My Activity Levels” Chart used in the School A, Trial 1 (Pilot).

Figure J.2. “My Activity Levels” Chart used in School B, Trial 2.
Figure J.3. “My Activity Levels” Chart used in School B, Trial 3.

Figure J.4. “My Activity Levels” Chart used in School B, Trial 4.
Appendix K
The ‘Climb Mt Fuji’ Poster

**Figure K.1.** The “Climb to Mt Fuji” Poster displayed in the Experimental classroom (Blank).

**Figure K.2.** The “Climb to Mt Fuji” Poster displayed in the Experimental classroom (in use).
Appendix L
All versions of the HAPPE Teachers’ Manual

The draft of the Teachers’ Manual used in School A, Trial 1 (Pilot):

The Movin’ It!

Project

School of Psychology

Teacher’s Manual

2007

Project Contacts

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How the project will contribute to scholarly knowledge 14

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The project outline - In brief

There is currently a wide interest in the physical activity (PA) of children, but little understanding of its environmental and personal control. Physical inactivity is hypothesised to be a contributing factor to the development of a variety of diseases, including obesity and Type 1 and Type 2 diabetes, and an important factor in bone development, learning and school performance, cognitive health, and health risk behaviours (Dencker, et al., 2005; Rippe & Hess, 1998). In adults, a lack of physical activity is second only to tobacco as the leading contributor to the overall burden of disease among Australians (Armstrong, Bauman & Davies, 2000).

The rapid increase in childhood obesity and being overweight since the 1980’s; combined with today’s relatively sedentary lifestyles has now come into sharper political focus (NHMRC, 2003). Presently there are governments around the world mandating certain levels of physical activity for school children. However, it is not clear what evidence these recommendations are based on. Many have concluded that children’s physical activity levels have declined over the past 20 years (Dollman, et al, 2005; Luepker, 1999; Rippe & Hess, 1998), with popular ideas presented in the media that today’s children are part of a “couch-potato generation” (Gard, 2007). However, it is not possible to describe physical activity trends conclusively because of the absence of objective, reliable normative data (Dollman, et al., 2005).

Presently, there is little consistency in identifying and measuring variables that control children’s PA levels (Wilkin, et al, 2006). Anecdotal evidence would suggest that an increasingly sedentary lifestyle, including TV viewing, computer time and the increase in the use of labour saving devices that have contributed to children’s
assumed decrease observed PA levels. However, recent research, by Wilkin et al (2006), has suggested that variations in children’s physical activity levels could be explained by some internal mechanism of regulation (like the “appestat”, which controls appetite), rather than the different external environments and/or opportunities for PA. This is referred to in the literature as the “activity stat” hypothesis.

It is generally acknowledged by the research that there is a wide range of activity among children and those who do more seem generally healthier. Yet the big questions remain – Can children increase their habitual overall levels of daily PA? What is the best way to prompt inactive children to do more consistently over time? Does being more active affect measures of weight, fitness and well-being in primary-aged children? And, what levels of activity are adequate for maintaining healthy ranges of weight, fitness level and well-being indicators at different ages through the primary school years?

The Movin’ It! Project hopes to shed some light on these questions by collecting daily physical activity data from over 100 primary school children (using pedometers) and correlating this data with physiological measures (Body Mass Index (height and weight); skin fold; hip and waist circumference; cardiovascular fitness levels and blood pressure) as well as other variables related to psychological health and well-being (for example, Child Depression Inventory; Pier’s Harris Self-Concept scale; Revised Child Manifest Anxiety Scale; Conners’ Parent Rating Scale; and a Family Circumstance Questionnaire). Participating children will be required to wear a pedometer during all their waking hours for nine weeks in Term 3 or Term 4, with a two week follow-up period for both groups in Term 1, the following year.

The project also aims to investigate the possibility of changing PA levels in children, including those children who are already active and those who are inactive, through a planned, cost-effective intervention - The Movin’ It Project – which takes the form of a program, created and trialled by myself, that has been designed to increase children’s daily physical activity levels at school and at home. It aims to increase daily levels of physical activity through changing daily habits and activities, and does not necessitate special sports or training. The Movin’ It! Project is a teacher implemented behavioural program designed to increase children’s PA levels as a result of the systematic dissemination of feedback regarding individual and group PA levels (for
pedometer recordings) and both individual and group participation in goal setting on a
daily basis in the classroom.

The evaluation of a school-based intervention – using a minimal, low-cost approach to
increase activity levels with a large cohort of children – will allow us to examine the
proportion of typical children who may benefit and the proportion of children who do
not benefit (as defined by increased activity levels, improved psychological and/or
body composition measures) from changes in their daily activity patterns without
specially arranged exercise programmes (for example, aerobics; gym activities). This
will then enable an analysis of factors that may predict the numbers and characteristics
of children likely to benefit from such school-based interventions. The information
will also improve our understanding of what controls children’s overall PA levels and
identify individual and contextual factors that support higher levels of children’s
physical activity on a daily basis.
The questions we hope to answer

Specifically the project aims to answer the following questions:

1. What are the current daily physical activity levels – as measured by a pedometer – in a sample of ‘typical’ West Australian primary school-aged children from Year 2 and Year 3?
2. Do levels of physical activity at school and out of school have an inverse relationship?
3. What relationships exist between activity levels and other physical, psychological and contextual measures, including height, weight, BMI, waist and hip circumferences, skin-fold thickness, blood pressure, resting heart rate, depression, self-esteem, peer acceptance and parent ratings of adjustment, transport to school, parental BMI, family circumstance?
4. Can children’s daily activity levels be increased over the long-term using the feedback of pedometer readings, goal setting and weekly reinforcement at school?
5. To what extent do increases (or decreases) in activity levels affect an individual’s physical and psychological measures, including BMI, height, weight, skin-fold thickness, waist and hip circumferences, depression, self-esteem, peer acceptance and parent’s rating of behaviour, relative to their peers of the same age?
6. Are changes in activity levels maintained after the Movin’ It Project intervention is withdrawn?
7. What contextual factors support children’s ability to increase and maintain higher levels of physical activity, both in the presence and absence of the Movin’ It Project intervention?
The nature and aims of the study

The Movin’ It Project: An evaluation of an intervention to increase levels of physical activity in primary-aged children at home and at school

There is currently a wide interest in the physical activity (PA) of children, but little understanding of its environmental and personal control. Physical inactivity is hypothesised to be a contributing factor to the development of a variety of diseases, including obesity and Type 1 and Type 2 diabetes, and an important factor in bone development, learning and school performance, cognitive health, and health risk behaviours (Dencker, et al., 2005; Rippe & Hess, 1998). In adults, a lack of physical activity is second only to tobacco as the leading contributor to the overall burden of disease among Australians (Armstrong, Bauman & Davies, 2000).

The rapid increase in childhood obesity and being overweight since the 1980’s; combined with today’s relatively sedentary lifestyles has now come into sharper political focus (NHMRC, 2003). Presently there are governments around the world mandating certain levels of physical activity for school children. However, it is not clear what evidence these recommendations are based on. Many have concluded that children’s physical activity levels have declined over the past 20 years (Dollman, et al, 2005; Luepker, 1999; Rippe & Hess, 1998), with popular ideas presented in the media that today’s children are part of a “couch-potato generation” (Gard, 2007). However, it is not possible to describe physical activity trends conclusively because of the absence of objective, reliable normative data (Dollman, et al., 2005). To date, findings that fitness levels have been declining are used as evidence for physical activity levels declining (NHMRC, 2003). However, the relationship between fitness and physical activity levels is less clear with children. A review of 20 studies that reported 53 correlations in free-living child populations found that physical activity could only account for 3% of the variance in aerobic fitness (Morrow and Freedson, 1994 cited in Sallis and Owen, 1999).
Presently, there is little consistency in identifying and measuring variables that control children’s PA levels (Wilkin, et al, 2006). Anecdotal evidence would suggest that an increasingly sedentary lifestyle, including TV viewing, computer time and the increase in the use of labour saving devices that have contributed to children’s observed PA levels. Also, findings from the 2003 Child and Adolescent Physical Activity and Nutrition Survey (CAPANS) study revealed that across age groups females reported spending between 10.2-17.3 hours a week and males reported between 14.7-20.6 hours per week on screen-based sedentary activities (Hands, et al, 2004). However, in an attempt to map the major variables regulating children’s PA levels Sallis, Prochaska and Taylor (2000) reviewed studies that had found correlations of contextual variables with children’s PA levels. Their review identified the lack of agreement between research studies in the field to date and served to highlight the inconsistent and sometimes conflicting results that form the basis of reports in the popular press. Even basic physical measures used to identify obesity (BMI and skin-fold thicknesses) were concluded to have an inconsistent relationship with children’s PA levels. Behavioural variables, such as the time spent in sedentary activities and contextual variables, such as parent’s level of physical activity yielded a weak relationship with children’s PA levels. Variables related to the physical environment, such as access to facilities and programs and the time spent in doors were found to have a more significant relationship, while other variables such as perceived safety concerns in the environment and transport to school were found to be unrelated.

The variables related to the physical environment are of increasing interest to researchers and are a central focus to this project. Of fundamental interest is the relationship between children’s PA levels measured during school hours and PA levels measured in the hours out of school, and the possible correlation these PA levels may have with other physical, psychological and contextual variables in a child’s life.

The Plymouth EarlyBird Cohort Study has made a significant contribution to research in this area. A very recent study monitored a week of physical activity during waking hours among 215 children aged 7 to 10 at three schools with different sports facilities and timetables. A private preparatory school with playing fields offered nine hours of PE a week; a village school 2.2 hours; and an inner-
city school with a small playground 1.8 hours (Wilkin, et al, 2006). All the children were fitted with accelerometers (tiny electronic boxes that sample activity 600 times a minute and record every movement) with the PA monitoring results shown below in Figure 1.

As expected, students in School 1 recorded the most activity during school hours. Yet the total physical activity between the schools was similar because those who had little activity during school time compensated with large amounts of activity in the after-school hours. Interestingly, there was no overall relationship between the school attended and the amount of activity undertaken, leading Wilkin et al (2006) to conclude that the total amount of activity of primary school children may not depend on how much PE and games they do at school. They went further to hypothesise that the variance (or lack thereof) in children’s PA levels across schools could be explained by some internal mechanism of regulation (like the “appestat”), rather than the different external environments and/or opportunities for PA. This is referred to in the literature as the “activity stat” hypothesis.

These results paint a bleak picture in terms of interventions for children, in that it may not only be extremely difficult to increase children’s exercise 

over their
whole day, but also that it may be pointless for fighting obesity through the regulation of physical activity alone. Wilkin et al (2006) acknowledge that there is a wide range of activity among children and those who do more seem generally healthier. Yet the big questions remain – Can children increase their habitual overall levels of daily PA? What is the best way to prompt inactive children to do more consistently over time? Does being more active affect measures of weight, fitness and well-being in primary-aged children? And, what levels of activity are adequate for maintaining healthy ranges of weight, fitness level and well-being indicators at different ages through the primary school years?

