Understanding the social-ecological influences within school playgrounds on children’s enjoyment and participation in physical activity during school lunch breaks

Mr. Brendon Hyndman
B. Ed. (Physical Education) Honours, University of Ballarat
Grad. Cert. Ed. (Tertiary Education), University of Ballarat

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Doctor of Philosophy
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RMIT University
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As the doctoral thesis supervisor of Brendon Hyndman (B.Ed. (PE) Hons, Grad. Cert. Ed. (Tertiary Ed.) I certify that I consider this thesis ‘Understanding the social-ecological influences within school playgrounds on children’s quality of life, enjoyment and participation in physical activity during school lunch breaks’ to be suitable for examination.

Signed: ______________________________

Date:_____________________

Assoc. Prof. Amanda Telford, PhD
Discipline of Exercise Sciences
School of Medical Sciences
RMIT University, Australia

Signed: ______________________________

Date:_____________________

Dr. Amanda Benson, PhD
Discipline of Exercise Sciences
School of Medical Sciences
RMIT University, Australia
Declaration of the Author

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed.

Signed: ..................................................

Brendon Hyndman

Date: ....................................................
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<td>ABS</td>
<td>Australian Bureau of Statistics</td>
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<tr>
<td>CI</td>
<td>Confidence Interval</td>
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<td>CVD</td>
<td>Cardiovascular Disease</td>
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<td>DEECD</td>
<td>Department of Education and Early Childhood Development</td>
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<td>FMS</td>
<td>Fundamental Motor Skills</td>
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<td>IQR</td>
<td>Interquartile Range</td>
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<td>LEAP</td>
<td>Lunchtime Enjoyment of Activity and Play (Questionnaire); Lunchtime Enjoyment Activity and Play (Intervention Project)</td>
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<td>LPA</td>
<td>Light Physical Activity</td>
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<td>MPA</td>
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<td>MVPA</td>
<td>Moderate-Vigorous Physical Activity</td>
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<td>PA</td>
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<td>PE</td>
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<td>PACES</td>
<td>Physical Activity Children’s Enjoyment Scale</td>
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<td>PEDS QL 4.0</td>
<td>Pediatric Quality of Life Inventory</td>
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<td>RE-AIM</td>
<td>Reach, Effectiveness, Adoption, Implementation, Maintenance</td>
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<tr>
<td>SD</td>
<td>Standard Deviation</td>
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<tr>
<td>SOPLAY</td>
<td>System of Observing Play and Leisure Activities in Youth</td>
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<td>UK</td>
<td>United Kingdom</td>
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USA       United States of America
VPA       Vigorous Physical Activity
WHO       World Health Organisation
Thesis Summary
Understanding the social-ecological influences within school playgrounds on children’s enjoyment and participation in physical activity during school lunch breaks

Background

The promotion of regular physical activity within society has become a major public health objective in an effort to improve health internationally and to prevent the development of obesity and chronic diseases such as type 2 diabetes, cardiovascular disease (CVD) (1) and mental health conditions (2). Childhood is a crucial period to develop health behaviours such as physical activity that can track into adolescence and to a lesser extent into adulthood. Establishing physical activity habits in children is vital, with recent International trends revealing that many children prefer sedentary activities despite physical activity opportunities being readily available (3). Additionally, 31% of Australian children aren’t meeting national physical activity guidelines and almost 70% of children are exceeding the guidelines recommended for screen time (4). Despite childhood being an essential stage to develop physical activity habits, our understanding of how to enhance and maintain the physical activity and health of school children and adolescents remains underdeveloped, necessitating a continuing focus for researchers (1).

An increase in sedentary behaviour, overweight and obese youth worldwide has identified schools as a key setting to develop children’s physical activity. Schools are expected to enhance children’s physical activity, and to provide children with the essential skills, knowledge and attitudes to be physically active (5). Evidence has highlighted schools as the most influential setting for children’s physical activity (5-7). Children spend the majority of their weekdays (> 30 hours per week) in schools, making schools an obvious and suitable setting to promote and implement physical activity interventions (5). The school setting
provides physical activity opportunities for children who may have limited active opportunities within their home or community setting (5). Schools offer a range of physical activity programs that are either curricular (e.g. Physical Education and Sport Education programs), co-curricular (e.g. inter-school sport and school break periods) and non-curricular initiatives (e.g. after school activity programs and active transport programs) (5). Rather than continually increasing the demands placed upon busy Physical Education staff, school break periods have emerged as a critical period to target children’s physical activity (8, 9). Children in some schools engage in up to 4200 school breaks during their primary schooling (3-times per day, 5-days per week, 39-weeks per year (10), 7-years of primary school). Additionally, school breaks can contribute up to 50% of children’s recommended daily physical activity (11). Developing a greater understanding and awareness of the facilitators and barriers of children’s physical activity during school breaks is vital in order to implement school break interventions effectively in an attempt to achieve sustainable health benefits (7, 8). In addition to developing children’s physical activity skills and participation, active play experiences can have a major influence on children’s development of social and cognitive skills through the ‘informal’ curriculum of school breaks (12).

There are a number of measures that can be used effectively during school breaks to assess specific dimensions of children’s physical activity (frequency, duration, intensity and type) including: direct observation, accelerometers, pedometers and self-report instruments (13). However, as all measurement tools have limitations, it is important that where possible a combination of methods are employed to assess children’s school-based physical activity (13, 14). Children’s physical activity behaviour can be very complex and multifaceted. Therefore, using a social-ecological model consisting of multiple levels of influence provides a useful framework from which to understand children’s physical activity behaviour (15). To date there has been limited research employing the key components of the social-ecological model
in children and adolescents (16), especially within a school-context. Social-ecological models suggest that to understand children’s health behaviours such as physical activity it is necessary to consider the interaction between multiple levels of influence including: intra-personal (individual), inter-personal (social), physical environment and policy/organisation environmental factors (15). It is important to gain a broad understanding of the multiple levels of influence on children’s physical activity during school breaks because physical activity behaviour is context-specific (8).

Although school breaks provide an important opportunity for children to be physically active, there are a number of research areas that require further investigation to enhance our understanding of effective strategies to foster health enhancing physical activity among children. Further research is needed to examine the multi-level mediation effects (e.g. enjoyment) on children’s school-based physical activity (7). Another component of health that may be affected by physical activity during school breaks is a child’s quality of life (17). Investigation of children’s quality of life at school has been limited, despite alarming increases in the mental health problems among children (18) and quality of life being linked to many educational benefits (19). Few studies have explored the relationship between physical activity and children’s quality of life (20) and no study we are aware of has examined the influence of changes to a school environment during school breaks on children’s quality of life.

There is growing evidence of the benefits of introducing a diverse range of items into school playgrounds on children’s physical activity (12, 21-23). Interventions that promote variety and choice within school breaks such as school greening projects and movable/recycled materials are an emerging concept to develop multiple childhood health and developmental outcomes in addition to the promotion of physical activity (12, 21-25). Furthermore, interventions that encourage ‘unstructured’ physical activity via non-competitive, open-ended
play opportunities can address low physical activity levels reported among females (24, 25).

The concept of introducing movable/recycled materials shows considerable promise as a sustainable school playground intervention strategy due to the cost-effective and accessible nature of the intervention (e.g. hay bales, milk crates, tyre tubes) (12, 21-23). As movable/recycled materials can be found within the home and community settings, these intervention strategies are easily replicated by children beyond the school setting (12).

Despite research calling for comprehensive evaluations of school-based physical activity interventions (7), only two studies have applied a recognised evaluation framework to examine translatability of implementing a physical activity intervention targeting school breaks (26, 27) using structured-type physical activity interventions. No study we are aware of has comprehensively evaluated the transferability and feasibility of a school playground intervention encouraging ‘unstructured’ physical activity. Comprehensively evaluating the effectiveness of school-based interventions is essential for school settings to achieve sustainable health benefits and to develop a range of physical, cognitive and social skills via the ‘informal’ curriculum of school lunch breaks.

**Purpose**

This thesis aimed to understand the influences within school playgrounds on children’s enjoyment and participation in physical activity during school lunch breaks within the context of the social-ecological model as a framework for understanding physical activity behaviour. A mixed methods approach was utilised to develop a comprehensive understanding of the research questions in this project.

**Study 1:**

The aim of the first study was to investigate the facilitators and barriers of children’s physical activity. Focus groups and drawing were used to qualitatively explore the broader influences
on primary (n=47) and secondary (n=29) school children’s physical activity behaviour beyond the school classroom. Facilitators and barriers to children’s physical activity were categorised using a multiple level social-ecological framework incorporating intra-personal, inter-personal, physical environment and policy factors. Based on children’s drawings, comparisons between children’s existing play spaces and their perception of their ideal play space were made. Additionally, children depicted what features within a play space would encourage physical activity. The research from this study revealed that children had a desire for a variety of new features and activities within their school play spaces to facilitate physical activity during school breaks. However, these suggestions often contrasted the features of their existing school play spaces. The findings suggest that there is a lack of facilities and play spaces conducive to active play during school breaks. The identification of multiple level facilitators and barriers to children’s perceived physical activity has the potential to inform the development of future school-based physical activity interventions and self-report measures targeting physical activity behaviour during school breaks.

**Study 2:**

The findings from study one in conjunction with a review of existing literature were used to inform the development of study two which involved the creation of a school context-specific questionnaire. The aim of the cross-sectional study was to develop the face and content validity and examine the reliability of the Lunchtime Enjoyment of Activity and Play (LEAP) Questionnaire. Questionnaire items were categorised employing a social-ecological framework including intra-personal (20 items), inter-personal (2 items) and physical environment/policy (17 items) components to identify the broader influences on children’s enjoyment. An identical questionnaire was administered as a test-retest on two occasions, 10 days apart, to 176 children aged 8-12-years-old, attending a government primary school in
regional Victoria, Australia. The test-retest reliability of questionnaire items were determined using a weighted kappa. Test-retest reliability confirmed that 35 of 39 LEAP questionnaire items had at least moderate kappa agreement ranging from 0.44-0.78. Although four individual kappa values were low, median kappa scores for each aggregated social-ecological component reached at least moderate agreement (0.44-0.60). The findings confirmed the LEAP questionnaire as a reliable instrument with sound content and face validity. The LEAP questionnaire employed a social-ecological framework to assess children’s enjoyment of school play and lunchtime activities, including the number and type of school play activities children enjoy and the extent of his/her enjoyment. When assessing children’s enjoyment of play and lunchtime activity and tailoring intervention strategies during school breaks, it is essential to ensure that measurement tools consider the multiple faceted nature of physical activity behaviour. The findings suggest that sex can be an influential factor on the overall test-retest reliability of a group’s enjoyment of school play and lunchtime activity.

**Study 3:**

The aim of this cross-sectional reliability study was to examine the intra-day variability and inter-day reliability of children’s enjoyment of school lunchtime play. Questionnaires used to assess children’s enjoyment of lunchtime play were completed by 197 children (112 males, 85 females), aged 8-12-years-old attending a primary school in Victoria, Australia. Children completed the surveys during class before lunch (expected enjoyment) and after lunch (actual enjoyment) for five days. The intra-day variability and inter-day reliability of children’s enjoyment of school lunchtime play were determined using a weighted kappa. Intra-day agreement values ranged from fair (0.31) to substantial (0.75) within each of the five days (median agreement=0.41). In comparison, ‘expected’ (0.09-0.40; median 0.30) and ‘actual’ (0.05-0.46; median 0.28) inter-day enjoyment of lunchtime play displayed low agreement.
Study three addresses a significant gap in the literature by examining the variability and reliability of measuring children’s enjoyment of lunchtime play within and across multiple days. The level of agreement between children’s ‘expected’ and ‘actual’ enjoyment of lunchtime play scores reached at least a moderate level for most days. This acceptable agreement within most of the school days suggested that measuring children’s ‘expected’ or ‘actual’ enjoyment of lunchtime play was likely to represent that particular school day. In contrast, only a very small proportion of inter-day comparisons for enjoyment of lunchtime play reached a moderate level of agreement. This indicated that factors influencing children’s experiences from day to day may affect the variation of enjoyment scores on other school days and therefore may not necessarily be representative of children’s enjoyment of lunchtime play across different days of the week. Generally, children expected to enjoy lunchtime play in greater proportions than they actually did, indicating children expected to have a positive experience during their school lunchtime play. The findings suggested that age didn’t appear to affect the variability of enjoyment scores in the sample surveyed however, sex can be an influential factor on the overall variability of a group’s enjoyment of lunchtime play.

Study 4:

The aim of this study was to evaluate the effects the LEAP (Lunchtime Enjoyment Activity and Play) school playground intervention had on children’s quality of life, enjoyment and participation in physical activity during school lunch breaks. This study consisted of a movable/recycled materials intervention underpinned by a social-ecological theoretical framework that included baseline, a seven-week post-test and an eight-month follow-up data collection phase. Children within an intervention school (n=123) and a matched control school (n=152) aged 5-to-12-years-old were recruited for the study. Children’s physical
activity was measured using a combination of pedometers and direct observation (SOPLAY). Quality of life, enjoyment of physical activity and enjoyment of lunchtime activities were assessed in the 8-12 year children. A multi-level mixed effect linear regression model was applied in STATA (version 12.0) using the *xtmixed* command to fit linear mixed models to each of the variables to examine whether there was a significant difference (p < 0.05) between the intervention and control school at the three time points (pre, post and follow-up). Significant overall interaction effects (group x time) were identified for children’s mean steps and distance (pedometers) in the intervention school compared with the control school. Intervention school children also spent significantly higher proportions within specified target areas engaged in higher physical activity intensities in comparison to the control school at both the seven-week post-test and eight-month follow-up. A short-term treatment effect was revealed after seven-weeks for children’s physical health scale quality of life, enjoyment of physical activity and enjoyment of intra-personal play activities. Direct observation of the school playground at designated time points throughout the school year revealed that children sustained their engagement with the intervention materials during play. The intervention school’s predominant physical activity type also evolved over time from imaginative play with the movable/recycled materials during post-testing (7-weeks after baseline) to building and construction during follow-up (8 months after baseline). Examining the effects of this school playground intervention over a school year suggested that the introduction of movable/recycled materials can have a significant, positive long-term intervention effect on children’s physical activity. The implications from this simple, low-cost intervention provide impetus for schools to consider introducing the concept of a movable/recycled materials intervention on a wider scale within primary school settings.
Study 5:

A process evaluation of the LEAP school playground intervention was conducted. The study aimed to provide insight for teachers of the external validity of the LEAP playground intervention to the wider school community by applying the reach, effectiveness, adoption, implementation and maintenance (RE-AIM) evaluation framework. Data was collected using a mixed methods approach for two and a half years including direct observation, field notes and a teacher focus group interview nine months after the commencement of the intervention. The results from this study indicate that the LEAP intervention could feasibly be implemented and maintained for at least a two and a half year period. Reach, Effectiveness, Adoption, Implementation and Maintenance were revealed to be successful. The cost-effectiveness, diversity and sustainability of the movable/recycled materials were seen as major factors for the success of the LEAP intervention. The multiple individual and social health developments of the children from the intervention warrant further replication in other school settings. The findings from this study provide a guide for schools to be able to implement the LEAP intervention in school playgrounds on a wider scale.

Overall Conclusions

In summary, from this series of studies, it is possible to suggest that researchers can now target children’s physical activity during school lunch breaks with more confidence. Multiple social-ecological levels of influence on children’s physical activity during school breaks were identified. The facilitators and barriers to children’s physical activity during school breaks provided the framework to develop a reliable self-report measure examining multiple levels of influence on primary school children’s enjoyment of lunchtime play activities (LEAP questionnaire). The LEAP questionnaire study filled an important gap in the literature via the development of a school context-specific instrument to measure enjoyment, a key mediator of
children’s school-based physical activity. Important for measuring children’s enjoyment of
play during interventions targeting school lunch breaks, the intra- and inter-day reliability
measurements established that measuring children’s enjoyment of lunchtime play would be
representative of that particular day, but not necessarily that school week. Furthermore, a
range of overall physical activity (steps, distance, intensity, activity types) and short-term
quality of life and enjoyment effects from introducing a movable/recycled materials school
playground intervention were evident. The RE-AIM evaluation and social-ecological model
frameworks revealed that due to the cost-effectiveness, diversity and sustainability of
introducing movable/recycled materials, the movable/recycled materials intervention could
feasibly be implemented and maintained in a school for at least two and a half years. The
positive and multiple social-ecological levels of influence from the intervention suggested
that the simple implementation of movable/recycled materials could challenge the concept of
conventional, fixed school playgrounds for use during school breaks. There are a number of
challenges that face schools to promote children’s physical activity in our modern, urbanised
society. This thesis builds upon previous literature to provide a range of multiple level
strategies to ensure schools can take an active role in providing their children with a variety
of daily physical activity opportunities within the crucial setting of schools and context of
lunch breaks.
Chapter 1

Introduction
1 Introduction

The promotion of regular physical activity is a public health priority worldwide for the prevention of obesity and chronic diseases such as type 2 diabetes, osteoporosis and cardiovascular disease (1). Physical activity is vital and defined as “any bodily movement produced by skeletal muscles that results in energy expenditure” (p126) (28). Promotion of regular physical activity during childhood within schools, home and community settings is important (5) as childhood forms the foundation for physical activity habits that can track into adulthood (29). Evidence suggests many children prefer engaging in sedentary activities despite physical activity options being available (30). Moreover, evidence from a recent Australian population survey suggests 31% of children are not meeting national guidelines for moderate-vigorous physical activity (MVPA) and 67% of children are exceeding recommendations for electronic screen time (4). Despite childhood being a crucial period for developing physical activity behaviour, we have a limited understanding of how to develop and sustain the physical activity and health of school children and adolescents (1, 31). This introduction will explore some of the influences on children’s health, current physical activity guidelines and trends in children’s physical activity, measurement strategies, theories underpinning health behaviour and key settings to target children’s physical activity.

1.1. The Importance of Physical Activity for Children’s Health

In this section, the importance of promoting regular childhood physical activity to prevent obesity and chronic diseases such as type 2 diabetes, cardiovascular disease and osteoporosis and to enhance cognitive/mental functioning are outlined.
1.1.1 Obesity

School-aged children’s obesity rates have soared to become an epidemic in recent decades (32). Recent reports indicate physical inactivity accounts for 1.5% to 3.0% of total direct healthcare costs in developed countries (32) or an estimated 1.9 million deaths worldwide (33). Childhood obesity has been linked with metabolic syndrome, cardiovascular disease (34), premature mortality, psychological illness, joint and respiratory problems (35). Energy consumption has been suggested to have increased among Australian children (aged 10-15-years-old) by 10 per cent between 1985 and 1995 emphasising the importance of concurrently increasing children’s energy expenditure via regular physical activity (36). The increase of children’s energy consumption could be a key reason for the rate of overweight and obesity in children is plateauing (37).

Although energy consumption can be a key contributor of obesity, a major preventative strategy is for children to participate in regular physical activity (38). Numerous studies have identified the positive relationship between regular physical activity and the reduction of body mass index (BMI) and waist circumference associated with obese children (39-41). To counteract the growing obesity epidemic (37), research conducted in the United States (US), Europe and Australia has recognised that regular physical activity can have a positive effect in reducing the effects of obesity susceptible genes in children and adolescents (42, 43). Research highlights that children’s motivation to be active should be targeted during early childhood, as physical activity can decline significantly by year four in primary schools (44).

Moreover, a number of physical activity tracking studies have established children’s physical activity habits can track into adulthood (29). Physical activity habits that have been established by year six in primary schools have been shown to track consistently into adulthood (45). It is important to target children’s physical activity during primary school as once children reach adolescence physical activity behaviour is difficult to modify. It is likely
that a lack of physical activity during childhood contributes to the development of obesity, which in turn results in reduced levels of physical activity, thus increasing the associated morbidity and mortality (45).

1.1.2 Type 2 Diabetes

Evidence also suggests physical activity is beneficial in reducing the risk of type 2 diabetes among youth. A six-year longitudinal study examining the relationship between physical activity and insulin resistance discovered that both volume and intensity of physical activity could improve children’s and adolescents’ insulin resistance associated with type 2 diabetes (46). Many large studies of adults have identified that the risk of type 2 diabetes can be decreased by participating in brisk walking or vigorous physical activity for five hours per week (47), reducing electronic screen time (47), increasing sports activity (48) and a number of exercise and diet intervention programs (49-51). Although evidence of such programs has been rare in children, the development of cardiopulmonary fitness and weight reduction from physical activity are suggested to be successful measures to prevent type 2 diabetes in children (52-54). Once considered a rarity in childhood, type 2 diabetes has escalated (55), highlighting the importance of encouraging such exercise programs to decrease the risk factors associated with type 2 diabetes amongst children. Previous research suggests that preventing an age related decline in physical activity levels could be an effective strategy to reduce insulin resistance and type 2 diabetes occurrence in youth.

1.1.3 Cardiovascular Disease

Similar to reducing the risk of obesity and type 2 diabetes, evidence suggests physical activity can reduce the risk of cardiovascular disease (CVD), the leading cause of adult death in many countries worldwide (56-58). Although, cardiovascular disease isn’t expected to impact on childhood mortality, participation in regular physical activity early in life can
significantly reduce its occurrence during adulthood (59). Research has linked children’s physical activity to the development of cardio-respiratory fitness and the reduction of cholesterol profiles and hypertension (60). Similarly, an examination of CVD risk factors has revealed that participation in physical activity and weight control interventions are required to reduce CVD events amongst children (61). The studies highlight that even moderate levels of physical activity can have a positive impact on CVD and reinforce the need to establish a physically active lifestyle at an early age.

1.1.4 Bone Density

Bone mineral density also appears to be positively influenced by physical activity in childhood. Evidence suggests that childhood is a critical period in which physical activity can have a significant effect on factors related to bone strength (62-64). Interventions and longitudinal studies in children support this evidence that physical activity stimulates bone mineral density (65, 66). Many reports across age groups have also uncovered that children who participate in regular physical activity have increased bone density, which prevents bone loss and osteoporosis as individuals age (67). Maintaining bone density also appears to reduce the risk of bone fractures, emphasising the importance of participation in regular physical activity (68). With childhood a critical window of opportunity in which bone is most responsive to exercise in order to establish strong bones later in life (69), it is crucial that our younger generation participate in regular physical activity. Whilst the importance of developing habitual physical activity at an early age has been recognised, key strategies to develop children’s physical activity behaviour need to be established and warrant further investigation.
1.1.5 Cognitive Functioning and Mental Health

Increasing physical activity levels among school-aged children enhances cognitive and academic performance (70-75). Evidence suggests physically fit children have greater capacity to process information in their working memory than unfit children (70, 71). Children that participate in regular physical activity have also been reported to have greater attention spans (70), executive control (assists planning, monitoring and retrieving information) (71) and achievement on academic assessments (73, 74). In addition to cognitive functioning, physical activity has been shown to counteract psychological distress in youth (76). This is an important finding as the rate of Australian children with mental health problems is on the rise (2). Enhancing children’s physical activity participation within schools could be a key strategy to develop children’s learning capacity and relieve mental stress.

1.2 International and Australian Guidelines for Children’s Physical Activity and Sedentary Behaviour for Children

In an effort to encourage young people to be active, Australian and International organisations have developed physical activity guidelines and recommendations (77-80). Introduced in 2004, Australia’s physical activity guidelines for 5-18-year-olds recommend that children and adolescents should engage in a minimum of one hour of moderate to vigorous physical activity (MVPA) each day (up to several hours) and should not spend more than two hours per day using electronic media for entertainment (e.g. computer games, internet, television) (77). Examples of MVPA include brisk walking, jogging, stair climbing, basketball, racquet sports, soccer, dance, swimming laps, skating, strength training, lawn mowing, strenuous housework, cross-country skiing and cycling (5). Based on research
linking active lifestyles to a reduction in obesity, the guidelines provide children with a physical activity target and assist in categorising individuals as sufficiently active (81).

Prior to the Australian physical activity guidelines, the “Young and Active?” framework was released in the United Kingdom (UK), featuring physical activity guidelines for children (78). The primary recommendation for UK children was to participate in an hour of daily, moderate physical activity (MPA) to encourage aerobic benefits and energy expenditure (82). A secondary recommendation was to engage in two sessions of weight bearing activities per week to develop muscular strength, flexibility and bone density (82). The recommendations were described as focusing on a suitable range of fitness components, realistic for children and encouraging physical activity enjoyment (82). Reflecting Australian physical activity guidelines, the UK guidelines were updated in 2011 to outline that children should be engaging in one hour of MVPA each day (up to several hours). Vigorous intensity activities that strengthen muscle and bone for at least three days a week and minimising the time spent sedentary (e.g. sitting) for extended periods were also recommended for children (83), but unlike the Australian sedentary behaviour guidelines do not quantify the time requirement.

Similar childhood physical activity recommendations have been established in the USA and Canada (84, 85). In the USA and Canada, guidelines recommend children and adolescents should complete a minimum of one hour of MVPA per day that should include at least three days a week participating in vigorous, muscle strengthening and bone strengthening physical activities (84, 85). The USA guidelines also outline that children should undertake a variety of age-appropriate and enjoyable physical activities (84).

1.3 Current Patterns in Children’s Physical Activity and Sedentary Behaviour

A major concern is that physical activity habits can track from childhood into adulthood (86-88). According to Friedman and colleagues, “Active, energetic children tended to become
active, energetic adults, and in turn remain active” (p1100) (89). More recently, a large literature review confirmed the tracking of physical activity habits from childhood to adulthood (coefficient range; males=0.03-0.44; females=0.07-0.66), emphasising the need to develop physical activity behaviours early in life (90). A 20-year tracking study of physical activity domains also identified that childhood participation in school Physical Education (PE) could predict total weekly physical activity (coefficient= 0.09) and daily steps in adulthood (older females; coefficient= 0.12), leisure physical activity in childhood could predict adult leisure activity (older males; coefficient= 0.12) and childhood sport participation could predict a range of physical activity types in adulthood (coefficient range= 0.08-0.14) (88).

Children are becoming more sedentary in many countries worldwide (55) and sedentary behaviour is reported to track from childhood through to adulthood (29). In response to concerns about the prevalence of sedentary behaviour in children and the implications for the development of chronic disease, large population surveys were conducted in the UK, USA and Australia to measure the current patterns in children’s physical activity participation (91, 92). Recent reports indicate physical inactivity (not meeting the physical activity guidelines) accounts for 1.5% to 3.0% of total direct healthcare costs in developed countries (32) or an estimated 1.9 million deaths worldwide (33). Within the UK, national data revealed that 44% of children weren’t meeting recommended levels of physical activity of one hour of daily MVPA, with girls’ activity levels decreasing with age (93). It has been reported in the USA that many American children aren’t sufficiently vigorously active and males are more likely to meet physical activity guidelines than females (94). Similar to the findings in the USA and UK, a recent Australian population survey of children revealed that 37% of children were not participating in organised sport activity outside of school and 75% of children were using a computer on more than one day each week outside of school hours (92). The Australian
Sedentary behaviour guidelines state screen time should be limited to a maximum of two hours per day (92). It has also been suggested that energy consumption has increased in Australian children aged 10-15-years-old by 10% between 1985 and 1995, highlighting the importance of increasing energy expenditure in children via regular physical activity (36).

The New South Wales (NSW) Schools Physical Activity and Nutrition Survey (SPANS) (91) reported that 10-20% of children weren’t meeting the Australian childhood physical activity recommendation of one hour of MVPA each day. More specifically, 40% of year 10 girls (aged 15-16-years-old) weren’t meeting the national physical activity guidelines. The report revealed that physical activity declined from year six (11-12-years-old) to year 10 (15-16-years-old) and healthy weight children were only slightly more active than obese children. Similar to the proportion of NSW children not meeting national physical activity guidelines, findings from the Australian Nutrition and Physical Activity Survey (2007) concluded that 31% of children weren’t meeting the national guidelines for MVPA (95) and 67% of children aged 9-16-years-old in the national survey were exceeding the recommended maximum of two hours of electronic screen time. The findings are reinforced by the 2009 Victorian Population Health survey that reported almost 40% of children aged 5-12-years-old weren’t meeting national physical activity guidelines, a rise of 10% from the 2006 Victorian survey (96). Furthermore, of concern is the increase in the proportion of children not meeting physical activity guidelines in the 5-8-year-old (31.3%) and the 9-12-year-old (47.8%) age groups. Children are an important group to target for interventions as they form personal identities, morals, beliefs and values towards physical activity (97), therefore it is important children are encouraged to be active early in life. The declining trends of children’s physical activity levels identified from state-wide, national and International reports should be addressed at an early age to ensure the risk of chronic diseases are prevented from tracking from youth into adulthood (29).
1.4 Measurement of Physical Activity and Sedentary Behaviour in Children

Valid and reliable measures are essential to monitor the adherence to physical activity guidelines (98). Many different instruments have been used to measure the physical activity behaviour of children and adolescents that can be categorised as either objective or subjective measures. Objective measures include direct observation, accelerometry, heart rate monitoring, pedometry and subjective measures include questionnaires, diary or log book. Accurate use of both subjective and objective measurement of children’s physical activity is important to identify physical activity trends and prevalence, health outcomes and evaluating physical activity interventions (13). The sporadic nature of children’s physical activity means measurement of physical activity is a challenging and complex process.

All physical activity measures have advantages and limitations associated with their use. Direct observation is an effective measure when assessing the physical activity levels of a small group in a specific setting, yet can be costly and relies on a number of trained observers (13). There is evidence that pedometers are becoming increasingly popular in physical activity research to measure children’s steps and distance. Pedometers however, provide no information on the dimensions of physical activity including; intensity or duration, cannot be used for contact sports or during water activities, are insensitive to non-locomotor activities and are vulnerable to data loss (13). In contrast, the use of accelerometers can capture specific time periods, duration and intensity of children’s physical activity and can be effective to assess children’s physical activity in large groups, individually and to measure the effectiveness of interventions. Limitations of the accelerometer however include the large cost of the instrument, complexity to operate and analyse data and a failure to provide data regarding type of physical activity (13). Heart rate monitoring is effectively measured at the individual level via fixing a strap around the chest, but can be negatively affected by fitness,
emotion and temperature, doesn’t take into account the type of activity performed and is not recommended for use with children (13).

Subjective measures such as questionnaires, log books and diaries tend to be used with larger groups, although diaries are also used to obtain data from smaller populations. When questionnaires are conducted with children under eight-years, it is recommended that proxy-report is used, as children under eight-years of age have difficulty recalling their health behaviour (99). The positives of subjective instruments is the reduced cost of measuring physical activity amongst larger groups and the capability to obtain data on physical activity habits and contextual information that objective measures are unable to derive (13). As most measures have limitations, the most effective approach to assess children’s physical activity is to utilise a combination of methods (14).

1.5 Understanding Children’s Physical Activity

1.5.1 Models that Explain Physical Activity Behaviour

There is no single, accepted theory, model or approach which explains children’s physical activity behaviour or strategies to target this behaviour. Multiple theories, models and approaches have been applied or recommended in the international literature. The trans-theoretical model integrates multiple theoretical concepts and describes the cognitive strategies to modify an individual’s experiences and the environment (100). These strategies are to support attempts to progress through stages of change from intention to adoption and maintenance of physical activity (100). The theory of planned behaviour is similar to the trans-theoretical approach however, within the theory of planned behaviour, intention is outlined as the most significant determinant of physical activity behaviour (101). The Social Cognitive Theory (SCT) is a model describing behavior change describing the individual, behavior and environmental factors that interact to predict behavior (102). The SCT outlines
that an individual’s perception of their ability to demonstrate a specific behavior (e.g. goals, standards, facilitators and barriers), are suggested to be a key predictor of behavior change (102). Moreover, the Health Belief Model attempts to explain the thought process behind an individual’s decisions to modify and maintain health behavior (103). The Health Belief Model outlines that an individual is more likely to modify health behaviour if they perceive benefits and feasibility of the behaviour change (103). Additionally, Self-Determination Theory (SDT) describes a framework of motivation that considers individuals to be searching for challenges and experiences to engage with and master (104, 105). The SDT considers human beings to be motivated to achieve certain objectives (e.g. intrinsic, extrinsic and extrinsic motivations) (105).

Until recent times, previous research had not investigated the context and broader determinants within which health behaviour occurs, rather focusing on the individual influences on physical activity behaviour (106, 107). These broader influences on health behaviour may be linked to the social-ecological model of human behaviour, which emphasises a need for a ‘person-environment’ fit (107), implying that there is an association between the intra-personal (individual) level, inter-personal (social) environment level, physical environment level and policy level influences (Figure 1.1). Many health behaviour models do not show the interactions between the environmental factors and can miss vitally important influences on children’s physical activity. Knowledge of these environmental factors are important to guide physical activity interventions. Attempts to modify physical activity behaviour at a single level on its own (e.g. self-efficacy) will be resisted by other environmental factors (15). Many factors within the environment can conspire against changes that are applied addressing a single environmental level (15, 107). Successful behaviour modification programs must not only modify an individual’s behaviour, but also the multiple level environmental context in which the behaviour is taking place (15, 107).
Figure 1.1. The social-ecological model levels of influence on children’s physical activity. Adapted from Salmon and King, p188 (15).
Thus, there is an increasing need to address the world’s health problems by implementing multilevel interventions applying a social-ecological theoretical model (15, 108).

Within the thesis, the social-ecological model will be used as a framework to explore information within each of the levels of influence and children’s physical activity behaviour. Interventions that simultaneously affect multiple levels and multiple settings can be expected to achieve effective and long lasting physical activity outcomes (15). The framework aims to present an account of the diverse range of possible intra-personal, inter-personal, physical environment and policy influences on physical activity. The many levels of the social-ecological framework ensure health behaviour change is comprehensively accounted for. Therefore, the social-ecological model is the most appropriate theoretical model to examine children’s physical activity behaviour.

1.5.2 Mediators of Children’s Physical Activity Behaviour

The lack of effective interventions targeting children could be due to the poor understanding of the mediators of behavior change (109). Mediators are defined as, “intervening causal variables that are necessary to complete a cause-effect pathway between an intervention and physical activity” (p13-14) (110). Measurement of the mediators (e.g. mechanisms for change) of children’s physical activity behavior has been limited (109, 111, 112). There are three types of mediators for physical activity behaviour that include cognitive mediators (e.g. self-efficacy, enjoyment, outcome expectancy, perceived benefits/barriers), behavioural mediators (e.g. goal setting, rewards) and inter-personal mediators (e.g. social and peer support) (109).

A systematic review investigated studies conducted over a 21-year period examining mediators of behavioural change on children’s physical activity. This review revealed that physical activity knowledge/beliefs, self-efficacy and enjoyment or preference for physical
activity were the most commonly measured mediators (113). Despite positive changes being identified for each of these mediators, none of these studies examined whether the positive changes in the mediator influenced children’s physical activity behaviour. Identifying the underlying mechanisms behind children’s physical activity is important to understand and modify children’s physical activity behaviour (114).

More recently, the most commonly reported mediator of children’s physical activity has been established as self-efficacy and this has been linked to physical activity participation within a number of studies (115-117). Outcome expectancy, perceived benefits and physical activity enjoyment have also been positively associated with children’s physical activity (115-117). Despite the limited evidence, research has revealed no mediation effects of changing perceived barriers, social support and enjoyment of Physical Education on children’s physical activity participation (115-117).

Emerging research is starting to emphasise the important link between the mediator of enjoyment and children’s participation in physical activity (118, 119). Enjoyment stems from kinaesthetic experiences and the achievement of personal goals and is defined as “a positive affective response to an experience that reflects generalised feelings such as pleasure, liking, and fun” (p32) (120). The positive association between enjoyment and behaviour change is emphasised by the Self-Determination Theory (SDT) (121). Self-Determination Theory outlines that if children enjoy participating in a particular physical activity (e.g. intrinsic motivation) this increases the likelihood of children adopting and maintaining participation in physical activity. Enjoyment has been shown to mediate involvement and participation in sport (122) and physical activities (118, 123, 124). Other studies have also recognised the link between enjoyment and correlates of physical activity including self-determination (125), motor skill proficiency (126), task orientation (127), self-efficacy (128), goal setting (128) and perceived competence (127). The emerging research examining enjoyment
suggests studies should examine this mediator when judging the success of implementing physical activity interventions targeting children. Researchers have also identified a need for further investigation into mediators of physical activity and whether mediators such as enjoyment can explain the effects of interventions (7, 114, 129).