Epstein et al (1994; 2004) have made significant contributions to the field of obesity interventions with children. They rely on the energy balance equation- to control weight through the regulation of diet and physical activity- with the aim of decreasing energy intake relative to energy expenditure (or vice versa). Their basic intervention usually involves a mix of behavioural change principles (self-monitoring and feedback) delivered via a group treatment model with family involvement. Their approach includes a focus on increasing physical activity (usually targeting “lifestyle” activities and a specialised programmed aerobic fitness regime), reducing sedentary activity, making dietary changes, and applying cognitive-behavioural therapy where necessary. This complex array of independent variables usually happens over a relatively short-term intervention period of two to three months, with a 12 month follow up. Intervention outcomes from studies utilizing Epstein et al’s intervention model, have been found to be variable across individuals. However, recent findings from a study utilising Epstein et al’s long list of intervention components identified parent and child self-monitoring (using pedometers) as a major determinant of success in the treatment of morbid obesity (Germann, Kirschenbaum & Rich, 2006).

Prior to the 1980’s, most PA interventions promoted vigorous exercise programmes until Epstein et al (1985) evaluated a number of alternative approaches to increase PA in young people in a longitudinal study spanning 10 years. All children in the study received assistance in adhering to a weight loss diet, but they were randomised to programmed exercise, lifestyle activity integrated into daily routines, or callisthenics. At a 12-month follow-up, children in the lifestyle group lost the most weight, suggesting that children were more
successful when adhering to lifestyle changes than to the other, specifically arranged exercises. However, at the 5 and 10 year follow-ups, both programmed exercise and lifestyle exercise groups had reduced their percentage of being overweight, whereas the callisthenics group had actually increased their percentage of being overweight (Epstein et al, 1994).

These studies have led to a closer examination of the benefits of encouraging children to maintain higher activity levels as a routine part of their daily lives. The first stage of this proposed study (already completed (though not submitted), originally for a masters research project) monitored and evaluated five, single-case intervention programmes based on feedback and goal setting over a period of five months. This stage showed that sustained growth in more activity per day could have highly significant effects on skin fold measures and general well-being even without attention to diet or specifically arranged exercise programmes. It also identified a number of factors that impeded activity increases in primary school children.

Specific interests of the second stage of the study are (1) to examine the activity levels of over 100 typically developing children in Years 2 and 3 who attend a Perth metropolitan primary school that is rated as being in a median SES area for the state, (2) to examine the relationship between objectively measured physical activity levels and weight, fitness and well-being measures, (3) to correlate activity levels with contextual factors such as family composition and circumstances (for example, parents’ occupations, parents’ BMI, amount of time the child spends watching TV, space/facilities for the child to play inside/outside the home) and (4) to examine the (possibly negative) relationship that may exist between children’s PA levels recorded in-school and out-of-school hours (the ‘activity stat’ hypothesis).

The second stage of the project will collect daily physical activity data from over 100 primary school children (using pedometers) and correlate these with physiological measures (Body Mass Index (height and weight); skin fold; hip and waist circumference; cardiovascular fitness levels and blood pressure) as well as other variables related to psychological health and well-being (for example, Child Depression Inventory; Pier’s Harris Self-Concept scale; Revised Child Manifest Anxiety Scale; Conners’ Parent Rating Scale; and a Family Circumstance
Participating children will be required to wear a pedometer during all their waking hours for nine weeks in Term 3 or Term 4, with a two week follow-up period for both groups in Term 1, the following year.

The project also aims to investigate the possibility of changing PA levels in children, including those children who are already active and those who are inactive, through a planned, cost-effective intervention - The Movin’ It Project – which takes the form of a program, created and trialled by myself, that has been designed to increase daily levels of physical activity in primary aged children through changed daily habits and activities that do not necessitate special sports or training. The Movin’ It! Project is a teacher implemented behavioural program designed to increase children’s PA levels as a result of the systematic dissemination of feedback regarding individual and group PA levels (for pedometer recordings) and both individual and group participation in goal setting on a daily basis in the classroom.

How the project will contribute to scholarly knowledge

The 2003 Child and Adolescent Physical Activity and Nutrition Survey (CAPANS) study would be the most notable research into the variation of children’s PA levels that has been conducted previously in Western Australia (Hands, et al., 2004). The study reported a number of key findings, such as those stated above. However, specific research questions relating to the physical, psychological and contextual correlates of the variation in children’s PA levels were not addressed, which limits its ability to inform future interventions that target PA to improve child health and well-being.

In line with the findings from the 2003 CAPANS study, several recommendations were put forward in the report regarding improved child and adolescent PA and nutrition. Of these, the current project has targeted five of the 10 recommendations, specifically to “enhance the…curriculum emphasis on the physical activity…delivered in schools with monitoring and evaluation of the educational outcomes in line with other literacy and numeracy outcomes”; to “support the delivery of quality physical activity…programs”; to “provide ongoing…monitoring of child and adolescent physical activity levels”; provide
“professional development of the health work-force to promote physical activity”; and “promoting physical activity opportunities both in and out of school hours” (Hands, et al, 2004, p 92).

The current project also aims to extend the focus on PA from the weekly and daily totals reported in the CAPANS study, to differentiate the activity accrued during school hours and activity accrued out of school hours. The CAPANS study could only provide analyses of activity on school days versus non-school days – whereas the current project will be monitoring activity levels for the time spent at school and the time spent out of school on the same day. This is part of the current project’s aim to replicate the EarlyBird study and to test the “activity stat” hypothesis (see earlier). Evidence consistent with the “activity stat” hypothesis would have important implications for prescriptions for overweight/unhealthy children that aim to increase their levels of physical activity, and will indicate to what extant simply providing the opportunity to exercise, or to increase activity at school is enough to raise children’s daily activity levels overall.

The findings from research to date on understanding and influencing children’s physical activity levels has lead Sallis and Owen (1999) to conclude that:

“Education and information have only a very limited impact. Behaviour modification interventions that directly alter environmental variables controlling physical activity are particularly successful, but it is sometimes difficult to control the antecedents and consequences. Trials of cognitive-behavioural interventions such as goal setting and self-reward show these techniques to be effective. Children’s habitual activity can be significantly influenced by reducing reinforcers for sedentary behaviours and making activity more rewarding. However, family programs that do not include direct reinforcement for physical activity have not been effective. Interventions targeting moderate-intensity or lifestyle activities seem to be effective for children and adults” (p 152).

In terms of the intervention to increase children’s PA levels, the current project aims to evaluate a specific behavioural program that is naturalistic and that involves the whole school, incorporating goal setting and reinforcement. It is
noteworthy that while researchers so far have looked at nutrition and activity simultaneously in interventions, this project is unique in that only the effects of variations in daily PA across ‘typical’ children over time are being evaluated. Similarly, ‘typical’ expectations of activity levels across age groups and at home and school will be sampled.

As stated earlier, the second stage of the project is based on the results obtained from single-case studies undertaken in 2006 that assessed the effects of the *Movin’ It* programme on the physical activity of five inactive, overweight children from different SES families and different primary schools in Perth. The intervention involved continuous, objective measurement of physical activity levels with a pedometer, monitoring, feedback, goal setting and reinforcement of small incremental, weekly increases. Weekly review meetings were held at home with the child and parent (in some case the entire family) to identify and overcome barriers to increasing and maintaining physical activity levels (for example, family activities and daily routines). The single cases also showed to what extent activity levels were maintained by self-management procedures when components of the intervention were withdrawn. While the children in these single-case studies were able to increase their habitual physical activity levels by up to a remarkable 60% over a period of 18 weeks, the findings indicated that each family context had its own maintaining and controlling factors affecting a child’s level of physical activity. The single-case studies showed that simply exhorting overweight and inactive children to ‘be more active’ (as in some current media campaigns) is highly unlikely to have any effects on their daily activity levels that are in fact under the control of powerful escape, withdrawal and avoidance motivation variables in the home environment.

The implementation and evaluation of a school-based intervention - based on the same intervention components as used in the first stage – and that uses a minimal, low-cost approach to increase activity levels with a large cohort of children will allow examination of the percentages of typical children who do benefit and the percentages of children who do not benefit (as defined by increased activity levels, improved psychological and/or body composition measures) from changes in their daily activity patterns without specially arranged exercise programmes (for example, aerobics; gym activities). This will then enable an analysis of factors that
may predict the numbers and characteristics of children likely to benefit from such school-based interventions. The information will improve our understanding of what controls children’s overall PA levels and identify individual and contextual factors that support higher levels of children’s physical activity on a daily basis.

Project Design

– Preparatory period

– ABBA design

  ▪ (x 2 (two classes in Term 3, and two new classes in Term 4)
    ▪ A – Baseline Phase (2 weeks)
    ▪ B – Intervention Phase 1 (2 week)
    ▪ B – Intervention Phase 2 (3 weeks)
    ▪ A – Baseline Phase (2 weeks)

  ▪ Activity Monitoring and Intervention Group (Two classes from Team 2)

  ▪ Waitlist Control Group (Two classes from Team 2)

Preparation for the project

Over 200 children and their teachers from Years 2 and 3 who attend a Perth metropolitan primary school, rated as being in a median SES area for the state, will take part in *The Movin’ It Project*. It is necessary that a majority of children from each class take part in the project at the same time to encourage class cohesion and maximise the impact of the intervention on increasing activity levels.

As resources (pedometers) are limited, only certain Team 2 classes can be involved in the activity monitoring aspect of the study at any one time. It is anticipated this will include approximately 50 students (two whole classes) during
each data collection period. These classes will be selected randomly.

Classes not selected for activity monitoring will be asked to take part in the physiological data collection process to enable us to make psychological and physiological comparisons between children who were and were not involved in the activity intervention. This will form the waitlist control groups for Team 2 classes for each data collection period (n = approximately 50).

Children who are in the classes selected for the first round of data collection (including the control group participants) will have consent forms mailed out to their homes by their class teacher and / or Ms Herbert (the teacher motivated to assist and liaise with the researcher throughout the project) on behalf of the Principal of the school. Consent forms are to be signed by both parent/guardian and child, and participation will only be accepted if children have returned their signed consent forms. Children who cannot provide a signed consent form will be appropriately taken care of by the school, where there are standard arrangements for such cases and the Principal has agreed for these to be in place.

There will be a training session for the teachers involved in the first round of data collection, which will cover issues relating to the technical aspects of using the pedometers, recording data, withholding feedback during baseline phases and disseminating feedback as part of the intervention. Following this training session, teachers will conduct a lesson in class prior to the baseline data collection phase to instruct children how and when to wear and look after the pedometers. A letter will also be sent home to parents to explain the care procedure for the pedometer (please refer to Appendix A for a copy of this letter).

**Baseline Phase (2 weeks)**

**Initial measures**

A convenient time and place on the Currambine Primary School campus will be arranged for the Physiological and Psychological data collection to take place with the attendance and assistance of Ms Herbert and the Principal Terry Coumbe. The
location chosen (e.g., sick/medical room) will provide adequate space for individual privacy to protect the modesty of students during the physiological assessment process. It is anticipated that all children selected to participate (both intervention and waitlist groups) will undergo these assessments during the first baseline activity monitoring period in Term 3.

Physiological measures that will be taken in this period will include: Body Mass Index (height and weight); skin fold; hip and waist circumference; resting heart rate and blood pressure. Each child’s average step length will also be measured and programmed into their pedometer. Psychological and general health measures that will be taken during this period will include: the Child Depression Inventory; the Pier’s Harris Self-Concept scale; the Revised Child Manifest Anxiety Scale; the EAS Temperament survey; and a peer popularity survey, and will be completed at school. The Conner’s Parent Rating Scale and a Family Circumstance Questionnaire will be sent home for parents to fill out. For a description of these measures, please see the end of this document.

I, (Cath Price) as the Co-Investigator/Student Researcher, will carry out all assessments under the supervision of Associate Professor David Leach, and with the assistance of Ms Herbert helping to organise and communicate with the staff and students.

Additional assistance will be sought from graduate Medical students from Notre Dame University and graduates of Exercise and Health Science from UWA to carry out the specific physiological assessments for which they have undergone specialist training (i.e., skin-fold measures, heart rate and blood pressure checks). Myself and all assistants will have valid ‘Working with Children’ checks, and a copy of these will be provided to the school for their records.

**Activity monitoring**

Baseline activity measuring will commence in the morning of a school day, and each child will be fitted with the pedometer to his/her waist (attached by a metal clip to the waist band on his/her clothing). Children will be instructed to only open the device under the strict supervision of their teacher. Children will be instructed
to wear the pedometer for their entire day, during waking hours, and to take it off only when bathing or swimming, or when ready for bed. A letter will be sent home to parents with information regarding the care and use of the pedometer.

During the Baseline Phase, formal feedback will be withheld from children and teachers. Daily individual monitoring will take place twice a day with the guidance of the class teacher. A timetable of the daily data collection is illustrated in Table 1, below. At the beginning of each school day, children will be asked to come to the teachers desk one at a time, so that the teacher can record the number of steps (and equivalent km’s) recorded for the morning period before school. At the end of each school day, children will be asked to come to the teachers desk one at a time, so that the teacher can record the number of steps (and equivalent km’s) obtained over the school day.

Table 1
Daily timetable of physical activity monitoring

<table>
<thead>
<tr>
<th>Tuesday – Friday</th>
</tr>
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<tbody>
<tr>
<td>School day 8.30am – 2.40pm</td>
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</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>Wake up / / get ready for school / / / Put on Pedometer</td>
<td>Class starts Pedometer recording</td>
<td>Classes</td>
<td>recess (Wed meeting 10.15 – 10.50)</td>
<td>Classes</td>
<td>Sit and eat lunch</td>
<td>Lunch Play</td>
<td>Classes (Mon finish 2pm)</td>
<td>Pedometer recording</td>
<td>/ /</td>
<td>/ /</td>
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</tbody>
</table>

Bed time
Take off pedometer
AutoReset @ 12 am
Please refer to *Appendix B* for the teacher activity monitoring forms

**Intervention Phase (3 weeks)**

The second aim of the study is to evaluate the impact of a low cost, teacher implemented, intervention program, to see if children can increase and maintain their daily physical activity levels. Intervention Phase 1 will begin immediately after the initial baseline period, when feedback will be disseminated by the teacher in a systematic way, as a group with class aggregated feedback. This will continue for two weeks.

*Daily monitoring will continue as in the baseline phase.* However, parents will be asked to make a note of what kind of activities the child participated in during the after school period for that day. This is to help us understand what a child’s activity levels represent and will also help to explain times when the pedometer can not be worn. Please refer to *Appendix C* for the parents’ daily activity monitoring forms.

Children will be encouraged as a class to increase individual activity levels in an attempt to increase *the class’s total* that was obtained during the baseline period. The teacher will guide students in setting a goal for the class to reach at the end of the week, and discuss ideas with students regarding how to get their activity levels up on a daily basis. The class will also collaborate in deciding an appropriate reward for the class, should they reach their goal (wearing “I’m a Movin’ It! Queen”/ “I’m a Movin’ It! King” badge, a mention at the next assembly, etc).
During the intervention we aim to create a collaborative ethos/class environment, where each child can feel that their individual activity contribution is important to the whole class outcome. Each child will vary in what he/she contributes, but each child’s contribution is important regardless of how it compares to others’ contributions.

Children will be given individual feedback privately from their teacher regarding their previous day activity levels, during the morning recording period. Each child will have his/her daily total activity levels plotted on a graph over the course of the week, and will be able to see, privately, how much he/she has done compared to the days before. The teacher will praise them for their efforts and encourage them to keep up their good effort and try to see if they can do more over the day. All children will be reminded that:

“there will always be ups and downs in your individual activity levels (from day to day), and we are trying to see if - when we add everyone’s together at the end of the week - the class total will be more than the class total from the previous week. So every little bit more you do today/this week will help the whole class in reaching this goal.”

A similar graph or illustration will be created that represents the class total for each day (also highlighting the class’s goal), and shall be posted in a prominent position in the classroom.

The same message will be reiterated to the group as a whole:

“There will always be ups and downs in your individual activity levels (from day to day), and we are trying to see if - when we add everyone’s activity together at the end of the week - the class total will be more than the class total from the previous week. So every
little bit more you do today/this week will help the whole class in reaching this goal.”

This will continue until the final day of the first week in Intervention Phase, which will be a Sunday. On the following school day, the class will be told the outcome of their efforts. The class will be praised for their efforts and encouraged keep up their activity levels, and the agreed on reward will also be given.

This procedure will be repeated again during the following two week. The class will set a new goal, decide on an appropriate reward and also brainstorm ideas to increase/maintain activity levels.

**Maintenance phase (2 weeks)**

A return to the baseline phase will occur immediately after Intervention Phase 2 is completed. On the following school day, students will be told that the *Movin’ It Project* activity is over for this term. Pedometers will still be worn every day to monitor the class’s activity levels when the *Movin’ it Project* has been withdrawn.

Daily monitoring will continue as in the baseline phase; however no systematic feedback will be given during this period. Parents will be asked to continue to make a note of what kind of activities the child participated in during the after school period for that day.

On the final day of Term, children will return pedometers to the teacher. The children will be thanked for their participation and told that they will be wearing the pedometers again for two weeks sometime next year.

All children who participated (intervention and waitlist control) will undergo a repeat of the physiological and psychological assessments during the final baseline phase. The procedure will be the same as that undertaken in the initial baseline phase.
## Visual Project Outline

### Term 3 Group

<table>
<thead>
<tr>
<th>Preparation</th>
<th>A–Baseline</th>
<th>B–Intervention 1</th>
<th>B-Intervention 2</th>
<th>A-Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental consent obtained</td>
<td>Term 3, 2007</td>
<td>Term 3</td>
<td>Term 3</td>
<td>Term 3</td>
</tr>
<tr>
<td>Classes selected (control groups &amp; activity monitoring groups)</td>
<td>Ongoing PA monitoring (pedometer/accelerometer)</td>
<td>2 weeks</td>
<td>3 weeks</td>
<td>2 weeks</td>
</tr>
<tr>
<td>Teacher Induction</td>
<td>NO FEEDBACK</td>
<td>Ongoing PA monitoring (pedometer/accelerometer)</td>
<td>Ongoing PA monitoring (pedometer/accelerometer)</td>
<td>Ongoing PA monitoring (pedometer/accelerometer)</td>
</tr>
<tr>
<td>Physical Measurements:</td>
<td>Daily basis</td>
<td>NO FEEDBACK</td>
<td>NO FEEDBACK</td>
<td>NO FEEDBACK</td>
</tr>
<tr>
<td>Body Composition [BMI, height, weight, waist circumference, hip circumference, skin folds (four locations; biceps, triceps, subscapular, suprailiac)]</td>
<td>INDIVIDUAL FEEDBACK</td>
<td>INDIVIDUAL FEEDBACK</td>
<td>INDIVIDUAL FEEDBACK</td>
<td>INDIVIDUAL FEEDBACK</td>
</tr>
<tr>
<td>Heart rate</td>
<td>GROUP FEEDBACK</td>
<td>GROUP FEEDBACK</td>
<td>GROUP FEEDBACK</td>
<td>GROUP FEEDBACK</td>
</tr>
<tr>
<td>Blood pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychological Measurements:</td>
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<td>Child Depression Inventory (CDI); Revised Child Manifest Anxiety Scale (RCMAS); Conner’s Parent Rating Scale; Family Circumstance Questionnaire</td>
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### Interventions

- **Groups**
  - **Activity Monitoring**
    - Term 3
    - Tested
    - Tested

<table>
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<th>Activity monitoring</th>
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<td>B</td>
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<tr>
<td>Activity monitoring</td>
<td>Tested</td>
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</table>

### Physical Measurements:

- **Body Composition**
  - BMI, height, weight, waist circumference, hip circumference, skin folds (four locations; biceps, triceps, subscapular, suprailiac)
- **Heart rate**
- **Blood pressure**
- **Psychological Measurements:**
  - Child Depression Inventory (CDI)
  - Revised Child Manifest Anxiety Scale (RCMAS)
  - Conner’s Parent Rating Scale
  - Family Circumstance Questionnaire
The Revised draft of the Teachers’ Manual used in School B, Trial 2:

Teacher Guide

Palmyra p.s.
Room 1

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• Room 1’s Weekly Outline Table
• Week 3 Outline
• Week 6 Outline
• Week 7 Outline
• Week 8 Outline
• Week 9 Outline
• Room 15’s weekly outline table
### Room 1’s Weekly Outline

<table>
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<tr>
<th>Term week</th>
<th>Week 2</th>
<th>Week 3</th>
<th>Week 4</th>
<th>Week 5</th>
<th>Week 6</th>
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<tr>
<td>Approx Dates</td>
<td>5th-11th May</td>
<td>12th-18th May</td>
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<td>30th June to 4th July</td>
</tr>
<tr>
<td>Phase</td>
<td>Prep</td>
<td>Baseline</td>
<td>Baseline</td>
<td>Let’s Climb Mt. Fuji Week 1</td>
<td>Let’s Climb Mt. Fuji Week 2</td>
<td>Let’s Climb Mt. Fuji Week 3</td>
<td>Return to Baseline</td>
<td>Return to Baseline</td>
<td>Last week of term and end</td>
</tr>
</tbody>
</table>

#### Tasks:

- **Mrs. Kettle’s Class**
  - Collect Consent forms and Fit pedometer sets
  - Baseline measurements (physical & psychological)
  - Encourage record morning and afternoon activity levels
  - Encourage students to remember pedometer settings
  - Encourage students to do what they typically do to minimize exercise
  - Increase habitual activity levels
  - Set class target for the week
  - Brainstorm activity ideas
  - Provide feedback at group level in private, individually
  - Group rewards for increasing activity
  - Individual rewards for effort
  - Encourage (group individual) increase habitual activity levels
  - Set class target for the week
  - Brainstorm activity ideas
  - Provide feedback at group level in private, individually
  - Group rewards for increasing activity
  - Individual rewards for effort
  - Encourage (group individual) increase habitual activity levels
  - Set class target for the week
  - Brainstorm activity ideas
  - Provide feedback at group level in private, individually
  - Group rewards for increasing activity
  - Individual rewards for effort
  - Encourage remember pedometers
  - Just do what they want to do
  - Reward for wearing pedometers and counting steps
  - Repeat baseline measurements (physical & psychological)
  - Public acknowledgment of class effort

---

### Let’s Climb Mt. Fuji - Stage 1

**Term 2, week 5**

This is the week to get them really excited - it’s time to start the Ascent!