1.5.3 Correlates of Children’s Physical Activity

In order to develop appropriate physical activity interventions in children, correlates (statistical associations between measured variables) of children’s physical activity need to be clearly understood. Interventions that take into account influences on physical activity participation are suggested to be most effective in modifying physical activity behaviour (130). Many studies have been conducted to identify the correlates of childhood and adolescent physical activity. A comprehensive review of 108 studies published over 28-years, conducted by Sallis and colleagues (131), reported almost 60% of the variables evaluated possessed a significant relationship with physical activity participation. The variables that were consistently linked to childhood physical activity behaviour included time outdoors, eating nutritional food, access to facilities, exercise motivation, sex (male), low parental body mass index (BMI), preferences for physical activity and past physical activity participation (131). Additionally, exercise opportunities, sex (male), exercise motivation, past physical activity participation, family and social support, Caucasian ethnicity, community sports and exercise self-efficacy were associated with physical activity participation in adolescence (131). The failure to perform an effective meta-analysis due to the varied participants, methods, determinants and modes of analysis was a limitation of the study. Researchers also indicated the possibility that articles could have been overlooked and that many studies failed to publish negative findings. The review had strong implications for future intervention
programs aimed at children and adolescence and identified groups that should be targeted for physical activity intervention including females, older adolescents and certain ethnic groups.

More recently, understanding of the correlates of youth physical activity was further enhanced. Similar to the findings from Sallis, a review of studies (n=60) published between 1999 and 2005 revealed sex (male) and exercise motivation were consistently reported to influence children’s physical activity participation. In contrast to the earlier review, parental education, attitude, self-efficacy, school physical activity opportunities, family influences and social support all had a significant association with children’s physical activity. Furthermore, sex (male) and Caucasian ethnicity were again positively associated with adolescent physical activity. Education level of parents and socioeconomic status has been consistently shown to be correlated with physical activity in adolescents (132). Researchers suggested that further investigation into the correlates of youth physical activity is necessary to inform the development of interventions targeting physical activity and sedentary behaviour of children and adolescents (132).

1.6 Important Settings for Children’s Physical Activity

Understanding the most effective strategies to promote physical activity behaviour and the settings in which to intervene is necessary to minimise sedentary behaviour and physical inactivity during childhood that can lead to chronic disease (133). By developing an understanding of the components that are important within settings and which settings are important to develop children’s physical activity may inform the development of effective intervention strategies.
1.6.1 Children’s Physical Activity in the Home Setting

The home setting is suggested to be an influential setting for youth physical activity. Researchers conducted a systematic review of 150 studies published over 25-years to establish associations between environmental settings and children’s physical activity (134). Although investigators revealed many strong associations between the school setting and children’s physical activity behaviour, it was revealed that home support for physical activity also had a significant influence on children’s physical activity participation. The home setting has been suggested as crucial for providing children with access to opportunities for physical activity beyond the school setting (135, 136).

It has been well established that parents have control over children’s access and availability to physical activity opportunities (137, 138) and children are more likely to participate in increased physical activity at home, when equipment is available (139, 140). Children with at least seven items to facilitate physical activity in the home have been reported to be two to four times more likely to engage in high levels of physical activity (14). Outside of the school setting, the yard or garden at home has been reported as the most frequent place for children to engage in physical activity (14). Additionally, it has been implied that children possessing a large yard are more active than those with a smaller yard size (14). Crawford and colleagues established that children are more active within the home environment with the presence of parental role models, physical activity rules and siblings (138). Timperio and colleagues (140) also revealed that sibling physical activity and environmental stimuli could be key physical activity strategies in the home setting. Moreover, a study of children’s perceptions of physical activity in the home environment revealed bicycles, swimming pools, trampolines and basketball rings are important for children’s physical activity (141). Although a concerning finding from the study was that fewer than half of the primary school
aged children accessed any physical activity opportunities at home, and over half of the children engaged in sedentary opportunities (141).

Children spend a substantial proportion of their days at home during evenings, weekends, holidays and pupil free days. Despite the potential for children to be active within the home setting, sedentary opportunities are abundant. Girls who have a preference for watching TV and who spend greater than 30 minutes engaged with electronic media are more likely to engage in low physical activity (142). It is possible that some children may see the home setting as more of a place for sedentary opportunities in comparison to the school setting (141). Mapping methodology employed by Hume and colleagues identified that within the 72 maps of the home environment children drew at least one television and regularly drew a computer (141). In contrast, a mapping study of children’s perceptions of the school environment discovered primary school children rarely drew a sedentary opportunity (30). As there are many physical activity opportunities available during a school day (30), children may view the home setting as an environment to rest and recover rather than complementing the physical activities performed during the school day. Despite the home environment providing opportunities for children to be physically active, most children spend large portions of their mornings and nights in transit to and from school (5). This can limit children’s time to be active at home. As children spend much of their days getting ready for or attending school, the school setting has emerged as the major setting for children to be physically active.

1.6.2 Children's Physical Activity in Community Settings

Researchers have identified that there are many physical activity opportunities for children within community settings. Community settings have been associated with positive physical activity participation in children living in low crime rate areas (134). It has been reported that
design features, personal motivation, presence of friends and play equipment can positively influence children’s use of public open spaces for physical activity (143). Studies have also reported that children would like to live in a neighbourhood with people who are physically active and have access to multiple public recreation facilities that are affordable (144). Safety has also been established as a major influence on children’s physical activity within the community (143, 145). Parental concerns regarding safety can restrict primary school-aged children’s potential to be independently active in the community setting and the time children spend engaged in active, outdoor physical activity beyond school hours (146). Within the community, the most frequently reported places for children’s physical activity are the park, playground, friend’s house and relative’s backyard (145). More recent studies have revealed that being outdoors (147), having friends in the neighbourhood and living in a closed street could also positively influence children’s community physical activity (148).

Although many studies have explored the influence of the home (141) and community settings (141, 145, 149), the limited time and barriers for children to engage in the recommended physical activity within these settings highlight the school environment as the key physical activity setting for children (6, 134).

1.6.3 Children’s Physical Activity and School Settings

A reduction in children’s physical activity opportunities (150) and the growth of overweight and obese youth worldwide (151) has placed emphasis on schools as a crucial setting to develop children’s physical activity. With growing attention on schools to develop physical activity, there is a need to provide children with the essential skills to be physically active (152). The school environment is suggested to be the most influential setting for children’s physical activity. A systematic review of 150 studies from over a 25-year period established strong associations between school physical activity policies and school attendance on
children’s physical activity (134). School is the setting in which almost all children spend the majority of their weekdays (above 30 hours per week) and an ideal environment for preventative public health interventions (5). The school setting provides a number of programs and positive physical activity opportunities for children that have limited access to play areas at home and the surrounding community (5). School-based physical activity programs may include curricular initiatives (e.g. Physical Education and Sport Education programs) co-curricular (e.g. inter-school sport and school break periods) and non-curricular initiatives (e.g. after school activity programs and active transport programs) (5). As school-aged children spend the majority of their waking hours either in transit to school or within the school setting and international standards require children to attend school well into adolescence, there is encouraging scope for the school setting to reduce chronic diseases that can track into the adult population (5). Targeting the school setting can promote knowledge and behaviour to develop the health behaviour of those children susceptible to disease and to maintain the habits of healthy children (5). Schools are learning environments, therefore the capacity to equip children with the attributes to be physically active can be readily achieved. It is the quality of facilitating school physical activity programs that need to be investigated to ensure children can develop into physically educated citizens (152). The provision of quality school physical activity experiences for children’s development can be affected by multiple level factors that can be facilitators or barriers to children’s physical activity behaviour. Interventions need to be designed to maximise facilitators and minimise barriers to ensure children can experience engaging physical activity opportunities within the school setting.
Chapter 2

Literature Review
2 Literature Review

2.1 Introduction

This literature review will discuss existing peer-reviewed published evidence pertaining to the importance of children engaging in regular physical activity within the context of school break periods. The discussion will begin by highlighting the importance of being active within the school setting via curricular and non-curricular physical activity opportunities. The review will continue by outlining instruments used to measure children’s school-based physical activity. The chapter will continue with a discussion about the diverse influences on children’s physical activity during school breaks, categorised using a social-ecological framework. Previous playground interventions targeting children’s participation in physical activity during school breaks will also be outlined. Finally, the review will conclude with the research questions to be addressed and the aims of the research presented within this thesis.

2.2 Importance of the School Setting for children’s physical activity

2.2.1 Curricular Opportunities for Physical Activity for Children

School Physical Education and Sport Education programs are the major ‘curricular’ and ‘structured’ avenue for teachers to develop children’s physical skills and physical activity levels (153, 154). With growing parental safety concerns (155) and economic pressures (131, 156, 157) on parents beyond the school setting, having curricular opportunities for children to develop physical activity is important. The Physical Education and Sport curriculum provides a unique opportunity for teachers to develop children’s physical activity and lifestyle skills and knowledge within a safe and supportive learning environment (153). Fundamental motor skills developed via curricular programs provide essential building blocks for children to become equipped to participate in structured, competitive sports as they get older (158).
Without fundamental motor skill proficiency, children may avoid or drop out of sporting experiences with their peers as they get older and subsequently lose vital social experiences (159). Curricular classes providing children with an opportunity to be physically active are an invaluable period in children’s lives and play a large part in children’s physical, cognitive and social development (153, 154).

Despite the benefits of Physical Education and Sport Education, research has identified a host of institutional and teacher related barriers restricting the implementation of effective Physical Education in schools worldwide (160). A Canadian qualitative study by De Corby and colleagues (161) that interviewed a principal, three teachers, three parents and 11 children identified that Physical Education teachers didn’t have the appropriate Physical Education knowledge, experienced multiple competing curricular demands, barriers to accessing facilities and other time constraints in the delivery of effective Physical Education. Similarly, an investigation was conducted examining the teaching confidence of primary school Physical Education teachers in Australia (162). The quality of Physical Education teaching in primary schools was seen as lacking due to the low confidence of teachers to teach Physical Education and a perceived inadequacy of Physical Education teacher preparation programs. Further limitations of school-based Physical Education programs have been identified during the ‘Co-ordinated Approach to Child Health: CATCH’ program (163). Over a four-year period Physical Education specialists were surveyed in the USA, with questions examining Physical Education barriers, implementation and satisfaction. Findings from the study indicated that Physical Education is a low priority in comparison to other curricular subjects and a lack of funding was also a barrier to the delivery of Physical Education programs. Additionally, Canadian Physical Education teachers (n=45) were interviewed with teachers reporting that children were not engaged in daily MVPA during Physical Education (164). Similar to the above studies, Physical Education was a low
priority, lack of performance assessment for physical activity and an absence of appropriate facilities and equipment were identified as barriers.

Further barriers to primary school Physical Education have been reported in the USA with data from the 2006 ‘School Health Policies and Programs Study’ indicating that just 3.8% of primary schools provide daily Physical Education and 13.7% of primary schools are providing children with a minimum of three days of Physical Education per week (165). Similar to the findings from Dwyer’s Canadian study, policies in the USA have a core emphasis on math, reading and science subjects, rather than Physical Education in a ‘No Child Left Behind (NCLB)’ strategy (166). In addition, a reduced emphasis on Physical Education could be leaving many aspects of children’s development behind (153).

Secondary school Physical Education also has its limitations with previous research identifying the barriers to implementing Physical Education from 115 secondary school Physical Education teachers via an online questionnaire (160). Within secondary schools, the provisional barriers to Physical Education were found to be largely institutional and that more effective strategies could be employed to engage adolescents’ participation in Physical Education (160). This study reported secondary school teachers also had to contend with a low level of student interest in Physical Education (160). Given some of the issues associated with the delivery of effective Physical Education, more research investigating non-curricular strategies to promoting physical activity in school age groups is warranted.

2.2.2 Non-Curricular Physical Activity Opportunities for Children

With the already demanding nature of school teachers’ daily roles and responsibilities, it is important to acknowledge that it is not ideal to continually burden teachers with further duties in an effort to address all of societal ills (160). Rather than relying on organisational input from teachers, emerging international evidence has highlighted that non-curricular initiatives
can enhance children’s physical activity (12, 167). There are a number of non-curricular opportunities within the school setting to develop children’s physical activity including active transport to and from school, before and after school programs and school break periods.

2.2.2.1 Active Transport to and from School

Active transport includes modes of travel such as walking, cycling and skating and is considered an important source of physical activity for children (168). Several reviews of literature have identified that children who engage in active transport to and from school tend to be more physically active (169-171) and engage in more social interaction (172). Initiative programs such as Safe Routes to School, the Walking School Bus, or the Walk to School programs have been implemented to increase children's walking and bicycling to school with some success (173). However, active transport is often reliant on safe routes to school (173) and the presence of walking or bicycle paths (168). As active transport to school is more common in low income and minority groups, active transport programs targeting low SES areas can be worthwhile (174).

There has been a decrease in active travel to school among children and adolescents in many countries (175, 176). Similarly in the USA, transportation population survey data has revealed that the percentage of children and adolescents aged 5-18-years-old that walked or cycled to school decreased by 28% over a 32-year period (176). In 2003, less than 16% of USA children and adolescents walked or biked to school (177). Moreover, rather than a major source of children’s physical activity, the physical activity benefits of active transport to school are used to complement other physical activity opportunities throughout the school day (178). There are also a number of ‘stranger dangers’ that act as barriers for primary school-aged children to participate in active transport to and from school such as distance, busyness and the potential dangers of walking in public places (155). Air pollution and traffic
injury is another concern for children participating in active transport (179). Once again, given the numerous barriers associated with active transport, investigating non-curricular opportunities in more detail is warranted.

2.2.2.2 After School Activity Programs

Previous research has examined children’s physical activity during the after school period (180) with some promising outcomes in relation to children’s physical activity (11, 181-183). Statistics from 2005 suggest that there were 6.5 million children attending after-school programs in the USA and this statistic was likely to increase due to a rise in parental employment and an emphasis on children’s academic performance (184). After school programs provide children with both structured and unstructured physical activity opportunities and can extend children’s learning and development of physical skills beyond the daily school curriculum (185). Although after school programs have the potential to engage children and adolescents in regular physical activity, the research hasn’t comprehensively evaluated this non-curricular segment of the day (186, 187). In addition, like active transport, not all children engage in non-curricular after-school activity programs (187). Moreover, an increase in the number of parents working has limited primary school children from being picked up or delivered to after school physical activity and sports programs within non-school settings (131, 156, 157). When children have limited opportunities to be sufficiently physically active during the school day, they do not compensate by increasing their after school physical activity levels (188). In light of the barriers associated with children engaging in active transport and after school physical activity programs, a key strategy to increase children’s physical activity levels is to target the non-curricular windows during school break periods (e.g. morning recess, lunchtime recess).
School breaks hold promise for promoting physical activity. Children’s playgrounds during school break periods are supervised, safe and provide accessible play opportunities to all types of children (25). School break periods are emerging as the key option to develop children’s physical activity (11). Within the USA, many schools have minimised or eliminated Physical Education classes altogether, yet school breaks are consistently provided across the country, providing over two hours per week and far more time than structured Physical Education for children to be active (152). School break periods can provide almost half the daily opportunities for children to participate in physical activity (189). Rather than continually burdening Physical Education teachers, who may have low confidence or skills with further duties (162), play opportunities during school breaks require minimal teacher instruction. Children in most schools spend hundreds of school breaks per year engaged in MVPA (190). Additionally, break periods have been recognised as the principal source of children’s physical activity (11), contributing up to 50% of children’s recommended daily physical activity (11, 191-193). Developing greater knowledge of the influences on children’s play during school breaks is vital in order to tailor interventions within school break periods and provide sustainable preventative public health benefits.

Unstructured active play during school breaks has been acknowledged as a powerful developmental and learning tool (194), generating a strong international pursuit of advancing school playground features to encourage further school physical activity opportunities (195). International governments (UK, Canada, USA, Sweden, Wales) have identified the value of children’s active play areas as outdoor teaching spaces, informing widespread strategies to develop school grounds to boost the quality of children’s play (196). Physical activity via active play has been labelled a significantly natural and powerful strategy for enhancing
childhood learning (197) and children’s play has been linked to improvements in a broad range of social, physical and cognitive development (194, 196, 198).

Active play during school breaks allows children to understand the world and develop skills, as children are influenced by elements within school play spaces that facilitate physical activity, therefore play spaces should be planned in a manner to enhance development and physical functioning (6). Beyond the school playground during school breaks, children may have limited access to physical activity opportunities, therefore further awareness of school play spaces should be obtained to ensure children’s opportunities to move and experience the enjoyment of being active are achieved (199). Whilst a well-designed school environment can enhance physical activity participation during school breaks, Australian trends reveal many schools have eliminated play spaces and equipment, experience crowded play spaces and enforce restrictive policies that act as barriers to the use of play spaces, resulting in fewer opportunities for children to experience active play (198, 200). As non-curricular physical activity during school breaks is a key to enhancing children’s physical activity, the development and understanding of how to sustain physical activity outcomes during this critical window becomes an important consideration for teachers and school decision makers. Knowledge of how to develop children’s physical activity during school breaks is important for teachers and school decision makers who rarely consider children when planning and designing school play spaces, instead approaching this process from an adult perspective of what they think would encourage children to be active during school breaks (30, 196, 201, 202). Teachers should be provided with greater awareness of how school play spaces can enhance children’s physical activity opportunities during school breaks (30). It is important to ensure school decision makers design school playgrounds in a manner to maximise children’s opportunities to move and experience the enjoyment of being active during school breaks (199).
2.3 Measurement of Children’s Physical Activity during School Breaks

Accurate measurement of children’s physical activity levels is important to determine the contribution school break periods make towards children meeting recommended daily physical activity guidelines. Assessment of physical activity is also conducted to examine the effectiveness of interventions targeting children’s physical activity during school break periods, and to identify psychosocial and environmental factors that can affect children’s physical activity behaviour during school break periods. There are a number of measures that can be used effectively within school break periods to assess the dimensions (frequency, intensity, duration, activity type) of children’s physical activity including direct observation, accelerometers, pedometers and self-reporting instruments (13).

2.3.1 Direct observation

Direct observation is a technique by which a trained observer objectively records children’s physical activity. Advantages of direct observation is that it can provide comprehensive contextual data in relation to children’s physical activity behavior, it can identify the type, frequency, duration and intensity of children’s physical activity and can be applied to a number of target settings within schools. Data can also be entered directly into a computer or be coded via video to increase reliability (203). However, direct observation can be time consuming and include lengthy data coding and data input.

Individual level direct observation instruments have been developed including the Children Activity Rating Scale (CARS) that rates children’s activity intensity level on a likert scale (204). The System of Observing Fitness Instruction Time (SOFIT) and System of Observing Play and Recreation in Communities (SOPARC) have been established as reliable and valid observation instruments (205, 206) however, these are designed for instructional classes and the community setting respectively. As most direct observation measures (except the
community focused SOPARC) are designed to observe the physical activity of individuals, a measure to capture the area-level changes in physical activity is an important consideration within school settings.

The System for Observing Play and Leisure Activity in Youth (SOPLAY) has emerged as a commonly used instrument for use within the school setting during break periods as it is an area level measure (207). The SOPLAY instrument is highly reliable (203) and consists of a brief scan of a specific target area that captures the number of children present, the intensity of children’s physical activity and the predominant type of physical activity children are engaged in. The SOPLAY instrument provides a tool that can examine modifiable contextual factors during school break periods (25, 199). Inter-rater agreements for five SOPLAY variables are recognised as high for; usability (95%), area accessibility (97%), presence of supervision (93%), provision of equipment (96%) and presence of organised activity (88%) (203). The reliability of activity counts observed by different coders have also correlated strongly for sedentary girls \(r = .98\) and walking girls \(r = .95\) but correlated less with very active girls \(r = .76\). High correlations were also established for sedentary boys \(r = .98\), walking boys \(r = .98\), and very active boys \(r = .97\) (203). The SOPLAY has been established to move beyond the limitations of self-reporting measures by unobtrusively obtaining data on large numbers of children within their natural school settings (207). However, determining sex can be difficult within Australian schools as many children are required to wear a hat and school uniforms can be very similar (208). Additionally, in larger observational studies there can be potential reactivity, costs involved of recruiting research assistants for training, coding and data entry during the data collection period (208). The SOPLAY has been successfully used to examine the contextual influences on children’s physical activity levels, sex-specific physical activity and school-based interventions during school break periods (25, 199, 209). The potential of examining the contextual information of
large groups of children’s physical activity behavior makes the use of the SOPLAY instrument an attractive option for use during school break periods.

2.3.2 Accelerometers

Accelerometers are commonly used to measure children’s school-based physical activity due to the small, lightweight nature and the ease of children wearing the monitor attached to an elastic belt (210). The accelerometer can accurately measure children’s intensity and duration of children’s daily physical activity at school and therefore determine children’s contribution to achieving national physical activity guidelines for optimal health (211). The motion sensors can be used to measure the frequency, intensity and duration of children’s physical activity during specified times (13), such as school break periods. There are two types of accelerometer, uniaxial accelerometers (e.g. Actigraph GT1M accelerometer) and tri-axial accelerometers (e.g. Tritrac-R3D) (212, 213). Both types of accelerometer have been established as valid and reliable measures of children’s physical activity (212, 213). During children’s physical activity, accelerometers record the frequency and magnitude of the child’s accelerated movement (213) and an activity count is recorded from an acceleration signal (213). The activity count is summed over a specific time sample (e.g. epoch length). Accelerometers have also been established to be responsive to different intensities of children’s physical activity within laboratory settings (214). As children’s physical activity is sporadic in nature and accelerometers have a large memory capacity (215), it is recommended that when measuring children’s physical activity the pre-determined epoch length is short (e.g. calibrated to five second time sampling) (215). Longer periods of time sampling (e.g. 30 seconds or 1 minute) may not identify children’s intermittent play patterns during school breaks (215). It has also been determined that a minimum of four days of accelerometer measurement is necessary to achieve an accurate representation of habitual
physical activity (216).

During school break periods, studies have used accelerometers to assess physical activity levels (217-219), compare sex differences in physical activity (220), evaluate the effectiveness of interventions (12, 192) and compare physical activity during break periods with Physical Education classes (221). Accelerometers have been validated against criterion measures in five studies with values ranging from $r=0.43$ (validation with a metabolic system) (222), $r=0.86-0.87$ (validation with activities assigned with MET values/energy expenditure) (223, 224) and $r=0.41-0.89$ (validation with a heart rate monitor) (225, 226). Inter-accelerometer reliability is also strong, ranging from $r=0.86$ to 0.96 (222-224, 226). Although, accelerometer outputs are suggested to vary depending on the specific cut-point that is implemented (227, 228), which could potentially lead to under or overestimating physical activity participation (229).

There are limitations of using accelerometers, including not being able to determine between sitting and standing (230) and to determine an increased exertion of individuals walking up stairs or a hill, carrying or lifting objects and cycling (214, 231, 232). Within studies examining physical activity during school breaks, accelerometers can be limited by missing data, possible reactivity and small sample sizes (219, 233). When assessing the effectiveness of school-based interventions, accelerometers can be challenging, time consuming and costly to administer to large groups (234). In addition, researchers must also consider the cost of computer programs, pouches and accelerometer belts for the monitor to be attached to the child (234). Children must also wear the monitor for the duration of a study, which can be problematic as a minimum of four days of children’s physical activity is required to represent habitual physical activity (234). Combining observational measurements with accelerometer data has been suggested to determine the context of children’s accelerometer determined physical activity (192, 235). As accelerometers can be costly (234), cheaper motion sensors
such as pedometers are often used instead to assess physical activity in large school populations during school breaks.

2.3.3 Pedometers

A cost-effective alternative to other motion sensors to measure children’s physical activity is the use of pedometry. Pedometers have been widely used during school break periods to assess children’s physical activity patterns (11, 236), compare sex-specific physical activity (11, 236, 237), examine inter-instrument reliability (238) and examine the effects of interventions on children’s physical activity (237). Pedometers can also be used by children within the school setting as an intervention to obtain recommended step count thresholds to reach health goals (239). The 10,000 steps per day guideline is for adults to achieve appropriate health outcomes (240) however, children are expected to accumulate higher step counts to maximise health outcomes. Previously, 13,000 steps per day were recommended for boys and 11,000 steps per day were recommended for girls based on norm-referenced standards (241). Tudor-Locke identified pedometer step thresholds of 15,000 steps (boys) and 12,000 steps (girls) from samples of children from three countries to be associated with a higher probability of being a healthy weight (241). More recently, pedometer step thresholds for children have been evaluated to address children’s weight status in order to guide public health policy (239). From a sample of almost 1200 children aged 5-12-years-old, Dollman and colleagues (239) recommend that optimal pedometer step thresholds for children to reach are 12,000 steps per day for boys and 11,000 steps for girls.

The pedometer is a small, lightweight motion sensor that can be placed just above the right hip on an elastic belt or trousers. Two commonly used pedometers that have been recognised as being highly valid measures of step counts (242) are the Digiwalker SW-200 and Walk4life 2502. Pedometers can also measure the accumulative effect of a population’s (e.g.
school) overall locomotor movements (243). Pedometers have been validated against heart rate monitoring during free play, self-paced walking and treadmill walking (ranging from r=0.73-0.997) (242, 244, 245). Inter-instrument reliability has also been established with free play during morning school breaks (r=0.096-0.98) (238) and during treadmill walking (r=0.81) (244). There is a consensus that aggregated step counts provide an efficient indicator of children’s physical activity behavior (246, 247). Due to the validity, reliability and cost-effective nature of pedometers, they can be administered to large school populations to objectively measure the accumulative physical activity patterns of large school populations during school breaks.

Duncan and colleagues (248) revealed that children completed greater pedometer step counts during weekdays in comparison to weekends. Within these weekday periods, Tudor-Locke discovered that lunchtime physical activity contributed the most significant proportion of children’s daily step counts (15-16% of total daily steps), followed by morning school breaks (8-9% of total daily steps) (11). Furthermore, identifying a child’s stride length can assist determining children’s distance covered during school break periods. By identifying children’s distance, this can counteract potential size differences on step counts associated with children’s age (249). However, it should be noted that pedometers are limited by not being able to determine the intensity of movements and can record a step regardless of the specific locomotor movements being performed (e.g. walking, climbing, jumping). Furthermore, pedometer determined physical activity during school break periods can be limited by possible reactivity, battery or monitor malfunction, children self-recording data and a small sample size (11, 236-238). Despite these limitations, when combined with other measures, pedometers can provide useful information on children’s physical activity during school breaks.
2.3.4 Self-report/Proxy

Although only suitable for children above eight-years-old (99), self-report instruments were the predominant method of assessing children’s physical activity prior to the introduction of motion sensors (3). Self-report instruments are an attractive option for researchers to evaluate children’s physical activity behaviour as they are inexpensive, easy to administer and can obtain detailed information from the children regarding their physical activity behaviour patterns (3). There has been limited use of self-report instruments to recall children’s school-based physical activity patterns. As self-report instruments are cost-effective they are useful for research in large school populations (3). There are a diverse range of self-report instruments that have been developed and there are a number of considerations when selecting an instrument that need to be examined. Considerations of self-report instruments include the age group targeted, ease of completion, validity and reliability. Additionally, the domains, contexts and recall period of children’s physical activity behaviour need to be accounted for in self-report instruments (13). Self-report instruments can be used to assess all dimensions of children’s physical activity (e.g. physical activity type, frequency, duration).

A review of 89 studies that assessed children’s physical activity behaviour via self-report deemed the Physical Activity Questionnaire for Children (PAQ-C) for 8-14-year-olds (3) to be the most appropriate for surveillance of children. The PAQ-C is a reliable instrument that examines frequency, intensity and the context of children’s school physical activity. The PAQ-C is also a self-administered seven day recall questionnaire (3). However, as motion sensors are now available in modern research to accurately measure the same dimensions of complex physical activity as the PAQ-C (3), self-report measures are mainly being used for surveillance of children’s physical activity within large populations beyond the size of primary schools (3). There are also motivational challenges for children to complete a self-
report instrument and children can have difficulty remembering physical activity behaviour that can include duration, intensity and experiences of physical activity participation (250-253). Moreover, motion sensors capture the sporadic nature of children’s physical activity and the physical activity behaviour of younger children that presents challenges for self-reporting methods (254). Although motion sensors are becoming the favoured method for researchers to measure children’s physical activity (3), self-report instruments continue to be an effective method to assess the mediators of school children’s physical activity (e.g. enjoyment, self-efficacy, outcome expectancy) (118, 255).

A major review of school-based physical activity interventions has identified a distinct need to further investigate the mediators of children’s physical activity (7). Evaluating the mediating effects of children’s school-based physical activity can provide further insight into the sustainability of interventions targeting school breaks (7). Reliable self-report instruments can be administered within the school setting to examine the effects of children’s physical activity on other health parameters (e.g. quality of life) (20). It should be noted however that many self-report instruments have only been deemed suitable for children aged above eight-years-old (99), restricting the obtainment of rich information from younger primary school children.

Children under eight-years-old are not able to accurately and reliably self-report on health behaviour (99), and therefore a strategy is for parents and/or teachers to ‘proxy’ report on the younger children’s physical activity and health behavior (251). Reviews of proxy reports have displayed little correlation with children’s physical activity via heart rate and direct observation data (251, 256). Although, teachers’ proxy reporting of children’s physical activity has also been moderately correlated with children’s accelerometer determined physical activity (251). Despite the potential for proxy reporting within large cohort physical activity surveillance studies, within a school setting, motion sensors have been established as
a much more valid measure of the physical activity of those aged under eight-years-old (257). Research suggests there is scope to improve the validity of proxy reporting on young children’s physical activity behaviour (258).

As all measurement methods have limitations, it is important that a combination of measures are employed to measure children’s school-based physical activity (13, 14). For example, the benefits of accelerometers in objectively measuring children’s frequency, intensity and duration of physical activity interventions are highly effective (5) for physical activity researchers. However, like pedometers, accelerometers are unable to capture the types of physical activity children are participating in and who they are participating with in a setting (235). The SOPLAY direct observation instrument can be combined with the use of accelerometers to provide detailed contextual information about the types of physical activity children are participating in. In addition, as accelerometers are quite expensive, combining direct observation with pedometers can ensure the physical activity patterns of each individual child within a school setting are accounted for. As physical activity can be objectively measured by motion sensors and direct observation (13), self-report measures can be used to identify the important mediators of children’s (8-12-years-old) physical activity (e.g. enjoyment). Despite the limitations of physical activity measures, there are a wealth of instruments to choose from (13) to comprehensively measure children’s physical activity effectively within the context of school break periods.

2.4 Influences on Children’s Physical Activity during School Breaks Based on the Social-Ecological Model

Identifying the determinants of children’s physical activity during school breaks is important to gain an understanding of the factors that influence children’s physical activity and inform school-based intervention development and programming (7, 8). Children’s physical activity
behaviour during school breaks is very complex, therefore applying a social-ecological framework to examine the multiple levels of influence on children’s physical activity is important (15). The social-ecological model framework provides a comprehensive approach to designing, implementing and evaluating interventions that target the multiple levels of influence on children’s physical activity behaviour during school breaks (15).

2.4.1 Intra-personal (Individual) Level of Influence

Factors within the intra-personal level of influence on children’s physical activity behaviour tend to relate to an individual’s knowledge, behaviour, attitudes and skills. Age, sex and body mass index (BMI) are the most commonly measured intra-personal environmental factors in relation to children’s physical activity during school breaks (8).

The relationship between age and physical activity during school breaks is not yet clear. A number of studies have found no association between age and children’s physical activity during school breaks (233, 236, 259). However, findings from a 12-month playground intervention revealed that an increased age had a negative association with children’s MVPA and VPA during both morning and lunch breaks (260). A similar study also discovered that older children participate in a higher proportion of sedentary behaviour or light accelerometer-determined physical activity than younger children during school breaks (219). This finding is further supported by a Filipino study that revealed older children reported less MVPA (n=380) via a modified version of the Physical Activity Questionnaire for Older Children (PAQ_C) (261). In contrast to these studies, researchers examined the influence of themed weekly activities during school breaks (e.g. a fitness circuit week, obstacle course week, frisbee week) on children’s pedometer-determined physical activity (n=65), revealing that older children had significantly higher steps than younger children (262). However, the study was limited by a small sample size and the measurement of a single physical activity
dimension (steps), rather than examining the intensity, duration and frequency dimensions of children’s physical activity during school breaks.

Sex is the most common demographic variable that has been investigated as a correlate to children’s physical activity during school breaks (8). A major review of the intra-personal correlates of children’s physical activity during school breaks between January 1990 and April 2011 revealed that being male correlated with physical activity participation across 31 studies (8). This finding of boys being more active than girls during school breaks supports previous literature reviews of pre-school (263), childhood (131) and adolescence (132). It is suggested that girls often view school breaks as an opportunity to socialise (75, 77), therefore promoting physical activities in which girls can be social and physically active should be a high priority. Future research is needed to examine the correlates of boys’ and girls’ physical activity individually, rather than simultaneously (8).

Limited research has examined the relationship between body mass index (BMI) and children’s physical activity during school breaks. BMI was examined within a twelve month school break intervention with overweight children participating in less physical activity than healthy weight children (260). However, in a cross-sectional study of 3,471 New Zealand children, self-report measures revealed that overweight or obese children were at least 27% more likely to be active than children that weren’t overweight or obese (264). Whilst these findings were mixed, other studies have discovered no association between BMI and children’s physical activity during school breaks (167, 262, 265). This suggests there is still significant scope for researchers to determine more conclusive associations between intra-personal variables during school breaks such as BMI and children’s physical activity. Intra-personal variables such as ethnicity, religion and the influence of disability on physical activity have also been relatively unexplored and warrant further investigation (8).
More recently, Stanley and colleagues (266) discovered intra-personal facilitators and barriers to children’s physical activity during school breaks within a qualitative study of 54 children aged 10-13-years-old. Children’s enjoyment of socialising and challenges, self-efficacy, development of skills, freedom to make up rules and positive feelings about physical activity were found to be intra-personal facilitators of children’s lunchtime physical activity (266). Intra-personal barriers to children’s lunchtime physical activity included low perceived competence, low physical activity motivation and a preference for sedentary behaviour. Consistent to previous studies (30, 266), Parrish and colleagues (208) interviewed six principals, three teachers and 20 children from six primary schools regarding the influences on children’s physical activity within the school playground. The level of development of children’s fundamental motor skills (FMS) was identified as the major intra-personal factor that influenced children’s physical activity. Teachers from the school playground qualitative study suggested that as FMS weren’t a priority within the school many children lacked basic skills to engage in physical activity, were embarrassed to participate in physical activity and were bullied. Additionally, teachers revealed that overweight or obese children tended to not engage in adequate physical activity during school breaks. Consistent with findings from previous studies, Mulvihill and colleagues (2000) also identified intra-personal factors that motivate children to be physically active such as self-efficacy, fun, enjoyment and improving skills (267).

Although enjoyment has been regularly identified as a facilitator to children’s physical activity during school breaks, there is a gap in the literature examining the correlation of enjoyment and school break physical activity (255). Enjoyment has been established to be a mediator for participation in physical activities (118, 124, 255) and sport (122). Other studies have also recognised the link between enjoyment and correlates of physical activity including self-determination (125), motor skill proficiency (126), task orientation (127), self-efficacy
(128), goal setting (128), and perceived competence (127). Mediators of children’s school-based physical activity such as enjoyment have also been identified as important to evaluate the effects of school-based interventions (7). It is important to examine school children’s enjoyment of activities within school break periods and to determine if there is a correlation with children’s physical activity within the school-context (255). Although there is a need to further measure intra-personal correlates such as enjoyment within the school-context, research still needs to establish the reliability of measuring children’s enjoyment of lunchtime play within and between days (255) prior to evaluating children’s enjoyment of lunchtime play from school break interventions. As males are consistently reported to be more physically active compared with females during school breaks (8), interventions should be designed to facilitate greater physical activity amongst females. It is suggested that non-competitive (14) interventions promoting physical activity of an unstructured nature (25) could show promise to address a significant sex difference in school-based physical activity. An intervention providing more variety in playground equipment may also help enhance children’s opportunities for socialisation, development of FMS, interest in challenges and provide play freedom (e.g. create their own structures, rules and play activities) (266).

2.4.2 Inter-personal (Social) Factors

The inter-personal environment includes factors such as relationships, culture and societal influences in which a person interacts. The inter-personal environment is a major influence on children’s physical activity behaviour as many children prefer having someone to be physically active with (268).

Social support has been identified by studies to positively correlate with children’s physical activity during school breaks (264, 266). Researchers examined the self-reported physical activity of a cross-sectional sample of 3,471 children and adolescents aged 12-18-years-old...
Each participant reported on physical activity participation and the amount of encouragement received by family and friends. For lunchtime physical activity, peer support was positively associated with an increased likelihood of being active for all children, suggesting that social interaction needs to be considered when developing health promotion strategies (264). A limitation of the study was that the contexts of physical activity participation were determined subjectively via self-report, rather than objectively via direct observation (e.g. SOPLAY). It was also noted that the definition of school support should be clarified in future studies and that a single question may not truly reflect encouragement (264). Stanley and colleagues (266) also identified that peer and teacher support are interpersonal facilitators to children’s physical activity during school breaks. Having company during school breaks and social acceptance were also perceived by children to be key facilitators of their physical activity during school breaks. Furthermore, Thompson and colleagues (269) identified that adult support and encouragement and teacher confidence in facilitating physical activity can positively influence children’s physical activity during school breaks.

The relationship of socioeconomic status (SES) and children’s physical activity has also been examined (261, 270). A total of 2,946 children aged 5-12-years-old from 13 regional primary schools participated in a cross-sectional playground physical activity study (270). Researchers used the direct observation instrument known as the Children’s Activity Scanning Tool 2 (CAST2) to reveal no significant differences between children’s playground physical activity and SES. In contrast, the physical activity of Filipino children aged 11-12-years-old (n=380) was measured from randomly selected public and private schools (261). A modified version of the PAQ-C was administered to reveal that children in private schools accumulated higher levels of MVPA during the school day than children attending public schools. Findings show that children attending public schools were more active during leisure
periods, but participated in less physical activities. However, due to costs, the study was limited by using a self-report method to determine children’s physical activity, rather than more accurate objective measures such as pedometers and accelerometers (261). More research is still needed to examine the link between children’s SES and physical activity.

The supervision of school playgrounds and children’s physical activity has been investigated widely with mixed results (167, 193, 199, 207, 271). SOPLAY observations of 137 activity areas in 13 primary schools over 18 months revealed that children were less active in areas which were directly supervised (207). The authors of the study suggested that the reduced physical activity from being directly supervised could be due to a culture of promoting safe play areas that can inhibit physical activity (207). The lack of association between supervision and physical activity also emerged from the observation of 18 primary schools within the ‘Move it or groove it’ project (272) and a further eight primary schools from two studies examining the influences on children’s physical activity during school breaks (167, 273). However, it should be noted that within the latter two studies that the playground observations weren’t broken down into specified areas and there was a small sample size. In addition, it was noted that supervising teachers were included in the observation counts (167).

In contrast, a study applying SOPLAY to directly observe 23 primary school playgrounds revealed that a higher proportion of children participated in VPA when teachers were supervising in comparison to not supervising (199). Due to the teachers playing a passive role during playground supervision by not encouraging physical activity, this finding was unexpected (199). Sallis and colleagues have also reported that higher levels of playground supervision can dramatically increase children’s playground physical activity (274). The inconsistent findings examining the relationship between teacher supervision and children’s school playground physical activity in the USA, UK and Australia could be attributed to different settings, cultural influences, staff and behaviours (198). If a Physical Education or
sport co-ordinator is supervising the playground, children at some schools may also feel more inclined to demonstrate their physical skills (199). Further investigation into children’s perceptions of teacher supervision on school playground physical activity is therefore warranted.

A major barrier to children’s physical activity that is emerging during school breaks is bullying (198, 208), including stealing equipment (266), sex and weight-related bullying can prevent engagement in adequate physical activity (275). Qualitative findings by Parrish and colleagues (2011) revealed that three out of four schools where the principal had suggested bullying was taking place were the lowest observed levels of physical activity during school breaks (208). Children can also become intimidated by large numbers and seek quiet playground areas (276). Other barriers identified by Stanley and colleagues (2012) included no peers to play with, not getting along with peers and children emphasised that a potential barrier could be that children play whatever activity the peer groups are participating in, even if the activity is sedentary (266).

With social encouragement a major factor identified from previous research to positively influence children’s physical activity; interventions need to focus on providing children with access to a supportive inter-personal environment to foster physical activity during school breaks. Additionally, Parrish et al (2011) highlight a need for interventions to engage children in activities that prevent bullying during school breaks (208). A promising intervention concept that has been shown to develop key inter-personal outcomes is the introduction of movable/recycled materials into a school playground (12). Teachers’ perceptions of a small pilot school playground intervention of movable/recycled materials revealed positive social inclusion, resilience and co-operative teamwork outcomes among children participating in the intervention (12). As interventions need to address multiple levels of an environment (including inter-personal level environments) to develop physical activity behaviour,
introducing movable/recycled materials into a school playground targeting children’s physical activity during school break periods is a promising concept.

2.4.3 Physical Environment Factors

The physical environment is the social-ecological level that many children would prefer to be enhanced to provide more opportunities to be physically active during school break periods (30). The physical environment of Australian school playgrounds contains a large proportion of natural environment features (e.g. bushy areas, grassed areas, trees, ponds and water features) and built environment features (e.g. fixed playground equipment, playground markings, sports equipment, sandpits, shade sails, asphalt and concrete areas) (198). An awareness of the physical environmental characteristics of a setting are important prior to implementing school or community initiatives (108).

2.4.3.1 Influence of Playground Facilities on Children’s Physical Activity During School Breaks

Factors within the physical environment that correlate with children’s physical activity during school breaks have been extensively examined (30). A frequently studied physical environmental factor (mainly in secondary schools) has been the availability of facilities in the outdoor school setting (e.g. sporting courts and grass areas) (254). This availability of facilities has had mixed outcomes with a sledding hill, soccer field (254) and green space (277) being associated with physical activity during school breaks. In contrast, no association has been found for ball areas, skiing areas, water, woods (277) and sporting fields (199). However, studies examining the quantity of playground facilities (254, 277, 278) and sporting facilities (279) during school breaks have revealed positive correlations with children’s physical activity. This suggests that school break interventions should focus on the provision of substantial equipment to ensure more children are engaged in physical activity.
Although direct observation has identified that the presence of loose sports equipment such as bats, balls and skipping ropes in the school playground positively influences children’s physical activity during school breaks (167, 199, 207, 272, 273), fixed playground equipment and markings have had inconclusive findings with both children and adolescents (25, 199, 254, 270, 277). Playground markings, shadings (25, 280), fixed equipment (199) and obstacle courses (277, 281) have been reported to facilitate children’s physical activity. Fixed equipment and hopscotch have also been shown to be positively associated with the physical activity of junior adolescents during school breaks (254). However, other studies have discovered that playground markings, fixed equipment (193), boarding areas (254, 277), playground design (279), climbing areas (277) and a fenced courtyard (277) had no association with children’s physical activity. Furthermore, no association has been identified for fixed playground equipment and hopscotch markings with the physical activity of female adolescents (254). It should be noted however that just three of the studies examining fixed playground equipment utilised valid objective methods (e.g. accelerometers, direct observation) to measure children’s physical activity (25, 199, 273). As standard regression modelling to evaluate the contribution to physical activity from fixed playground equipment and markings are limited due to the little variability in these predictors, further use of valid objective methods may obtain more conclusive associations with physical activity (13).

2.4.3.2 Influence of Weather on Children’s Physical Activity During School Breaks

Weather influences on children’s physical activity during school breaks continues to be investigated with a number of studies revealing that higher temperatures contribute to higher physical activity (45, 147, 156, 158) and rainfall can be a negative influence on children’s physical activity during school breaks (282). However, in the north of England cooler temperatures can be associated with dryer weather and higher physical activity (283). Higher temperatures can also have negative effects on children’s physical activity via heat stress
(272) and the time of year and season has been shown to have little influence on children’s physical activity during school breaks (284, 285). Similarly, despite children’s enjoyment being linked with children’s physical activity, children can possess high enjoyment of lunchtime play across multiple days, even within cold and wintry conditions (286).

2.4.3.3 Children’s Perceptions of School Playgrounds for Physical Activity during School Breaks

Spaces for physical activity are important within the school playground during school breaks, yet little research has examined the link between indoor (182) or outdoor space (273, 280) and children’s physical activity during school breaks. To examine children’s perceptions of the school playground for physical activity during school breaks, Ozdemir and Yilmaz conducted a study across five Turkish primary schools applying questionnaires (287). Student perceptions revealed that many children enjoyed active games (77%), spending school breaks in the school playground (52.1%) and having an area to produce food (79%). Almost half of the children believed their school playground was too small in size and lacked activity opportunities, trees and greenery, yet a similar number of children from poorer quality school playgrounds were satisfied with their school space. This is an interesting finding as Ridgers and colleagues (2012) suggest large sporting areas do not conclusively correlate with children’s physical activity during school breaks (8). In addition, children that were satisfied with their playground during school breaks preferred their playground for active play, with over a third of the children describing their ideal playground as containing many trees and greenery. Findings cannot be generalised from five primary schools however, the results combined with other studies examining children’s perceptions of the school playground environment could be used to inform future playground interventions targeting school breaks.
Understanding how children are physically active within the physical environment is important to identify and develop effective school physical activity interventions (30). In light of this, the influences on school playground physical activity choices were assessed via a mixed methods study (199). Although the observational component of the study has been highlighted earlier, children’s perceptions of their school playground for physical activity during school breaks were also explored using a photo ordering technique during focus group discussions (199). Consistent with a 2012 review (8), a need for greater equipment provision and variety of playground equipment were identified as key physical environment themes from the focus groups within the mixed methods study. In addition, access to fixed equipment for older children was identified as positively associated with higher physical activity during school breaks. This suggests that different equipment items may encourage physical activity, depending on which age group the equipment is suited to. Although a previous review had inconclusive findings for playground markings and fixed playground equipment (8), children within the mixed methods study had preferences for coloured bitumen markings with minimal lines, grassed areas to run and play games and highlighted the benefits of metal playground structures in comparison to wooden playground structures. As some children may prefer to play on fixed playground structures made of different materials (e.g. wood, plastic, metal), providing children with the opportunity to play on types of materials of their choice could provide a more conclusive assessment of the association between the presence of fixed playground equipment and children’s physical activity (8).

Providing a variety of playground equipment has been consistently reported to be a key factor positively correlated with children’s play and physical activity (24, 30). Therefore, providing children with diversity of options can promote ‘choice’, established to be a major aspect of children’s enjoyment of the school playground environment (262). School breaks are defined as a regularly occurring ‘free choice’ of play in primary schools and should allow children to
engage in enjoyable physical activity (262). Providing equipment within the school playground that promotes choices could be a strategy to accommodate physical activity for children’s different individual preferences for activities or equipment and ensure that equipment can cater for different sex, ages and weight statuses (262).

A recent study identified that children perceived the built environment (e.g. sporting facilities, adventure type equipment and fixed playground equipment) as a facilitator for participation in physical activity during school breaks (30) in contrast to lounge and food areas. Features within the natural environment (e.g. trees, grass and rocks) have been perceived as important influences to engage in physical activity, emphasised by a number of studies (24, 25, 288, 289). Stanley et al. (2012) revealed that spaces need to be suitable for certain activities (e.g. football on a field rather than court) and that weather could be a key influence on school break physical activity (266). In contrast, children perceived size of spaces, crowded spaces, conditions of facilities and type of weather as potential barriers to physical activity during school lunch breaks (266). It is important to gain an understanding of children’s perceptions of play spaces during school breaks to inform interventions and to develop self-report measures assessing variables from the children’s perspective (255).

2.4.3.4 Providing Movable School Playground Equipment to Encourage Physical Activity during School Breaks

Mounting evidence suggests that interventions should implement movable playground items (e.g. non-fixed playground items) into school playgrounds (8, 22) to develop children’s physical activity during school breaks. In addition to physical activity benefits, a qualitative study by Parrish and colleagues (208) revealed that movable playground equipment also had the potential to prevent bullying and that without movable play equipment there is just plain grass and cement. These positive findings are reaffirmed by a range of physical activity,
social and cognitive benefits identified from movable/recycled materials interventions implemented by Bundy and colleagues (12, 21, 23). As age and sex can have a significant influence on children’s choice of and engagement in physical activity (30), providing diverse, movable playground equipment could cater for more children’s physical activity preferences. A diverse range of equipment and structures has the potential to engage larger numbers of school children during school breaks (30).

2.4.4 Policy and Organisational Factors

Regardless of what strategies are implemented at the intra-personal, inter-personal and physical environment levels, each level needs to be reinforced by the enforcement of supportive policy. Policy level influences on school children’s physical activity during school breaks have been largely unexplored (278). With a reduced focus in schools to make time available for physical activity (290, 291), research suggests there should be a stronger focus on school policies to increase physical activity (278).

Implementation of policies to facilitate physical activity participation can be challenging however, policy strategies that coincide with societal physical activity participation priorities are more likely to succeed (108). Although policy variables have been examined in a number of studies, there has been limited, conclusive evidence of positive or negative correlations with children’s physical activity during school breaks (8). The provision of Physical Education classes on children’s physical activity during school breaks is one policy factor that has been examined, with mixed results (292, 293). A study investigated the sex-specific differences in physical activity between Physical Education and school break periods in 91 fifth year primary school children (221). Using accelerometers for three days, it was found that boys and girls completed similar physical activity during Physical Education however, boys were more active during break periods (221). Furthermore, continuous observations of
children aged 5-11-years-old during school breaks and Physical Education lessons over a year discovered that children were more active during school breaks than they were during Physical Education lessons (294).

The relationship between Physical Education and children’s physical activity during school breaks has also been examined in special needs settings (295). Heart rate telemetry has been used to measure the physical activity of 15 children with intellectual disabilities and revealed that a combination of Physical Education and school breaks contributed to children meeting and exceeding physical activity recommendations during the day (293). It has also been found that children with mild intellectual disabilities that participate in a program with a higher emphasis on sport are more likely to participate in higher intensity physical activity during Physical Education and school breaks (295). However, those that participate in a program with a higher recreational focus are more likely to accumulate more minutes in physical activity within the same contexts (295). Moreover, a study comparing the MVPA of children with disabilities’ during Physical Education and school breaks using accelerometry revealed that these children spent a higher proportion of time in MVPA during Physical Education in comparison to school breaks (296). Although some studies have examined the influence of both Physical Education and school breaks on physical activity, more recent research is required to investigate the school policy of providing a sufficient blend of time for structured Physical Education and unstructured school breaks, especially beyond special needs settings.

The association between the school policy of school break duration and children’s physical activity has also been mixed. Multiple studies examining school breaks (272) have revealed that children’s duration and intensity of physical activity is higher when school break time is increased. Although one study has revealed that the recorded physical activity of 287 children reduced with increased school break time (297), the proportion of children engaging in
MVPA has been found to increase with school break duration in more recent studies including the observation of 2,946 children across 13 rural schools (270) and the accelerometer-determined physical activity of children across 26 primary schools (298). Zask et al.’s (2001) observational study (272) also highlights the notion that longer school break time could allow children to further develop activity habits within the school playground. The limited findings suggest further research is needed to examine the influence of school policy variables on children’s physical activity during school breaks (8). Written policies (254) and fitness breaks (299) are two such options that warrant further investigation.

A number of policy factors were identified within a qualitative study on children’s physical activity during school lunch breaks (266). The main policy level factor perceived by children to facilitate physical activity during school breaks was access to sports equipment. However, barriers to children’s physical activity during school lunch breaks included a lack of access to facilities/programs, lack of replacement of facilities, weather policies (e.g. stay inside when it is too hot), safety rules around buildings and from scheduled lunchtime meetings that limited time to engage in physical activity. Parrish and colleagues (2011) revealed that school policies such as providing school uniforms that aren’t suitable for physical activity participation (e.g. dresses, formal footwear), less time available for play during school breaks and a ‘no hat, no play’ policy could negatively influence children’s physical activity during school breaks (208). Providing school uniforms suitable for physical activity participation is a policy level factor that may need to be reviewed, as children wear alternative uniforms to participate in sport, yet not during school breaks, a major source of children’s physical activity. A recent intervention examining the impact of replacing winter uniforms with sports uniform on 10-year-old children’s physical activity (n=68) was trialled during school breaks (300). It was revealed that girls were significantly more active during all school break periods when wearing sports uniform (300). This finding suggests children’s attire, especially for
girls, is not suited for physical activity during school breaks and warrants further research into the influence of clothing on children’s physical activity levels (208).

The policy level influences on children’s physical activity during school break periods within the context of the social-ecological model has been largely unexplored and warrants further investigation. In addition, children’s perceptions suggest that access to equipment is a major influencing factor in facilitating children’s physical activity. When developing playground interventions during school breaks it is therefore important to provide sufficient equipment items to ensure all children have access.

Identifying the correlates of children’s physical activity during school breaks within the context of the social-ecological model is important to inform the development and evaluation of interventions targeting school break periods. The social-ecological level correlates identified from the literature suggest that the promotion of choice, variety, movable (non-fixed) playground equipment, social encouragement and inclusion will most likely lead to long lasting physical activity outcomes in children during school breaks.

### 2.5 Interventions in Primary School Playgrounds to Promote Children’s Physical Activity during School Breaks

Children have limited access and opportunities for physical activity in areas other than playgrounds during school breaks (199) and research suggests school breaks allow children to increase physical activity levels (191), therefore interventions targeting school breaks are vital. Despite the health benefits of physical activity during childhood to counteract sedentary lifestyles (1, 301), there have been limited interventions designed to target children’s physical activity during school breaks (299).
2.5.1 School Playground Interventions to Promote Structured Physical Activity during School Breaks

A structured physical activity is an organised activity characterised by specified locations, time schedules and adult supervision (302). Structured physical activity can also include team sports, racquet sports and fitness classes (303). There have been a number of school playground interventions that have used specified playground or activity locations (e.g. playground markings, physical structures, allocated physical activity spaces, physical activity zones), teacher led activities (e.g. fitness breaks, Physical Education activities in the playground) and games/sports equipment to facilitate structured physical activity.

Games equipment has been trialled to develop children’s physical activity during school breaks (192, 304). Across seven primary schools, a games equipment intervention was implemented to investigate the impact on the physical activity levels of 122 children (192). Children’s levels of physical activity were measured before and after the games equipment intervention. During morning and lunch breaks, children’s MVPA increased from the games equipment intervention. However, the researchers acknowledged that it would have been beneficial to evaluate which aspects of the intervention were most successful and which aspects should be modified or enhanced (192). A Portuguese study also examined the effects of implementing games equipment within a school playground on children’s (n=158) physical activity during school breaks (305). The effects of the games equipment showed significant increases in the proportion of time children spent in physical activity across sex, age groups and BMI. However, this study was limited by a short intervention period, not examining the type of activities that were influencing children’s physical activity and no long term follow-up was implemented to determine if the positive physical activity effects could be sustained (305).
Similarly to introducing games equipment, a USA study investigated the effects of a games intervention on 56 children (304). Each day the children participated in a games-specific school break and a standard school break. Results suggested that children were more active during the games school breaks than the standard school breaks, highlighting that playground interventions have the potential to increase children’s physical activity behaviour.

Fitness breaks have also been implemented within the school setting to encourage children’s physical activity. A fitness break intervention to increase physical activity at schools was implemented by researchers for year five primary school children (n=27) (299). Fitness breaks involved children participating in their own structured circuit of locomotor and non-locomotor activities during morning and lunch breaks. The fitness breaks were monitored for three consecutive days and it was found that physical activity increased among both boys and girls. The fitness breaks encouraged the children to participate in MVPA for 50% of school break periods. However, the fitness break structure was least enjoyed by females and resulted in inconsistencies between heart rate telemetry and pedometry. Furthermore, due to the limited data collection period and solitary fifth year class, generalisability of the findings is limited. Structured fitness breaks have also been evaluated (306) where researchers introduced 30 minutes of structured games (n=22), resulting in increased energy expenditure. Significant increases in children’s MVPA were evident in the intervention group in comparison to the control school after the structured physical activity intervention. However, researchers acknowledged that implementing unstructured play activities during school breaks may promote greater developments in children’s social and emotional health. Staff training to facilitate physical activity in specified activity zones have also been trialled as an intervention to develop children’s (n=93) physical activity during school breaks (307). Each physical activity zone contained 10 to 15 equipment items and structured, daily school break activities within the physical activity zones would be planned by a Physical Education teacher, school
break staff leader and the Ph.D researcher. Significant increases in children’s MVPA were identified measured via accelerometer however, as direct observation wasn’t conducted, specific activity types within physical activity zones and their influence on children’s physical activity weren’t reported.

There have been a number of short-term playground marking intervention studies designed to increase children’s physical activity during school breaks (10, 308, 309). The first study investigated the physical activity levels of 36 English children (n=36) aged 5-7-years-old using heart rate telemetry during three school breaks (10). Stratton (2000) discovered that the playground markings intervention increased time spent in MVPA during school breaks by 18 minutes per day (10% increase during playtime) (10). Findings also revealed that children’s mean heart rate increased by six beats per minute during the intervention phase (10) and that MVPA made a significant contribution towards national physical activity guidelines (309). It was implied that the time spent in MVPA may have been inflated by a novelty effect from the playground markings and the study was also limited due to a small sample size. Similarly, the energy expenditure of children was also examined after the playground marking intervention (308). It was revealed that play duration, total energy expenditure, heart rate and rate of energy expenditure significantly increased from baseline to the post playground markings intervention. Total energy expenditure increased by 35% and rate of energy expenditure increased by 6%. However, by using heart rate as a measure of physical activity, it failed to provide information about the mode of activity children were participating in or which markings were most effective at increasing physical activity levels. The results of the study could also be a result of short-term novelty effects of the intervention, which could be counteracted by medium and long-term follow-up of the intervention.

Similarly, playground markings with the addition of skipping ropes (school one) and allocating different groups of children to the sports courts (school two) within school playgrounds were
trialed (237). The researchers measured children’s accumulated step counts from the simple intervention and discovered that both the playground markings/skipping ropes and space allocation interventions significantly increased children’s step counts during school breaks compared with the matched control school. Although the effects of the simple, short-term intervention on children’s step counts were positive, research has identified a need to evaluate the effects of school physical activity interventions over a longer period to determine if health effects can be sustained (7). Although cost-effective, there are also a number of limitations to measuring children’s physical activity with pedometers (13) and there is a need to examine where possible the effects of school-based interventions on further physical activity dimensions (7) such as frequency, intensity, duration and activity type during children’s physical activity.

The long-term effects of playground markings and changes to the physical structure of playgrounds on children’s physical activity during school breaks were assessed within deprived areas of London (235). Fifteen primary schools received funding to redesign their playground environments via a sporting playgrounds initiative. Accelerometer and heart rate telemetry were used to measure children’s physical activity, with findings suggesting that MVPA and VPA significantly increased across a two-year period. This reinforces findings from the literature (10, 192) that playground redesign and intervention can positively stimulate children’s physical activity during school breaks. Despite short-term intervention studies suggesting novelty effects positively influence physical activity levels, the long-term intervention study established that playground interventions increased physical activity during school breaks over a prolonged time span (235). The findings from Ridgers et al (2007) study reinforces the notion that school playground interventions can enhance children’s physical activity over a prolonged period to counteract sedentary lifestyles in childhood that can track into adulthood (235). Further studies of school playground interventions should implement a
long-term follow-up to evaluate if increases to children’s physical activity during school breaks can be sustained over prolonged periods (7).

Schedules have also been created for children to participate in themed weekly activities in the USA during school breaks. School break ‘activity weeks’ that included no school break activities, a fitness circuit course, an obstacle course (e.g. balancing beams, hoola hoops and skipping ropes) and the introduction of 30 soft Frisbees were trialled with 65 children (262). Children’s physical activity levels were measured by pedometers with findings demonstrating that different features and items within the school playground can facilitate physical activity depending on children’s sex, age and BMI (262). The step count results revealed that children’s accumulated physical activity was higher during the week with no organised activities and the week of the fitness circuit. Interestingly, males had accumulated significantly more steps than females during the obstacle course week, older children accumulated significantly more steps during the Frisbee week, younger children were significantly more active via the obstacle course and children with low BMI were significantly more active during the fitness circuit week (262). The findings from this study highlight that diverse equipment and activities need to be implemented within school playgrounds so that all children’s physical activity preferences can be catered for during school breaks (262). However, this study was limited by measuring physical activity solely with pedometers, therefore dimensions of physical activity such as the frequency, intensity, duration and the specific activity type during each activity week were not recorded. In addition, the activities were only introduced for a limited time (one week for each activity) to assess children’s physical activity behaviour.
2.5.2 Evaluating the Transferability and Feasibility of School Playground Interventions
Promoting Structured Physical Activity during School Breaks

The evaluation of the translation (transferability and feasibility) of school playground interventions to other school environments is emerging as an important consideration for researchers (7). Despite the importance of comprehensively evaluating playground interventions, there is little evidence from process evaluations to provide guidance to other schools of how to replicate positive school playground intervention effects (26, 27). In a recent study known as the ‘PlayZone’ intervention in Australia, a combination of intervention concepts including playground line markings, a games activity manual, games equipment (e.g. skipping ropes, balls) and an active peer leader training manual were introduced into six school playgrounds (26). The researchers applied the RE-AIM (Reach, Effectiveness, Adoption, Implementation, Maintenance) framework to examine the transferability of the research project on a wider scale. Providing insight for other schools of the barriers and facilitators to intervention implementation, the research team noted that assigning a staff member to paint line markings and addressing staff turnover of intervention leaders were key considerations. The ease of introducing the playground intervention and low burden on the schools to maintain the intervention were seen as positives of the ‘PlayZone’ intervention (26). The low complexity of the line markings and activity manual intervention ensured all schools could maintain the intervention concept for over a 12 month period (26). A RE-AIM evaluation was also conducted of the ‘PLAYgrounds’ intervention that provided Physical Education classes with playground activities so that children could gain ideas on how to use the school playground during school breaks (27). Children’s classes were provided with boxes of structured Physical Education equipment to stimulate playground physical activity ideas such as throw/catch equipment, balls and skipping ropes. Monthly playground physical activity themes were also encouraged by teachers (joined in with the children once a week) and parents (joined in with
the children once a month). Researchers suggested that the success of the intervention was due to it being delivered as a complete package with funding, staff support and equipment (27). However, not all schools can obtain this high level of support and future evaluation of the maintenance level of the PLAYgrounds intervention concept in school playgrounds should consider appointing a school employee to lead the program, especially when funding isn’t available (27). Both process evaluations of school playground intervention programs highlight a need for low complexity interventions and staff support for optimal replication. In addition, as the playground interventions were mainly designed to encourage structured physical activity, there is a need to evaluate the use of unstructured physical activity interventions during school breaks.

2.5.3 School Playground Interventions to Promote Unstructured Physical Activity during School Breaks

Unstructured physical activity is defined as the physical activity children participate in that is spontaneous and without a set regime or purpose (302) that can include digging, raking (310), lifting/carrying, exploring, planting, chasing (24), pushing objects into positions, construction, imaginative and creative play (12). The importance of children’s unstructured physical activity is reflected in the definition of school breaks by Wechsler and colleagues (2000), “as a regularly scheduled time for children to engage in ‘unstructured’ physical activity and play” (p123) (311). School breaks that encourage unstructured, open-ended free play are an important opportunity to promote children’s physical activity (24, 271, 289). Open-ended and diverse play opportunities have been identified as having a significant impact on key social-ecological levels such as intra-personal level factors (e.g. skill development, enjoyment, playability and cognitive improvements) and development of inter-personal skills (e.g. cooperation, reduced bullying, team-work) (12, 21, 25, 289). To address children’s diverse
playground interests and abilities, greening projects have been successfully introduced within school playgrounds to increase children’s physical activity during school breaks (24, 25, 289). Questionnaire data (n=105) was gathered from parents, teachers and administrators from 59 Canadian primary schools (24, 289). The results from the study revealed that active play was facilitated by space, diverse play opportunities and children’s interaction with natural environmental features (24, 289). The greening projects show promise as an avenue to promote non-competitive, open-ended, diverse and enjoyable play opportunities and can create a school play environment to cater for all ages, interests and abilities (24, 289). With children today having increasingly structured lives, school breaks should provide diverse activities for children to engage in open-ended, unstructured play opportunities (262).

A study of school greening in Canada and Australia showed the highest percentage of Australian children were engaged in VPA on manufactured equipment (25). However, the greening projects were reported to be the school play area in which the highest percentage of Canadian and Australian boys and girls were engaged in MPA (25). Despite the reported play benefits and MPA benefits of children in the greening areas, the researchers acknowledge that cost, maintenance and safety issues associated with implementing the greening projects need to be accounted for. The greening projects can also restrict children’s use of play spaces whilst the project is being implemented for prolonged periods (21). The authors identify that for schools to reach their optimum potential, school authorities and service providers should look to provide greater diversity within playground designs to engage all children’s abilities and play interests (24, 289). The importance of providing diverse items within the school playground is underlined by the definition of play, regarded as the diverse range of unstructured activities and behaviour that children engage in (312).

Responding to a need for playground variety and diverse play opportunities, materials with no fixed purpose (e.g. movable/recycled materials) were introduced to a school playground over
an 11 week period (12, 21). Movable/recycled materials were items generally not considered to be school play materials for children, including: milk crates, wooden planks, hay bales and tyre tubes. The effects on children’s physical activity (5-7-years-old) were measured via accelerometers and revealed children were significantly more active after the movable/recycled materials were introduced (12). Researchers also reported that the movable/recycled materials increased 5-7-year-old children’s playability within the school playground (21). Additionally, teachers perceived the intervention to have increased children’s social, creative and resilient play during school breaks. However, despite minimal injuries being reported, teachers still had concerns about potential risks and duty of care of the intervention within the school playground (12).

The movable/recycled materials intervention innovatively provided a low cost option for schools that do not have the necessary funding for expensive greening designs and other costly school playground projects. Moreover, as movable/recycled materials are found within the home and community environments, the play benefits from such an intervention can be replicated beyond the school playground for children’s continued development. Whilst there are a number of benefits of implementing a movable/recycled materials intervention, there is a need for further research to examine this concept targeting a whole school playground and older primary school age groups.

2.5.4 Designing Future School Playground Interventions Targeting Physical Activity during School Breaks

Numerous studies have highlighted that females are less physically active than their male counterparts within the school setting (8). As interventions that encourage open-ended and unstructured play have demonstrated positive physical activity outcomes in females (25), the physical activity and health effects of implementing a school playground movable/recycled
materials intervention on primary school females of all ages is warranted. Supporting this finding, Telford and colleagues (2005) (14) identified that young females tend to prefer engaging in non-competitive types of physical activity. The introduction of diverse items within school playgrounds during school breaks can be beneficial for children’s physical activity (24, 25, 288, 289), therefore the variety and choice associated with implementing a movable/recycled materials intervention is an important consideration for teachers and school decision makers. Furthermore, building upon Bundy and colleagues’ pilot intervention (12), there is scope to examine the effects of implementing a movable/recycled materials intervention on further physical activity and health outcomes. Cost-effective interventions such as movable/recycled materials within the school-context are encouraging for sustainable public health outcomes that are translatable to other school settings (7). As there are limitations to the assessment of children’s physical activity using single measures (13, 14), there is a need to evaluate school-based physical activity interventions by employing a combination of subjective and objective physical activity measures.

There are still a number of considerations to effectively conduct school-based physical activity interventions. Previous research identifies a distinct need to assess the long-term impact (i.e. from 6 months to several years) of school physical activity interventions (5, 7). However, research suggests long-term follow-ups are difficult, as only a small percentage of the original population can be reached (7). To our knowledge, only one school break intervention targeting children’s physical activity has implemented a long-term follow-up (235). In a major review of school-based physical activity intervention literature, Kriemler and colleagues identified a need for further research to examine the mediators of physical activity intervention effects (e.g. enjoyment) (7). There is also a need to identify the multi-level mediation effects of physical activity interventions such as enjoyment within a school lunchtime context (255). Furthermore, no physical activity intervention study we are aware of targeting school break has
comprehensively evaluated the intervention using the social-ecological model. Evaluating an intervention’s potential to modify the multiple levels of influence on children’s physical activity behaviour is important for long lasting physical activity outcomes (8, 15). Lastly, despite research calling for comprehensive evaluations of school-based physical activity interventions (7), only two studies have evaluated the feasibility and sustainability of implementing school break physical activity interventions on a wider public health scale (26, 27). As the two RE-AIM evaluations were structured school playground interventions, it is important to comprehensively evaluate levels of transferability and feasibility of unstructured school playground interventions in order to target physical activity and health outcomes during school breaks in wider settings. The current thesis specifically addresses research needs identified from the literature relating to children’s physical activity during school break periods.

In this thesis, children’s physical activity is examined within a behavioural epidemiological framework. Behavioural epidemiology research is based on five main phases for physical activity and health (101). The first phase consists of identifying the links between physical activity and health. The second phase is concerned with the development of methods to accurately assess physical activity. The third phase consists of identifying factors that can act as barriers and facilitators to physical activity (101). The fourth phase involves the evaluation of an intervention targeting the facilitation of physical activity (101). The final phase is concerned with translating the research into practice. The aims of this thesis are based on each of these behavioural epidemiological phases, therefore the outcomes of this research will have strong implications for the development of future interventions targeting school breaks and other programs aimed at increasing children’s school-based physical activity.
2.6 Aims

The aims of the research were to:

I. Identify the barriers and facilitators to children’s participation in school break physical activity within the context of a social-ecological model.

II. Develop a questionnaire to determine children’s enjoyment of lunchtime activities and play that would be a reliable, context-specific instrument addressing multiple social-ecological levels of influence.

III. Examine children’s enjoyment of lunchtime play, repeated on five consecutive days to determine the intra-day variability and inter-day reliability of measuring children’s enjoyment of play during school lunch breaks.

IV. Examine the effects of a movable/recycled materials school playground intervention on primary school children’s quality of life, enjoyment and participation in physical activity.

V. Evaluate the reach, efficacy, adoption, implementation and maintenance of a movable/recycled materials school playground intervention.
Chapter 3

Moving physical activity beyond the school classroom: A social-ecological insight for teachers of the barriers and facilitators to children’s non-curricular physical activity
3 Moving physical activity beyond the school classroom: A social-ecological insight for teachers of the barriers and facilitators to children’s non-curricular physical activity

3.1 Preface

Identifying barriers and facilitators of children’s physical activity during school breaks is important to gain an understanding of the factors that influence children’s physical activity and to inform school-based intervention development, programming (7, 8) and self-report measures (255). Providing teachers with a greater awareness of school play spaces to ensure school decision makers can also maximise children’s opportunities to move and experience the enjoyment of being physically active during school breaks (199). Teachers and school decision makers rarely consult children when planning and designing school play spaces, instead approaching this process from an adult perspective of what they think children would want and enjoy (196, 201, 202). A mixed method study was therefore employed to identify the social-ecological barriers and facilitators of school play spaces that influence primary and secondary school children’s physical activity during school breaks. This chapter is based on a manuscript that is published within the Australian Journal of Teacher Education.