- Start group discussion (20-30 mins) on Monday morning
  - State research question – “Can you do more together as a group?”
  - Introduce Mt Fuji Challenge and Poster:
    - Show the class total graph over baseline period – base camp figure
  - Set weekly target – stage 1 = 30% increase
    - Total of 40% more than baseline over whole project
    - Stage 2 = 20% increase
    - Summit = 10% increase
  - Get them thinking about what they can do to get more steps in their day – in a variety of contexts (at home, at school, etc. with different people)
    - Share ideas during class brainstorm sessions,
    - During private feedback time
  - Introduce feedback graphs
    - Check their progress in private feedback session with cath - try to make a time for it every day
      - They can view their individual graph daily and take it home at the end of the week
    - Check the group’s progress on a daily basis (on Mt Fuji graph)
  - Introduce the rewards (on Friday, before Mrs E goes away)
    - Negotiate as a class what the Group rewards will be on a weekly basis, if they reach their weekly target
    - Let them know how they can get “Individual Effort” awards (daily basis) (by doing more than they did the day before showing consistent improvement)

And see how it goes….it’s meant to be a minimalist intervention (pedometers, feedback)
Sometimes they need a bit more... their activity levels will show you what they need...

**Some things that might help get them moving more!**

- On a daily basis have a little group discussion about what people have been doing to get their activity levels up a bit;
  - It can be made a part of general housekeeping.
  - If the class is not reaching their target (or it doesn’t look like they’ll make it in time), **try to rev things up a bit!**
- Make the discussions more a part of the class timetable.
- Schedule little bouts of activity time, either inside the classroom or outside in the playground.
- Make a mention of things they can do at the start of school and the end of school day, also before they go to recess and lunch.
- Check that everyone has some ideas of how they can get extra steps in their day, to help the class reach their target.

Remember it’s all about habitual activity.

They don’t have to run a marathon or join the hockey team (and it should be said that proper rest is very important!), but in about finding simple and natural little ways to get more steps in your day...

Perhaps you can give them some ideas:

- walking to school,
- walking in the back yard,
- having a friend over to play with,
- getting mum or dad to go for a walk with you,
- asking the family to do something fun and active together,
- helping mum and dad at home with house chores (taking out the rubbish, cleaning the yard, etc)

---

**The H.A.P.P.E. Classroom Project Term 2 2008**

Health and Programmed Physical Education (H.A.P.P.E.) in the Classroom

These are more likely to become habits and, in theory, help them build an active lifestyle for themselves...

---

**What is the other class doing?**

They are helping us answer a different research question - “What are the typical activity levels of typical Aussie kids?”

**What will they do?**

- They will continue to wear the pedometer everyday and keep doing whatever they would typically do. We want to leave them in charge so we can find out what is typical for each individual.

**What will they get?**

- They will be rewarded for individual effort and for group effort, just like your class. But for them, the focus is on becoming aware of what they typically do.

In Term 4 you will have the chance to do this.
Climb to Stage 2 on Mt Fuji

Keep them excited - this is the week they get their first reward!
(If they have achieved their target)

- Caths will do the calculations for last week's total and class will be notified by mid-morning.
- Reward if previous target was met - OR - Problem solve if the target was unmet and continue until they get there
  - If they made it - Set new weekly target - stage 2 = 30% increase
    - total of 60% more than baseline over whole project
  - Get them thinking about what they can do to get more steps in their day –
    - Share ideas during class brainstorm sessions,
    - during private feedback time
      - Ideas about being more active in a variety of contexts (at home, at school, on the weekend etc. with different people)
  - Problem solve if the target was unmet
    - What happened this week? What activities have we been doing? What do we need to do?

- Provide feedback graphs
  - Check their progress in private feedback session
  - they can view their individual graph daily and take it home at the end of the week
  - Check the group’s progress on a daily basis (on Mt Fuji graph)
- Give rewards
  - Negotiate as a class what the Group rewards will be on a weekly basis, if they reach their weekly target
  - Let them know how they can get “Individual Effort” awards (daily basis)

Climbing to the Summit of Mt Fuji!

Time to get really razzed up - It's the final charge for the Summit!

- Caths will do the calculations for last week's total and class will be notified by mid-morning.
- Reward if previous target was met - OR - Problem solve if the target was unmet and continue until they get there
  - If they made it - Set new weekly target - summit = 10% increase
    - total of 60% more than baseline over whole project
  - Get them thinking about what they can do to get more steps in their day –
    - Share ideas during class brainstorm sessions,
    - during private feedback time
      - Ideas about being more active in a variety of contexts (at home, at school, on the weekend etc. with different people)
  - Problem solve if the target was unmet
    - What happened this week? What activities have we been doing? What do we need to do?

- Provide feedback graphs
  - Check their progress in private feedback session
  - they can view their individual graph daily and take it home at the end of the week
  - Check the group’s progress on a daily basis (on Mt Fuji Poster)
- Give rewards
  - Negotiate as a class what the Group rewards will be on a weekly basis, if they reach their weekly target
  - Let them know how they can get “Individual Effort” awards (daily basis)
Back to Base Camp

It’s time for the Big Reward; they’re at the top of the mountain!

- Cash will do the calculations for last week’s total and class will be notified by mid morning.
- Reward if previous target was met  -  OR  -  Problem solve if the target was unmet and continue until they get there

Gotta keep the energy up!
What will they do - continue increasing, maintain their increase, or decrease?

- Now they reached the summit, discuss what happens next
  - We want to see what will happen to your activity levels
  - They are in charge now
  - Will they:
    - Continue increasing? (Do you think you can do even more?)
    - Maintain their increase? (Do you think you will stay at this level?)
    - Decrease? (Do you think you will go back to what you were doing at the start of term?)

- Introduce rewards for continuing to wear pedometer
  - Same conditions as the control group

Back to Base Camp

The final week!

What will they do - continue increasing, maintain their increase, or decrease?

- Reward if previous target was met  -  OR  -  Problem solve if the target was unmet and continue until they get there

- Now they reached the summit, discuss what happens next
  - We want to see what will happen to your activity levels
  - They are in charge now
  - Will they:
    - Continue increasing? (Do you think you can do even more?)
    - Maintain their increase? (Do you think you will stay at this level?)
    - Decrease? (Do you think you will go back to what you were doing at the start of term?)

- Introduce rewards for continuing to wear pedometer
  - Same conditions as the control group
<table>
<thead>
<tr>
<th>Task/Week</th>
<th>Week 1</th>
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<th>Week 3</th>
<th>Week 4</th>
<th>Week 5</th>
<th>Week 6</th>
<th>Week 7</th>
<th>Week 8</th>
<th>Week 9</th>
<th>Week 10</th>
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<tbody>
<tr>
<td>Prep</td>
<td>5th-8th May</td>
<td>12th-15th May</td>
<td>19th-22nd May</td>
<td>26th May-1st June</td>
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<td>Phase</td>
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<td>Baseline</td>
<td>Baseline</td>
<td>Week 4</td>
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<td>Week 6</td>
<td>Week 7</td>
<td>Week 8</td>
<td>Week 9</td>
<td>Week 10</td>
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<tr>
<td>Tasks: Mrs. Thosab’s Class</td>
<td>Collect consent forms and PA pedometers</td>
<td>Encourage: remember pedometers</td>
<td>just do what they typically do</td>
<td>Self-monitoring activity in PA booklet</td>
<td>Reward for wearing pedometers and counting steps</td>
<td>Encourage: remember pedometers</td>
<td>just do what they typically do</td>
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The Revised draft of the Teachers’ Manual used in School B, Trial 3:

The H.A.P.P.E. Classroom Project
Health and Programmed Physical Education (H.A.P.P.E.) in the Classroom

Term 3, 2008
Teacher Guide

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MURDOCH UNIVERSITY
PERTH, WESTERN AUSTRALIA

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<th>Phase</th>
<th>Tasks</th>
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<tr>
<td>26th July</td>
<td>2</td>
<td>Information and Consent</td>
<td>• Collect Consent forms distribute pedometers</td>
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<td></td>
<td></td>
<td></td>
<td>• Discuss rules, procedures and instructions</td>
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<tr>
<td>4th August</td>
<td>3</td>
<td>Baseline monitoring</td>
<td>• Distribute HAPPE activity books for self-monitoring</td>
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<tr>
<td>11th August</td>
<td>4</td>
<td>Baseline monitoring</td>
<td>• Assist with self-monitoring remembering the pedometer and checking appropriate use of the pedometer</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Pre-Assessment (physical measures &amp; questionnaires)</td>
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<tr>
<td>Climb Mt. Fuji...</td>
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<td>• Discuss: Hold group discussions to encourage and support increases in habitual activity levels (set a class goal for the week; brainstorm activity ideas) Problem Solve if the goal was not achieved</td>
</tr>
<tr>
<td>18th August</td>
<td>5</td>
<td>The Path to Stage 1</td>
<td>• Feedback: Provide class feedback; provide individual feedback in private</td>
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<tr>
<td>25th August</td>
<td>6</td>
<td>The Path to Stage 2</td>
<td>• Reward: Negotiate and provide group rewards for increasing activity; Negotiate and provide individual rewards for increasing activity</td>
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<tr>
<td>1st September</td>
<td>7</td>
<td>The Path to the Summit</td>
<td>• Continue to assist with self-monitoring, etc</td>
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<tr>
<td>Back to Base Camp</td>
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<td>• Continue to assist with self-monitoring, remembering the pedometer and checking appropriate use of the pedometer</td>
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<tr>
<td>8th September</td>
<td>8</td>
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<td>• Follow-up Assessment (physical measures &amp; questionnaires)</td>
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<td>15th September</td>
<td>9</td>
<td>Baseline Monitoring</td>
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<tr>
<td>22nd September</td>
<td>10</td>
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Climbing Mt Fuji!

The H.A.P.P.E. Classroom Project is designed to be a classroom intervention to increase activity levels. It uses feedback from pedometers, sets goals, and issues group rewards as part of a class challenge to “Climb Mt Fuji” over three weeks.

It is a fun, whole-class project for children that can be achieved within the 2 hours per week allocated to physical activity, while involving no additional work for the teacher. The researcher will be tracking physical activity levels and providing feedback continuously throughout the Term.