3.2 Introduction

The promotion of regular physical activity in schools, homes and the community has become a major public health priority to improve health worldwide and prevent chronic disease, injury and other illness (1). Childhood lays the foundation for lifestyle behaviours that can track into adolescence and to some extent into adulthood. Increasing physical activity opportunities within a wide range of settings such as schools, home and community at an early age is vital for public health (5). Developing physical activity behaviour during childhood is important with evidence suggesting that young people are now choosing to participate in sedentary
activities even when options for physical activity are available (313). Despite childhood being a crucial period for developing physical activity behaviour, there is limited understanding of the impact and influence of physical activity on the health of school children and adolescents (1, 31).

3.2.1 Importance of Promoting Physical Activity Beyond the School Classroom

A gradual decline in children’s fitness, a lack of physical activity opportunities (150) and the rise of overweight and obese youth worldwide (151) have highlighted schools as a crucial setting in which children can be active. With an increasing focus on schools to facilitate physical activity, there is more demand than ever to equip children with the necessary skills to be physically active (152). Despite this demand, recent research has identified a number of institutional and teacher related barriers restricting the delivery of effective Physical Education in schools (160). Institutional Physical Education barriers have included a crowded curriculum, time, budget and sporting equipment constraints (150, 314, 315). Although mainly within primary schools, teacher related Physical Education barriers have included low confidence to teach Physical Education, declining teacher interest, negative past Physical Education experiences, inability to plan lessons and insufficient levels of knowledge and expertise (161, 316). Given the already busy nature of teachers’ roles, it is important to recognise that it is not appropriate to continually load teachers up with increasingly more responsibilities in an attempt to address all of society’s ills.

Rather than relying on teachers’ direct instruction to facilitate physical activity, growing evidence suggests that non-curricular avenues such as play during school breaks have the potential to enhance children’s physical activity levels and social skills (12, 167). These play opportunities require minimal organisational input from teachers and parents. Previous research has also indicated that school breaks are periods when youth can make substantial
contributions toward attaining recommended levels of physical activity (9). Additionally, break periods have been established as the main source of children’s physical activity (11).

Unstructured outdoor play during school breaks has been recognised as a powerful developmental and learning tool to complement or supplement the formal indoor curriculum (194). There is a strong interest in improving characteristics of school playgrounds to promote more and better quality physical activity opportunities in schools (195). Governments worldwide (UK, Canada, US, Sweden, Wales) have acknowledged the importance of children’s school play spaces as outdoor classrooms, leading to widespread policies to improve school grounds to enhance the quality of children’s play (196). Movement via play has been described as one of the most natural and powerful avenues of childhood learning (197) and has been associated with improvements in a wide range of physical, cognitive and social development (194, 196). This evidence is supported by recent research suggesting that enhancing school play spaces can lead to improvements in children’s physical skills, social skills and creativity (12) and improved cognitive functioning (317).

Childhood is a time for understanding the world through active play and, as children are directly affected by factors within the school environment that permit them to be physically active, their play spaces should be designed in such a way to maximise physical functioning and development (6). Beyond the school playground and within the classroom, children may have limited access to physical activity opportunities. Teachers should therefore gain a greater awareness of school play spaces and ensure school decision makers design school playgrounds in a manner to maximise children’s opportunities to move and experience the enjoyment of being active (199).

Although a well-designed school environment can facilitate physical activity, recent national trends suggest a number of schools have removed play spaces or play equipment, possess
crowded play spaces and implement restrictive policies limiting the use of play spaces that result in reduced opportunities for children’s active play (200). Additionally, teachers and school decision makers rarely consult children when planning and designing school play spaces, instead approaching this process from an adult perspective of what they think children would want and enjoy (196, 201, 202). The sole reliance on adults in the design and planning of children’s spaces can lead to overly safe play spaces that can have long-term consequences for children’s social and emotional development (196). In addition, children may believe they have little influence on their school environments. Children’s perceptions of the school environment for physical activity is something that teachers should consider in planning school play environments, particularly as children are the main consumers of these play areas, rather than teachers whose main purpose within a school playground is in a supervisory capacity.

3.2.2 Children’s Perceptions of School Physical Activity Beyond the Classroom

Despite a lack of input from children into the design of school environments, investigation of children’s perceptions of school play spaces have been limited. A recent study across five Turkish schools via questionnaire (287) found that many children enjoyed active games, spending school breaks in the school playground and having an area to produce food. Almost half of the children believed their school playgrounds were too small in size and lacked activity opportunities, trees and greenery. Similarly, the influences on children’s school playground physical activity choices were assessed via a photo ordering technique during a focus group format (199). A number of themes were identified from the focus groups, including a need for greater provision of equipment, increased variety of playground equipment and access to fixed equipment for ‘older’ primary children. Children also had preferences for coloured bitumen markings with minimal lines, grassed areas to run and play games on. These findings identified school playground features children perceived would facilitate school-based physical activity.
however, a limitation of these studies is that they only examined perceived influences on children’s physical activity within a primary school-context. In addition, little is understood about adolescent perceptions of secondary school playgrounds for physical activity.

A previous study aimed to identify the physical activity barriers and facilitators of urban and rural children and adolescents within school years six to eight (mean age= 12.6 years) via discussions in focus groups (318). The study investigated general influences on children and adolescent’s physical activity rather than specific to a school-context however, researchers identified school physical activity policies to be a major barrier to children and adolescent’s physical activity. The main facilitators for youth physical activity were identified as social interaction and availability of facilities. This research highlights a need to identify specific social factors and accessible facilities within the physical environment that would encourage children and adolescents to be active within a school setting.

3.2.3 Understanding Children’s School Physical Activity Beyond the Classroom

Increasing understanding of the factors affecting children’s enjoyment of their school play spaces will allow for the assessment and development of health promotion interventions targeting youth (251). Health promotion theories suggest that to motivate children to be physically active, multiple influences on children’s physical activity behaviour must be identified and addressed (15). These broader influences on physical activity behaviour are linked to the social-ecological model, which emphasises children’s physical activity behaviour is influenced by multiple levels including intra-personal, inter-personal, physical environment and policy factors (15). Despite the importance of applying a social-ecological framework to evaluate children’s health behaviour at multiple levels, there is a paucity of literature applying the framework to examine the facilitators and barriers of children’s physical activity (318), especially within a school-context.
No study we are aware of has provided an insight for teachers of the physical activity facilitators and barriers perceived by both primary and secondary school children, within the same study. Providing an understanding of children’s perceptions could help teachers remove barriers that prevent children’s activity within school play spaces and lead to increased physical activity levels among school children. Although school play spaces are acknowledged as a key setting for physical activity, it remains unclear which specific elements of school play spaces facilitate children’s physical activity and which are potential barriers to physical activity.

This important research therefore addresses a number of gaps within the literature relating to physical activity. The present investigation employed a mixed methods approach using focus groups and map drawing to achieve four objectives, which aimed to provide an insight for primary and secondary school teachers of the: (i) social-ecological components of school play spaces that influence primary and secondary school children’s physical activity, (ii) barriers and facilitators of physical activity between primary and secondary school children, (iii) young people’s perceptions of their existing and ideal school play spaces for physical activity (iv) suggestions from both primary and secondary school children for increasing school physical activity in the future.

3.3 Methods

3.3.1 Participants

The Principals of four government schools (two primary and two secondary) in the western region of Victoria were randomly selected and approached by researchers during Winter, Term 2 of 2009 (Winter). All schools from the western region were consecutively numbered, and a random number generator was used to select the four schools. Three schools approved the invitation and participated in the study (two secondary and one primary). Due to the difficulty
of obtaining one more primary school in the western region, a government primary school in regional outer Eastern Melbourne with a low Index of Community Socio-Educational Advantage (ICSEA) was recruited. This ensured two schools from low SES (lower percentile ICSEA) and two schools from mid SES (middle percentile ICSEA) with a primary and secondary for each SES category were included in the study.

Initially, primary school children (all Year 5 and 6 children; n=197) and secondary school children (all Year 7 and 8 children; n=643) were invited to participate via a letter and consent form distributed in June and July of 2009. Year five and six primary school children were invited to participate as children over eight-years-old are more capable of accurately and reliably self-reporting their own health behaviour (99). In order to compare the influences on physical activity between primary and secondary school children, year seven and eight secondary school children were invited to participate.

All children interested in participating were instructed to obtain parental consent and return their consent forms to the general office of their school. The first 15 children from each year level were invited to attend the scheduled focus group and/or map drawing session. During this study, 78 children from all four schools aged 10-13-years-old (50% females; 50% males) returned their consent forms by the due date and all children who volunteered participated in the study (Year 5= 29; Year 6= 20; Year 7= 29). The focus group discussions consisted of 54 children (32 primary and 22 secondary) and the map drawing sessions included 24 children (17 primary and 7 secondary).

Ethical approval for the study was obtained from the University of Ballarat Human Research Ethics Committee, the Department of Education and Early Childhood Development (DEECD) and permission was gained from the school Principals.
3.3.2 *Focus Group Discussions*

For the present study, seven focus groups (4 primary school and 3 secondary school) were conducted for children who agreed to participate. The six to ten children in each focus group were asked a series of questions using a semi-structured interview schedule in relation to the play spaces in their school playground. The focus group discussions were conducted for 30-60 minutes in a quiet room separate to where the map drawing exercise took place simultaneously to prevent the discussion influencing the drawings. All focus group discussions were audio recorded and detailed comments were taken of children’s focus group answers and body language during each session to aid transcription.

During the discussions, the children were asked to raise their hand when they wished to speak and each wore a name tag to assist the facilitator to ensure each participant had the opportunity to respond to each question. As part of the discussion, the children were also asked to state their name, sex, age and school year level. Focus groups were conducted until saturation of themes was reached. The focus groups were conducted by the Ph.D researcher that was a trained facilitator, using questions formulated based on a social-ecological framework and previous research evaluating children’s perceptions of the environment for physical activity (141, 145, 318). A sample of questions utilised, to demonstrate the application of a social-ecological framework, is presented in Table 3.1.
Table 3.1. Sample focus group questions applying a social-ecological model framework.

<table>
<thead>
<tr>
<th>Social-ecological model component</th>
<th>Sample question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intra-personal (Individual)</td>
<td>• Do you think a safe play space is fun?</td>
</tr>
<tr>
<td></td>
<td>• Do you think a safe play space is boring?</td>
</tr>
<tr>
<td>Inter-personal (Social)</td>
<td>• How many people would you design a play space for, to keep you active?</td>
</tr>
<tr>
<td>Physical Environment</td>
<td>• What parts of your existing play space encourage you to be physically active?</td>
</tr>
<tr>
<td></td>
<td>• If you were to design a play space for you to be active, what would you include?</td>
</tr>
<tr>
<td>Policy</td>
<td>• Do you think there should be a play space for each year level to ensure you are physically active?</td>
</tr>
<tr>
<td></td>
<td>• How supervised is your school play space?</td>
</tr>
</tbody>
</table>

3.3.3  **Map Drawing**

Map drawing has been suggested as a useful alternative to survey methods for exploring children’s awareness and knowledge of their environment (141) and has been used to explore children’s perceptions and thoughts about their environments by providing them with the opportunity to interpret and actively record their own experiences (145). Applying the use of map drawing in addition to focus group discussions aimed to provide a more complete, contextual insight into children’s perceptions (141) of the children’s school physical activity environments.

Sheets of A3 sized paper were distributed to children including an instruction sheet with the description of each mapping task that asked children to draw their: (1) ‘existing school play
space’; (2) ‘ideal school play space’ and (3) ‘ideal play space for physical activity.’ At the completion of the focus groups, children were invited to explain their maps to the researcher at which time they were video recorded. This ensured that map features were correctly interpreted to avoid misunderstanding and to clarify each child’s perspective of their drawings. For each focus group and map drawing session, an investigator and classroom teacher were in attendance to provide assistance if required. Children were positioned in quiet, separate areas during the drawing exercise to avoid distraction and to ensure that children’s perspective of their existing and ideal play spaces wasn’t influenced by peers. An example of a child’s map drawing is given in Figure 3.1.

![Figure 3.1. Two maps of a primary school child's ideal (A) and active school play space environment (B), including multiple items to facilitate physical activity.](image)

3.3.4 **Data Management**

All focus group data was de-identified and referred to by pseudonym. Data collected from focus group sessions was transcribed verbatim and analysed using the NVivo version 8 software package (QSR International, 2009). All audio recorded focus group and video recorded mapping sessions were transcribed by a trained transcriptionist. The analysis of the
transcriptions was based upon the social-ecological framework to identify emerging themes, similarities and differences within and between the primary and secondary school groups using the NVivo feature ‘nodes most frequently coded’. The information provided in the focus groups was used to determine features children included that would either facilitate or act as a barrier to physical activity.

Final analyses included a review using the NVivo feature of ‘nodes most frequently coded’ for each focus group, to ensure themes frequently coded were included. In order to gain further insight into these features, responses for both physical activity facilitator and barrier items were categorised using a social-ecological framework (15). Using a quantitative audit the frequency with which particular objects and locations appeared was noted within the mapping analysis for both primary and secondary school children. Percentages of item frequencies were calculated for each item/location within primary and secondary school children’s existing, ideal and physical activity play space maps.

3.4 Results

The social-ecological model provides a multiple level framework for teachers to examine the range of factors that can influence the physical activity participation of primary and secondary school children during school breaks. Themes from the focus group discussions based upon this framework allowed comparisons to be made between primary and secondary school children’s perceived physical activity facilitators and barriers as shown in tables 3.2 and 3.3.

3.4.1 Intra-personal (Individual) Factors

The two main themes that emerged from the focus group discussions in relation to intra-personal factors were outcome goals (e.g. health and social benefits) and task goals (e.g. focus on improvement or skill). A common outcome goal for both primary and secondary school
children to facilitate their physical activity was ‘fun’, and fun was often described when participating in activities with friends or when an activity gave the children a thrill. This outcome goal was also mentioned after children had reported a task goal such as ‘taking a risk’; “In every bit of enjoyment there is a certain amount of risk” (Primary school group); “...it’s fun taking risks and stuff...change is always good” (Secondary school group); ‘learning a skill’; “…if you are on the monkey bars you can learn how to go across and skip bars it’s really fun” (Primary school group) or ‘undertaking an exciting activity’; “...all the running and tackling and stuff, chasing after a ball and tiggy...just running away from the other person, it’s great” (Primary school group); “…have lots of tunnels...the teachers would have a really hard time trying to get them (children), it would be really fun” (Primary school group); (Table 3.3).

In contrast, the outcome goals of ‘safety’ and ‘relaxation’ were occasionally perceived to act as a barrier for secondary school children to be physically active, “…fun spaces aren’t in schools...the safer ones (spaces) have to be in schools” (Primary school group); “…you don’t have fun when you get hurt” (Primary school group); “…safe play spaces are pretty boring, yeah” (Secondary school group); “I hang out at the child lounge because it’s a nice place to relax” (Secondary school group);(Table 3.2).

3.4.2 Inter-personal (Social) Factors

The inter-personal factors that were mentioned were peers and teacher role models. The influence of peers was the most influential factor reported and it was often perceived that hanging around with friends provided a reason for children to be active in the school playground, “...in the tennis courts you usually just play with all your friends...on the oval we just play with everyone on the whole oval mucking around” (Primary school group); “…the more people the merrier is great...a massive basketball game is fun, because there is more
Table 3.2. A social-ecological framework of the *barriers* for children to participate in non-curricular physical activity.

<table>
<thead>
<tr>
<th>Social-ecological model component/Themes (Barriers)</th>
<th>Primary school groups (n=4)</th>
<th>Secondary school groups (n=3)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intra-personal (Individual)</strong></td>
<td>Task Goal*</td>
<td>Outcome Goal#</td>
</tr>
<tr>
<td></td>
<td>“Sometimes you are playing on the bars and want to do a new trick and might fall off” (Male, Year 5).</td>
<td>“I hang out at the student lounge because it’s a nice place to relax” (Male, Year 7).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Outcome Goal#</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>“Fun spaces aren’t in schools...the safer ones (spaces) have to be in schools, because it’s the teacher’s responsibility” (Female, Year 6).</td>
<td>“Some things that are fun aren’t always safe” (Female, Year 7).</td>
</tr>
<tr>
<td><strong>Inter-personal (Social)</strong></td>
<td>Peers</td>
<td>Peers</td>
</tr>
<tr>
<td></td>
<td>“Sometimes the boys bring footballs on the playground and it’s really annoying” (Female, Year 6).</td>
<td>“The only reason you wouldn’t feel safe is because the older kids are in the big area and you wouldn’t want to go there” (Female, Year 7).</td>
</tr>
<tr>
<td></td>
<td>“Sometimes year levels don’t mix...there is bullying” (Female, Year 6).</td>
<td></td>
</tr>
<tr>
<td><strong>Physical Environment</strong></td>
<td>Built Environment</td>
<td>Built Environment</td>
</tr>
<tr>
<td></td>
<td>“…the basketball nets... people hang off them so they break and have to buy a new one” (Male, Year 5).</td>
<td>“We always hang out in the student lounge...the student lounge is cool because there is a plasma TV and you watch all the music videos and stuff” (Male, Year 7).</td>
</tr>
<tr>
<td></td>
<td>“I’d say the 5-6 area, a little bit more equipment, because we are like over it...played on it about a 100 times” (Female, Year 6).</td>
<td>“…we wouldn’t really have a playground because we are too old for that” (Female, Year 7).</td>
</tr>
<tr>
<td><strong>Safe Surfaces and Structures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>“Rocky, bumpy, really hurts when you fall. And when you fall you have cuts,” (Male, Year 6).</td>
<td></td>
</tr>
</tbody>
</table>
**Policy**

```
Safe
ty Rules
“... normally all the teachers are down at the little kids areas” (Male, Year 6).
```

**Supervision**

```
“You have enclosed areas and you have rules and certain regulations in certain areas. Like on the concrete areas you can’t run” (Male, Year 5).

“I’d say more sports equipment...cause it gets lost a lot and include more sporty areas, not like 3-4 areas and 5-6 areas” (Female, Year 5).
```

```
Supervision
“It’s not really supervised, the only time there are teachers is when they walk through the corridor…” (Female, Year 7).

“If there was too many teachers around you wouldn’t be able to do anything, so it would be boring” (Male, Year 7).
```

**Access to Sports Equipment/Play Area Access**

```
“The teacher lends you stuff, but you’ve gotta be down there in like 5 minutes, because he only does it for 5 minutes or else he’s gone... if you’re not there in 5 minutes you can’t borrow sports equipment” (Male, Year 7).
```

---

*Task goal* = focus on task and/or personal improvement; *Outcome goal* = focus on rewards and/or comparing self to others.
<table>
<thead>
<tr>
<th>Social-ecological model component/Themes (Facilitators)</th>
<th>Primary school groups (n=4)</th>
<th>Secondary school groups (n=3)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intra-personal (Individual)</strong></td>
<td><strong>Task Goal</strong>&lt;sup&gt;1&lt;/sup&gt;</td>
<td><strong>Task Goal</strong>&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>“...on the monkey bars you can learn how to go across and skip bars it’s really fun” (Female, Year 6).</td>
<td>“...it’s fun taking risks and stuff...change is always good” (Male, Year 7).</td>
</tr>
<tr>
<td></td>
<td>“Have lots of tunnels... teachers would have a really hard time trying to get them (children), it would be really fun...” (Female, Year 6).</td>
<td><strong>Outcome Goal</strong>&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“You should have fun, but be safe at the same time” (Female, Year 7).</td>
</tr>
<tr>
<td><strong>Outcome Goal</strong>&lt;sup&gt;2&lt;/sup&gt;</td>
<td>“A playground needs to be fairly safe but a lot of fun for kids to be active...if they don’t enjoy lunchtime they are not going to want to learn” (Female, Year 6).</td>
<td></td>
</tr>
<tr>
<td><strong>Inter-personal (Social)</strong></td>
<td><strong>Peers</strong></td>
<td><strong>Peers</strong></td>
</tr>
<tr>
<td></td>
<td>“Probably my friends are the biggest influence on me being active, we usually just hang around and run around practically” (Female, Year 6).</td>
<td>“I’d have as many people that can that can fit in my play space, 40 or 50 people” (Male, Year 7).</td>
</tr>
<tr>
<td></td>
<td><strong>Teacher Role Models</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>“Some of the teachers could hold activities for play lunch and lunch ... some teachers might teach you to go around on the bike or something” (Male, Year 5).</td>
<td></td>
</tr>
</tbody>
</table>
Physical Environment

“...that would be cool...you can run around.” (Female, Year 5).

Natural Environment

“A vege garden would be good...but no one maintains it do they?” (Female, Year 6).

Safe Surfaces and Structures

“On the tennis courts they really grip, you can’t really slip on the tennis courts. It grips to any type of shoe really” (Male, Year 5).

Policy

“I would actually make it so that there’s a year 6 playground, instead of a 5/6 playground so that there is more room to play” (Female, Year 6).

Play Area Access

“I’d like to hang out in the gym, because they don’t let us hang out in the gym. Like on rainy days we could come in and play basketball...” (Female, Year 7).

Supervision

“I do believe at this school most of the playgrounds are pretty safe, because there is always a teacher walking around” (Female, Year 6).

Play Area Access

“I’d have a massive trampoline...then a massive sandpit” (Male, Year 7).

Natural Environment

“In our space (oval) there is heaps of room, so you can run around and do what you want” (Female, Year 7).

Safe Surfaces and Structures

“The footy oval is like ten metres away, so if you’ve got a footy you just play footy...” (Male, Year 7).

Policy

“I think have just a year level playground, because you can’t have little preppies running around...you might knock them over...” (Male, Year 6).

Supervision

“The year twelves have a place where they can hang out, the year sevens could have one of these” (Female, Year 7).

Supervision

“...there’s always teachers out the front, so if anything happens they will be there to give help” (Female, Year 7).

*Task goal= focus on task and/or personal improvement; # Outcome goal= focus on rewards and/or comparing self to others.
people to pass to” (Primary school group); “I’d have as many people that could fit into my play space, 40 or 50 people” (Secondary school group); (Table 3.3). However, the influence of older children was also mentioned as a barrier to physical activity due to ‘territorial’ issues, “...the only reason you wouldn’t feel safe is because the year 12’s are in the big area and you wouldn’t want to go there” (Secondary school group); Table 2. Some children also did not feel safe when in the same play area as older children or boys with sports equipment, “...sometimes year levels don’t mix...there is bullying” (Primary school group). “Sometimes the boys bring footballs on the playground and it’s really annoying” (Primary school group); “Well, a couple of people don’t like me, but they wouldn’t touch me” (Secondary school group); (Table 3.2).

In the secondary school groups, many children reported that they would rather just chat with friends during school breaks rather than be physically active “People have more fun when they are talking with their friends, cause lunchtime and morning recess are the only times for that” (Secondary school group); “Me and my friends hang out under the stairs...because it’s near our lockers and nice and quiet so we can talk to each other” (Secondary school group); (Table 3.2).

Teacher role models were also mentioned as a facilitating influence on physical activity, with children suggesting teachers could run lunchtime activities, “Some of the teachers could hold activities for like play lunch and lunch...some teachers might teach you to go around on the bike or something” (Primary school group); (Table 3.3).

3.4.3 Physical Environmental Factors

A number of themes were identified within the physical environment component regarding children’s physical activity participation. The built environment was a common theme, with many children perceiving that sporting facilities, adventure type equipment and playground equipment would facilitate their participation in physical activity, “An awesome playground
that would be just a bit higher...some really good monkey bars, handles...a tyre swing” (Primary school group); “...my space to make you active would be a better football field instead of some parts muddy and some parts really hard” (Secondary school group); “I’d have a massive trampoline and then a massive foam pit” (Secondary school group); (Table 3.3).

The built environment was also a major barrier to physical activity with many secondary school children mentioning that their existing play spaces possess multiple food locations and a number of sedentary rather than physical activity opportunities such as televisions, lounges, picnic tables and multiple food locations, “...it’s like a couch type of thing... different groups that sit at the different ones. There’s a huge one that all the year 12’s sit at and then there’s one next to the TV, which is the one we always sit at...” (Secondary school group); “...we always hang out in the student lounge...because there is a plasma TV and you watch all the music videos and stuff” (Secondary school group); (Table 3.2).

Primary school groups suggested an absence of new playground equipment could be a barrier to physical activity, “...sometimes the old playgrounds can get boring after you have played on them heaps, new playgrounds are not boring” (Primary school group); “...we are like over it, we’ve already played on it about a 100 times” (Primary school group); (Table 3.2).

The natural environment was also mentioned with children suggesting spacious play areas with trees, grass and rocks would encourage them to be physically active, “In our space there is heaps of room, so you can run around and do what you want” (Secondary school group); “...on the oval we play footy, you’ve got heaps of space and you don’t have to be aware of where you are kicking the ball” (Primary school group); (Table 3.3).

Children regularly identified that safe surfaces and structures were important for continued physical activity participation. Many primary school children stated that they would prefer a modified area to where they had become injured due to lack of safety, “...an indoor basketball
court, that doesn’t have all the concrete and stuff so you don’t hurt yourselves that much” (Primary school group); “…the basketball court being so bumpy and rips everyone open, I’d prefer one with a roof on it with a floor like the indoor stadium...so we won’t slip and hurt ourselves” (Primary school group); “…the platforms, because they’re square, maybe make the edges round and...provide access to knee or elbow pads” (Primary school group); (Table 3.3).

3.4.4 Policy Factors

Supervision, safety rules, access to sports equipment and accessing play areas were the key policy factors highlighted from the focus group discussions. Children identified that supervision was an important aspect in the play spaces to ensure they felt safe when participating in physical activity, “…at school, equipment is much safer because the teachers are in charge of you” (Primary school group); “I always know there’s a teacher watching out if me or my friend is in trouble” (Primary school group); “…there’s always teachers out the front so if anything happens they will be there to give help” (Secondary school group); (Table 3.3) however, a lack of, or too many, supervising teachers could restrict physical activity, “…normally all the teachers are down at the little kids areas” (Primary school group); “…if there were too many teachers around, you wouldn’t be able to do anything, so it would be boring” (Secondary school group); (Table 3.2).

Some children saw the school safety rules as a barrier to running “…on the concrete areas you can’t run” (Primary school group) and playing with sports equipment “…on the grassy areas you can’t kick balls around” (Primary school group); Table 2. Accessing sports equipment was seen as important to be active and restrictive borrowing policies made this difficult for them “…if you’re not there in five minutes you can’t borrow sports equipment” (Secondary school group); (Table 3.2).
Access to certain areas of the school (e.g. gym, year level spaces) was also seen as important to encourage physical activity, “...you should have an area for yourself, like year 7 and year 8, but then you should have a mixed area, because I've got friends in year 8...” (Secondary school group); “...they don’t let us hang out in the gym. Like on rainy days we could come in and play basketball. You could like work out in the gym” (Secondary school group); (Table 3.3).

3.4.5 Map Drawing Exercise: Primary School Groups

The map drawing exercise (Table 3.4) indicates that in general primary school groups:

- Possessed a higher proportion of playground features on their existing play space maps in comparison to their ideal and physical activity play spaces.

- Consistently drew multiple features that facilitated physical activity.

- Had minimal opportunities for sedentary behaviour.

- Did not include food items/locations.

- Focused on drawing of features within the natural and built environment.

- Features relating to the social environment were minimal.

- Regularly drew sporting equipment items/locations in physically active play space maps.

- Regularly drew playground equipment items/locations in ideal play space maps.

- Included a high proportion of natural environment items/locations in physically active play spaces.
3.4.6 Map Drawing Exercise: Secondary School Groups

In contrast to the primary school groups, the map drawing exercise (Table 3.4) indicates that in general secondary school groups:

- Had a high proportion of participants that had an existing play space without features to encourage physical activity.

- Drew multiple opportunities to be sedentary in their existing play spaces.

- Drew multiple food items/locations in their existing play spaces.

- Despite having minimal features to encourage physical activity, drew a high proportion of features with a sporting and playground focus in their ideal and physically active play spaces.

- Despite minimal natural environment features in their existing play space maps, drew a high proportion of natural environment features within their ideal and physically active play space maps.

3.4.7 Suggestions for Future Physical Activity Facilities

The focus group discussions provided some insight into what primary and secondary school children perceived would help facilitate physical activity within their school play spaces (Table 3.5). The secondary school children generally thought facilities with a sporting and adventure oriented focus would encourage physical activity, whereas the majority of primary school children’s suggestions implied a playground oriented focus. The suggestions were categorised into ‘smaller scale items’ (items that require a relatively small surface area) and ‘larger scale items’ (items that require a large surface area).
Table 3.4. Frequencies and percentages with which items within play spaces appeared in the children's map drawing.

<table>
<thead>
<tr>
<th></th>
<th>Existing School Play Space</th>
<th>Ideal School Play Space</th>
<th>School Play Space to Facilitate physical activity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Primary School (n=15)</td>
<td>Primary School (n=15)</td>
<td>Secondary School (n=7)</td>
</tr>
<tr>
<td>Number of opportunities for physical activity</td>
<td>0 (7%)</td>
<td>1 (7%)</td>
<td>5 (33%)</td>
</tr>
<tr>
<td></td>
<td>1 (27%)</td>
<td>4 (27%)</td>
<td>4 (57%)</td>
</tr>
<tr>
<td></td>
<td>&gt;2 (67%)</td>
<td>10 (67%)</td>
<td>10 (67%)</td>
</tr>
<tr>
<td>Number of opportunities for sedentary behaviour</td>
<td>0 (87%)</td>
<td>2 (29%)</td>
<td>15 (100%)</td>
</tr>
<tr>
<td></td>
<td>1 (13%)</td>
<td>1 (14%)</td>
<td>1 (7%)</td>
</tr>
<tr>
<td></td>
<td>&gt;2 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Number of items/locations to purchase food</td>
<td>0 (100%)</td>
<td>3 (43%)</td>
<td>15 (100%)</td>
</tr>
<tr>
<td></td>
<td>1 (0%)</td>
<td>2 (29%)</td>
<td>1 (14%)</td>
</tr>
<tr>
<td></td>
<td>&gt;2 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Number of opportunities for social interaction</td>
<td>0 (67%)</td>
<td>7 (100%)</td>
<td>13 (86%)</td>
</tr>
<tr>
<td></td>
<td>1 (13%)</td>
<td>0 (0%)</td>
<td>1 (7%)</td>
</tr>
<tr>
<td></td>
<td>&gt;2 (20%)</td>
<td>0 (0%)</td>
<td>1 (7%)</td>
</tr>
<tr>
<td>Number of playground items/locations identified in the school play space maps</td>
<td>0 (13%)</td>
<td>7 (100%)</td>
<td>9 (60%)</td>
</tr>
<tr>
<td></td>
<td>1 (14%)</td>
<td>4 (57%)</td>
<td>5 (71%)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>&gt;2</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>----</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>3 (20%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

| Number of sporting items/locations identified in the school play space maps |
|---|---|---|---|---|---|---|
|   | 0 | 1 | >2 |   |   |   |
|   | 7 (47%) | 3 (20%) | 5 (33%) | 6 (86%) | 1 (14%) | 0 (0%) |
|   | 6 (86%) | 1 (14%) | 0 (0%) | 11 (74%) | 2 (29%) | 2 (13%) |
|   | 11 (74%) | 2 (13%) | 2 (13%) | 2 (29%) | 6 (40%) | 4 (57%) |
|   | 2 (29%) | 1 (14%) | 4 (57%) | 6 (40%) | 3 (43%) |   |
|   | 6 (40%) | 2 (13%) | 7 (47%) | 3 (43%) |   |   |
|   | 3 (43%) | 0 (0%) | 4 (57%) |   |   |   |

| Number of natural environment items/locations identified in the school play space maps |
|---|---|---|---|---|---|---|
|   | 0 | 1 | >2 |   |   |   |
|   | 7 (47%) | 3 (20%) | 5 (33%) | 6 (86%) | 1 (14%) | 0 (0%) |
|   | 6 (86%) | 1 (14%) | 0 (0%) | 11 (74%) | 2 (29%) | 2 (13%) |
|   | 11 (74%) | 2 (13%) | 2 (13%) | 2 (29%) | 6 (40%) | 4 (57%) |
|   | 2 (29%) | 1 (14%) | 4 (57%) | 6 (40%) | 3 (43%) |   |
|   | 6 (40%) | 2 (13%) | 7 (47%) | 3 (43%) |   |   |
|   | 3 (43%) | 0 (0%) | 4 (57%) |   |   |   |
Table 3.5. Primary and secondary school children's suggestions for future physical activity facilities.

<table>
<thead>
<tr>
<th>Type of facility</th>
<th>Primary school groups</th>
<th>Secondary school groups</th>
</tr>
</thead>
</table>
| **Smaller scale items** | • Playground flying fox  
• Monkey bars  
• Pool table  
• Modified see saw  
• Spinning playground platform  
• Swings  
• Playground markings  
• Spider web playground climber  
• Vegetable garden | • A slide with vertical drop to the ground  
• Cricket pitch  
• Gymnastics equipment  
• Trampoline floor  
• Playground  
• Ample sports equipment  
• Rock climbing wall  
• Large Television or televisions with Nintendo Wii Sports  
• Trampoline |
| **Larger scale items** | • Low ropes course  
• Tunnels  
• Mazes  
• Obstacle course  
• Vertical play pen  
• Jumping pillow  
• Running track  
• Moving baggage carousel  
• High playground  
• Tennis court  
• Indoor basketball stadium | • Football oval  
• Tunnels  
• Basketball court  
• Horse riding area  
• Waterslide  
• Skate-park  
• Foam Pit  
• Adventure flying fox  
• Swimming pool  
• Race car track  
• Jumping castle  
• Adventure swings |

3.5 Discussion

This study provides greater understanding for teachers of the multiple levels of facilitators and barriers that influence both late primary and early secondary school children’s perceptions of physical activity within the school environment, which can be used by teachers
and those responsible for decision making to inform school-based physical activity interventions and planning.

The social-ecological model of health was used in this study to identify a range of factors across multiple levels that influence children’s participation in non-curricular physical activity. There have been limited investigations employing the key components of the social-ecological model of health in youth (16), especially within a school-context. With the provision of quality Physical Education declining (160, 319), the results of this study provide teachers with in-depth qualitative evidence of the intra-personal, inter-personal, physical environment and policy factors influencing primary and secondary children’s non-curricular physical activity. Highlighting the factors influencing non-curricular school physical activity may increase teachers’ awareness of school play spaces to ensure physical activity is facilitated if and when opportunities arise.

Despite year seven children only being one to two years older than the primary children there were distinct differences between the primary and secondary school children’s perspectives in relation to the social-ecological model. Adolescents who have just commenced secondary school are suggested to be particularly susceptible to low physical activity levels because they begin to undergo body image and self-esteem changes (intra-personal), changes to friendship groups and support structures (inter-personal) and their school environment (physical environment) changes; (320).

It was evident from children’s perceptions of their existing school play spaces that there are a different set of environmental priorities between primary and secondary schools. Within the existing play space maps drawn by primary school children’s playground structures and sporting facilities were abundant in contrast to the secondary school children’s existing play spaces that possessed a high proportion of sedentary features and locations to purchase food.
The environmental effects on each group’s social norms were evident in the focus groups; with primary school children consistently stating that they would be active during school breaks. In contrast, many secondary school children stated they were sedentary within the canteen or lounge and talked to friends or would seek quiet areas to relax. This is despite many of the secondary school children incorporating multiple features to facilitate physical activity within their ideal play space maps.

Many secondary school children also suggested a number of avenues to facilitate physical activity in contrast to their existing play spaces via both the focus groups and map drawing, indicating that reform could be necessary in secondary school to encourage more physical activity participation. Teachers should be aware of the environmental disconnect between primary and secondary play spaces, the vast difference in play spaces may be contributing to the decline in physical activity during the transition between primary and secondary school (321-323). The lack of connection from primary to secondary school environments to facilitate physical activity is supported by a recent study conducted by Haug and colleagues (277). Haug discovered that children’s physical activity peaked in year six, followed by a significant decline in year seven for females and in year eight for males. The study suggested that a lack of facilities in secondary schools could explain the significant reduction in physical activity of secondary school children during school time. Secondary school children were found to be three times more likely to be physically active if schools introduced more facilities.

Similar to the present study, research suggests there is an increased lure of sedentary opportunities and an increased focus on competitive sport activities for secondary school children which could be negatively influencing adolescents’ mood, energy, motivation, interest and desire for physical activity (324, 325). The winning and losing associated with structured competition could be turning secondary children away from physical activity. In
addition, the increased amount of sedentary opportunities at secondary school could also be influencing adolescents’ desire to socialise more (326, 327) as children are less focused on moving around the play spaces and more focused on talking to friends.

A number of social-ecological model influences on children’s non-curricular physical activity were identified. For teachers to better understand children’s physical activity behaviour, social-ecological models suggest it is necessary to consider multiple factors (Intra-personal, Inter-personal, Physical Environment and Policy)(15). An interesting finding in our study was the high proportion of primary school children who suggested playground items should be included within ideal play spaces (Physical Environment). This could be due to primary school children enjoying the lower level of motor skills required for school play equipment (126) or that school playground items allow for unstructured, imaginative play.

Many of the playground items mentioned by the primary school children to facilitate physical activity contrasted their existing playground items. Findings from the present study suggest that primary school children’s desire for new playground items could be due to interest in the existing playground items wearing off over time. Physical activity interventions may be necessary to continue to stimulate children’s interest in school playground physical activity. The positive impact of implementing school playground interventions on primary school children’s physical activity has been well documented (10, 12, 192, 309). In contrast, sports and adventurous activities seemed to appeal more to secondary school children, and this could be due to this age group enjoying the challenges associated with higher levels of motor skill development (126) and more structured physical activities are suggested to increase with age (194).

Outcome goals such as ‘having fun’ and ‘enjoyment’ were perceived to be a facilitator for children to be physically active (Intra-personal). Children stated they were able to have fun
due to interaction with friends (Inter-personal), taking risks and activities that gave them a thrill such as jumping, climbing, dropping, moving quickly and spinning. Primary school children consistently suggested playground items (Physical Environment) that included these thrills would be fun (Intra-personal). The secondary school children were a little more adventurous and suggested more extreme facilities such as a horse riding stable, racing track, adventure swings and skate parks (Physical Environment). However, given the current finding, supervision and legal implications of some of these suggestions may not be plausible to implement.

Similarly, all groups of children identified the task goal of risk taking was necessary to have fun and that having minimal risk could be boring (Intra-personal). Risk taking is suggested to increase children’s confidence in themselves and develop learning paths and dispositions (328) which are important educational considerations for enhancing and embracing the challenges of learning in any context. However, children mentioned that unsafe surfaces and structures (Physical Environment) could act as a barrier to their physical activity participation. This suggests that higher levels of perceived injury risk or past experiences of injury could be a barrier to physical activity in certain play areas (329). In addition, the level of access children had to sports equipment, play areas, supervision and rules (Policy) had an influence on the physical activity behaviour of both primary and secondary school children. It is vital teachers develop policies that are supportive of children being active. Research has revealed physical activity policies are unique to each school (330) and large discrepancies exist within schools between written physical activity policies and implementation (150, 319).

The methodology used in this study was innovative and to our knowledge was the first study that employed a combination of focus group discussion with map drawing to examine children’s perceptions of the influences on their non-curricular physical activity at school. The equal sex distribution and ability to obtain information from children about their actual
and ideal school play environments were also strengths of this study. However, it should be acknowledged that the mapping task may have been cognitively challenging for some of the younger children aged 10-13-years-old. Two previous studies have also undertaken mapping techniques with children aged 10-15-years-old (141, 145) suggesting that this method was suited to children’s cognitive capabilities. Nonetheless, the validity of these findings is reliant on children being able to understand the tasks and accurately report their responses. Having staff available to assist children when required, helped to minimise potential problems such as distractions from other children and confusion of interview questions and map instructions.

It is also important to acknowledge that the findings from this study are not generalisable to wider populations as they are only representative of the perceptions of groups of children from two primary and two secondary schools in two regional areas of Victoria.

3.6 Conclusion

The social-ecological components that could influence primary and secondary school children and adolescents’ physical activity included having outcome goals, task goals (intra-personal level of influence), peer influences, teacher role models (inter-personal levels of influence), the built environment, natural environment, safe surfaces and structures (physical environment levels of influence), play area access, supervision, safety rules and access to sports equipment (policy levels of influence) All children had a desire for new features in their school play spaces that could facilitate physical activity; these often contrasted the features of their existing school play spaces. Furthermore, the secondary school children’s perceptions of their existing play spaces promoted mostly sedentary behaviour, despite many secondary school children desiring school play space features to facilitate physical activity. The study suggests that there are a lack of facilities and play spaces conducive to active play during the transition from primary to secondary school, despite adolescence being such a
crucial time for children to participate in, and develop lifelong physical activity habits. The identification of facilitators and barriers to children’s perceived physical activity informs the development of future school-based physical activity interventions and self-report measures targeting children’s physical activity during school breaks. In addition, many school play spaces are designed by adults. Listening to children’s perspectives of the factors that encourage physical activity may further assist to reduce time children spend in sedentary behaviour and to promote healthy, active school play spaces.
Chapter 4

The Development of the Lunchtime Enjoyment of Activity and Play (LEAP) Questionnaire
The findings of the social-ecological facilitators and barriers to children’s physical activity during school breaks study [Chapter 3] informed the development of a self-report instrument to examine the multiple social-ecological levels of influence on children’s enjoyment of school lunchtime play activities. The development of such an instrument is important to address a lack of self-report measures examining children’s enjoyment of physical activity within the context of school lunch breaks. The instrument will also assist the investigation of the mediating effects of school playground interventions targeting children’s physical activity during school lunch breaks. This chapter is based on a manuscript that is published in the Journal of School Health.

4.2 Introduction

The promotion of an active lifestyle for children is important to establish foundation physical activity habits that can track into adulthood and help reduce the risk of chronic diseases (5). Schools are now being targeted as a major setting to develop children’s fitness standards and to alleviate the increasing prevalence of obesity and chronic diseases (151). Many physical activity opportunities exist in schools including Physical Education and Sport Education programs, after school activities and play during school breaks (331). However, curriculum time allocated to Physical Education is declining (319) and a number of institutional and teacher related barriers have been identified that are restricting the delivery of effective Physical Education (160). In many countries Physical Education doesn’t provide sufficient physical activity for children to meet national physical activity guidelines (332). In order to reduce the demands placed on schools in reflection to the provision of Physical Education,
sport and after school activity programs, there is a developing trend for schools to facilitate children’s physical activity via non-curricular play during school breaks (9). Rather than relying on teachers’ direct instruction to facilitate physical activity, growing evidence suggests schools should consider play during school breaks, now established as the major source for children’s physical activity, supplying up to 50% of children’s recommended daily physical activity (11). Children in some schools are engaging in up to 600 school breaks per year (3-times per day, 5-days per week, 39-weeks per year), (10) offering significant time for children to be physically active via active play. With children estimated to be spending 30 hours per week attending school and accumulating up to 35% of school breaks engaged in MVPA, (190) developing greater knowledge and awareness of the influences on children’s play during school breaks is vital.

In addition to being a major source of children’s physical activity, play during school breaks has been acknowledged as an effective developmental and learning tool to complement or supplement the curriculum (196). International governments (UK, Canada, US, Sweden) have recognised the importance of children’s play during school breaks, leading to a host of policies to enhance school play areas and the quality of children’s play (196). Active play has been described as a major form of childhood learning and has been associated with improvements in children’s physical, cognitive and social development (196), yet there is a gap in the literature on reliable self-report measures to examine children’s school play and lunchtime activity.

A key to ensuring schools develop children’s physical activity habits is to identify the psychosocial correlates of children’s physical activity (131, 132). Recent research is beginning to recognise the important link between the psychosocial correlate of enjoyment and children’s participation in physical activity (118, 333). Enjoyment stems from kinaesthetic experiences (e.g. jumping, sliding) and the attainment of personal goals (e.g.
crossing monkey bars) and is defined as “a positive affective response to an experience that reflects generalised feelings such as pleasure, liking, and fun (120).” The positive association between enjoyment and behaviour change is emphasised in the Youth Physical Activity Promotion (YPAP) model (334) and Self-Determination Theory (SDT) (121). These theoretical models outline that if children enjoy participating in a particular physical activity (e.g. intrinsic motivation) they are likely to continue to adopt and maintain participation in that activity. The YPAP and SDT theories have been used to explain the link between enjoyment and facilitating behaviour change by a number of studies that have identified the association between enjoyment and involvement and participation in sport (122) and physical activities (118, 124, 335). Other studies have also recognised the link between enjoyment and correlates of physical activity including self-determination (125), motor skill proficiency (126), task orientation (127), self-efficacy (128), goal setting (128), and perceived competence (127). Children are exposed to numerous influences within school play areas during break periods (e.g. kicking a ball, chasing a friend) that can impact on children’s enjoyment. Developing a questionnaire that identifies multiple levels of influence on children’s enjoyment of school play and lunchtime activities is therefore an important consideration for schools and researchers when facilitating children’s physical activity (behaviour change).

While studies have identified positive associations between children’s physical activity enjoyment and participation (124, 333, 335), there is a lack of acceptable and reliable measures to examine children’s enjoyment within the school-context. Studies have developed instruments to assess the suitability of school play areas for children’s physical activity via environmental audits (279, 336) and questionnaires of children (277). However, none of these studies have considered children’s enjoyment levels or different play and school lunchtime activities children participate in. The development of a reliable measure of children’s
enjoyment of school play and lunchtime activity with strong reliability, content and face validity is imperative for use in studies aiming to understand and improve children’s school-based health and physical activity. The purpose of the present study was to develop the face and content validity and examine the reliability of the Lunchtime Enjoyment of Activity and Play (LEAP) Questionnaire amongst school children aged 8-12-years-old.

4.3 Methods

4.3.1 Subjects

There were no published data available to inform the sample size calculation for our proposed study. Therefore, power calculations were based on the pilot study; a total of 107 children aged 8-12-years-old completed the LEAP questionnaire from the pilot study of two primary schools in regional Victoria. The overall mean =3.89 and the standard deviation =0.48 from the pilot study were calculated from the 5-point scale (1=strongly disagree to 5=strongly agree) to calculate the effect size. The effect size = 0.23, $\beta = 0.20$ and $\alpha = 0.05$ resulting in a required sample size of 150 children. To account for potential attrition (15%) of a questionnaire repeated 10 days apart in school children a sample of 173 participants was estimated.

In order to assess the LEAP questionnaire reliability a large government primary school was recruited from regional Victoria, Australia. An identical questionnaire was administered on two occasions, 10 days apart, to 176 children (99 males, 77 females) aged 8-12-years-old. All year 3 to 6 children were invited to participate in the study during school Term 2, 2010 (response rate: 54.3%).
4.3.2 Instruments

To inform the development of the LEAP questionnaire items focus group discussions examining the influences on primary school children’s physical activity, information from previous studies examining children’s perceptions of the environment for physical activity (141, 287), a review of the literature and consideration of the social-ecological model (15) were used. Face and content validity of these items was determined through review by five physical activity experts with experience in questionnaire development, ensuring multiple levels of school play activities were represented and the questionnaire’s formatting was suitable for primary school children. After the review by five physical activity experts, eight items were removed from the original 47 item LEAP questionnaire drafts. Three of the experts had both an education (former teachers) and physical activity research background and looked at the questions for age-appropriateness within the survey card. Two of the experts were current teachers with an education background who looked at the questions for developmental appropriateness for the age group. Initially, two likert scale items that examined children’s enjoyment if their school increased or decreased playground items were deemed unnecessary as there was already an item examining children’s enjoyment of the quantity of items within the school play area (physical environment/policy component, item 4). In addition, six non-likert scale items were excluded from the original LEAP questionnaire drafts as they examined additional play area information such as frequency or standard yes/no questions, not enjoyment. This resulted in 39 items in the final LEAP questionnaire to examine the reliability of how much children enjoy school play and lunchtime activity.

Taking into consideration children’s cognitive capabilities during primary school (99), the LEAP questionnaire items were formatted using pictorial representation (smiley faces) of the five point likert scale, underlining key words and grouping similar worded items. Item categories were tested by Cronbach’s alpha for internal reliability (337) and categorised into
social-ecological model levels of influence with components including: (1) intra-personal (individual), (2) inter-personal (social) and (3) physical environment and policy/organisation variables to identify the broader influences on children’s enjoyment of school play and lunchtime activities (15). Social-ecological models suggest that to understand children’s physical activity behaviour it is necessary to consider multiple factors; intra-personal, inter-personal, physical environment and policy/organisation (15). To address this, the intra-personal component included six categories (20 items) examining children’s enjoyment of activity during school breaks, basic locomotion, imaginative play, play-based movements, play variations and sedentary behaviour. The inter-personal component consisted of one category (two items) examining children’s enjoyment of social play. The physical environment and policy/organisation component included five categories (17 items) examining children’s enjoyment of climatic conditions (warm and cool), man-made items, natural items, play area size and play within sheltered areas.

All enjoyment items were rated on a five-point likert scale from very unhappy (1) to very happy (5). During pilot testing of the questionnaire the children and seven primary teachers reported little concern or difficulty with the LEAP questionnaire, therefore no changes were necessary and face and content validity of the questionnaire were confirmed for the test-retest reliability study.

4.3.3 Procedure

The initial administration of the LEAP questionnaire was conducted during class time and took approximately 10 minutes. The administration of the questionnaire was via guided completion, whereby one of the investigators and teachers were present to provide assistance to children as necessary and to ensure children completed all responses. To assess the test-retest reliability of the questionnaires, the children then completed a second, identical
questionnaire in class 10 days later (all participants completed both tests). The LEAP questionnaire was distributed at varying times during the baseline and retest administrations to fit in with classroom schedules.

Children received a plain language statement outlining the research, along with a participant and parental consent form. Ethical approval for the study was obtained from the University of Ballarat Human Research Ethics Committee, the Department of Education and Early Childhood Development (DEECD) and permission was gained from the school Principal.

4.3.4 Data Analysis

Overall, age and sex-specific reliability of the enjoyment questionnaire items were calculated using a weighted kappa (kw²) statistic with quadratic weights for ordinal items (338). Kappa values were categorised as slight agreement (0.01-0.20), fair agreement (0.21-0.40), moderate agreement (0.41-0.60), substantial agreement (0.61-0.80) and almost perfect agreement (0.81-0.99) (338). Cronbach’s alpha was calculated to determine internal reliability for the individual items within each category with values ≥ 0.6 considered acceptable. Cronbach’s alpha was also calculated to determine internal reliability between category items within the social-ecological model components with values ≥ 0.6 considered acceptable (339). The Statistical Package for Social Sciences (SPSS) version 18 (SPSS Inc., Chicago, USA.) was used to calculate the descriptive statistics and R version 2.12.0 (R Development Core Team, Vienna, Austria) was used for the weighted kappa statistics and 95% confidence intervals (CIs). The 95% CIs of weighted kappa was based on the empirical sampling distribution generated by the computer intensive bias corrected bootstrapping re-sampling method (340).
4.4 Results

The mean social-ecological component, mean category scores within each component, and their internal reliability, at both questionnaire administrations are shown in Table 4.1. Internal reliability of social-ecological components was acceptable ($\alpha \geq 0.60$) for intra-personal and physical environment/policy, however, the inter-personal component failed to reach acceptable internal reliability (Baseline $\alpha=0.48$; After 10 days $\alpha=0.45$). Within each social-ecological model component, nine of 13 categories reached acceptable internal reliability, although ‘natural items’, ‘social play’, ‘sheltered play’ and ‘warm conditions’ categories failed to reach an acceptable level of internal reliability ($\alpha= 0.08- 0.53$) during both test administrations. All mean scores increased during the retest after 10 days, except the ‘social play’ category, which remained the same.

Item-specific test-retest reliability results (Figure 4.1) indicate that 35 of 39 items reached at least moderate kappa agreement. In addition, median kappa scores suggest moderate agreement was obtained for each aggregated social-ecological model component (0.44-0.60) and all item categories (0.44-0.75). The highest category median agreement was reached for ‘imaginative play’ and ‘man made items’ in contrast to the lowest median agreement for ‘social play’ and ‘play variation’. Substantial agreement was obtained for 17/39 of the items, moderate agreement for 18/39 items and four LEAP questionnaire items failed to reach moderate agreement (Figure 4.1).

Sex-specific social-ecological component and category mean scores and median kappa (including kappa range) are displayed in Table 4.2. Sex-specific median kappa scores indicate acceptable agreement was reached for both male and females within all categories and aggregated social-ecological components except females for the ‘Social Play’ category (Inter-personal component).
Test-retest reliability results (Figure 4.2) indicate that substantial agreement for males was reached for 18/39 items, moderate agreement for 19/30 items and two LEAP questionnaire items failed to reach moderate agreement. Female test-retest reliability indicate that substantial agreement was reached for 17/39 items, moderate agreement for 15/39 items and seven LEAP questionnaire items failed to reach moderate agreement. There were no significant reliability differences between age groups for LEAP questionnaire items therefore this data is not reported.
Table 4.1. Mean scores and internal reliability of components in the Lunchtime Enjoyment of Activity and Play (LEAP) Questionnaire.

<table>
<thead>
<tr>
<th>Social-ecological model component [15]</th>
<th>Category</th>
<th>Number of items</th>
<th>Mean (1–5)(^a)</th>
<th>SD</th>
<th>Cronbach’s $\alpha$(^b)</th>
<th>Mean (1–5)(^a)</th>
<th>SD</th>
<th>Cronbach’s $\alpha$(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intra-personal</strong></td>
<td>School break activity</td>
<td>6</td>
<td>4.31</td>
<td>0.46</td>
<td>0.64</td>
<td>4.55</td>
<td>0.43</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td>Basic locomotion</td>
<td>3</td>
<td>4.00</td>
<td>0.83</td>
<td>0.72</td>
<td>4.11</td>
<td>0.80</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>Imaginative play</td>
<td>2</td>
<td>3.42</td>
<td>1.22</td>
<td>0.71</td>
<td>3.48</td>
<td>1.24</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>Play based movements</td>
<td>5</td>
<td>4.08</td>
<td>0.80</td>
<td>0.78</td>
<td>4.10</td>
<td>0.85</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td>Play variation</td>
<td>2</td>
<td>3.98</td>
<td>0.99</td>
<td>0.77</td>
<td>4.14</td>
<td>0.89</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>Sedentary behaviour</td>
<td>2</td>
<td>3.34</td>
<td>1.09</td>
<td>0.62</td>
<td>3.55</td>
<td>1.15</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td><strong>Overall</strong></td>
<td><strong>20</strong></td>
<td><strong>3.98</strong></td>
<td><strong>0.52</strong></td>
<td><strong>0.84</strong></td>
<td><strong>4.13</strong></td>
<td><strong>0.55</strong></td>
<td><strong>0.88</strong></td>
</tr>
<tr>
<td><strong>Inter-personal</strong></td>
<td>Social play</td>
<td>2</td>
<td>4.62</td>
<td>0.52</td>
<td>0.48</td>
<td>4.62</td>
<td>0.51</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td><strong>Overall</strong></td>
<td><strong>2</strong></td>
<td><strong>4.62</strong></td>
<td><strong>0.52</strong></td>
<td><strong>0.48</strong></td>
<td><strong>4.62</strong></td>
<td><strong>0.51</strong></td>
<td><strong>0.45</strong></td>
</tr>
<tr>
<td><strong>Physical environment/Policy</strong></td>
<td>Cool conditions</td>
<td>2</td>
<td>3.35</td>
<td>0.99</td>
<td>0.67</td>
<td>3.52</td>
<td>0.98</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>Man made items</td>
<td>7</td>
<td>4.13</td>
<td>0.55</td>
<td>0.65</td>
<td>4.19</td>
<td>0.66</td>
<td>0.73</td>
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<td></td>
<td>Natural items</td>
<td>2</td>
<td>4.19</td>
<td>0.65</td>
<td>0.08</td>
<td>4.35</td>
<td>0.67</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>Play area size</td>
<td>2</td>
<td>3.87</td>
<td>0.83</td>
<td>0.53</td>
<td>3.88</td>
<td>0.98</td>
<td>0.71</td>
</tr>
<tr>
<td></td>
<td>Play within sheltered areas</td>
<td>2</td>
<td>3.79</td>
<td>0.91</td>
<td>0.35</td>
<td>3.91</td>
<td>0.97</td>
<td>0.51</td>
</tr>
<tr>
<td></td>
<td>Warm conditions</td>
<td>2</td>
<td>4.05</td>
<td>0.79</td>
<td>0.50</td>
<td>4.17</td>
<td>0.84</td>
<td>0.53</td>
</tr>
<tr>
<td></td>
<td><strong>Overall</strong></td>
<td><strong>17</strong></td>
<td><strong>3.93</strong></td>
<td><strong>0.46</strong></td>
<td><strong>0.74</strong></td>
<td><strong>4.03</strong></td>
<td><strong>0.48</strong></td>
<td><strong>0.74</strong></td>
</tr>
</tbody>
</table>

\(^a\) enjoyment scale 1= very unhappy; 2= unhappy; 3= not sure; 4= happy; 5= very happy.

\(^b\) The Cronbach’s $\alpha$ was calculated for the individual items within each category of the social-ecological model components and the overall (bold face). The Cronbach’s $\alpha$ was calculated for all category items within each social-ecological model component.
Figure 4.1. Test-retest reliability of the Lunchtime Enjoyment of Activity and Play (LEAP) Questionnaire.
Table 4.2. Sex-specific mean scores and test-retest reliability of components in the Lunchtime Enjoyment of Activity and Play (LEAP) Questionnaire.

<table>
<thead>
<tr>
<th>Social-ecological model component</th>
<th>Category</th>
<th>Number of items</th>
<th>Mean (SD) (1–5)a</th>
<th>Mean (SD) (1–5)a</th>
<th>Median Kappa Agreement (Kappa Range)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Males</td>
<td>Females</td>
<td>Males</td>
<td>Females</td>
</tr>
<tr>
<td>Intra-personal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School break activity</td>
<td>6</td>
<td>4.29 (0.51)</td>
<td>4.33 (0.37)</td>
<td>4.53 (0.47)</td>
<td>4.57 (0.38)</td>
</tr>
<tr>
<td>Basic locomotion</td>
<td>3</td>
<td>3.94 (0.85)</td>
<td>4.08 (0.80)</td>
<td>4.09 (0.80)</td>
<td>4.13 (0.79)</td>
</tr>
<tr>
<td>Imaginative play</td>
<td>2</td>
<td>3.17 (1.29)</td>
<td>3.74 (1.04)</td>
<td>3.26 (1.32)</td>
<td>3.77 (1.08)</td>
</tr>
<tr>
<td>Play based movements</td>
<td>5</td>
<td>4.02 (0.87)</td>
<td>4.15 (0.75)</td>
<td>4.04 (0.87)</td>
<td>4.19 (0.79)</td>
</tr>
<tr>
<td>Play variation</td>
<td>2</td>
<td>3.85 (1.12)</td>
<td>4.15 (0.75)</td>
<td>4.02 (0.98)</td>
<td>4.31 (0.74)</td>
</tr>
<tr>
<td>Sedentary behaviour</td>
<td>2</td>
<td>3.17 (1.13)</td>
<td>3.65 (0.98)</td>
<td>3.48 (1.26)</td>
<td>3.65 (0.98)</td>
</tr>
<tr>
<td>Overall</td>
<td>20</td>
<td>3.74 (0.96)</td>
<td>4.02 (0.78)</td>
<td>3.90 (0.95)</td>
<td>4.10 (0.79)</td>
</tr>
<tr>
<td>Inter-personal</td>
<td>Social play</td>
<td>2</td>
<td>4.51 (0.60)</td>
<td>4.76 (0.35)</td>
<td>4.60 (0.53)</td>
</tr>
<tr>
<td>Overall</td>
<td>2</td>
<td>4.51 (0.60)</td>
<td>4.76 (0.35)</td>
<td>4.60 (0.53)</td>
<td>4.64 (0.48)</td>
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<td>Physical environment/Policy</td>
<td>Cool conditions</td>
<td>2</td>
<td>3.29 (1.28)</td>
<td>2.90 (1.01)</td>
<td>3.47 (1.32)</td>
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<td>Man-made items</td>
<td>7</td>
<td>4.06 (0.63)</td>
<td>4.20 (0.53)</td>
<td>4.18 (0.65)</td>
<td>4.20 (0.35)</td>
</tr>
<tr>
<td>Natural items</td>
<td>2</td>
<td>4.06 (0.70)</td>
<td>4.36 (0.54)</td>
<td>4.27 (0.73)</td>
<td>4.46 (0.57)</td>
</tr>
<tr>
<td>Play area size</td>
<td>2</td>
<td>2.90 (0.88)</td>
<td>2.86 (0.79)</td>
<td>3.02 (1.02)</td>
<td>2.92 (0.95)</td>
</tr>
<tr>
<td>Play within sheltered areas</td>
<td>2</td>
<td>3.73 (1.00)</td>
<td>3.86 (0.77)</td>
<td>3.81 (1.07)</td>
<td>4.03 (0.80)</td>
</tr>
<tr>
<td>Warm conditions</td>
<td>2</td>
<td>4.12 (0.87)</td>
<td>3.96 (0.68)</td>
<td>4.21 (0.94)</td>
<td>4.12 (0.70)</td>
</tr>
<tr>
<td>Overall</td>
<td>17</td>
<td>3.70 (0.89)</td>
<td>3.69 (0.72)</td>
<td>3.83 (0.96)</td>
<td>3.80 (0.75)</td>
</tr>
</tbody>
</table>

a enjoyment scale 1= very unhappy; 2= unhappy; 3= not sure; 4=happy; 5=very happy.
Figure 4.2. Sex-specific test-retest reliability of the Lunchtime Enjoyment of Activity and Play (LEAP) Questionnaire.
4.5 Discussion

The unique contribution this study makes to the international literature is that this is the first study to report the development and reliability of a questionnaire designed to assess children’s enjoyment of school play and lunchtime activity. All three social-ecological model components and 13 categories within the components (including 35/39 individual items) had a median kappa that reached at least moderate test-retest reliability when administered to a large sample of primary school children.

Many studies have measured children’s enjoyment of physical activity using single item measures or scales not validated in the childhood age group (118), yet there is little research describing the development of multiple item scales to measure children’s enjoyment of physical activities (118). King and colleagues developed and established the reliability of the children’s activity preferences and enjoyment (CAPE) instrument in children aged 6-21-years-old (341). In addition, the physical activity enjoyment scale (PACES) originally designed for college students was recently simplified for younger children and was validated in 564 year 3 children (118). However, these measures assess children’s enjoyment of leisure activities (CAPE) or being physically active (PACES) in contrast to the present study where the LEAP questionnaire contextualises children’s enjoyment of play and lunchtime activity using a multiple faceted social-ecological framework (15) within a school setting. An enhanced understanding of the complex and multiple factors that influence children’s physical activity behaviour needs to be considered when developing interventions for school break periods.

Of the 39 LEAP questionnaire items, 35 displayed at least moderate reliability. Three of the four LEAP questionnaire items displayed less than moderate reliability including playing with friends at lunchtime (inter-personal component, item 13), changing play
space location (intra-personal, item 38), and playing outside (intra-personal component, item 34) due to sex-specific reliability influences. A major sex-specific difference that could be attributed to the lower reliability for the three items could be that males are more physically active and play different activities to females during school breaks (331). If females are less physically active there could be more time to be affected by social and weather-related influences (females had low reliability for the ‘Social Play’ category and ‘Playing Outside’ item). Males’ lower reliability for the changing play location item could be due to the spontaneous nature of active play and the competitive sports activities (e.g. winning and losing) that males tend to participate in (342). Males are suggested to be peer pressured into playing games and sporting activities (342), therefore males’ enjoyment could vary between tests if friends are pressuring them to play in school play areas that the males don’t enjoy. It is unclear why there was lower reliability for children’s enjoyment of recess play (intra-personal component, item 3) in comparison to lunchtime, therefore further research may be warranted to examine this and the factors contributing to sex-specific influences on children’s enjoyment during different school breaks during the day.

The unpredictable nature of children’s social relationships (343) confirms why just two items were included within the inter-personal component and that lower reliability of inter-personal items should be expected. Evidence suggests children’s social relationships are relatively unstable as children’s social well-being can be influenced by a number of variables including level of peer acceptance, victimisation and popularity (343). In addition, females are suggested to display more emotional behaviour and participate in more social activities than males that could influence females’ lower reliability for the inter-personal component (344). Future research may be required to determine more reliable inter-personal variables before further inter-personal items are
added to the LEAP questionnaire. However, despite the lower test-retest and internal reliability for the inter-personal items, the identical mean enjoyment scores between tests indicate that the group’s overall enjoyment within the inter-personal component remained consistently high (mean= 4.62) over the test re-test period.

Given that this study was conducted in winter with maximum daily temperatures ranging from 8.5 to 12.5 degrees Celsius at a school with limited outdoor sheltered areas, it is not unreasonable to expect the low internal reliability for the ‘play in sheltered areas’ and ‘warm conditions’ categories. High mean enjoyment and kappa agreement scores reflect strong reliability for the ‘natural items’ category however, the very low internal reliability may indicate that children perceive the function of a grass oval differently to other natural features such as trees, rocks and gardens. Therefore, the internal reliability of ‘natural items’ may need further investigation and needs to be interpreted with caution.

Data frequencies for the other categories within the intra-personal and physical environment and policy/organisation components indicate children may have experienced a ‘learning effect’ during the re-test. Rather than selecting ‘not sure (3)’ for certain items, more children selected ‘happy/very happy (4/5)’, subsequently increasing re-test enjoyment. Despite the slight increase in re-test enjoyment scores and four items that failed to reach moderate kappa agreement, findings indicate strong reliability for the remaining LEAP questionnaire items and these items should be included in future compositions of the LEAP questionnaire. To ensure the questionnaire was appropriate for primary school aged children a pictorial scale was employed using developmentally appropriate images of smiley faces and the LEAP questionnaire items were found to be mainly reliable with this age group, showing promise for use in longitudinal research. It
is recommended that the LEAP questionnaire be considered in the development of enjoyment scales in other contexts such as community settings.

Previous physical activity literature would indicate that high levels of physical activity enjoyment could correlate with physical activity participation (118, 333). This study identifies the high level of children’s enjoyment of school play and lunchtime activities among a sample of primary school children. Despite literature suggesting males are more physically active than females during school time (331), females’ mean enjoyment was higher for most categories within the current study. Future research investigating correlations between children’s enjoyment of school play and lunchtime activity and physical activity participation is therefore warranted. Given the concerns regarding the declining levels of physical activity among adolescents (5) it may also be useful to investigate adolescents’ enjoyment of school play and lunchtime activity within a secondary school-context.

4.6 Conclusion

In summary, this study confirms the LEAP questionnaire to be a reliable, context-specific instrument with sound content and face validity. The LEAP questionnaire employs a social-ecological framework to assess children’s enjoyment of school play and lunchtime activities, including the number and type of school play activities children enjoy and the extent of his/her enjoyment. When assessing children’s enjoyment of play and lunchtime activity and tailoring intervention strategies during school breaks, it is essential to ensure that measurement tools consider the multi-faceted nature of the social-ecological model. The findings suggest that sex can be an influential factor on the overall test-retest reliability of a group’s enjoyment of school play and lunchtime activity.
Chapter 5

Children’s enjoyment of play during school lunch breaks: An examination of intra-day variability and inter-day reliability
5 Children’s enjoyment of play during school lunch breaks: An examination of intra-day variability and inter-day reliability

5.1 Preface

Following the development of the school context-specific Lunchtime Enjoyment of Activity and Play (LEAP) questionnaire [Chapter 4] it was important to examine the reliability of measuring children’s enjoyment of lunchtime play across multiple days. Investigating the consistency of children’s enjoyment of lunchtime play within and between school days would provide evidence for health professionals and researchers of the frequency of measurement necessary to provide a representative assessment of children’s enjoyment of lunchtime play. This chapter is based on a manuscript that is published in the Journal of Physical Activity and Health.

5.2 Introduction

The development of healthy lifestyle behaviours early in life is important. Childhood is a crucial time to develop activity habits that can prevent potential health consequences associated with a sedentary lifestyle in adulthood (5). Schools have been identified as a major setting for providing children with physical activity (physical activity) opportunities such as Physical Education, sport programs, after school activities and play during school breaks (151, 192). However, there are a number of barriers to implementing Physical Education effectively and in most countries Physical Education doesn’t provide sufficient physical activity for children to meet national physical activity guidelines (345-347). With school curricular time devoted to children and adolescents’ Physical Education declining (190, 319), and to reduce the burden on schools to provide Physical Education, sport and after school activity programs, there is an increasing trend towards schools facilitating children’s physical activity via non-curricular avenues such
as play during school breaks (30, 193). Play during school breaks is now recognised as the major source for children’s daily physical activity (11, 191-193), contributing up to 50% of children’s recommended daily physical activity. Evidence suggests children spend up to 35% of school breaks engaged in moderate to vigorous physical activity (MVPA) (190). With children reported to be spending approximately 30 hours per week at school (190), access and opportunities for physical activity during periods other than school breaks are limited, therefore developing a greater understanding of children’s play during school lunchtime is vital.

Play during school lunch breaks is crucial for children’s development of cognitive, physical, social and emotional well-being (12, 348) and play has been acknowledged by the United Nations High Commission for Human Rights as an entitlement for every child (362). School lunch breaks provide children with an opportunity to engage in unstructured active play to build active, healthy bodies and develop decision making, negotiating and motor skills (348). Ultimately, the more positive responses (e.g. enjoyment) children experience via active play through opportunities such as unstructured school lunch breaks the more likely children will adopt an active lifestyle and minimise the adoption of sedentary behaviours (348). More research relating to predisposing factors of physical activity such as enjoyment (334) and their associations with play during school lunchtime are needed (193). Measuring children’s self-reported enjoyment of school lunchtime experiences may reflect the quality of the school play environment. Despite age and sex being the most common demographic variable that has been investigated as a correlate to children’s physical activity during school breaks (8), little is known on whether enjoyment of play varies according to age and sex. A greater understanding of children’s enjoyment of play within the school-context is an important consideration in future evaluations of interventions designed to improve or change play.
environments (124, 335). Many studies investigating enjoyment did not consider the extent to which measuring enjoyment may vary within and between school days. No study we are aware of has assessed children’s enjoyment of lunchtime play however, instruments have been developed to measure children’s enjoyment of being physically active in general (118, 124, 335) and leisure activities (341).

An essential element of tailoring physical activity interventions to target children requires identification of key psychosocial correlates that may explain behaviour change (131). Children’s physical activity behaviour can include active play (348), structured sport (349), Physical Education (160) and active transport (350). Literature reviews have consistently identified exercise motivation, social support and self-efficacy as key psychosocial correlates of physical activity (131, 132) and suggest further investigation into the psychosocial correlates of children and adolescent physical activity is warranted (131, 132, 351). More recently, research has examined the association between the psychosocial correlate ‘enjoyment’ and children’s physical activity (118, 122, 333). The connection between enjoyment and behaviour change can be explained by the Self-Determination Theory (SDT) which outlines that if behaviour such as physical activity is motivated by intrinsic factors (e.g. experiencing enjoyment after exercise) physical activity participation is more likely to be sustained than via extrinsic factors (e.g. obtaining rewards) (352). Enjoyment has been shown to be positively correlated with children’s motivation for involvement (122), and sustained participation in sport (122) and physical activity (118, 119). There are numerous developmental, physical and psychological benefits associated with an active lifestyle however, a ‘lack of enjoyment’ has been identified as a potential determinant of declining participation in physical activity (353). Similar to the Self-Determination Theory, The Youth Physical Activity Promotion (YPAP) model proposed by Welk suggests that if children enjoy participating
in particular activities, they are more likely to engage in and maintain participation in those activities (334). Enjoyment is derived intrinsically via kinaesthetic experiences and achievement of personal goals and extrinsically via social recognition and comparative achievement (354). Researchers define enjoyment of physical activity as “a positive affective response to an experience that reflects generalised feelings such as pleasure, liking, and fun (p.32) (354).” Therefore, with so many experiences encountered by children from day to day, psychosocial influences on behaviour such as enjoyment are an important consideration when assessing the physical activity and health behaviour of children and adolescents.