There are 3 major components...

---

**Group Discussions**

- **The Question is:**
  “While working together as a group, can typical Aussie kids increase their personal level of physical activity – i.e. do more than they normally do – over three weeks?”

- **Get Them Thinking:**
  Get them thinking about what they are doing now that accounts for their steps each day. Ask them to think about what they can do to get more steps in their day, in a variety of contexts – home and school; indoors outdoors; with family, friends, alone. Ask people to share their ideas with the class.

- **The Mt Fuji Challenge and Poster**

- **The Rewards**
  Negotiate as a class what the Group rewards will be on a weekly basis, if they reach their weekly target.
  They can also get “Individual Effort” awards on a daily basis, if they have achieved their Personal Target the previous day or have been showing consistent improvement. Names will be read out once the data has been compiled by the researcher.

- **It’s a good idea to have group discussions (20-30mins) in the mornings before recess. Try to make the discussions part of the class daily timetable.**
Class Feedback

- Use the symbolic Mt Fuji poster to set goals and communicate feedback to the class as part of the group discussions.
- The Base Camp figure is determined by a total of the class daily average during the baseline period.
- We are aiming for a total of an approx 60% increase in physical activity levels in the group.
- The weekly goals can be based on these approximations –

  Stage 1 = 30% increase  
  Stage 2 = 20% increase  
  Summit = 10% increase

- Check the group’s progress on a daily basis by writing the class total for the previous day on the poster. Also note the daily Target the class needs to maintain to achieve the target by the end of the week. This keeps it interesting each day!

---

**it's all about increasing habitual activity.**

Students don’t have to run a marathon or join a hockey team, in fact it should be stressed that healthy eating and proper rest is very important.

It’s about finding simple and natural little ways to get more steps in your day...

...These are more likely to become habits and, in theory, help each child develop an active lifestyle for themselves...

---

Individual Feedback

- The students receive feedback on their individual activity levels in a private feedback session with the researcher on a daily basis.
- Students can view their activity levels (based on the pedometer output) on an individual graph, showing Personal Target and their progress towards it. Personal Targets are set based on the class targets, and will increase approximately 30%, 20% and 10% at each stage of the climb.
- Students will receive praise for their efforts, learn to make sense of the trends their graph is showing, and also have an opportunity to talk about how they are going.
- Any issues with participation or data recording will be dealt with in these sessions. Students can take home their graphs at the end of each week and are encouraged to show their family what they have achieved.
How to Rev things up!

Some students will need a bit more of a push.

If it looks like the class won't reach their goal in time...

...try revving things up a bit...

Some things that might get the class moving more!

- By the end of each day, every student should have a plan for what they will do when they go home...plan A, plan B and plan C
- Schedule little bouts of activity time, either inside the classroom or outside in the playground
- Make a mention of things they can do during the day at the start of school and also before they go to recess and lunch.
- Mention things they can do at home at the end of the school day
- Check that everyone has some ideas of how they can get extra steps in their day, to help the class reach their target

Some ideas that have worked for other kids

- walk to / from school
- Create games at school that use lots of steps...(new rules for basketball, four square, etc)
- Games in the back yard
- Invite a friend over to play with
- Help someone else reach their personal target by being active with them...
- Ask mum or dad to go for a walk with you
- Organise the family to do something fun and active together (ideas...go to the zoo, a picnic in the park etc)
- Help mum and dad at home by doing more of the chores around the house (taking out the rubbish, clearing the yard, etc)

Any form of walking will get you closer to your target.....
......so get those legs moving...!
Interesting Mt Fuji facts....

- Mount Fuji is called "Fujiyama" or more frequently "Fujisan" in Japanese.
- Fujisan is of course the tallest (3776 meters) in Japan.
- Fujisan is not super high...and it comes no where near the height of the Himalayas where Everest and a few others tower over 8000 meters.
- With the base at only 300 meters above sea level, the remaining 3479 meters of the mountain is beautifully exposed for a complete view of the mountain. On this measurement basis (base-to-summit) Fuji is more than twice the net vertical height of any in the Rocky Mountains in the USA.
- From base-to-summit it can take 14 hours for a fit healthy adult to climb Mt Fuji, and it can take about 8 hours to descend.
- Most people climb the mountain at night time so they can see the sunrise when they reach the summit. The weather can get a bit nippy (5 deg C) as you get close to the summit. Getting to the top can be quite strenuous physical activity, and many mountain climbers are aware of the simple mantra of foot-in-front-of-foot....
- The terrain is quite barren. After passing the tree line things immediately turn to a lifeless mixture of volcanic ash, small volcanic stones, the occasional larger granite rock, and an under layer of hard volcanic structure. Each step puts you in about a 3-5 inch layer of this volcanic "dirt" mixture.
- Arriving at the summit you can trek around the crater rim (it takes about 1 hour) on weekends there can be several thousand people on the top of Fujisan trying to view the sunrise.
- The crater itself is a hundred meters or more deep, and the last eruption of Fujisan was in 1707 A.D.

Basic Mountaineering Tips

- Never leave a man / woman behind! When climbing a mountain with other people you want to share the experience with trusted friends who will watch out for you. You need to work together as a team. At all times the team makes sure that someone stays behind with the last person to make sure they make it safely.
- You need to respect each other as everyone will have their own pace...you can all collect together again at the rest stations.
- Help out your fellow climbers...you are only as fast as the slowest climber.
- Know what you’re getting into - what can you do to prepare yourself for the journey?
- Don’t rush ahead – pace yourself. You set the speed based on how much you can achieve.
- Learn from your experiences and problem solve along the way. The problems you face during the climb can be analysed. Ask yourself ‘what led me to that situation?’ Note it down and the same mistake will not happen again.
- Learn each day and relax each night. Tibetan monks know that climbing a mountain is not about being at the top, rather it is about the journey along the way... (even if you never make the top, it doesn’t matter)
- You just have to keep choosing to put one foot in front of the other. Remember the mantra, foot-in-front-of-foot.....
What is the other class doing?

They are helping us answer a different research question –

“What are the typical physical activity levels of Aussie kids today?”

What will they do?

- They will continue to wear the pedometer everyday and keep doing whatever they would typically do. We want to leave them in charge so we can find out what is typical for each individual.

What will they get?

- They will be rewarded for individual effort and for group effort, just like your class. But for them, the focus is on becoming aware of what they typically do.
- They will get their graphs at the end of Term.
The Ascent begins... The Path to Stage 1

This is the week to get them really excited - It’s time to start the Ascent!

<table>
<thead>
<tr>
<th>Week beginning...</th>
<th>Week</th>
<th>Phase</th>
<th>Tasks</th>
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<tr>
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</table>

Set the Stage

Use the information on the previous pages to introduce the challenge.
Explain the poster and the aim of the coming weeks.
Discuss ideas for increasing activity levels.
Set the class goal for the week and discuss what group reward will be issued.

What will happen on a daily basis?

The researcher will be present each morning to collect the HAPPE activity books and enter the class data into the computer. The researcher will calculate:

1. the Class Daily Total - to show them how far they’ve come
2. the Class Daily Target – so they know what the class needs to maintain to reach the goal by the end of the week and,
3. An idea of how far to go, expressed as a fraction (e.g. 2/3rds of the way...)

The information should be reported to the class and written on the Mt Fuji Poster before the lunchtime break. This would usually be a convenient time for a class discussion.

The researcher will make an effort to see all students individually to show them a graph of their pedometer data. They will be given an individual goal to aim for each day (based on the same percentage increase as the class total). Each day, students who achieved their individual goal will be rewarded with the opportunity to wear a special badge for that day (badges can also be designed by the student themselves).
The Path to Stage 2

Keep them excited! This is the week they get their first reward...if they have achieved the goal!

<table>
<thead>
<tr>
<th>Week beginning...</th>
<th>Week</th>
<th>Phase</th>
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</thead>
</table>
| 25th August      | 6    | The Path to Stage 2 | • Discuss: Hold group discussions to encourage and support increases in habitual activity levels (set a class goal for the week; brainstorm activity ideas). Problem Solve if the goal was not achieved.  
• Feedback: Provide class feedback; provide individual feedback in private  
• Reward: Negotiate and provide group rewards for increasing activity. Negotiate and provide individual rewards for increasing activity  
• Continue to assist with self-monitoring, etc |

Issue Rewards...

The researcher will do the calculations for the previous week’s total and the class will be notified by mid morning.

Issue the group reward if the class goal was achieved, set a new goal for Stage 2 (20% increase) and negotiate a new group reward.

Or,

Problem solve if the target was unmet - What happened last week? Was it the weather? What activities were we doing? What do we need to do now? Set a new goal for Stage 2 (20% increase if appropriate) and negotiate a new group reward.

The class may need to rev things up a bit.

Take home feedback graphs.

What will happen on a daily basis?

Hold group discussions to get them thinking about what they can do to get more steps in their day. Report the class daily total, the class daily target, and how far it is to go using the Mt Fuji poster. Issue individual awards (badges) to students who achieve their personal goal.

The researcher will continue to monitor individual progress in private feedback sessions.
The Path to the Summit

Time to get really razzed up – it’s the final charge for the Summit!

<table>
<thead>
<tr>
<th>Week beginning...</th>
<th>Week</th>
<th>Phase</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st September</td>
<td>7</td>
<td>The Path to the Summit</td>
<td>Discuss: Hold group discussions to encourage and support increases in habitual activity levels (set a class goal for the week; brainstorm activity ideas). Problem Solve if the goal was not achieved.</td>
</tr>
</tbody>
</table>

Issue Rewards...

The researcher will do the calculations for the previous week’s total and the class will be notified by mid morning.

Issue the group reward if the class goal was achieved, set a new goal for the Summit (10% increase) and negotiate a new group reward.

Or,

Problem solve if the target was unmet - What happened last week? Was it the weather? What activities were we doing? What do we need to do now? Set a new goal for the Summit (10% increase if appropriate) and negotiate a new group reward.

The class may need to rev things up a LOT.

Take home feedback graphs.

What will happen on a daily basis?

Hold group discussions to get them thinking about what they can do to get more steps in their day. Report the class daily total, the class daily target, and how far it is to go using the Mt Fuji poster. Issue individual awards (badges) to students who achieve their personal goal. The researcher will continue to monitor individual progress in private feedback sessions.
Back to Base Camp...baseline monitoring

It’s also time for the BiG reward...did they achieve their goal for the Summit?

Issue Rewards...

The researcher will do the calculations for the previous week’s total and the class will be notified by mid morning.

Issue the group reward if the class goal was achieved

Or,

Problem solve if the target was unmet - What happened last week? Was it the weather? What activities were we doing? What do we need to do now?

Take home feedback graphs.