Previous physical activity literature would indicate that the high levels of ‘expected’ and ‘actual’ enjoyment of lunchtime play from this study could be correlated with high physical activity participation (118, 119). A number of studies have recognised the positive association between children’s enjoyment of physical activity and participation (363, 364). Studies have identified associations between enjoyment and correlates of physical activity including self-determination (125), motor skill proficiency (126), task orientation (127), self-efficacy (128), goal setting (128) and perceived competence (127). Physical activity interventions have also targeted enjoyment as a key psychosocial mediator of behavioural changes (333, 365). Positive correlations exist between children’s enjoyment of physical activity and participation (118, 119), yet little is known about children’s enjoyment of play during school lunch breaks, a major source of children’s physical activity, both on a single day and across days of the week (298).

Recent studies have explored the intra (188, 355, 356) and inter-day patterns (216, 357, 358) of children’s physical activity across multiple school days. However, none of these
studies considered children’s enjoyment levels. Determining the consistency of children’s enjoyment of lunchtime play within and between school days may provide evidence for health professionals and researchers of the frequency of measurement necessary to provide a representative assessment of children’s enjoyment of lunchtime play. To our knowledge, no study has previously reported children’s enjoyment levels of school lunchtime play or age/sex-specific enjoyment of lunchtime play variability. The question of whether children’s enjoyment of lunchtime play is representative of other school days is currently unknown. The purpose of the present study was to examine the intra-day variability and inter-day reliability of children’s enjoyment of playing at lunchtime.

5.3 Methods

5.3.1 Participants and Study Design

During the pilot study, survey cards were administered to 107 year 3-6 children (aged 8-12-years-old) in two primary schools from regional Victoria. Children reported little concern or difficulty when using the small survey cards; therefore no changes were necessary for the current study, which assessed enjoyment of lunchtime play. As children’s cognitive capabilities are developing during primary school, the suitability of the survey cards for children aged less than 10-years was deemed acceptable based on feedback from primary school teachers after the initial pilot study. Additionally, face validity of the small survey card was reviewed by five physical activity experts with experience in the development of self-report measures. Three of the experts had both an education (former teachers) and physical activity research background and looked at the questions for age-appropriateness within the survey card. Two of the experts were teachers who looked at the questions for developmental appropriateness for the age
group. In addition to the expert review, readability was also assessed by conducting a pilot test with a group of 15 children aged 8-12-years-old. As a result of the pilot test, a minor change of underlining key words was implemented based on the questions children asked. The final readability of the enjoyment of lunchtime play survey cards were assessed using seven readability formulas via an online tool that indicated the instrument could be easily read by 8-9-year-olds (359).

Within the current study enjoyment of lunchtime play survey cards were administered to 197 children aged 8-12-years-old (112 males, 85 females) from a large government primary school campus (n=326) in regional Victoria, Australia. All year 3 to 6 children that were participating in the Lunchtime Enjoyment of Activity and Play (LEAP) questionnaire reliability study were invited to participate in the study during Winter (June) in school Term 2, 2010 (response rate: 60.8%). Children’s ‘expected’ (before lunch) and ‘actual’ (after lunch) enjoyment of lunchtime play were measured and compared on each day over a five day period (35.9% missing responses). Completion of the survey cards took approximately 20 seconds and required children to circle on a five point likert pictorial scale how much they expected to enjoy lunchtime play or how much they actually enjoyed lunchtime play. The enjoyment item was rated on a five-point likert scale from very unhappy (1) to very happy (5). The card also recorded the child name, year and day of the week. Demographic details such as the child’s age and sex were collected from a larger survey as part of the same research project being conducted at the primary school. Children generally had no difficulties completing the questionnaire, only 2-3 children per class asked for clarification. Two children who required assistance reading the survey card had been previously identified as having learning disabilities; therefore their data were excluded from the analyses.

Playground features of the primary school included a courtyard, basketball court,
synthetic surfaced ball area, large grass oval, rain and sun sheltered playground (including monkey bars, slide, wooden bridge), painted court markings (e.g. hopscotch) and a large grass area with many trees and large rocks at the front of the school. Sports equipment that was made available for the children during lunchtime included balls, bats, hoops and skipping ropes.

Ethical approval for the study was obtained from the University of Ballarat Human Research Ethics Committee, the Department of Education and Early Childhood Development (DEECD) in Victoria and permission was gained from the school principal. Children and their parents received a plain language statement outlining the research, along with a participant and parental consent form.

5.3.2  Data Analysis

Intra-day variability and inter-day reliability (including age and sex-specific variability) of children’s enjoyment of lunchtime play were calculated using a Weighted Kappa ($k_w^2$) statistic for ordinal items. Kappa values were categorised as slight agreement (0.01-0.20), fair agreement (0.21-0.40), moderate agreement (0.41-0.60), substantial agreement (0.61-0.80) and almost perfect agreement (0.81-0.99) (338). The 95% confidence intervals of weighted kappa were based on the empirical sampling distribution generated by the computer intensive bias corrected bootstrapping re-sampling method (340). The Z statistic, which follows standard normal distribution with mean 0 and variance 1, was used to compare the level of reliability between sex and age groups (360). The values were set at a 5% level of significance. The Statistical Package for Social Sciences (SPSS) version 18 (SPSS Inc., Chicago, US) was used to calculate the descriptive statistics and R version 2.12.0 (R Development Core Team, Vienna, Austria) was used for the weighted
kappa statistics, 95% confidence intervals (CI) and reliability comparisons using Z statistic.

5.4 Results

Overall, both ‘expected’ and ‘actual’ enjoyment of lunchtime play was rated as very high or high (Table 5.1). Table 1 presents the intra-day consistency for the enjoyment of lunchtime play between school day one (Wednesday, week one) to school day five (Tuesday, week two). Monday displays a substantial level of agreement (kappa), Wednesday and Friday display moderate level of agreement (kappa) and Tuesday and Thursday display a fair level of agreement (kappa), between expected and actual enjoyment of lunchtime play scores. A decrease in the percentage of enjoyment of lunchtime play was evident from before lunch (expected play enjoyment) to after lunch (actual play enjoyment) across all days.

Age and sex-specific intra-day variability in enjoyment of lunchtime play data is also presented (Table 5.2). Intra-day variability was only significantly different between sex on Monday (Day 4 of 5), \( Z = 3.66; p < 0.001 \). Monday displayed the highest level of agreement (kappa) score for males (almost perfect agreement) and the lowest level of agreement (kappa) score for females (fair agreement). Although the intra-day variability was not significantly different on Wednesday, the highest level of agreement (kappa) is displayed for females (moderate agreement) and the lowest level of agreement (kappa) for males (fair agreement). There were no significant differences in the level of agreement scores between age groups however, the greatest differences in the level of agreement (kappa) were evident for Tuesday \( Z = 1.71; p = 0.09 \) and Thursday \( Z = 1.01; p = 0.31 \). The level of agreement (kappa) scores were highest for both age groups on Monday \( Z = 0.24; p = 0.81 \).
Inter-day reliability of children’s enjoyment of lunchtime play results (Table 5.2) indicate ‘expected’ enjoyment of lunchtime play between each of the five days failed to reach a moderate level of agreement, ranging from 0.09 to 0.40 (median kappa=0.30). Similarly low ‘actual’ inter-day reliability scores for enjoyment of lunchtime play were identified, ranging from 0.05-0.46 (median kappa=0.28). The lowest ‘expected’ inter-day reliability was between Wednesday and Monday (slight agreement) and the highest ‘expected’ inter-day reliability was between Monday and Friday (fair agreement). In contrast, the lowest ‘actual’ inter-day reliability was identified between Tuesday and Wednesday (slight agreement) and the highest ‘actual’ inter-day reliability was identified between Wednesday and Friday (moderate agreement). No significant differences were identified
Table 5.1. Intra-day variability including age and sex-specific intra-day variability (weighted kappa (95% CI)) of children's enjoyment of school lunchtime play.

<table>
<thead>
<tr>
<th>Day</th>
<th>‘Expected’ Enjoyment of Lunchtime Play</th>
<th>‘Actual’ Enjoyment of Lunchtime Play</th>
<th>Intra-day variability (weighted kappa (95%CI))</th>
<th>Sex</th>
<th>Age</th>
<th>Intra-day Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VH/H NS VU/U</td>
<td>VH/H NS VU/U</td>
<td>Male (Weighted Kappa (95% CI)) Female (Weighted Kappa (95% CI))</td>
<td>Z</td>
<td>P Value</td>
<td>Z</td>
</tr>
<tr>
<td></td>
<td>% % %</td>
<td>% % %</td>
<td>ZP Value†</td>
<td>Z</td>
<td>P Value</td>
<td>Z</td>
</tr>
<tr>
<td>Wednesday (1)</td>
<td>94.7 4.3 1.0</td>
<td>88.1 6.7 5.2</td>
<td>0.27 (-0.05 – 0.59) 0.55 (0.19 – 0.91) 1.17 0.24</td>
<td>0.54 (0.14 – 0.94) 0.40 (0.08 – 0.73) 0.51 0.61</td>
<td>0.49 (0.15-0.76)</td>
<td></td>
</tr>
<tr>
<td>Thursday (2)</td>
<td>93.0 5.4 1.6</td>
<td>91.7 4.8 3.5</td>
<td>0.29 (0.07 – 0.52) 0.34 (0.01 – 0.67) 0.22 0.83</td>
<td>0.40 (0.18 – 0.63) 0.22 (-0.04 – 0.49) 1.01 0.31</td>
<td>0.31 (0.11-0.50)</td>
<td></td>
</tr>
<tr>
<td>Friday (3)</td>
<td>89.9 7.2 2.9</td>
<td>84.7 6.5 8.8</td>
<td>0.42 (0.09 – 0.76) 0.37 (0.02 – 0.72) 0.21 0.84</td>
<td>0.45 (0.10 – 0.80) 0.33 (-0.02 – 0.67) 0.48 0.63</td>
<td>0.41 (0.17-0.66)</td>
<td></td>
</tr>
<tr>
<td>Monday (4)</td>
<td>93.9 3.0 3.1</td>
<td>89.8 6.1 4.1</td>
<td>0.87 (0.76 – 0.98) 0.32 (0.05 – 0.60) 3.66 &lt;0.001†</td>
<td>0.71 (0.49 – 0.93) 0.77 (0.40 – 0.98) 0.24 0.81</td>
<td>0.75 (0.50-0.90)</td>
<td></td>
</tr>
<tr>
<td>Tuesday (5)</td>
<td>95.5 3.6 0.9</td>
<td>86.2 7.6 6.2</td>
<td>0.28 (0.08 – 0.48) 0.36 (0.26 – 0.46) 0.72 0.47</td>
<td>0.24 (0.07 – 0.40) 0.42 (0.29 – 0.56) 1.71 0.09</td>
<td>0.32 (0.21-0.44)</td>
<td></td>
</tr>
</tbody>
</table>

CI= confidence interval; Day 1-5 represents the order of testing with the first day of testing beginning on a Wednesday; Z= Standard Normal variate; † P value from the standard normal test (Z test); CI= confidence interval; * = Significant difference; VH/H= Very Happy/Happy; NS= Not Sure; VU/U= Very Unhappy/Unhappy.
Table 5.2. Inter-day reliability of children's enjoyment of school lunchtime play. The upper panel shows the 'expected' and the lower panel shows the 'actual' enjoyment of lunchtime play.

<table>
<thead>
<tr>
<th>Level of Agreement (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wednesday (1)</td>
</tr>
<tr>
<td>0.35 (0.10 - 0.57)</td>
</tr>
<tr>
<td>Thursday (2)</td>
</tr>
<tr>
<td>0.25 (0.06 - 0.43)</td>
</tr>
<tr>
<td>0.10 (-0.09 - 0.36)</td>
</tr>
<tr>
<td>0.46 (0.20 - 0.70)</td>
</tr>
<tr>
<td>Friday (3)</td>
</tr>
<tr>
<td>0.09 (-0.10 - 0.30)</td>
</tr>
<tr>
<td>0.14 (-0.08 - 0.41)</td>
</tr>
<tr>
<td>Monday (4)</td>
</tr>
<tr>
<td>0.16 (0.01 - 0.31)</td>
</tr>
<tr>
<td>0.05 (-0.10 - 0.28)</td>
</tr>
<tr>
<td>Tuesday (5)</td>
</tr>
<tr>
<td>0.37 (0.15 - 0.57)</td>
</tr>
<tr>
<td>0.19 (-0.02 - 0.49)</td>
</tr>
<tr>
<td>0.40 (0.17 - 0.62)</td>
</tr>
<tr>
<td>0.44 (0.10 - 0.72)</td>
</tr>
<tr>
<td>0.28 (0.19 - 0.39)</td>
</tr>
<tr>
<td>0.30 (0.07 - 0.53)</td>
</tr>
<tr>
<td>0.27 (0.14 - 0.44)</td>
</tr>
<tr>
<td>0.37 (0.11 - 0.65)</td>
</tr>
<tr>
<td>0.31 (0.19 - 0.56)</td>
</tr>
<tr>
<td>0.41 (0.09 - 0.71)</td>
</tr>
</tbody>
</table>

CI = confidence interval; Day 1-5 represents the order of testing with the first day of testing beginning on a Wednesday.
For age or sex-specific inter-day comparisons (including 79% (63/80) of inter-day comparisons failing to reach moderate reliability); therefore age and sex-specific inter-day lunchtime play enjoyment comparisons are not presented. The mean maximum temperature for the five days was 11.2°C, ranging from 9.6°C on day two (Thursday, week one) to 12.4°C on day five (Tuesday, week two). Minimum temperatures were all <2°C for all days except day two (Thursday, week one), which reached 7.2°C (361). The mean rainfall was 2.2mm, ranging from 1.2mm on day four (Monday, week two) to 5.2mm on day three (Friday, week one). No rainfall was recorded on both day one (Wednesday, week 1) and day five (Tuesday, week 2) (361). These are usual temperatures for the area at this time of year (361).

5.5 Discussion

Examination of children’s intra-day and inter-day enjoyment of lunchtime play suggests that children’s expected and actual enjoyment of lunchtime play is relatively consistent within a single day. However, consistency is lower when comparing children’s enjoyment scores of lunchtime play across multiple school days. The higher consistency of children’s enjoyment of lunchtime play within a single day may suggest that influences on children’s enjoyment within a single school day may be less varied than across multiple school days. Alternatively it could also mean children can easily remember what their expected enjoyment was when rating their actual enjoyment, potentially biasing the response.

A theoretical framework that could explain the variation in enjoyment from day to day is the social-ecological model (15). The social-ecological model highlights that multiple influences such as intra-personal (individual), inter-personal (social), physical environment and policy factors within a setting can be modified and affect children’s behaviour (15). Intra-personal influences on behaviour includes changes in an individual child’s mood; inter-personal influences include variation in family circumstances, behaviour and mood of teachers/peers;
physical environment influences include variation in climatic conditions, children’s access and availability of play spaces/activities and policy influences may include different/quantity of teachers supervising the playground, changes to rules and access to sports and play equipment or play area allocation by year level. With so many potential influences on children’s behaviour from day to day, these influences could be major factors contributing to the lower levels of agreement across days (including 79% of age and sex-specific inter-day kappa comparisons failing to reach moderate reliability).

The higher reliability for enjoyment of lunchtime play at the beginning of the study (Wednesday, Week 1) and at the beginning of a school week (Monday, Week 2) may reflect that reliability decreases when self-report measures are repeated each day. Children had completed the enjoyment of lunchtime play survey card for the first time on the Wednesday and on the Monday children had experienced the weekend break. In contrast, when the administration of the survey cards were repeated the day after the start of the study and school week, on the Thursday (Week 1) and Tuesday (Week 2), the intra-day variability dropped from substantial and moderate to a fair level of agreement. Although intra-day variability for Friday (Week 1) was moderate, the findings suggest that consistency may be increased if administration of the self-report is spaced out over time, rather than repeating each day.

It should be acknowledged that the lower intra-day variability (fair) of lunchtime enjoyment scores on the final day (Tuesday) could be attributed to five days being too many days of repeated measures. Thursday (Day 2) could also have been affected by the cooler weather (maximum temperature <10°C), as the mean maximum temperature for the other four days was 11.7°C (SD=0.76). Temperature variation has been found to influence children’s physical activity (193, 368) and this could also be the case for correlates of physical activity
such as enjoyment of play. In addition, it should also be noted that lower percentages of ‘actual’ enjoyment of play after lunch may suggest children could be more optimistic about enjoying lunchtime play before lunchtime commences. This would be due to children being unable to predict or take into account potential influences on their play that can occur during lunch breaks that may affect their level of enjoyment.

The greatest intra-day level of agreement (kappa) score differences between males and females earlier in the week could indicate that administering self-report measures earlier in the school week may detect greater sex differences than later in the school week. This is reinforced by a significant level of agreement score difference between males and females for Monday (day four). Before children experience the demands of different subjects, homework and other school commitments of the school week, children could be taking more time and be more specific when rating the enjoyment of lunchtime play survey, resulting in the sex differences in level of agreement (kappa) scores being more identifiable. Another possibility could be due to Monday (day four) and Tuesday (day five) being the final two days of the study and having completed repeated measures over the previous three days may have resulted in one of the sex being less accurate in self-reporting their enjoyment of lunchtime play during the fourth and fifth days of survey administration. In other words, the boys quite simply may have been ‘over it!’ Evidence also suggests males and females participate in and prefer different physical activities (369) and behaviour (370) during school lunchtime play, which could have influenced sex-specific differences in the level of agreement (kappa).

Interestingly, female enjoyment scores were most reliable and males were least reliable during the start of the study (Wednesday/Day one) between ‘expected’ and ‘actual’ enjoyment of lunchtime play. In contrast, male enjoyment of lunchtime play scores contained ‘almost perfect’ level of agreement at the start of the school week (Monday/Day four), the
day in which females possessed their lowest consistency (fair agreement) between ‘expected’ and ‘actual’ enjoyment of lunchtime play.

An important finding from the study was the similar kappa agreement scores between the 8-9 and 10-12-year-old age groups. Although previous research that has examined enjoyment of sport and physical activity suggests children’s sources of enjoyment varies with age (122), reliability comparisons between the age groups were relatively consistent. Similar to the males, both age groups possessed enjoyment of lunchtime play scores that displayed very high consistency on Monday (substantial agreement) and the high intra-day consistency for both age groups on Monday may suggest that administering self-report enjoyment measures on a Monday could strongly represent enjoyment of play throughout that school day.

This is the first study we are aware of to examine the intra-day variability and inter-day reliability of enjoyment of lunchtime play. There is a lack of consensus as to how many days of measurement are required to assess children’s enjoyment of lunchtime, therefore a typical school week (five days) was chosen. The moderate intra-day variability of enjoyment of lunchtime play for three out of five school days suggests that assessing children’s enjoyment of play after lunch would be representative of enjoyment of lunchtime play on that particular day, but not necessarily that school week. It should be acknowledged this study relied on children under 12-years-old accurately predicting and recalling enjoyment play during school lunchtime. Concerns have previously been raised about using self-report instruments with primary school aged children (99) however, we minimised this potential complication by piloting the survey cards and by considering the format of the questionnaire and employing the use of a pictorial scale using developmentally appropriate images of smiley faces (371).

As this was the first study of its kind, we recommend future research should investigate patterns of children’s enjoyment of lunchtime play. In addition, future research is needed to
identify the sources and influences of children’s enjoyment of lunchtime play. A limitation of this study was the high number of missing responses across the five days however, as the research was conducted within a usual school environment children are absent from school throughout a week for a variety of reasons (e.g. illness, music, inter-school sport). It should also be noted that because the research was conducted within a single primary school, any generalising of findings are not necessarily representative of the wider population.

While we were able to identify the intra-day variability and inter-day reliability for actual and predicted lunchtime enjoyment and our field notes suggest active play occurred during lunchtime; future studies should consider objectively measuring the type and duration of the play activities undertaken during the lunch period. As the primary school children expected to enjoy lunchtime play more than they actually did, further research could examine how children’s levels of resilience to enjoy lunchtime play can be affected by the multiple social-ecological levels of influence during school play activities. Given that current literature has demonstrated a relationship between physical activity participation and enjoyment (118, 119) this would enable additional analysis to be conducted on the relationship between the type and intensity of the play and children’s predicted and actual enjoyment of the lunchtime activity.

5.6 Conclusion

In summary, this research addresses a significant gap in the literature by examining the consistency of children’s enjoyment of lunchtime play across multiple days. The level of agreement between children’s ‘expected’ and ‘actual’ enjoyment of lunchtime play scores reached at least moderate agreement for most days. This acceptable level of agreement within most of the school days suggests that measuring children’s ‘expected’ or ‘actual’ enjoyment of lunchtime play is likely to represent that particular school day. In contrast, only a very
small proportion of inter-day comparisons for enjoyment of lunchtime play reached a moderate level of reliability. This may indicate that factors influencing children’s experiences from day to day may affect the variation of enjoyment scores on other school days and therefore may not necessarily be representative of children’s enjoyment of lunchtime play across different days of the week. The findings suggest that age didn’t appear to affect the consistency or reliability of enjoyment scores in the sample surveyed however, sex can be an influential factor on the overall reliability of a group’s enjoyment of lunchtime play. Generally, children expected to enjoy lunchtime play in greater proportions than they actually did, indicating children expect to have a positive experience during their school lunchtime play.
Chapter 6

Evaluating the effects of the Lunchtime Enjoyment Activity and Play (LEAP) school playground intervention on children’s quality of life, enjoyment and participation in physical activity
6 Evaluating the effects of the Lunchtime Enjoyment Activity and Play (LEAP) school playground intervention on children’s quality of life, enjoyment and participation in physical activity during school lunch breaks

6.1 Preface

The LEAP intervention builds upon the qualitative findings from chapter three by evaluating the multiple level social-ecological effects of a movable/recycled materials school playground intervention on children’s health. Movable/recycled materials have been demonstrated to have a positive effect on a number of facilitators identified from chapter three on children’s physical activity during school breaks such as social restrictions (interpersonal level factor), access to equipment (policy level factor) and a need for diversity of playground equipment (physical environment level factor) (12). Movable/recycled materials have also been shown to demonstrate positive individual level outcomes identified in chapter three such as task (e.g. taking risks) and outcome goals during school breaks (e.g. having fun, enjoyment) (12). This chapter builds upon chapters four and five by putting the LEAP questionnaire into practice to evaluate the effects of an intervention on children’s enjoyment of lunchtime play activities (255) and to measure children’s lunchtime enjoyment on multiple occasions (286). This study fills important gaps identified in previous chapters such as examining the mediating effect of an intervention on children’s physical activity (e.g. enjoyment) identified in chapters two and four (7, 255), providing further understanding of the external validity of the LEAP questionnaire identified in chapter four (255) and to develop a greater understanding of children’s enjoyment of play within the school lunchtime-context identified in chapter five. Furthermore, a greater understanding of interventions that encourage open-ended and uncompetitive play opportunities for girls (25), a need to evaluate the long-term effects of physical activity interventions (7) in multiple physical activity
dimensions (13, 14) are warranted [Chapter 2]. This chapter is based on a manuscript that has been submitted for publication and is currently under peer-review.

6.2 Introduction

The promotion of physical activity in society has become a significant public health priority to enhance health worldwide and prevent obesity and chronic diseases such as type two diabetes, osteoporosis and cardiovascular disease (1). In Australia, similar to other countries (372), 31% of Australian children are not meeting national guidelines for physical activity (4). Despite childhood being an important period to establish regular physical activity patterns that can track across the lifespan (29), our understanding of strategies to develop and sustain health enhancing physical activity behaviours among school children is limited (1, 31).

The school environment has been established as one of the most important settings to facilitate children’s physical activity (6, 134), particularly as children spend significant portions of their day at or in transit to and from school (5). A reduction in children’s physical activity opportunities (150) and the growth of overweight and obese youth worldwide (151) has placed schools at the forefront of preventative public health as a key setting to develop children’s physical activity. With growing attention on schools to offer physical activity opportunities, there is a need to provide children with the essential skills to be physically active (165). Despite this attention, research has identified a number of barriers to the delivery of effective Physical Education in schools (160). With the many demands and responsibilities placed upon Physical Education teachers (160), it is important to explore other avenues within the school setting to facilitate physical activity (30). Children’s diverse learning needs and personalities may also respond to a range of non-curricular opportunities that facilitate physical activity (373).
6.2.1 Moving School Physical Activity Beyond Structured Physical Education

A key area of school-based physical activity research that has gained momentum is the implementation of strategies during school breaks (30, 286). Beyond school breaks, children may have limited access to physical activity opportunities (199), therefore providing active play opportunities that can be replicated within the home and community settings could produce many health benefits (22). Active play is regarded as the diverse range of unstructured activities and behaviour that children engage in (312). Active play has been acknowledged as the ‘informal curriculum’ (374) to facilitate children’s learning and development, generating a widespread international pursuit to improve school playgrounds to optimise children’s play (196). Active play has also been acknowledged by the United Nations High Commission for Human Rights as a basic entitlement for every child (362).

Children’s active play opportunities during school breaks require little organisational input and instruction from teachers and parents. Children in many schools are engaging in up to 600 school break periods per year (3-times per day, 5-days per week, 39-weeks per year) (10). School breaks offer substantial time and opportunity for children to be physically active. Primary school children aged 5-12-years-old are estimated to spend at least 30 hours per week attending school and can accumulate up to 35% of their active play during school breaks engaged in moderate to vigorous physical activity (MVPA) (190). Additionally, active play during break periods has been recognised as the primary source of children’s physical activity (11), contributing up to 50% of children’s recommended daily physical activity (9, 11, 192, 273), improvements in classroom behaviour (9) and development of social and physical skills (75). Active play has also been reported to enhance children’s coping skills and has been suggested to promote psychological wellbeing by fostering intrinsic motivation, competence and a sense of belonging (75). With approximately 14% of Australian children
experiencing mental health problems (75), maximising quality play opportunities during school breaks has the potential to enhance children’s physical and mental health.

An important component of childhood that may be greatly influenced by children’s participation in physical activities during school breaks is a child’s quality of life (17). Quality of life is defined as a multi-level component that considers an individual’s perception of their contentment with life (20). Investigation of children’s quality of life at school has been limited, yet quality of life has been stated as an achievement enhancer and having its own educational value; suggesting a need to further explore quality of life in schools (19). A number of researchers have highlighted the importance of school break activities for children’s health and quality of life, calling for schools to offer alternatives to withdrawing children from school breaks as a discipline strategy (193) and to address the quality of life benefits from school breaks within the curriculum (193). The promotion of children’s quality of life is a significant challenge for teachers and school health providers (1). Whilst a significant relationship between lean body mass and quality of life has been established in school-aged children (20), there is an absence of literature investigating the relationship between school children’s participation in physical activity and quality of life [49], especially during school breaks. Additionally, no study we are aware of has examined the effects of a school playground intervention during school breaks on children’s quality of life.

6.2.2 Targeting School Break Periods to Encourage Physical Activity and Active Play

Whilst a well-designed school environment can enhance children’s physical and mental health, Australian data reveals many schools have eliminated play spaces and equipment, have crowded play spaces and implement restrictive policies, resulting in fewer opportunities for children to experience active play (200). A number of interventions targeting school
breaks have successfully attempted to counteract this decline in children’s physical activity by implementing active supervision (375), school break periods with a weekly activity theme (262), the provision of sports or games equipment and activity cards (192, 219), fitness breaks (299, 306, 307), school playground markings (10, 309) and physical playground structures (235) to facilitate children’s physical activity. These interventions generally foster structured physical activity with specified locations, time schedules, adult supervision (202) and the facilitation of sport and fitness (310); there is a need to examine school break interventions that encourage unstructured play (24, 25, 289).

Unstructured physical activity is defined as the physical activity children participate in that is spontaneous and without a set regime or purpose (302) that can include digging, raking (310), lifting/carrying, exploring, planting, chasing (24), pushing objects into positions, construction, imaginative and creative play (12). The importance of children’s unstructured physical activity is reflected in the definition of school breaks by Wechsler and colleagues (2000), ‘as a regularly scheduled time for children to engage in ‘unstructured’ physical activity and play’ (p123) (311). Introducing natural environmental features (25, 194), play pods (376) and movable/recycled materials (12, 21-23) are examples of unstructured interventions that can be used during school breaks that have provided diversity to children’s play, developing playfulness (e.g. spontaneous, intrinsic activity without a set regime or purpose) physical, cognitive and social outcomes and appeal to a broad range of children.

The effects of introducing movable/recycled materials have been reported after a small pilot (n=12) (12) and larger trial (n=226; 12 schools) (23) in children aged 5-7-years-old via the use of a playfulness measure (21), a single physical activity measure (accelerometers) and teacher interviews (12). The positive increases in physical activity and playfulness reported in the pilot study and larger trial demonstrate the potential to examine a movable/recycled
materials intervention targeting a whole school (5-12-years-old) with the measurement of additional health and physical activity outcomes. There is also a need to increase our understanding of the mediators on children’s physical activity within school settings (7) (e.g. enjoyment), as well as long-term intervention effects (7). No study we are aware of has examined the influences of a school playground intervention on children’s quality of life or examined the effects of a school playground intervention on factors within all levels of the social-ecological model (intra-personal, inter-personal, physical environment and policy) (15). There is a need to examine the effectiveness of interventions targeting school breaks underpinned by the social-ecological model framework (15). The aim of this study was to examine the effects of the Lunchtime Enjoyment Activity and Play (LEAP) movable/recycled materials school playground intervention on primary school children’s quality of life, enjoyment and participation in physical activity.

6.3 Methods

6.3.1 Overall Study Design

This matched controlled trial, the LEAP intervention study, was uniquely tailored to compare the intervention and control schools at baseline (March/April, 2010), post-testing (after 7-weeks; April-June, 2010) and at follow-up (after 8-months; November, 2010) (Figure 6.1). The intervention provided movable/recycled materials for children to use in the school playground with usual playground supervision by teachers (yard duty) [377]. Children in the control school continued their physical activity with their usual sports equipment, fixed playground equipment and teacher supervision.
6.3.2 Participants and Recruitment

All children within each primary school (aged 5-12-years-old) received a plain language statement outlining the research, along with a participant and parental consent form. A total of 123 children from the intervention school (mean 7.0-years-old ±1.9; 90% response rate) and 152 children from the control school (mean 8.2-years-old ±2.1; 86% response rate) returned signed informed parental consent forms to participate in the study (Figure 6.1; Table 6.1). Ethical approval for the study was obtained from the University of Ballarat Human Research Ethics Committee, the Catholic Education Office of the Archdiocese of Ballarat and permission was gained from the school principals.

6.3.3 School Selection

A newly developed catholic co-educational primary school with no fixed playground equipment was approached to participate. A control school matched by sector, school type (co-education, prep to year 6; 5-12-year-olds), socio-economic status (Middle band- Index of Community Socio-Educational Advantage (ICSEA)), size of school grounds (approximately 6-7000 metres$^2$) and enrolment was selected and recruited to participate in the study, via emails, phone calls and on-site visits to the Principal. Both schools were located in the same geographical area in Regional Western Victoria, Australia. All children in the study participated in their regular daily school routines.
LEAP questionnaire [255] = Lunchtime Enjoyment of Activity and Play Questionnaire; PedsQL 4.0 [378] = Pediatric Quality of Life Inventory; PACES [118] = Physical Activity Children’s Enjoyment Scale; SOPLAY [203] = System of Observing Play and Leisure Activities in Youth.

**Baseline (0-weeks)**
- **Self-report measures (8-12-year-olds)** (PACES, PedsQL, LEAP Questionnaire)
  - Completed= 34, Not completed= 0
  - Reasons: Moved interstate (n=1)
- **Pedometer wear > 4 days (5-12-year-olds)**
  - Completed=119, Not completed=4
  - Reasons: Absent (n=3); battery flat (n=1)
- **SOPLAY observations: 5 days (5-12-year-olds)**
  - Targeted playground areas= 5; Playground area scans per lunchtime= 5
  - Completed playground area scans= 125

**Post-test (7-weeks after baseline)**
- **Self-report measures completed from baseline sample (n=34)**
  - Completed= 33, Not completed= 1
  - Reasons: Moved interstate (n=1)
- **Pedometer wear > 4 days from baseline sample (n=119)**
  - Completed=113, Not completed=6
  - Reasons: Absent (n=4); Battery flat (n=2)
- **SOPLAY observations: 5 days**
  - Targeted playground areas= 5; Playground area scans per lunchtime= 5
  - Completed playground area scans= 125

**LEAP intervention (7-weeks)**

**Follow-up (8-months after baseline)**
- **Self-report measures completed from post-test sample (n=33)**
  - Completed= 32, Not completed= 1
  - Reasons: Moved interstate (n=1)
- **Pedometer wear > 4 days from post-test sample (n=113)**
  - Completed=103, Not completed=10
  - Reasons: Absent (n=8); Wore upside down (n=2)
- **SOPLAY observations: 5 days**
  - Targeted playground areas= 5; Playground area scans per lunchtime= 5
  - Completed playground area scans= 125

**Schools meeting criteria invited to participate (n=2)**

**Intervention school**
- Invited= 136 children
- Recruited=123 children (Response rate 90%)

**Control school**
- Invited= 176 children
- Recruited= 152 children (Response rate 86%)

**Regular school lunch break routines**

**Post-test (7-weeks after baseline)**
- **Self-report measures from post-test sample (n=71)**
  - Completed= 70, Not completed= 1
  - Reasons: Moved interstate (n=1)
- **Pedometer wear > 4 days from post-test sample (n=140)**
  - Completed=136, Not completed=4
  - Reasons: Absent (n=4), Battery flat (n=2)
- **SOPLAY observations: 5 days**
  - Targeted playground areas= 5; Playground area scans per lunchtime= 5
  - Completed playground area scans= 125

**Follow-up (8-months after baseline)**
- **Self-report measures from post-test sample (n=61)**
  - Completed= 60, Not completed= 1
  - Reasons: Moved interstate (n=1)
- **Pedometer wear > 4 days from post-test sample (n=140)**
  - Completed=136, Not completed=4
  - Reasons: Absent (n=4), Battery flat (n=2)
- **SOPLAY observations: 5 days**
  - Targeted playground areas= 5; Playground area scans per lunchtime= 5
  - Completed playground area scans= 125

**LEAP Intervention continued (8-13-weeks after baseline)**
- Minimum of 2 movable/recycled materials introduced each week

**Figure 6.1. Flow of LEAP intervention recruitment, measures and responses.**

LEAP Questionnaire [255] = Lunchtime Enjoyment of Activity and Play Questionnaire; PedsQL 4.0 [378] = Pediatric Quality of Life Inventory; PACES [118] = Physical Activity Children’s Enjoyment Scale; SOPLAY [203] = System of Observing Play and Leisure Activities in Youth.
Table 6.1. Baseline demographic variables, self-report measures of quality of life, enjoyment and objective measures of participation in physical activity during school lunch breaks.

<table>
<thead>
<tr>
<th>Baseline characteristics</th>
<th>Intervention school (n=123)</th>
<th>Control school (n=152)</th>
<th>( p )(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boy (%)</td>
<td>53.7</td>
<td>46.7</td>
<td>0.05</td>
</tr>
<tr>
<td>Age (Years) (Mean (SD))</td>
<td>7.0 (1.9)</td>
<td>8.2 (2.1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age (Years) (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-7</td>
<td>65.0</td>
<td>40.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>8-9</td>
<td>20.3</td>
<td>31.4</td>
<td></td>
</tr>
<tr>
<td>10-12</td>
<td>14.6</td>
<td>28.1</td>
<td></td>
</tr>
<tr>
<td><strong>Objective measures of physical activity</strong></td>
<td><strong>Pedometer</strong></td>
<td><strong>Distance per minute (metres)</strong></td>
<td></td>
</tr>
<tr>
<td>Pedometer Mean (SD)</td>
<td>Steps per minute</td>
<td>62.2 (20.2)</td>
<td>53.0 (17.2)</td>
</tr>
<tr>
<td></td>
<td>Distance per minute</td>
<td>41.9 (17.1)</td>
<td>38.8 (15.3)</td>
</tr>
<tr>
<td><strong>Self-reported measures</strong></td>
<td><strong>PEDS QL 4.0 [378]</strong></td>
<td><strong>Median (IQR)</strong></td>
<td><strong>PACES Survey [118]</strong></td>
</tr>
<tr>
<td>Physical health scale quality of life</td>
<td>78.1 (62.5-90.6)</td>
<td>87.5 (75.0-93.8)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Psychosocial scale quality of life</td>
<td>73.3 (61.7-85.0)</td>
<td>78.3 (68.3-88.3)</td>
<td>0.20</td>
</tr>
<tr>
<td>Overall quality of life</td>
<td>76.9 (62.1-85.8)</td>
<td>83.4 (70.8-90.8)</td>
<td>0.04</td>
</tr>
<tr>
<td>Enjoyment of physical activity</td>
<td>4.5 (4.2-4.9)</td>
<td>4.5 (4.1-4.8)</td>
<td>0.38</td>
</tr>
<tr>
<td>Intra-personal level enjoyment</td>
<td>4.3 (3.8-4.6)</td>
<td>4.1 (3.7-4.5)</td>
<td>0.31</td>
</tr>
<tr>
<td>Inter-personal level enjoyment</td>
<td>5.0 (4.5-5.0)</td>
<td>5.0 (4.5-5.0)</td>
<td>0.59</td>
</tr>
<tr>
<td>Physical environment/policy level enjoyment</td>
<td>4.1 (3.8-4.4)</td>
<td>4.1 (3.7-4.5)</td>
<td>0.95</td>
</tr>
</tbody>
</table>

\(^1\)\( p \) values are based on independent sample \( t \)-test for continuous normal data and Chi-square test for categorical data.
\(^2\)\( p \) values are based on Mann Whitney U test for non-normal data.

IQR= Interquartile Range; SD= Standard Deviation; %= Percentage.
6.3.4 Intervention School Playground Environment

During the LEAP intervention, mean (SD) maximum temperatures during baseline, post-test and follow-up at the intervention school were 23.25 (±4.68°C), 14.88 (±2.06°C) and 21.36 (±4.83°C) respectively. The LEAP intervention, which included movable/recycled materials, was designed based upon the social-ecological model; which emphasises that intra-personal, inter-personal, physical environment and policy levels may all influence behaviour (15). Table 6.2 reports how the social-ecological model underpinned the design of the present study, depicting how the multiple levels of influence on children’s health behaviour were measured.

Movable/recycled materials with no fixed purpose were introduced to a grass field in a newly developed Catholic primary school from the end of term 1 to the middle of term 2 (after 7-weeks: post-test) and continued to be introduced until the end of term 2 during Autumn and Winter in 2010 (Figure 6.1). As the school grounds were newly developed, there was only one other play area, a car-park area which was commonly used during wet conditions or for those children not interested in playing on the field. There was no fixed play equipment in the school grounds during the intervention (e.g. climbing frames, monkey bars, slides). The movable/recycled materials introduced to the playground by the researchers were items generally not considered to be typical play materials for children within schools, with the exception of play balls, hoops and skipping ropes. The materials included milk crates, swimming noodles, buckets, cardboard boxes, tyre tubes, pipes, vacuum/pool hoses, plastic walls and sheets, hessian bags, buckets, water/sand shells, tractor/motorbike and bicycle tyres, swimming boards, exercise mats, buckets and hay bales. Five materials were introduced during the first week of the program, and each week thereafter a maximum of two additional types of material were introduced during the intervention period to avoid over-
stimulation. All items remained on the field after being added, except for the removal or replacement of items that were broken or if teachers perceived an item presented a safety issue.

The grass field at the intervention school was of triangular shape and a steep incline, with each boundary 95m (bottom) x 105m (top) x 90m (left side) bordered by trees and bushes on the bottom and left boundaries. The top boundary was bordered by a main road. Near the entrance beyond the left side border was a rectangular stretch of grass 50m x 20m on a downward incline, which was considered out of bounds. Conforming to Australian/New Zealand Safety Standards (377), children were instructed to not stack more than two hay bales on top of each other, which was considered notionally the same as waist height. In addition, teachers instructed the students that only the research team and teaching staff could move the tractor tyres to other parts of the grass field, children were not permitted to strike each other with the swimming noodles and children had to return all equipment at the end of the week to the entrance of the grass field.

Children were on the playground for 30 minutes at morning break and 30 minutes during the lunchtime period. All children (5-12-year-olds), including those with disabilities had access to the playground simultaneously. The provision of small pieces of portable sports equipment was made available by the school such as footballs, bats and balls as per usual practice in primary schools. Two teachers were rostered on school playground supervision (yard duty) during school breaks as was usual practice, one teacher was allocated to supervise the grass field and the other to supervise the bitumen car park area. The Principal briefed the teachers prior to students commencing the intervention, explaining that the items were to encourage children to create their own play and not to intervene unless children’s safety was at risk.
Table 6.2. Assessment of social-ecological model levels of influence during the LEAP intervention.

<table>
<thead>
<tr>
<th>Social-ecological model levels [50]</th>
<th>Outcome variable</th>
<th>Measurement tool</th>
<th>Data collection method</th>
<th>Baseline</th>
<th>Post-test (7-weeks)</th>
<th>Follow-up (8-months)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intra-personal (Individual) level factors</strong></td>
<td>• Individual level physical activity duration, frequency, steps and distances during school lunch breaks. • Enjoyment of general physical activity. • Enjoyment of intra-personal related play activities. • Physical health domain score of quality of life.</td>
<td>• Pedometers • PACES • LEAP Questionnaire • Peds QL 4.0</td>
<td>• Worn by children on the right hip • Child self-report</td>
<td>• 5 days</td>
<td>• 5 days</td>
<td>• 5 days</td>
</tr>
<tr>
<td><strong>Inter-personal (Social) level factors</strong></td>
<td>• Area-level physical activity intensities over the school year. • Enjoyment of inter-personal-related play activities. • School, social and home-related quality of life as a result of the intervention (within psychosocial and overall quality of life domains).</td>
<td>• SOPLAY • LEAP Questionnaire • Peds QL 4.0</td>
<td>• Video • Child self-report</td>
<td>• 5 days</td>
<td>• 5 days</td>
<td>• 5 days</td>
</tr>
<tr>
<td><strong>Physical environment level factors</strong></td>
<td>• The physical activity types children participated in within the school playground during school lunch breaks. • Enjoyment of physical environment-related play activities.</td>
<td>• SOPLAY • LEAP Questionnaire</td>
<td>• Video • Child self-report</td>
<td>• 5 days</td>
<td>• 5 days</td>
<td>• 5 days</td>
</tr>
<tr>
<td><strong>Policy level factors</strong></td>
<td>• Enjoyment of policy-related influences on play activities. • Enjoyment of policies relating to play activities.</td>
<td>• LEAP Questionnaire • Field Notes • Researcher</td>
<td>• Child self-report • As required</td>
<td>• 1 occasion • As required</td>
<td>• 1 occasion • As required</td>
<td>• 1 occasion • As required</td>
</tr>
</tbody>
</table>

SOPLAY [203]= System of Observing Play and Leisure Activities in Youth; LEAP [255]= Lunchtime Enjoyment of Activity and Play; PedsQL 4.0 [378]= Pediatric Quality of Life Inventory; PACES [118]=Physical Activity Children’s Enjoyment Scale; LEAP questionnaire consisted of 39 items (Intra-personal level component: 20 items; Inter-personal level component: 2 items; Physical Environment/Policy level component: 17 items); PACES consisted of 16 scale items; Peds QL consisted of 23 items (Psychosocial health scale quality of life: 15 items; Physical health scale quality of life: 8 items).
6.3.5 Control School Playground Environment

The Control School did not have access to the movable/recycled materials used with the intervention school and consisted of a morning break of 15 minutes and a lunch break of 45 minutes. Children had access to sports equipment as is usual practice in many primary schools to use on the hard-surfaced area at the front of the school and on the grass field during break periods. Mean (SD) maximum temperatures during baseline, post-test and follow-up at the control school were 22.86 (±5.96°C), 12.76 (±2.37°C) and 16.54 (±3.92°C) respectively. The control school’s playground area consisted of a 10m x 70m bitumen area stretch alongside the school buildings at the front of the school with playground markings (for hopscotch and down-ball type activities). Also at the front of the school alongside the hard-surfaced area was a 10m x 10m area of rocks and a 37m x 17m area that included three built playgrounds with wooden bridges, climbing frames, monkey bars, ladders and slides. Connecting the front of the school to the school’s 75m x 70m grassed oval was a 23m walkway. The control school’s grass field consisted of a set of Australian Rules Football and soccer goal posts and was surrounded by a line of tall trees, a spider web playground structure and a large sandpit. Beyond the control school’s grass field was a 34m x 36m basketball court area. Two teachers supervised the playground during lunchtime at all times (one supervisor was allocated to the fixed playground area at the front of the school, the other teacher supervised the grass field and basketball court areas at the bottom of the school).

6.3.6 Intervention Outcome Measures

The primary outcome variable of the LEAP intervention was physical activity, individually and objectively measured by pedometers in children aged 5-12-years-old. In addition, the System of Observing Play and Leisure Activities in Youth (SOPLAY), an area-level direct observation instrument was used to provide contextual information on the children’s physical
activity within the school playground (56). The secondary outcome variables included enjoyment of physical activity (13), enjoyment of lunchtime play activities (255) and quality of life (378) in those children aged 8-12-years-old.

6.3.7 Pedometers

Children’s steps and distance were assessed using a Yamax Digiwalker SW200 pedometer (the monitor was taped closed to prevent tampering during the lunch breaks). The Yamax Digiwalker pedometer has been validated for measurement in children within laboratory and field settings (245, 379). On the initial day of monitoring, children were instructed on how to wear the pedometer (attachment on the right hip) and the pedometer’s removal (immediately after school lunch breaks). Children were asked to wear the pedometer during the whole of school lunch breaks for the five days of a school week and instructed to place the monitor into a storage box at the conclusion of lunch breaks as they were lining up to enter their classroom. The investigators and class teacher ensured that no child was still wearing a pedometer. The total step counts for each individual child were recorded immediately after school lunch breaks into a Microsoft Excel version 14.0 (Windows Corporation, 2010) spread-sheet. Researchers recorded if the child’s pedometer battery went flat, the child was absent or if the pedometer was faulty. Pedometer counts were converted to steps per minute by dividing total steps by the number of lunchtime minutes to ensure school lunch break length differences were accounted for between the two schools. For a number of reasons (e.g. child forgetting to wear the pedometer, student was absent, battery was flat) full pedometer data were not available for all children for all lunch break periods (Figure 6.1).

To calculate children’s stride length, children were instructed to walk one at a time across a flat surfaced area of the school playground twice over a 20 metre distance at each of the measurement time points. Investigators counted and recorded the steps it took the child to
walk the 20 metres and the mean steps from the two trials were calculated. The stride length
was calculated by dividing the total distance walked (20 metres) by the mean step count
(380). Measuring stride length allowed for the calculation of total distance (metres) of
physical activity during the data collection phases to be calculated by using the following
formula; stride length x steps = distance (metres) (381).

6.3.8 Direct Observation

Area-level physical activity was measured using the System of Observing Play and Leisure
Activities in Youth (SOPLAY) (203). The SOPLAY instrument provides a tool that can
examine modifiable contextual factors during school break periods (25, 199). Inter-rater
agreements for five SOPLAY variables are recognised as high for; usability (95%), area
accessibility (97%), presence of supervision (93%), provision of equipment (96%) and
presence of organised activity (88%) (203). The reliability of activity counts observed by
different coders have also correlated strongly for sedentary girls ($r = .98$) and walking girls ($r = .95$) but correlated less with very active girls ($r = .76$). High correlations were also
established for sedentary boys ($r = .98$), walking boys ($r = .98$), and very active boys ($r = .97$)
(203). Training of assessors included familiarisation with the protocol and codes and
practising observations using video examples of school breaks. Lunchtime video recordings
were conducted for five days during each data collection phase. Video cameras captured each
defined target area within the playgrounds of the intervention (video footage of 30 minute
lunchtime period) and control schools (video footage of 45 minute lunchtime period). Video
facilitated direct observation is suggested to increase reliability of direct observation
measurement (258). All school playground target areas were identified prior to physical
activity measurement by determining key areas in which play generally took place. No indoor
observations were conducted during the study. Investigators and research assistants provided
commentary to assist in activity coding and ensured each video camera was unimpeded from capturing school playground footage. After consultation with the SOPLAY designer Thom Mckenzie, it was decided that capturing video would allow the original lunchtime scanning protocol of two scans (scan one: 15 minutes after the commencement of lunchtime; scan two: 10 minutes after scan one) to be increased to scanning at five minute intervals (5 x scans over the 30 minute lunchtime period: intervention school; 8 x scans over the 45 minute lunchtime period: control school) during school lunch breaks to increase the sensitivity of the instrument over a lunchtime-specific data collection period. Intra-observer reliability was established by the researcher ensuring repeated video scans reached at least 90% observation agreement for each school playground target area. The videos were transferred to computers using the iMovie 2011™ (Apple Inc., 2011) software and stored. After the transfer, the captured data were coded using the SOPLAY instrument. Due to Australia having high levels of skin cancer (208) both schools had a policy for skin protection of ‘No Hat, No Play’. This meant it was not possible to determine the sex-specific identification of students during the physical activity scans from all video recordings and therefore this sub-categorisation was not captured. Children whose parents didn’t provide consent to participate in the study were assigned by the school principals to specified play areas to ensure that the children could be identified and that their physical activity behaviour wasn’t included in the data.

6.3.9 Quality of Life

The Pediatric Quality of Life Inventory 4.0 (PedsQL), a 23-item validated questionnaire was used to measure the quality of life in children aged 8-12-years-old (378). The PedsQL instrument measures quality of life in three scales; psychosocial, physical and total quality of life. The PedsQL has been established as reliable for use with school children as young as eight-years-old (378). The questionnaire is scored using a five-point likert scale (0=never;
1=almost never; 2=sometimes; 3=almost always; 4=always), with items then converted to a score out of 100 (0=100; 1=75; 2=50; 3=25; 4=0). A mean score is calculated for the psychosocial and physical quality of life scales. The scales are averaged to obtain a total quality of life score (378).

6.3.10 Enjoyment of Physical Activity and Lunchtime Play Activities

The Physical Activity Children’s Enjoyment Scale (PACES) was used to determine children’s general enjoyment of physical activity. The revised PACES is reliable (118) and comprehensive (124) for school-aged children aged eight-years-old and over, consisting of a 16 statement scale starting with the question stem ‘When I am physically active…” with a 5-point likert scale (1=disagree a lot; 2=disagree; 3=no opinion; 4=agree; 5=agree a lot). A score is computed by calculating the mean of the 16 items (118).

The Lunchtime Enjoyment of Activity and Play (LEAP) Questionnaire was used to measure children’s enjoyment of school play activities (255). The LEAP questionnaire is a reliable, context-specific questionnaire consisting of 39 items, categorised by social-ecological model levels (intra-personal, inter-personal, physical environment/policy) to identify the broader influences on children’s enjoyment of school play and lunchtime activities (255). All enjoyment items were rated on a five-point likert scale (1=very unhappy; 2=unhappy; 3=not sure; 4=happy; 5=very happy) (255). A score is computed by calculating the average of each social-ecological model component.

6.4 Data Analysis

An independent sample t-test and chi-square test were used to determine significant differences between the intervention and control schools for demographic characteristics and baseline objective measurements (p<0.05 was significant). A non-parametric Mann-Whitney
A significant treatment effect was identified from the multiple level linear regression model for the intervention school children’s pedometer-determined mean steps per minute in comparison to the control school from baseline to the seven week post-test (+13.08 adjusted mean steps per minute, 95% CI 7.31-18.84, p<0.001) and from baseline to the eight-month follow-up (+5.93 adjusted mean steps per minute, 95% CI 0.14-11.72, p=0.045). Similarly, a
significant treatment effect was also identified for the intervention school children’s distance per minute in comparison to the control school from baseline to the seven week post-test (+9.32 adjusted mean metres per minute, 95% CI 4.82-13.82, p<0.001) and from baseline to the eight-month follow-up (+4.47 adjusted mean metres per minute, 95% CI -0.02-9.96, p=0.051) (Table 6.3; Figure 6.2). However, the increments were lower during follow-up than post-test for both steps and distance. A significant overall interaction effect from the intervention was identified for both steps and distance per minute in the intervention school compared with the control school for the three time points (Table 6.3; Figure 6.2).

Direct observation comparisons from the chi-square statistical test identified no significant differences in the area-level physical activity between schools during lunch breaks at baseline for the mean proportion of children in sedentary behaviour, moderate physical activity (MPA) and vigorous physical activity (VPA). After the LEAP intervention was introduced, the mean proportion of children observed at the intervention school participating in VPA was significantly higher than the control school (7-week post-test: +6.2% mean proportion of observed children, p=<0.01; 8-month follow-up: +6.2% mean proportion of observed children, p=0.01) and the mean proportion of children observed participating in sedentary behaviour was significantly less than the control school (7-week post-test: -5.6% mean proportion of observed children, p=<0.01; 8-month follow-up: -15.2% mean proportion of observed children, p=<0.001).

There was no significant difference in the mean proportion of children observed participating in moderate physical activity (MPA) between schools at the seven week post-test however, the mean proportion of children participating in MPA was significantly higher in the intervention school at the eight-month follow-up compared with the control school (+9.0% mean proportion of observed children, p=<0.001) (Table 6.4). The most predominant
physical activity type observed at the intervention school during baseline were recorded as ‘no identifiable activity’, ‘soccer’ and ‘sandpit play’ (Table 6.4). However, after the LEAP intervention was introduced, students within the intervention school were using the movable/recycled materials as the predominant activity at the seven week post-test and eight-month follow-up for ‘imaginative play with movable/recycled materials’ and ‘construction with movable/recycled materials’. The other predominant physical activity during post-test and follow-up were ‘soccer’ (post-test and follow-up) and ‘Australian Rules Football’ (post-test). In contrast, the predominant physical activity types children engaged in at the control school were ‘imaginative play with fixed equipment’ (post-test and follow-up), ‘soccer’ (follow-up), ‘sandpit play’ (post-test and follow-up) and ‘Australian Rules Football’ (post-test).

6.5.2 Enjoyment of Physical Activity and Lunchtime Play Activities

A significant treatment effect from the LEAP intervention in the intervention school compared with the control school was identified from baseline to the seven week post-test for children’s mean enjoyment of physical activity (+0.32 adjusted mean change, 95% CI= 0.04-0.61, p=0.03), and enjoyment of intra-personal lunchtime play activities (+0.24 adjusted mean change, 95% CI= 0.004-0.48, p=0.045). There were no significant treatment effects from the intervention on children’s enjoyment of physical environment or policy level factors associated with lunchtime play activities throughout the school year. Similarly, there was no significant overall interaction effect of the LEAP intervention on children’s enjoyment of physical activity and lunchtime play activities (Table 6.3; Figure 6.2).

6.5.3 Quality of Life

A significant treatment effect from the LEAP intervention in the intervention school compared with the control school was identified from baseline to the seven week post-test for
children’s mean physical health scale of quality of life (+4.61 adjusted mean change, 95% CI= -2.42-11.64, p=0.05). There were no significant treatment effects identified in the intervention school children’s mean psychosocial scale quality of life and mean overall quality of life compared with the control school (Table 6.3; Figure 6.2) however, trends suggest a treatment effect of borderline significance from baseline to post-test (7-weeks) (Table 3). There was no significant overall interaction effect of the LEAP intervention on children’s mean quality of life scores.

6.5.4 Correlations Between Measures

Throughout the school year moderate, positive correlations were identified between children’s overall quality of life with overall enjoyment scores from the PACES and LEAP questionnaire (baseline, r=0.38 (Appendix 1) and post-test, r=0.38 (Appendix 2). There were no significant correlations between children’s pedometer steps per minute with overall quality of life and enjoyment. No significant correlations were identified between test and control schools for the measures, therefore this data isn’t reported.

There were no significant (p>0.05) age or sex-specific effects from the LEAP intervention throughout the school year for any of the measures; data not reported.
Table 6.3. Multi-level linear regression model of measures between intervention and control schools at baseline, post-test and follow-up from the LEAP intervention.

<table>
<thead>
<tr>
<th>Measurement tool</th>
<th>Category</th>
<th>Time</th>
<th>Intervention (n=123)</th>
<th>Control (n=152)</th>
<th>Treatment effect&lt;sup&gt;Δ&lt;/sup&gt;</th>
<th>p value (treatment effect)</th>
<th>p value (overall interaction effect)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective measures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Steps per minute</td>
<td>Baseline</td>
<td>9.48 (5.17-13.78)</td>
<td>-3.60 (-7.43-0.24)</td>
<td>13.08 (7.31-18.84)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>6.44 (3.34-9.55)</td>
<td>-2.88 (-6.13-0.38)</td>
<td>9.32 (4.82-13.82)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Distance per minute (metres)</td>
<td>Baseline</td>
<td>9.48 (5.17-13.78)</td>
<td>-3.60 (-7.43-0.24)</td>
<td>13.08 (7.31-18.84)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>6.44 (3.34-9.55)</td>
<td>-2.88 (-6.13-0.38)</td>
<td>9.32 (4.82-13.82)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td><strong>Self-report measures</strong></td>
<td>Physical health scale of quality of life</td>
<td>Baseline</td>
<td>6.07 (0.36-11.77)</td>
<td>1.46 (-2.66-5.57)</td>
<td>4.61 (-2.42-11.64)</td>
<td>0.20</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>4.76 (-1.02-10.54)</td>
<td>-2.08 (-6.10-1.94)</td>
<td>6.84 (-0.10-13.78)</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Psychosocial scale of quality of life</td>
<td>Baseline</td>
<td>5.74 (1.13-10.35)</td>
<td>0.28 (-3.05-3.61)</td>
<td>5.46 (-0.22-11.14)</td>
<td>0.06</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>5.74 (1.13-10.35)</td>
<td>0.28 (-3.05-3.61)</td>
<td>5.46 (-0.22-11.14)</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overall quality of life</td>
<td>Baseline</td>
<td>2.01 (-2.38-6.41)</td>
<td>-0.95 (-4.01-2.11)</td>
<td>2.96 (-2.31-8.23)</td>
<td>0.27</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>2.01 (-2.38-6.41)</td>
<td>-0.95 (-4.01-2.11)</td>
<td>2.96 (-2.31-8.23)</td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enjoyment of physical activity</td>
<td>Baseline</td>
<td>-0.06 (-0.29-0.18)</td>
<td>-0.38 (-0.54--0.21)</td>
<td>0.32 (0.04-0.61)</td>
<td>0.03</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>-0.06 (-0.29-0.18)</td>
<td>-0.38 (-0.54--0.21)</td>
<td>0.32 (0.04-0.61)</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intra-personal level enjoyment</td>
<td>Baseline</td>
<td>0.08 (-0.11-0.28)</td>
<td>-0.16 (-0.30--0.02)</td>
<td>0.24 (0.004-0.48)</td>
<td>0.05</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>0.08 (-0.11-0.28)</td>
<td>-0.16 (-0.30--0.02)</td>
<td>0.24 (0.004-0.48)</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inter-personal level enjoyment</td>
<td>Baseline</td>
<td>0.07 (-0.11 (0.25)</td>
<td>-0.13 (-0.26-0.01)</td>
<td>0.20 (-0.03-0.42)</td>
<td>0.09</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>0.07 (-0.11 (0.25)</td>
<td>-0.13 (-0.26-0.01)</td>
<td>0.20 (-0.03-0.42)</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physical environment/policy level enjoyment</td>
<td>Baseline</td>
<td>0.08 (-0.09-0.26)</td>
<td>-0.04 (-0.17-0.08)</td>
<td>0.12 (-0.09-0.34)</td>
<td>0.26</td>
<td>0.52</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>0.08 (-0.09-0.26)</td>
<td>-0.04 (-0.17-0.08)</td>
<td>0.12 (-0.09-0.34)</td>
<td>0.26</td>
<td></td>
</tr>
</tbody>
</table>

PEDS QL 4.0 [378]= Paediatric Quality of Life Inventory; PACES [118]= Physical Activity Children’s Enjoyment Scale; LEAP [255]= Lunchtime Enjoyment of Activity and Play; Δ = Adjusted mean change between baseline and post intervention from the multi-level linear regression model; Model adjusted by age, sex and baseline measurements; Effects in intervention school compared with the control school after adjustment for age, sex and baseline measures from the multi-level linear regression model; 95% CI= Confidence interval.
(A) Pedometer steps per minute; (B) Pedometer distance per minute (metres); (C) Physical health scale quality of life; (D) Psychosocial health scale quality of life; (E) Overall quality of life; (F) Enjoyment of physical activity; (G) Enjoyment of intra-personal level play activities; (H) Enjoyment of inter-personal level play activities; (I) Enjoyment of physical environment/policy level play activities; Model adjusted by age, sex and baseline measurements; ‡ = significant treatment effect, \( p<0.001 \); * = significant treatment effect, \( p<0.05 \); # = significant overall interaction effect, \( p<0.001 \); — intervention school, = control school; 95%CI = Confidence interval.

Figure 6.2. Adjusted means of outcome measures for intervention and control schools at baseline, post-test and follow-up.
6.6 Discussion

The primary aim of this study was to examine the multiple levels of influence of a simple, cost-effective, whole school playground intervention of movable/recycled materials, underpinned by a social-ecological model framework were determined. The results reveal that the LEAP intervention had a significant overall interaction effect on children’s pedometer-determined physical activity (e.g. steps/min, distance/min). Similar to short-term effects identified in previous school playground interventions using alternative strategies [22, 30], a significant treatment effect was evident from baseline to post-test for the intervention school compared with the control school for physical health scale of quality of life, children’s enjoyment of physical activity and enjoyment of intra-personal play activities. A significantly higher proportion of children in the LEAP intervention were also observed undertaking vigorous intensity physical activity compared with children in the control school seven-weeks and eight-months after baseline. These findings highlight that movable/recycled materials can be used as a sustainable strategy to promote children’s physical activity over an eight-month period and can also enhance physical health quality of life and enjoyment of physical activity.

The findings of the present intervention study on children’s physical activity provide further evidence of the benefits of implementing movable/recycled materials during school breaks (12). Field notes suggested that the positive intervention effects could be due to children purposefully running (VPA) and walking (MPA) at high intensity to other building stations around the playground or to collect further movable/recycled materials for building and construction. The safety policies including stacking restrictions, not striking others and the removal of damaged equipment may also have helped facilitate an environment in which children could freely and safely engage in physical activity. Movable/recycled materials are suggested to stimulate creativity and diversity to children’s play and provide active play
experiences by facilitating pushing, pulling and lifting and the construction of structures (e.g. cubby houses, rockets, ships) whilst engaging in social interaction and problem-solving (12). This diversity and evolving play in the school playground environment is evident within this study with the dominant physical activity type imaginative play with the movable/recycled materials during post-test and building and construction during follow-up. Despite significantly higher steps and distances in the intervention school compared with the control school, the reduced locomotor movements associated with building and construction may reflect the reduced steps and distance identified in the intervention school from baseline to follow-up. Consistent with findings from a similar intervention targeting 5-7-year-old children (n=223) (23), the LEAP intervention also demonstrated a significant impact on the physical activity intensity of 5-12-year-old children over eight-months. Therefore, this study further elucidates that introducing movable/recycled materials to a school playground has potential to engage all levels of primary school children. Despite a steep incline on the grass field (increased difficulty to accumulate steps), students within the intervention school were consistently above children’s school lunchtime steps per minute from a USA physical activity study (53 steps/min) (11), yet the control school were below this mark. The lower physical activity of the control school could be related to the presence of several fixed playground equipment, which encourage climbing, swinging and sliding, rather than locomotor movements. Although loose sports equipment was made available to the control school children, fixed equipment provides no opportunity to move objects around and is an area warranting further examination.
Table 6.4. Objectively measured physical activity intensities and types between intervention and control schools at the three time points.

<table>
<thead>
<tr>
<th>Physical activity measure</th>
<th>Baseline</th>
<th>Post-test (7-Weeks)</th>
<th>Follow-up (8-Months)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage comparison of mean children in each physical activity intensity within direct observation scans&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Percentage comparison of the predominant activity type within direct observation scans&lt;sup&gt;2&lt;/sup&gt;</td>
<td>p</td>
</tr>
<tr>
<td><strong>Intervention</strong></td>
<td><strong>Control</strong></td>
<td>p</td>
<td><strong>Intervention</strong></td>
</tr>
<tr>
<td>Sedentary behaviour (%)</td>
<td>7.4 (61.5)</td>
<td>9.7 (61.5)</td>
<td>0.99</td>
</tr>
<tr>
<td>Moderate physical activity (%)</td>
<td>3.5 (28.8)</td>
<td>4.3 (27.5)</td>
<td>0.61</td>
</tr>
<tr>
<td>Vigorous physical activity (%)</td>
<td>1.2 (9.7)</td>
<td>1.7 (11.0)</td>
<td>0.66</td>
</tr>
</tbody>
</table>

**Direct Observation (Activity)**

| Australian rules football (%) | - | 12 (5.0) | - | 11 (8.8) | 54 (22.5) | 0.30 | - | 6 (1.9) | - |
| Baseball/Softball (%) | - | 3 (1.3) | - | - | - | - | - | - | - |
| Basketball (%) | - | 11 (4.6) | - | - | - | - | - | - | - |
| Cricket (%) | 5 (4.0) | 3 (1.3) | 0.83 | 1 (0.8) | - | - | - | 2 (1.6) | - |
| Down-ball (%) | - | 36 (15.0) | - | - | - | 1 (0.4) | - | - | - |
| Imaginative play (Fixed equipment) (%) | - | 69 (28.7) | - | - | - | 70 (29.2) | - | - | 76 (24.4) |
| Imaginative play (No equipment) (%) | 7 (5.6) | 12 (5.0) | 0.95 | 7 (5.6) | 7 (2.8) | 0.79 | 4 (3.2) | 6 (2.6) | 0.96 |
| Imaginative play movable/recycled materials (%) | - | - | - | 66 (52.8) | - | - | 30 (24.0) | - | - |
| Construction with recycled materials (%) | - | - | - | 16 (12.8) | - | - | 33 (26.4) | - | - |
| No identifiable activity (%) | 59 (47.2) | 70 (29.2) | 0.04 | 9 (7.2) | 37 (15.4) | 0.52 | 7 (5.6) | 78 (25.0) | 0.25 |
| Play with loose sports equipment (%) | - | - | - | - | 9 (3.8) | - | - | 40 (12.8) | - |
| Racquet sports (%) | 10 (8.0) | 4 (1.7) | 0.66 | - | - | - | - | - | - |
| Sandpit play (%) | 12 (9.6) | - | - | - | 33 (13.8) | - | - | 6 (4.8) | 39 (12.5) |
| Soccer (%) | 32 (25.6) | 18 (7.4) | 0.18 | 15 (12.0) | 14 (5.8) | 0.56 | 43 (34.4) | 62 (19.8) | 0.58 |

**Total Lunchtime Target Setting Scans (%)**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Control</th>
<th>p</th>
<th>Intervention</th>
<th>Control</th>
<th>p</th>
<th>Intervention</th>
<th>Control</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>125 (100)</td>
<td>240 (100)</td>
<td>-</td>
<td>125 (100)</td>
<td>240 (100)</td>
<td>-</td>
<td>125 (100)</td>
<td>320 (100)</td>
<td>-</td>
</tr>
</tbody>
</table>

<sup>1</sup>The p values are based on Chi-square test for comparing proportions between intervention and control schools; <sup>2</sup>Two more lunchtime target defined areas were introduced at the control school during follow-up; Intervention school lunchtime= 30 minutes, control school lunchtime=45 minutes; Direct observation utilised SOPLAY [203].
Similar to a previous study (12), direct observation and field notes of children’s construction with the movable/recycled materials during follow-up revealed that children engaged in leadership, co-operation, teamwork and problem solving social skills. Interestingly, despite soccer being a dominant physical activity type, children would be seen using movable/recycled items (e.g. milk crates) as football goals throughout the school year. Many children were also playing with the movable/recycled materials within defined areas where structured football activities were commonly undertaken. Children’s use of movable/recycled materials was the dominant physical activity type for children during the post-test despite the close timing to the 2010 World Cup Tournament and boys’ soccer (football) being a major physical activity type within primary school playgrounds (382).

Consistent with previous studies, which have reported that children are engaging in high proportions of MVPA (11, 191, 192), over 50% of children at the intervention school observed at both the seven week post-test and eight-month follow-up were engaged in MVPA during school lunch breaks. Although these measurements were of the area-level proportions of children engaged in different physical activity intensities; there may be potential for children to reach the recommended physical activity guidelines of one hour of MVPA per day by using the movable/recycled materials to participate in MVPA during multiple break periods (e.g. morning and afternoon breaks) in addition to lunch breaks. Although the steps and distance measurements declined from baseline to follow-up in the intervention school, the significant overall interaction effect on the intervention school children’s accumulated steps and distance could reflect more options being present within the school playground (25) via the movable/recycled materials. Despite the statistical reduction in steps and distance, direct observation of higher intensity physical activity was evident and this could be related to greater proportions of students constructing play areas and playing with more purpose within and around the constructed spaces vigorously at the 8-month follow-up, rather than
accumulating steps moving around the grass field. Children are suggested to enjoy having choice in their playground activities (30) and implementing an intervention with a diverse range of equipment may have assisted in improved physical activity outcomes.

A possible explanation for the lack of significant overall interaction effects being identified for the psychosocial scale quality of life, overall quality of life, enjoyment of inter-personal and physical environment/policy level lunchtime play activities could simply be that baseline measurements were undertaken at the beginning of the school year, as children may have been content with or enjoying returning to school play activities during the warm weather after a long summer break. As there was a sense that quality of life and enjoyment data was already high at baseline, a ceiling effect may have been evident, with little margin for mean enjoyment or quality of life increases after introducing the LEAP intervention. Furthermore, children’s mean enjoyment and quality of life scores at the intervention school were higher than previous studies using the LEAP questionnaire (255) and Peds QL 4.0 (20, 383) with similar aged primary school children. Further administration of the enjoyment questionnaires throughout the school year may also have increased the insight into children’s enjoyment of play from the intervention (286).

Movable playground materials have previously been reported to correlate with children’s physical activity during school breaks (8). Similar to a greening project (25), there are many benefits to offering children with varying interests and abilities a diverse range of opportunities to engage in active play with movable/recycled materials. However, school greening projects can be quite expensive and can limit playground use for extended periods whilst natural features are introduced (21). Movable/recycled materials are a cost-effective option for schools and are readily available for play behaviour to be replicated within the home and community settings (12), an important consideration when facilitating children’s physical activity (373). Similar to previous studies (12, 21, 23), having diverse items
introduced to the playground that could be moved, used and placed where the children
desired developed a number of physical activity outcomes within the intervention school
children. Although children generally convert most spaces into play areas (30), the quality of
play opportunities determines how successful the environment will be in developing health
behaviours.