<table>
<thead>
<tr>
<th>Week beginning...</th>
<th>Week</th>
<th>Phase</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>8th September</td>
<td>8</td>
<td>Baseline Monitoring</td>
<td>Continue to assist with self-monitoring, remembering the pedometer and checking appropriate use of the pedometer</td>
</tr>
<tr>
<td>15th September</td>
<td>9</td>
<td>Baseline Monitoring</td>
<td>Follow-up Assessment (physical measures &amp; questionnaires)</td>
</tr>
<tr>
<td>22nd September</td>
<td>10</td>
<td>Baseline Monitoring</td>
<td></td>
</tr>
</tbody>
</table>

What will happen on a daily basis?

Now they have reached the summit (or not), discuss what happens next.

The researcher will continue monitoring activity levels on a daily basis to see what will happen to the class’s activity levels now they have completed the Mt. Fuji Challenge. Will they:

- Continue climbing? (Do you think you can do even more?)
- Maintain? (Do you think you will stay at this level?)
- Descend? (Do you think you will go back to what you were doing before?)

Keep the energy up!

What will they do now?

Continue climbing, maintain, or descend?
Consolidate learning....

In the final week of Term try to find a time to talk with the class about what they have learnt while participating in the Mt Fuji Class Challenge.

You might like to celebrate the class achievement and consolidate any important points that were raised throughout the term, regarding:

- physical activity
- setting realistic goals
- achieving goals
- team work
- living a healthy lifestyle

Please add any notes, observations, comments, or feedback for the researcher.....

____________________________________
____________________________________
____________________________________
____________________________________
____________________________________
____________________________________
Appendix M
HAPPE Group behavioural consultation *pro forma*

The researcher designed a group behavioural consultation *pro forma* in order to standardise procedures during the intervention and across trials. During the intervention, the class meet with the researcher on a daily basis so that the additional components of the intervention could be delivered. The pro forma itemised the tasks to be carried out during behavioural consultations such as, providing activity feedback to the group and evaluating progress, discussing the goals, delivering reinforcement and tangible rewards and planning and problem solving. It was written in a way to be easily understood by the teacher, so that consultations could be co-facilitated (and at times entirely facilitated by the teacher) to capitalise on the rapport the teacher has built with their students.

Intervention components delivered on a daily basis during group behavioural consultations during the intervention phase:

**Feedback**
- Provide “climbing” feedback (daily class total, progress toward the goal)
- Reminder of the group reward, and what they need to achieve in order to be eligible for it

**Goal setting**
- Evaluate class performance and deal with under performance (discuss likelihood of class achieving their goal)
- Re-articulate the class’ mission

**Planning**
- Assist individuals and the group in planning to achieve activity goals
- Discuss individual anecdotes about feeling better when being active…
- Discuss what they have planned for this week, this weekend, this afternoon, etc…
- “Conducting an analysis of participants’ personal contextual factors (including discriminative stimuli (SD), consequences, and establishing operations) that could be arranged to support more active alternative behaviours.”
- “Arranging contingencies such that least preferred and more effortful activities were engaged in first before the more preferred and less effortful activities”. For example, going for a walk after school before sitting down to play games on the computer, or organising to ride a bike to a friend’s house instead of playing with them at home.

**Reinforcement**
- Provide verbal reinforcement
- Recognise and appreciate contributions from individuals – name them and give badges

**COPY OF GROUP BEHAVIOURAL CONSULTATION PRO FORMA**

**Class Feedback:**

Yesterday,

we travelled………………………………………steps,

which is the same as …………………….km.

We need to increase our activity levels by about ____ km’s so we need to do about 2,400 steps // 1.27 km more each per day.

So we need to keep trying to do more than what we normally do, if we are going to get to the top of Mt Fuji, by the end of the Term.

(Praise if they are on target)

When we get there, we will all …………………………. (Remind them of the reward)

Do you think we’ll make it?

I think we can. How can we? What do we need to do?

**Class Discussion:**

*Brainstorm ideas and Plan activities*

- What things are we doing already that give us lots of steps?
- What else can you do to get your steps up?
  - Pro-social ways – (e.g., offer to do extra chores around the house)
  - Fun ways – (play active games, go for a nice walk)
  - Everyday ways – (walk to places instead of sitting or driving)

(Kids can ask parents / grandparents to take them out and do things together. They can suggest activities for the whole family to do. They can also volunteer to go along with the activities other family members engage in (e.g., go with sibling/mother/father when they exercise or do something physically active.))

- Does everybody have some good ideas now?
- What plans do you have for Today / This Afternoon / This Weekend?
- Even if it’s raining, what are you going to do?
- Make sure you have a “Plan A”, a “Plan B” and a “Plan C”

Make sure you wear your pedometer all the time, everyday so that it does not miss out on counting all the steps you take!
Appendix N

Instructions for administration of the battery of psychological questionnaires in HAPPE

A battery of psychological questionnaires was administered on a single day during the baseline and maintenance phases of Study II to obtain a pre-post evaluation of the intervention. The general set of instructions read to all participants at the start of their administration is presented here.

The H.A.P.P.E. Classroom Project 2008
Health and Programmed Physical Education (H.A.P.P.E.) in the Classroom

**Psychological questionnaires – general instructions**

These are some questions about how people feel some times.

We would like to know if you ever feel like this, particularly if you have felt this way in the **last 2 weeks**

Some of the questions might seem silly to you, but just answer it as best you can.

You don’t have to share your answers with anyone, and you may prefer to keep your answers private.

It is best to keep quite while completing the forms.

If you change your mind about your answer, or make a mistake, please rub it out and mark your answer clearly again.

If you have any questions, please raise your hand and I will come to you and help you.
Appendix O
HAPPE Physical Measures Record Form

A copy of the Physical Measures Record Form, which contains detailed instructions for the measurement procedures followed for each measure of physical health, is presented here.
Physical Measures Record Form - Pre / Post

Name: __________________________

Age: ______ Year at school: ______ Date: ______

Teacher's Name: ________________________

Height:
Ask child to remove shoes (socks are ok to be left on) and stand with their heels and butt in contact with the wall and with eyes looking straight ahead (not with their nose tipped upwards). During measurement the child should be told to stretch his/her neck to be as tall as possible (checking heels are always on the ground), while gentle but firm upward pressure should be applied behind the ear by the measurer to help the child stretch.

Height: ______ (cm.mm)  Height: ______ (cm.mm)  Height: ______ (cm.mm)

Average: ______ (cm.mm)

Weight:
Ask child to wear minimal clothing, or a gown, and make sure they have an empty bladder before measurements are taken. Measure to the nearest 0.1 kg on the scales marked for use in the study, and record below. Measure three times and take an average as the final height.

***Program weight into the child's pedometer***

Weight: ______ (kg.g)  Weight: ______ (kg.g)  Weight: ______ (kg.g)

Average: ______ (kg.g)

Body Mass Index (BMI): The BMI can now be calculated using the following equation, and recorded (BMI = kg/m²). (See: www.healthscope.com/content/view/223/The-European-Child-BMI-calculator-and-classification)

BMI: ______

Percentile: ______

Waist / Hip Ratio:
Waist circumference should be measured midway between the lower rib margin and the iliac crest, at the end of a gentle expiration.

Hip circumference: take the upper hip circumference - comfortably measure the distance around the largest extension of the buttocks with the tape measure.

Divide the waist circumference by the hip circumference to obtain the ratio.

Waist: ______ (cm)  Waist: ______ (cm)  Waist: ______

Hip: ______ (cm)  Hip: ______

Average: ______

Average: ______

Blood Pressure & Heart Rate:
Empty bladder and rest for 3 to 5 minutes before measuring. Do not talk.

Have the child lie down or sit quietly reading a book. Reliable estimates of actual resting heart rate should be made only under conditions of total relaxation.

Have the child sit in a comfortable position, with legs and ankles uncrossed and back supported. Place arm, raised to the level of your heart, on a square edge table or desk, and sitting still. Wrap the correctly sized cuff smoothly and snugly around the upper part of bare arm. The cuff should fit snugly, but should be loose enough to slip one finger under the cuff. Be certain that the bottom edge of the cuff is 1 inch above the crease of elbow.

<table>
<thead>
<tr>
<th>1st Read</th>
<th>2nd Read</th>
<th>3rd Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syst:</td>
<td>Syst:</td>
<td>Syst:</td>
</tr>
<tr>
<td>Dia:</td>
<td>Dia:</td>
<td>Dia:</td>
</tr>
<tr>
<td>HR:</td>
<td>HR:</td>
<td>HR:</td>
</tr>
</tbody>
</table>

Averages:

Syst: ______  Dia: ______  HR: ______
### Physical Measures Record Form - Pre / Post

**Skin Fold Measurements:**

There need to be conducted in a private area, to preserve the child’s modesty. Make sure you do an example skin fold measurement on yourself (on your arm) to help the child know what to expect. Measurements should all be taken on the right side of the body and need to be repeated three times, using the pen (whiteboard marker) to mark where measurements were taken from. Use the average of the three as the final record and sum the measures together.

<table>
<thead>
<tr>
<th>Meas.</th>
<th>1st (mm)</th>
<th>2nd (mm)</th>
<th>3rd (mm)</th>
<th>Average (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triceps</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biceps</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biceps: The pinch position is at the same level as for triceps, though on the front surface of the arm.</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Biceps</td>
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<td></td>
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<tr>
<td>Biceps</td>
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<tr>
<td>Biceps</td>
<td></td>
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<tr>
<td>Biceps: The pinch is made below the bottom tip of the scapula, on a line of a 45 degree angle running downwards and away from the body.</td>
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<td></td>
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<tr>
<td>Biceps</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Biceps</td>
<td></td>
<td></td>
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<tr>
<td>Biceps</td>
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<td></td>
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</tr>
<tr>
<td>Sub-Scapular: The skin fold is located immediately above the crest of the ilium. The fold is lifted at a slight angle running downward and toward the centre of the body.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-Scapular</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-Scapular</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Suprailiac: The skin fold is located midway on the back of the upper arm. The arm hangs freely and the skin fold is lifted parallel to its long axis.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suprailiac</td>
<td></td>
<td></td>
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<tr>
<td>Suprailiac</td>
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<tr>
<td>Suprailiac</td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Sum of Averages:**

Σ Av.: ___________(mm)

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**Questionnaires Completed:**

Child: 
- CDI
- RCMAS
- Pers - Harms

Parent: 
- Connors’ (Parent)
- Family
- Circ. Q.
Appendix P

Details of the introductory information for participants in the HAPPE “Climb Mt Fuji Challenge”

A script containing the detailed information delivered to participants during the introduction procedure is presented here:

SCRIPT:

1. **Provide a rationale.** Provide general information about children’s current physical activity levels, the concerns with regards to current levels being inadequate and its impact on health and well-being (for example, obesity and feeling good). “Ok class, first I want to thank you for all the wonderful physical activity data you have been collecting these past weeks. We are now starting to see some trends in the data that can tells how much physical activity you guys are and how that compares to other children. Does anyone know why we’re interested in your activity levels, and what we are trying to find out? Well, there is a lot of stuff in the media about rates of childhood obesity have been increasing over the last 20 years. Do you know what obesity is? Some people think that being overweight is linked with how physically active you are. Being physically active makes us feel good and can have benefits for people suffering a whole range of other physical and mental health problems. Many experts also believe that children today are not doing enough physical activity. So that’s why we are doing this study. We are trying to find out how active kids are today. We are also going to try and find out if kids could do more physical activity, and make a habit of it, just by doing things a little differently. So for these past weeks, you’ve just been going about your normal lives, but wearing the pedometer to see how much you typically do. Now we are going to do something different, as a class you guys are going to do an experiment,
and we are going to see if it’s possible for you to be more active than what you’ve been doing so far.”

2. **Provide feedback.** Systematic and targeted feedback on the class’s baseline activity levels were provided and discussed with the group. Feedback on different aspects of activity behaviour, such as the difference between week days and weekends; and the difference between girls and boys, was highlighted. This information was used to help introduce the challenge. “Given that many experts believe children today are not as active as children used to be in previous generations. What is preventing you from being more active these days? Do you think that you guys could be more active? Do you think you could change some of those things yourself, and do things a bit differently to get more steps on your pedometer? Do you think you’ve got room to be more active than you currently are? Are you ready to do MORE!!!? Great, I’m glad to hear it. Because I’ve got a special surprise for you all. We are going to play a game over the next couple of weeks to see if you can beat ‘this’ number (the class’s total daily steps), and increase your activity levels as a whole class. This is going to be a team challenge and you are all going to work together and help each other to increase your physical activity levels.”

3. **Goal setting.** Introduce the Climb Mt Fuji Challenge and use the Climb Mt Fuji poster to illustrate the idea of increasing habitual physical activity levels. “One way to imagine increasing our physical activity levels is to imagine we are climbing a staircase, each step upwards, represents an increase and doing more than what you used to do. But for you guys, we are going to imagine a mountain! But this mountain is going to be a bit like a stair case. We aren’t going to climb it all in one go – that would be too hard. Do people climb Mt Everest in one day? No, it takes several weeks. So we are going to break it down into three stages. You can see here on the poster, “stage one”, “stage two” and “the Summit”. We will have to stick to a time limit though, and we will have one week (seven days) to reach each stage. We need a time limit because some people do not cope well in high altitudes for very long, and if they stay high up in the mountains for too long they can become sick. This is because the air is thinner (less oxygen I the air) and people feel weak because they can’t breathe normally. You don’t want to be on
the side of a mountain when you feel like that, climbing can get dangerous and you can make mistakes and fall. This is the time when you need to call for a helicopter rescue! So we need to achieve these stages in the time limit that we have, so that everyone can have a safe climb and get home safely. Our first goal is to reach stage one in one week. So remember, in an average week (5 weekdays and 2 weekend days) this entire class takes a total of ________ steps. Think of the steps you took last week. Your steps are here, in this total figure. This we will call the Base Camp figure – that’s where you started from. Now think about how much more you could’ve done. How many more steps you could’ve taken if you’d done things differently. How much more could you do above this figure, if you try this week. Maybe you could do 5% more, 10% more, what would that be like? Too easy? What about 25% more? Other children who have done this program have managed to achieve a 25% increase in their first week. That means everyone here in the room will be trying to increase their activity level by 25%. If everyone can do that, then that will raise the class total by 25%, and maybe set a new record for this game! Do you think you want to try to do that? I think you can do it. It might be hard. Climbing a mountain is not easy, but we’ve got some other things that might help you along the way. [Baseline average weekly total ((class weekday average x 5) + (class weekend average x 2) x number of participants). Stage 1 Goal = Baseline average weekly total +25%. Stage 2 Goal = +40%. Summit Goal = +50%]. “Now I know what your thinking, ‘if that’s the goal for the first stage, then what’s the goal for the Summit!’? Well, just remember this is an experiment. And in science we don’t always know what’s going to happen. These goals are really up to you, and how far you want to climb! So, your goals for stage 2 and the summit might change, depending on how you go along the way. If you guys can achieve the Summit goal of 50% that’d really be something huh! That’s half of what you do already, added on top of what you do already. If you can increase your everyday activity levels by that much, then that’d really give those experts something to talk about. They’d be thinking, ‘Geese wow, maybe Kids today can be just as active as they’ve ever been.’ They just need a little bit of extra support!”
4. **Planning.** Enabling children to increase their individual physical activity levels to achieve a group goal required planning. During the initial behavioural consultation the class took time to brainstorm different ways, times and places where they could be more physically active, specifically in ways to get more steps on their pedometer, so the class would achieve the goal. Ideas were written on the whiteboard and everyone was encouraged to leave school that day with a plan of what they were going to do to get more steps on their pedometer. Many children wrote down their plan on a piece of paper, and plans generally involved a “Plan A”, as well as a “Plan B” and “Plan C”, in case the original plan could not occur. “So now we have to think about how you guys are going to achieve this goal. It’s going to mean that most of you will be making some big changes in the way you do things and how you spend your time. But that’s ok, we are going to start off really slow and see how it goes. And we’ll be making sure you’re all having plenty of fun along the way! What are some of the activities you’ve noticed already that get lots of steps on your pedometers…? [walking and running type activities] What activities have you noticed don’t get many steps on your pedometer? [sit down type activities] Where are the best places to be more active? What time of week/day is the best time to fit in more activity? Who are the best people for you to spend time with if you want to get more steps on your pedometer? [Refer to feedback from baseline to plan times of the week/day (weekends, after school, during school) and locations where there are plenty of opportunities to do more.]

5. **Positive consequences and tangible rewards.** A variety of rewards were on offer to the group as well as to individuals for increases in PA levels and achieving physical activity goals. The type of consequence and the specific contingency arrangements for each were explained, discussed and agreed on by the class. “Making changes to what you normally do is hard for everyone. And for some people it can be harder than it is for others. So to help you along the way, and to celebrate the changes you will be making, we are going to be offering you rewards! YAY! If you can all increase your activity enough over this week, and the class is able to reach their goal of an increase of 25%, then that deserves a celebration. And we will celebrate it together. That means we need to
think of something that we would all enjoy doing as a class, as a reward for achieving the goal. What do you think you guys might like to do? 
[Negotiate with class and teacher what is feasible] Every week that you guys achieve the class goal, we will all celebrate that achievement. The reward for the summit should be something pretty special - I wonder what idea’s your teacher might have? [Agree on a summit reward with the class]. Now remember that you only get to celebrate if you achieve the goal. If you can’t achieve the goal in time, then we will spend a bit of time thinking about what happened, and what we need to do next to make sure you achieve the next goal, so that you can celebrate your next achievement! Sometimes we set goals that are too hard, and sometimes they are too easy, just remember this is an experiment and we will be finding out what you are all capable of along the way. So just remember that if the class doesn’t achieve the goal, it doesn’t mean any of you have failed. It just means we need to think more about what we are doing.

Now, to keep you going each day, I am going to be rewarding those people who have got some great steps counts. We’ve got these special HAPPE badges, that if you achieve your step target, I will call out your name to come and get a special badge that you can wear for the day. I hope you all like them. They are pretty cool. We had them specially made for you.”
Appendix Q
Details of the individual consultations for participants in the HAPPE “Climb Mt Fuji Challenge”

Individual behavioural consultations were an opportunity to recognise each participant’s individual effort and appreciate their contribution to the group’s achievements in a one-to-one environment with the researcher. It provided a confidential space to problem solve any obstacles to their behaviour change and tailor the package to meet the level of each individual (for example, if they were highly active or under active) with respect to their unique circumstances. Examples of how each behavioural component was implemented by the researcher are presented below:

**Feedback** “Let’s take a look at your graph. How many days have you been wearing the pedometer this week. How much quality data do we have? Are your levels increasing or decreasing, what’s the trend here? How often have you been reaching your daily target? What your out-of-school levels are like compared to your in-school levels? What are weekends like compared to weekdays?” (Avoid comparisons to the class mean, and avoid comparisons to peers).

**Goal setting** – Individual goals determined by the baseline level of the individual and the goal (percentage increase) the class agreed to aim for. Daily step target is what they are trying to achieve each day. If they can maintain this new level then they will be doing their bit to help the class get up the mountain in time. Is your goal too easy? Is your goal too hard? Adjust goal to suit individual.

**Planning** “What have you been doing to get your levels up? What do you think you need to do to be able to get your levels up? Your levels are high this week, perhaps you can spend some time to help another person in the class get their steps up a bit higher. Do you know anyone who has been struggling to achieve their goal? What have you got planned for this week, this weekend, this afternoon? Do you have your Plan A, Plan B and Plan C?” Conduct an analysis of participants’ personal contextual factors (including discriminative stimuli (SD), consequences, and establishing operations) that could be arranged to support more active alternative behaviours. Educate participant to arrange contingencies such that least preferred and more effortful activities were
engaged in first before the more preferred and less effortful activities. For example, going for a walk after school before sitting down to play games on the computer, or organising to ride a bike to a friend’s house instead of playing with them at home.

**Positive consequences**— verbal praise and encouragement was provided to individuals for wearing the pedometer, for any improvements in activity levels, for the contribution they are making to the class’s goal and when they had achieved their personal daily step target. Those who had achieved their personal step targets congratulated in front of the class and offered the chance to wear a badge for the day.
Appendix R
Advertisement of the HAPPE Classroom Project for Teachers

The advertisement about the HAPPE Classroom Project sent on the State’s Department of Education and Training’s “Ed-email” system.
Are you interested in physical activity?

Or, maybe you are looking for support to help you meet the two hour physical activity requirement?

Why not take advantage of the free resources offered to schools when they take part in:

**The H.A.P.P.E. Classroom Challenge**
Murdoch University’s physical activity research initiative

You will be given:

1. **50 Yamax Digi-Walker Pedometers** (to count steps, km, calories and activity time) to use with your students (ideally to use with two classes)

2. **Expert support** from a Murdoch University PhD researcher to help monitor activity levels with the pedometers, record and collate information (all that techie stuff)

3. **A classroom poster and resources** for giving feedback about physical activity levels to the kids (these will be in the form of a neat graphical output which children can take home each week).

**It’s as easy as 1-2-3!**

The H.A.P.P.E classroom challenge is a program designed to increase children’s physical activity levels using pedometers and individual and group feedback.

This is a fun, whole-class project for children that can be achieved within the 2 hours per week allocated to physical activity.

The project is also flexible and can be fitted to suit different school structures and is easy enough for anyone to work with (e.g., class teachers, teaching assistants and/or health and P.E. coordinators and specialists). Also, teachers interested in making use of the resources in their classroom should not worry, as there is no additional work involved for the teacher.
So why are we doing this?
In June 2001, the Premier of Western Australia announced a target of raising the level of physical activity in the state by 5 percent over 10 years. The Physical Activity Taskforce was introduced to develop a strategy to fulfill this goal. In parallel with the government initiative to develop strategies to increase physical activity levels, researchers at Murdoch University’s School of Psychology have been conducting research and program evaluation in the area of children’s physical activity because we are keen to find answers to questions like...

c) What are “normal” levels of physical activity for a group of typical Australian children, using pedometers to measure activity levels?
b) Can children increase their habitual physical activity levels?
c) If so, what measurable effects will this have on general health, well-being and development?
   Specifically regarding:
   i. Height, weight, skin folds, waist circumference and B.M.I.
   ii. Heart rate & blood pressure
   iii. Depression, anxiety & self-esteem

c) Is it possible to identify the individual, contextual and environmental characteristics of those children who tend to be very active and those children who are less active?

In order to answer these questions The H.A.P.P.E Classroom Project was designed (and also meets two of the five the focus areas identified by the taskforce). Phase 1 & 2 of the evaluation are already underway at a Perth metropolitan primary school. Currently, we are looking for 2 more schools that are keen to be involved, so that we can begin Phase 3 & 4 of the program’s evaluation.

The outcome aims of this project align well with the D.E.T.’s own Physical Activity Project initiatives and the project has been granted full approval by both the D.E.T. Ethics Committee and the Murdoch Human Research Ethics Committee.

To find out more information;
To have one of the researchers visit your school and/or give a presentation at your next staff / P&C meeting;
or, To get started as soon as possible - please contact the researchers, Cath or David, at Murdoch University.

Contact
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Murdoch University  
Email: c.price@murdoch.edu.au  
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A/Prof David Leach  
Co-Investigator  
The H.A.P.P.E Project  
School of Psychology  
Murdoch University  
Email: d.leach@murdoch.edu.au  
Phone: 6330 7005
A “Wearing my Pedometer” incentive poster was used with the control ‘Ped only’ group in Trial’s 2 to 4 to encourage the use of the pedometer on a daily basis. Names of participants were written down the left column and a tick mark appeared next to their name for each day they wore their pedometer and had usable data recorded.

Figure S.1. The “Wearing my Pedometer” incentive poster used with the control ‘Ped only’ groups.
Appendix T

“My HAPPE Activity Book”

The versions of the “My HAPPE Activity Book” used in Trial 3 and Trial 4 were completed by participants with assistance from the teacher or researcher and was considered to be a valid and reliable method of collecting pedometer data and was.
Welcome!

This is your very own H.A.P.P.E. activity book.

1. Your HAPPE activity book is where you will make a note of what your pedometer is reading each morning and afternoon during school. This will help us understand how active (or inactive) typical Aussie kids are during school hours and how active (or inactive) they are after school. You may also be asked to record the daily total each day.

2. We are relying on you to be HONEST about your activity levels. Remember we want to see what you do by yourself. It doesn’t matter what the number is at the end of the day. It is always best to be honest with yourself about your own activity levels, so you know realistically where you started from and you can see if you have changed over time.

3. We are interested to see how your activity levels change from one day to the next. We all have ups and downs, and this is what Australian researchers need to learn more about. Your individual books will also be kept private so no one else will be able to see what your activity levels are.

4. If you forget to wear your pedometer, don’t worry about taking it down the before and after school measurements. We all forget from time to time, but it helps to get into a routine of putting your pedometer on your clothes as soon as you get dressed in the morning ready for school.

---

<table>
<thead>
<tr>
<th>Practice week</th>
<th>Start of School - 8:50am</th>
<th>End of School - 3:10pm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
<td>Date</td>
<td>step</td>
</tr>
<tr>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thursday</td>
<td>31/07/08</td>
<td></td>
</tr>
<tr>
<td>Friday</td>
<td>01/08/08</td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Practice week</th>
<th>Daily Total</th>
<th>What I did after school.......</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
<td>Date</td>
<td>step</td>
</tr>
<tr>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuesday</td>
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<td>Thursday</td>
<td>31/07/08</td>
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<tr>
<td>Friday</td>
<td>01/08/08</td>
<td></td>
</tr>
<tr>
<td>Saturday</td>
<td>02/08/08</td>
<td></td>
</tr>
<tr>
<td>Sunday</td>
<td>03/08/08</td>
<td></td>
</tr>
</tbody>
</table>

Figure T.1 First two pages of the “My HAPPE Activity Book” used with participants in Trial 3 (aged 11- to 12-years old).
Figure T.2 First four pages of the “My HAPPE Activity Book” used with participants in Trial 4 (aged 8- to 10-years old).
Figure T.2 cont.d Subsequent pages of the “My HAPPE Activity Book” used with participants in Trial 4 (aged 8- to 10-years old).
Appendix U
Bivariate correlation matrix

Table U.1 displays the correlation matrix from the bivariate correlation analysis of the overall sample (i.e., participants from Trial’s 1 to 3).
## Table U.1

### Correlation matrix from Bivariate Correlation analysis

| Correlations | MAX OVERALL CHANGE | Pearson Correlation | Sig. (2-tailed) | N | Pearson Correlation | Sig. (2-tailed) | N | Pearson Correlation | Sig. (2-tailed) | N | Pearson Correlation | Sig. (2-tailed) | N | Pearson Correlation | Sig. (2-tailed) | N | Pearson Correlation | Sig. (2-tailed) | N |
|--------------|-------------------|---------------------|---------------|---|-------------------|---------------|---|-------------------|---------------|---|-------------------|---------------|---|-------------------|---------------|---|-------------------|---------------|---|-------------------|---------------|---|
| CHANG       | -0.044            | 0.049              | 0.046         | 0.130   | -0.042            | 0.130         | 0.085   | 0.061             | 0.037   | 0.042            | 0.138         | 0.142   | 0.157             | 0.048         | 0.176   | 0.061             | 0.074         | 0.102 |
| _of_4       |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _SF_Tot_    |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _B_Dis     |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _Hip R     |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _Chan     |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _N        |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _Change    |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _Heigh     |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _t_Av     |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _Wtch     |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _U_Av     |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _Change    |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _BMI      |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _Waist     |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _Av       |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _Change    |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _Hip       |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |
| _Av       |                   |                     |               |         |                   |               |         |                   |         |                   |               |         |                   |               |         |                   |               |         |

### Notes
- Correlation is significant at the 0.05 level (2-tailed).
- **Correlation is significant at the 0.01 level (2-tailed).**
Appendix V

Flow of participants \((n)\) through each Trial

Diagrams showing the flow of participants through each stage in each trial separately (including data from those who participated in Trials 1 to 4) is presented in Figure’s V.1 to V.4.
Figure V.1. Diagram showing the flow of all participants through each stage of Trial 1, School A, with children aged 7 to 9 years.
Figure V.2. Diagram showing the flow of all participants through each stage of Trial 2, School B, with children aged 8 to 10 years.
Figure V.3. Diagram showing the flow of all participants through each stage of Trial 3, School B, with children aged 11 to 12 years.
Figure V.4. Diagram showing the flow of all participants through each stage of Trial 4, School B, with children aged 8 to 10 years (including the same groups of participants from Trial 2, crossed over to the other condition).
Appendix W
Preliminary cost analysis of the School-based
HAPPE Classroom Program

Assumptions underpinning the preliminary cost analysis of implementing a
HAPPE program in all Western Australian Primary schools:

1. Using curriculum integration approach (in line with numeracy/literacy
   requirements)
2. Program can be facilitated/implemented by classroom teacher or other
   suitably qualified/trained school personnel, already employed at the school
3. Program facilitator/implementer can obtain access to additional specialised
   support/consult with the researcher during the time they run the program.
4. A trained teacher/facilitator may run the program a maximum of 4 times per
   year as there is 4 terms in a school calendar year. Realistically, trained
   teachers may only run program 2 times a year (with different children)
5. May only need 3 teachers per school to be trained (to meet needs of lower,
   middle and upper primary aged children). Thus, a child may be exposed to the
   program a minimum of three times throughout their primary schooling.
6. As of 01/08/2014 there were:
   a. 671 government and non-government primary schools in WA
   b. 21,6614 students attending government and non-government primary schools
      in WA
   (Based on survey data from: http://www.det.wa.edu.au/schoolinformation/detcms/navigation/statistical-reports/)

Tables W.1 to W.4 present data and information on the total costs in the first year
of the HAPPE, areas of potential savings, potential ongoing costs of the HAPPE and the
potential gains of the HAPPE in terms of additional children meeting PA guidelines for
health and well-being.
Table W.1

Data, calculations and information on estimating the total cost of the HAPPE in the first year.

<table>
<thead>
<tr>
<th>Costs in First year:</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-day training course for HAPPE program facilitators. Based on course facilitator costing $100/hr., with groups of up to 16 participants.</td>
<td>$1,000 per course.</td>
<td>Number of teachers receiving training (based on 3 teachers per school)</td>
<td>Number of courses in first year</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional consultation /specialised support. Based on 2 x 1hr. consultations, at $50/hr. per year</td>
<td>$100</td>
<td>2013</td>
<td></td>
</tr>
</tbody>
</table>

Pedometers

|  | Cost per unit based on using research grade pedometers | Number of pedometers per school (3 teachers per school require pedometers) | Number of primary schools in WA |  |
|  | $30 | 90 (approx. 30 pedometers required per HAPPE programme/class) | 671 | $1,811,700 |

Total costs in first year $2,148,000

Table W.2

Areas of potential savings.

Areas of Potential savings:

- Pedometers do not have to be research grade.
- Many schools already have access to large supplies of pedometers, suitable for use in PA interventions.
- Saving approx. $1,000,000
Table W.2

*Estimated potential ongoing yearly costs of the HAPPE.*

<table>
<thead>
<tr>
<th>Potential ongoing yearly costs:</th>
<th>Number of teachers receiving training/ consultations</th>
<th>Number of training courses required per year</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top up facilitator training course (e.g., new staff/refresher course)</td>
<td>671</td>
<td>45</td>
<td>$45,000</td>
</tr>
<tr>
<td>Top up facilitator training course (e.g., new staff/refresher course)</td>
<td>$1,000 per course (Based on course facilitator costing $100/hr.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional consultation /specialised support (1 hr. with teacher)</td>
<td>2013</td>
<td></td>
<td>$201,300</td>
</tr>
<tr>
<td>Additional consultation /specialised support (1 hr. with teacher)</td>
<td>$100 (based on 2 x 1hr. consultations, at $50/hr.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pedometers</td>
<td>671</td>
<td></td>
<td>$402,600</td>
</tr>
<tr>
<td>(Cost per unit based on using <em>research grade</em> pedometers)</td>
<td>20 (approx.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pedometers</td>
<td>$30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total ongoing yearly costs**

$648,900

Table W.3

*Potential gains of the HAPPE in terms of additional children meeting PA guidelines for health and well-being, based on findings from Study II*

| Potential gains:                                                                 |                                             |                                             |         |
| Number of children per HAPPE programme                                       | 30 (approx. class size)                      |
| Potential number of children exposed to HAPPE programme per year              | 120,780                                   |
| Potential number of *additional* children meeting PA guidelines for health     |                                             |                                             |         |
| and well-being per year:                                                      |                                             |                                             |         |
| On weekdays (17%)                                                            | 20,532                                    |
| On weekends (21%)                                                            | 25,364                                    |


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