Diversity of play areas (25) and providing choice (262) are major predictors of children’s
physical activity, and the provision of alternatives within the school playground to suit
children who are less interested or physically able to participate in vigorous, structured
activities (e.g. soccer, basketball) that contain a set of rules and boundaries (25) may ensure
playgrounds appeal to a broader range of school children. Providing more play options during
school breaks can also assist with common childhood issues including boredom, inactivity
and bullying problems (25, 194, 208). As the movable/recycled materials could be moved to
different places, the mobility of the items may also have developed a greater sense of
ownership and place for the school children. A ‘good’ school playground has been described
as an environment that children can invent activities and use more places (30). It is difficult
for children to be creative, social and imaginative within bleak, hard surfaced areas (194).
The physical activity, enjoyment and quality of life outcomes from the LEAP intervention
provide impetus for further evaluation of movable/recycled materials implemented on a wider
public health scale (12) within primary school settings. As overly safe playgrounds can stifle
children’s play (30) and with teachers reporting no or minimal injury or behaviour concerns
from introducing movable/recycled materials in both the LEAP intervention and in a previous
study (12), it may be useful to examine the influence of introducing movable/recycled
materials on the levels of risk taking behaviour of primary school children. Contrasting
previous studies (282, 384), the intervention school children’s physical activity levels
increased when temperatures were cooler during the post-test and decreased during follow-up
when temperatures became warmer. Further investigation of weather influences on children’s physical activity with movable/recycled materials is therefore warranted.

Strengths of the study include responding to a range of recommendations for school-based physical activity interventions (7), including the use of valid objective physical activity measures, examining the mediators of physical activity intervention effects (e.g. enjoyment), measuring multiple dimensions of school children’s physical activity participation and a long-term follow-up. As all physical activity measures have limitations, it is important that a combination of measures were used to assess children’s school-based physical activity. Area-level contextual information of the types of activities children engaged in over the year were also outlined, which is often lacking in physical activity studies (382). The present study fills a gap in the literature by examining the multi-level mediation effects of children’s enjoyment of physical activity within a school lunchtime context (255). Furthermore, no physical activity intervention study we are aware of targeting primary school breaks has evaluated each level of the social-ecological model, examined children’s physical activity distances covered or quality of life outcomes. Evaluating an intervention’s potential to positively influence multiple social-ecological levels of influence on children’s physical activity is important to enhance long-term physical activity outcomes (8, 15). The long-term patterns of physical activity identified from the LEAP intervention can help inform public policy and debate regarding school playground environments during school breaks (260). Understanding children’s health behaviours within the school context is important (75, 191) however, little research has examined how children’s physical activity and play behaviour can change over time in response to a modified school playground. In addition, little research has used the PACES questionnaire in younger age groups since being validated in primary school children (118). This is also the first school lunchtime intervention we are aware of to use the context-specific LEAP questionnaire to evaluate an intervention targeting school lunch breaks (255).
As many playgrounds are designed and installed without consultation with children (30), providing children with the materials to facilitate and direct their own play reflects growing educational trends to provide student, rather than teacher-directed physical activity opportunities [14]. Unstructured, active play allows children to understand their world and develop skills, therefore school playground environments should be developed in a manner that enhances development and physical functioning of children (6). With the modern demands on schools to equip children with skills to be physically active, the LEAP intervention could be implemented without placing increased burden on already busy teaching staff. The LEAP intervention provides a cost-effective, sustainable key public health strategy that could be used to develop children’s physical activity within the ‘informal’ curriculum of school breaks.

There were several limitations to the study. Firstly, it should be acknowledged that the effects of the intervention were intended to be assessed 13-weeks after baseline as well as at seven-weeks however, due to the highest rainfall for the region on record, investigators could only complete data collection at two time points after baseline (7-weeks and 8-months). As the data was collected during school lunch breaks, the findings may not be reflective of physical activity during morning or afternoon school breaks. The intervention school did not contain any regular fixed playground equipment and it is possible that children may have embraced the movable/recycled materials more readily than a school with a conventional school playground. Although conventional, fixed playground equipment has been reported to restrict diverse play opportunities (25), future research could examine the physical activity of school children with access to both movable/recycled materials and conventional, fixed playground equipment. As the LEAP intervention was implemented within a single primary school, the findings from the study should not be generalised. Due to both schools implementing a ‘no hat, no play’ policy as part of being sun-smart schools, sex-specific identification was unable
to be determined via direct observation. Those conducting the direct observation of the school playground areas were also unblinded to condition. Furthermore, the physical benefits of lifting, dragging and carrying movable/recycled materials around the playground were unable to objectively measured, despite multiple dimensions of physical activity being accounted for (13). Moreover, the mean maximum temperature at the control school during follow-up was significantly lower than the intervention school and the lower mean age also resulted in a smaller sub-sample of the intervention school that completed self-report measurements. The control school also installed two small play areas (synthetic soccer court and an empty natural play area) during follow-up. However, this can be expected within a long-term research intervention targeting a real world setting such as a school.

6.7 Conclusion

This LEAP intervention was designed to target all social-ecological levels of influence and had a significant overall interaction effect on children’s objectively measured physical activity, including mean steps and distance per minute in the intervention school compared with the control school for the three time points. A short-term treatment effect was revealed in the intervention school compared with the control school for children’s physical health scale quality of life, enjoyment of physical activity and enjoyment of intra-personal play activities after seven-weeks. However, there were no significant effects from the intervention on children’s enjoyment of inter-personal level play activities, enjoyment of physical environment/policy level play activities, physical health scale quality of life and overall quality of life. The intervention school children spent significantly higher proportions within specified playground target areas in more vigorous physical activity intensities than the control school children at both seven-weeks and eight-months after baseline. Direct observation of the intervention school children’s lunch break activities throughout the school
year revealed that the intervention facilitated evolving play opportunities, including imaginative play with the movable/recycled materials (predominant physical activity type during post-test) which eventually evolved into a building and construction phase with the materials (predominant physical activity type during follow-up). The positive quality of life, enjoyment and physical activity outcomes from this simple, low-cost intervention could be used to inform the development of future intervention programs using movable/recycled materials on a wider scale within primary school settings.
Chapter 7

A guide for teachers to move beyond conventional school playgrounds: The RE-AIM evaluation of the Lunchtime Enjoyment Activity and Play (LEAP) intervention

“Play is the greatest form of research” – Albert Einstein
A guide for teachers to move beyond conventional school playgrounds: The RE-AIM evaluation of the Lunchtime Enjoyment Activity and Play (LEAP) intervention

7.1 Preface

In addition to the effectiveness of the LEAP intervention being examined [Chapter 6], research has identified a need to comprehensively evaluate school-based physical activity interventions (7). It is important to evaluate the translatability and sustainability of school-based interventions to ensure that the positive effects identified from an intervention can be maintained and potentially be replicated to benefit other schools on a wider public health scale. No study we are aware of has conducted a comprehensive process evaluation of a whole school playground intervention promoting ‘unstructured’ physical activity opportunities for children. This chapter is based on a manuscript that has been published in the Australian Journal of Teacher Education.

7.2 Introduction

The school environment is recognised to be one of the most important settings to develop children’s physical activity (6, 134), as children spend a large portion of their day at school. Primary school-aged children are within a ‘critical window’ to establish physical activity behaviour patterns that can track into adulthood (29). The need to establish childhood physical activity habits is further reinforced by physical inactivity (not meeting the physical activity guidelines) accounting for 1.5% to 3.0% of total direct healthcare costs in developed countries (385) or an estimated 1.9 million deaths worldwide (386).

A key strategy that is gaining more attention is to increase physical activity opportunities through non-curricular play during school breaks (255). Primary school children can be
engaged in up to 4200 school break periods during primary schooling (3-times per day, 5-days per week, 39-weeks per year, over 7-years) (10), offering substantial time for children to be physically active. Primary school children aged 5-12-years-old are estimated to spend at least 30 hours per week attending school and can accumulate up to 35% of their play during school breaks engaged in moderate to vigorous physical activity (MVPA) (190). Furthermore, play during break periods has been revealed as the principle source of children’s physical activity (11), contributing up to 50% of children’s recommended daily physical activity (11) and has been linked to improvements in classroom behaviour (233), cognitive performance (75) and the enhancement of social and physical skills (317). With mounting barriers associated with teachers’ ability to deliver Physical Education in schools (160) and with many children having restricted access to active play opportunities beyond school breaks (286), it is essential that effective school-based physical activity interventions within school breaks are implemented to reduce the burdens on Physical Education teachers.

Whilst a well-designed school environment can facilitate opportunities for physical activity during school breaks, many Australian schools have reduced or eliminated play facilities or have crowded play areas (200). Additionally, some schools implement play policies that act as barriers to the use of play spaces, resulting in decreased opportunity for children to experience active play (200). A number of school break interventions have successfully attempted to reduce the decline in children’s physical activities by introducing equipment and policies that encourage structured physical activities (192, 235, 299) that tend not to engage all children’s interests and abilities (24). Physical activity participation that is enjoyable and non-competitive is emerging as an important alternative for children who prefer less structured and vigorous-intensity physical activities (25). Natural environmental features (25, 289) and movable/recycled materials (12, 21, 23) are an emerging alternative to enable teachers to provide diversity of school play activities, develop physical activity participation,
playability and appeal to a broader range of children. However, natural environmental features (greening projects) can be quite expensive and can restrict the use of play areas while the greening projects are being implemented (21). A cheaper, more convenient alternative is the implementation of movable/recycled materials within the school environment (12), as children often prefer the flexibility of using movable materials (387).

Although there has been an increase in effective school physical activity interventions, there is an absence of literature focused on long-term physical activity interventions (235) and limited evaluation of the transferability of school-based interventions (26, 27), especially for teachers. Providing teachers with the knowledge of how to translate school-based interventions on a wider scale can facilitate the behavioural shifts necessary to develop preventative health (26). The importance of examining the translatability and feasibility of interventions for the setting in which interventions are implemented is critical to positively impact on public health (Collard, Chinapaw, Verhagen, and Van Mechelen, 2010). As teachers are the gatekeepers to informing school playground policies, planning and implementation (30), teachers can play a key role in facilitating such interventions (27).

The RE-AIM framework (reach, efficacy, adoption, implementation and maintenance) was conceptualised to develop a comprehensive, systematic model for examining research translation and dissemination (26). The RE-AIM framework evaluates the ‘reach’ to the target population (e.g. response rate of children); the ‘efficacy’ of the intervention (e.g. efficacy of the intervention for developing children’s physical activity, learning and other health outcomes); extent of ‘adoption’ in the target setting (e.g. the school’s acceptance of the intervention; ‘implementation’ (e.g. facilitators/barriers to children using the materials); and ‘maintenance’ of the intervention effects (e.g. was the intervention sustained by the school?) (388).
No study to our knowledge has provided an insight for teachers of the social-ecological levels of influence on children’s physical activity and health after a primary school playground intervention during school breaks. The social-ecological model was applied as the theoretical foundation of the study to provide teachers with insight into whether the intervention can successfully develop multiple levels of influence (intra-personal, inter-personal, physical environment and policy) for long-lasting health and learning outcomes (15). The Lunchtime Enjoyment Activity and Play (LEAP) intervention builds upon a previous pilot (12) to examine the effect of implementing movable/recycled materials on an entire primary school (ages 5 to 12). The primary aim of this mixed methods process evaluation was to evaluate reach, efficacy, adoption, implementation and maintenance of the LEAP intervention.

### 7.3 Methods

The RE-AIM health promotion framework (388) was applied to evaluate each level of the LEAP intervention. Applying the RE-AIM framework to evaluate the intervention is important to ensure teachers can replicate the intervention within schools on a wider scale and give consideration to potential facilitators and barriers. An outline of the RE-AIM evaluation of the LEAP intervention is shown in Table 7.1.

### 7.4 Participants

All children aged 5-12-years-old received a plain language statement outlining the research, along with a dual consent form (participant and parental). A total of 123 children from the intervention school (90% response rate) returned signed informed parental consent to participate in the study.
Table 7.1. How each dimension of the RE-AIM framework was evaluated in the Lunchtime Enjoyment Activity and Play (LEAP) intervention.

<table>
<thead>
<tr>
<th>RE-AIM dimension</th>
<th>Method of evaluating each RE-AIM dimension</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reach</strong> (e.g. participation of the target population)</td>
<td>• Response rates of children and teachers to participate in the LEAP intervention.</td>
<td>• Participant/parental consent form return rate compared with total enrolments in each class.</td>
</tr>
</tbody>
</table>
| **Efficacy** (e.g. efficacy of the intervention for children’s physical activity, learning and other health outcomes) | • Efficacy of the LEAP intervention for children’s participation in physical activity.  
• Teachers’ perceptions of the efficacy of the intervention for children’s play and other learning outcomes.  
• School’s/teachers’ willingness to allow children access to the movable/recycled materials. | • System of Observing Play and Leisure Activities in Youth (SOPLAY)- (Area level physical activity).  
• Teacher focus group discussion at the intervention school. |
| **Adoption** (e.g. the school’s acceptance of the intervention) | • Examining the proportion of children using the materials during school lunchtime.  
• Teachers’ perceptions of the uptake and use of the movable/recycled materials by the children. | • System of Observing Play and Leisure Activities in Youth (SOPLAY)- (Area level physical activity).  
• Teacher focus group discussion at the intervention school. |
| **Implementation** (e.g. facilitators/barriers affecting implementation) | • Teachers’ perceptions of the physical environment and policy social-ecological level facilitators and barriers to implementing the intervention materials.  
• Field notes recording how successfully movable/recycled materials were introduced into the school playground. | • Teacher focus group discussion at the intervention school.  
• Field note observations of the school playground. |
| **Maintenance** (e.g. extent to which the school maintained the LEAP intervention) | • Follow-up phase 1: measurements (8 months after baseline), teacher perceptions (9 months after baseline), Follow-up phase 2: measurements (2 ½ years after baseline). | • Teacher focus group discussion at the intervention school.  
• System of Observing Play and Leisure Activities in Youth (SOPLAY)- (Area level physical activity) for follow-up phase 1 and 2. |
Nine female teachers and one male principal who taught at the same Catholic primary school took part in the qualitative focus group study prior to a weekly staff meeting nine months after the commencement of the intervention (100% response rate). All nine teachers were included in the yard duty supervision roster of the intervention playground area throughout the year as per usual school practice. Teachers varied in their ages (24-53-years-old) and years of experience teaching (Range 1-31years). All teachers were invited to participate via a letter and consent form distributed during term four, 2010. Teachers interested in participating in the study were instructed to complete their consent forms prior to the focus group discussion.

Ethical approval was obtained from both the University of Ballarat Human Research Ethics Committee and the Ballarat Catholic Diocese. A Catholic Co-educational Primary School in Regional Western Victoria was approached to participate in the study, via emails, phone calls and on-site meetings with the principal. All children participating in the study participated in their regular daily school routines.

7.5 The Intervention

The LEAP intervention was developed to provide teachers with a simple, low cost, low burden school playground intervention, implementing movable/recycled materials to encourage children’s active play. The intervention builds upon an earlier pilot study that examined teachers’ perceptions of risk and the physical activity intensity of a small group of 5-7-year-old primary school children (12). Teachers reported benefits of the small, pilot study on children’s physical, cognitive and social skills, showing promise for movable/recycled materials to be implemented within a whole primary school environment (all age groups) and further examining the effect on physical activity and health outcomes.
At the intervention school, an information session was provided to staff prior to the LEAP intervention to describe the aim, benefits and organisation of the program. In brief, the LEAP intervention consisted of introducing movable/recycled materials with no fixed purpose on a grass field within a Catholic Primary school on a newly developed campus with no fixed playground equipment. The materials were introduced during 2010 from the end of term one to the middle of term two, post-testing was conducted seven-weeks after the intervention commenced and additional items were introduced up until 13-weeks after the intervention commenced (Autumn/Winter). The grass field where the LEAP intervention was implemented was 6,094m² and there were also hard surfaced play areas external to the grass field measuring 530m².

Introduced movable/recycled materials were generally not considered usual school play materials for children. Examples of the movable/recycled materials included milk crates, swimming noodles, buckets, cardboard boxes and tyre tubes. In addition to these materials, different types of play balls, hoops and skipping ropes were also added during the LEAP intervention. Five materials were introduced during the first week and each week thereafter a minimum of two types of material were introduced throughout the LEAP intervention period. Materials were excluded from the school playground or replaced when broken or if teachers had any safety concerns. The LEAP intervention effects were measured at multiple phases over a two and a half year period including baseline (0-weeks); post-test (7-weeks since baseline); follow-up phase one (8-months since baseline: direct observation; 9-months since baseline: qualitative teacher focus group) and follow-up phase two (2 ½-years since baseline; direct observation).
7.6 Data Collection

Data collection consisted of different methods to address each RE-AIM dimension (Table 7.1). Focus group discussions were guided by two investigators and lasted approximately an hour in duration. The focus group discussions explored the adoption and implementation of the LEAP program nine months after baseline measurements. The focus group discussion was held at the intervention school prior to teachers’ weekly staff meeting and was audio taped with transcription undertaken at a later time. An interview script using a semi-structured interview format guided the focus group, with all questions structured within the context of a social-ecological framework considering intra-personal, inter-personal, physical environment and policy level factors. Applying a social-ecological framework is important to identify the multiple levels of environmental influence from the LEAP intervention on children’s health (15).

All participant data was de-identified and referred to by pseudonym. The data collected from focus group session was transcribed and analysed using the NVivo software package (QSR International, Version 9). Transcripts were analysed using content analysis and emerging themes within the context of the social-ecological model were identified. The intra-personal and inter-personal level social-ecological themes explored teachers’ perceptions of children’s adoption of the LEAP intervention materials. Questions relating to the physical environment and policy level social-ecological themes explored the facilitators and barriers to the school implementing the LEAP intervention as intended. Focus groups also provided some insight into the teachers’ perceptions of the efficacy and maintenance dimensions of the RE-AIM framework.

The System of Observing Play and Leisure Activities in Youth (SOPLAY) (203) was used to evaluate the efficacy, adoption and maintenance dimensions of the RE-AIM framework.
SOPLAY was initially used to measure the type and intensity of children’s baseline playground activities. After which, SOPLAY was used to determine if the children within the school were still using the movable/recycled materials and engaged in physical activity intensities above or similar to baseline levels. Observation training included familiarisation with the SOPLAY protocol and undertaking practice observations using video examples of playtimes. All school playground defined areas were identified prior to physical activity measurement by determining key areas in which physical activities were taking place and there was visibility of the children’s activity level and type. No indoor observations were included in the study. SOPLAY scans were conducted at five minute intervals (5 x scans over 30 minutes). Children whose parents didn’t provide consent to participate in the study were assigned by the school principals to specified play areas to ensure that the children could be identified and that their physical activity behaviour wasn’t included in the data.

The SOPLAY is based on observing children’s physical activity, in which defined targeted areas are scanned from left to right, and counts are made of the number of children undertaking sedentary behaviour (e.g. sitting and standing), moderate-intensity physical activity (MPA; walking, climbing, arm movements) and vigorous-intensity physical activity (VPA; skipping, running). There were five defined target areas to record observations within the intervention school. A SOPLAY measurement follow-up phase two (2 ½-years after baseline) assessed whether the intervention had been maintained evaluating the maintenance level of the RE-AIM framework. Weekly onsite visits to record field notes in relation to the children’s and school’s use of the LEAP intervention materials were also undertaken throughout the first 12 months. Field notes assisted in the evaluation of the adoption and implementation dimensions of the RE-AIM framework.
7.7 Results

7.7.1 REACH

Within the intervention school a total cohort of 136 children were available for potential recruitment. The primary school encouraged all children to participate however, if they chose not to, children did not have to participate in the LEAP intervention. During LEAP intervention measurements, 123 children (response rate of 90%) and 10 teachers participated in the study (response rate of 100%).

7.7.2 EFFECTIVENESS

7.7.2.1 Objectively Measured Physical Activity

Direct observation (using SOPLAY of children’s school lunchtime activities revealed that the intervention had a positive influence on children’s physical activity intensity. The quantity of children within the school playground engaged in sedentary behaviour from baseline to post-test significantly decreased by 17.9%, MPA remained consistent (-0.7%) and the quantity of children who were engaged in VPA significantly increased by 18.6% (Figure 7.1). The increases in physical activity intensity were maintained at eight-months and again after two and a half years (see maintenance section).

7.7.2.2 Teachers Perceptions of the Efficacy of the Intervention

In addition to the direct observation measurements, the focus group discussions with the teachers suggested that there were many benefits for children in relation to play behaviour, “I think if you were measuring whether play is more powerful or more purposeful you would find a huge impact... a huge increase”; “they are really busy aren’t they....it’s more productive play”. The importance of the playground intervention for children was regularly mentioned by the teachers, “for children in those early years, the intervention is crucial.”
7.7.3 ADOPTION (School/Organisation Level)

Before the commencement of the LEAP intervention, investigators conducted a briefing session for teaching staff outlining the program elements including the cost-effective materials in addition to findings from an earlier pilot project applying a similar concept on a smaller scale (12). The intervention was branded using a program name and logo allowing children to identify the LEAP intervention and a section within the school newsletter outlined the details of the intervention. Within the newsletter, the school community was invited to donate movable/recycled materials to the school. This resulted in one family donating milk crates and another donating tractor tyres. Later in the LEAP intervention a local university donated play balls for the children. The rest of the materials were provided by the investigators throughout the intervention.
The high level of student adoption of the LEAP intervention from the outset also provided a catalyst for teachers and the school to adopt the initiative. Intra-personal and inter-personal social-ecological themes from the teacher focus groups and direct observation of the physical environment assisted the evaluation of the participant level ‘adoption’ dimension of the RE-AIM framework (Table 7.2).

7.7.4 ADOPTION (Participant Level)

7.7.4.1 Intra-personal Level of Influence

Intra-personal themes emerging from teachers’ perceptions were that children exhibited increased amounts of excitement, engagement, creativity, problem solving and physical activity during their play with the introduced movable/recycled materials (Table 7.2). Children’s excitement about the materials were identified by the teachers who stated that the children were returning to class talking about what they had made, “Our kids talk about it a lot...they come in and tell us what they made.”

The level of engagement of the children in using the materials appeared to be a key reason for the school to adopt the LEAP intervention (Table 7.2), “… anyone that drives past can see the level of engagement...you hear that...from the community.” Although many of the older boys “just wanted to play football”, the intervention was seen to have an impact on girls’ activities, “...they (girls) were lost at the beginning of the year....but when we introduced the materials...they were aware of everything”; “all the girls were running to play with things”; “girls who might have stayed in the one spot...are now drifting around doing something.” Children’s engagement in play was linked to the availability of the many different materials (Table 7.3) and this was perceived to have produced a sense of purpose in the children’s play. The many different materials available were seen to stimulate the children’s creative play as
they created different structures such as cubbies, boats, rockets and space-ships with the materials (Figure 7.2).

![Figure 7.2. Images of a structure created by children with the movable/recycled materials (left) and a girl balancing on a wooden plank (right).](image)

Teachers highlighted the benefits of the LEAP intervention on creative play (Table 7.2), “in comparison to more traditional games….imaginative play or planning or designing with the materials….the oral language benefits would have been huge”; “developmental play and imaginative play is coming into the classrooms…but this is putting it out to the playgrounds as well”; “the imaginative play…that just keeps going.” As the children created the different structures, teachers also reported that there were many physical activity benefits during children’s play including lifting and carrying materials, jumping off hay bales and balancing on wooden planks (Table 7.2). When broom sticks were introduced some of the children were also observed to have been sweeping their play areas and riding the broomsticks around the field.

Teachers believed children developed higher order thinking skills, such as the ability to problem solve within the school playground and that playground issues had decreased since the inception of the LEAP intervention (Table 7.2). As the LEAP intervention was quite different to conventional playgrounds with fixed structures and structured games many of the teachers made comparisons to these designs when highlighting the benefits of the intervention.
<table>
<thead>
<tr>
<th>RE-AIM dimension</th>
<th>Social-ecological component</th>
<th>Theme</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Participant Level Adoption</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intra-personal (Individual)</td>
<td>Excitement/Joy</td>
<td>“you would see the children rushing out to play…just excitement on their faces when the equipment came and the way that they went about it.”&lt;br&gt;“the joy on the faces in those first few weeks was terrific and you still see them running out with excitement to play.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engagement in Play</td>
<td>“play now has a specific purpose…moving things around is important.”&lt;br&gt;“you don’t look around and see many children just walking around not knowing what to do…everybody has got something in their hand.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Creative Play</td>
<td>“they were setting up their rocket or boat.”&lt;br&gt;“they used to make a fort…the balls would be like the cannons.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical Activity</td>
<td>“carting and carrying…moving things from one place to another...they are quite able to lift them”&lt;br&gt;“play has increased physical activity…it will have”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problem Solving</td>
<td>“having been in many schools, they (children) play with far greater effectiveness…problem solving…more independently and with less adult intervention of any school I’ve ever seen.”&lt;br&gt;“problems are just more easily solved…it’s not like there isn’t problems arising…but they are easier to sort out and the children manage more often.”&lt;br&gt;“you rarely get a comment…they go off and solve it and there are no major issues at all and we don’t see any tears.”</td>
</tr>
<tr>
<td></td>
<td>Inter-personal (Social)</td>
<td>Social Modelling</td>
<td>“they’re watching how others play…so they are learning those skills of play from the children that are really confident.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Team Work</td>
<td>“they are working like a team…you go to this group, you go to that group…they really had it worked out…I think you can say we see a lot of teamwork.”&lt;br&gt;“they make sure they’ve got a purpose within those little groups.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negotiating Skills</td>
<td>“one girl said…I’ve just traded the washing basket for two more sacs…if they’ve got excess stuff that they don’t need…they’ve just picked up on those things.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Social Inclusion</td>
<td>“I’ve found kids in my room mixed in with kids that they wouldn’t normally hang out with.”&lt;br&gt;“there’s not a distinct or set number that can or can’t be involved.”&lt;br&gt;“we don’t hear much anymore of I don’t have anyone to play with or they won’t let me play.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Co-operative Play</td>
<td>“the interaction between year levels has been fantastic…it has just kept going.”&lt;br&gt;“nobody says that’s our spot…they’ve all sort of got their spots around the field.”</td>
</tr>
<tr>
<td>Implementation</td>
<td>Physical Environment</td>
<td>Materials with Positive Effects</td>
<td>“we are seeing them (children) now build cubbies with the tarps and PVC pipe lengths and broom handles and fresh straw bales.”&lt;br&gt;“the shells when the children were using them as sleighs…that was enormous…that was really active.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials with Negative Effects</td>
<td>“they (cardboard boxes) got wet and out of nick pretty quickly…I don’t think it’s practical…the waste.”&lt;br&gt;“they don’t tend to be able to do much with them (plastic water containers)...they don’t seem to be able to stack them and have become less practical.”</td>
</tr>
<tr>
<td>Implementation</td>
<td>Policy</td>
<td>Safety Policies</td>
<td>“all of the boys picking everything up and beating each other…of course had to be talked about”&lt;br&gt;“if you are jumping off hay bales the maximum was two on top of each other…which was essentially waist height.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Organisational</td>
<td>“children were allowed to keep their chosen equipment for that week and then after that, it would be dismantled and equipment would be re-issued.”&lt;br&gt;“on a Friday we would bring it all in so that then it would physically have to be taken out again.”</td>
</tr>
</tbody>
</table>
7.7.4.2 Inter-personal Level of Influence

The inter-personal social-ecological component was the most talked about by teachers. Teachers described a range of improvements to children’s social skills as a result of the LEAP intervention such as social modelling, teamwork, negotiation, social inclusion and co-operative play (Table 7.2). Teachers reported that the groups of children would work together by creating their own imaginary worlds and structures and this would allow children who are less socially confident to observe how others play and participate with others they wouldn’t normally play with. Children’s co-operative play from the LEAP intervention was a positive, “the way they interact with each other…it’s lovely to listen to” and across year levels, “the co-operative play has really increased…they do negotiations…interactions between levels has been fantastic.” As well as co-operative play, teachers believed social inclusion increased, “we don’t hear anymore of I don’t have anyone to play with or they won’t let me play”; “kids in my room have mixed with kids they wouldn’t normally hang out with”; “there’s not a…set number who can or can’t be involved.” The teachers perceived that the playground culture had changed and become more team-oriented (Table 7.2), “there is an expectation that children are allowed to join in and there’s not much…dispute over that anymore.”

In addition, teachers reported no territorial issues from the LEAP intervention as the children’s co-operative play developed. The principal, who had been teaching for 31 years, believed that playground issues were more likely to arise from structured sporting, competitive type activities in the playground. Children’s negotiation skills were another higher order thinking skill teachers believed was developed (Table 7.2). Children had to negotiate in the playground with the exchange of materials and one teacher even talked about...
children who developed a shop that sells free playground materials. Another teacher highlighted how the complexity of children’s play had evolved over the nine month period, from a dragging, pulling and moving phase, to the imaginative, building and negotiation phases. The intra-personal and inter-personal development of the children throughout the school year from the LEAP intervention were major factors in the school’s adoption of the intervention program.

7.7.4.3 Physical Environment Level of Influence (Adoption)

Direct observation of school playground areas revealed that the intervention facilitated further lunchtime play opportunities. At baseline, ‘no identifiable activity’ and ‘soccer’ were the predominant physical activity types identified (Figure 7.3). Playing with the movable/recycled materials was the predominant activity children engaged in post-intervention (Figure 7.3).

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**Figure 7.3.** The proportion of predominant activity types measured by SOPLAY within each specified target area at baseline and post-test (7-weeks).
7.7.5 IMPLEMENTATION

There were a number of facilitators and barriers reported by the teachers which schools need to be aware of when implementing the LEAP intervention program on a wider scale in the future. The facilitators and barriers to implementing the intervention are categorised into physical environment and policy levels of influence.

7.7.5.1 Physical Environment Level of Influence (Implementation)

The impact of the introduced materials were categorised as having a positive or negative effect on the children’s play. The main materials that were suggested by teachers to have the most positive impact on the children’s play included tarpolines (plastic sheets), empty plastic sand shells, piping, milk crates, tyre tubes and the hay bales (Table 7.2). The milk crates were reported to be the most popular and useful material with teachers mentioning children could most easily build structures and the crates were light weight and therefore could be transported around the field quite easily (Figure 7.4). The milk crates were often combined with pipes when children were creating structures.

Figure 7.4. Images of children using the milk crates for building and construction.

Hay bales were also popular with the children and were seen by the teachers as a useful material for children to jump off and over to promote physical activity, build structures with and one teacher even reported children using a hay bale to slide over moving water containers like a conveyor belt (Figure 7.5).
The plastic sand shells were reported by the principal to have dramatically increased children’s physical activity levels as they used their initiative to create a sand-shell sleigh (Figure 7.6; Table 7.2 and 7.3).

The play balls introduced later in the LEAP intervention were also effective for building, rather than games (Table 7.2). The variety of tyres introduced were seen as effective, “the tyres are something the kids really love.” Moreover, tarpolines (plastic sheets) were unanimously reported to be used as roof tops and walls when children created their cubby houses.

As one of the teachers noted, “it’s about letting kids teach us how to play” and the journey of children’s play from the LEAP intervention highlighted that “children became a lot more complex in what they did...it was a real journey...there was...dragging, pulling and moving...then came the building phase...then came the dramatic phase...but all of those remain there.” Stations of materials were spread out around the grass field, “they’ve all got
their spots around the field.” Within each of the stations around the field children would be creating things (Table 7.2), “we are now seeing them build cubbies” and “they want you to come and look at all the things...buy things from the shop they’ve made.”

There were a number of materials described by the teachers as barriers to children’s play. The twine (from hay bales) was noted as an issue, “was a bit annoying...trying to undo knots and things.” Cardboard boxes were also seen as a potential problem, losing shape within a cooler, wetter climate (Table 7.2). The cardboard boxes were suggested to be more beneficial in a warmer climate, “If it was implemented in Queensland (warmer climate) I think it would be fine.” Another material that was seen to have little use were plastic bottles (Table 7.2). The size of the tractor tyres was a safety concern for the school and it was enforced that, “tractor tyres shouldn’t be for anything other than walking on, climbing on, balancing and playing on”. The weather was also seen as a major barrier to packing up the LEAP intervention materials, “It’s beautiful when kids are playing... it’s not so good when it’s raining and there’s stuff all over your yard”; “rain’s a big issue.”

7.7.5.2 Policy/Organisational Level of Influence

There were a number of facilitators to the success of the intervention, including a senior teacher who thoroughly supported the LEAP intervention throughout; reported as essential in previous intervention studies (26, 389). When using movable/recycled materials, an obvious consideration for the teachers from the outset of the LEAP intervention was safety. Therefore, two of the policies that teachers unanimously introduced was the rule of not striking anyone and not stacking or jumping off materials above waist height, “if you are jumping off hay bales the maximum was two on top of each other.” In addition, with so many materials introduced over a 13-week period, the teachers suggested that the packing up (organisational factor) of the materials had to be talked about. Teachers decided that leaving
the materials out for the entire week, packing everything up on the Friday and re-administering the equipment to the children the following week was the most feasible option.

Having a rule that allowed children to have certain equipment for the entire week and then distributed to others the following week was determined by teachers to ensure all children would have equal opportunity to use the different materials (Table 7.2). Despite children’s engagement with the many materials a teacher cautioned about surplus equipment, “… you can over-provide as well…you have to be careful not to have too many things.” Therefore, beyond the initial intervention of seven-weeks the only materials introduced by the school were cubby houses, goal posts, plastic cups/plates and the replacement of hay bales and milk crates.

Table 7.3. Field note examples of how the movable/recycled materials were used by the children to engage in various unstructured play activities.

<table>
<thead>
<tr>
<th>Movable/recycled materials</th>
<th>Activities children engaged when using the movable/recycled materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>All materials</td>
<td>Obstacle course, imaginary play, building</td>
</tr>
<tr>
<td>Bike tyres</td>
<td>Rolling, stacking</td>
</tr>
<tr>
<td>Broom sticks</td>
<td>Riding, sweeping activity stations</td>
</tr>
<tr>
<td>Buckets</td>
<td>Filling with materials, driving cars</td>
</tr>
<tr>
<td>Cardboard boxes</td>
<td>Hiding, clothing, sliding, stacking</td>
</tr>
<tr>
<td>Hay bales</td>
<td>Jumping, landings, building, cubby houses</td>
</tr>
<tr>
<td>Hoola hoops</td>
<td>Rolling, hoola hooping around waist</td>
</tr>
<tr>
<td>Mats</td>
<td>Sleigh seat, hay bale cover</td>
</tr>
<tr>
<td>Milk crates</td>
<td>Building houses, space ships, cars, castles, rockets, tunnels and</td>
</tr>
<tr>
<td></td>
<td>boats, climbing, jumping, soccer goals</td>
</tr>
<tr>
<td>Netting</td>
<td>Dresses, capes, house roofs. sails</td>
</tr>
<tr>
<td>Plastic cones</td>
<td>Activity station borders, hats, goals</td>
</tr>
<tr>
<td>Plastic cylinders</td>
<td>Telescopes, rockets, cannons</td>
</tr>
<tr>
<td>Plastic sand shells</td>
<td>Sleigh running (toboganning), sand play, walls</td>
</tr>
<tr>
<td>Plastic walls</td>
<td>Cubby house roofing/walls, climbing</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Play balls</td>
<td>Cannon balls, rolling, groceries</td>
</tr>
<tr>
<td>Swimming kick boards</td>
<td>Sleigh seat, dragging, building</td>
</tr>
<tr>
<td>Swimming noodles</td>
<td>Riding horses, fencing, tug of war</td>
</tr>
<tr>
<td>Tarpolines</td>
<td>Cubby house roofing/walls, sails</td>
</tr>
<tr>
<td>Tyre tubes</td>
<td>Jumping, stacking, rolling</td>
</tr>
<tr>
<td>Vacuum tubes</td>
<td>Instruments, phone call centre</td>
</tr>
<tr>
<td>Wooden planks</td>
<td>Balancing beams, house walls</td>
</tr>
</tbody>
</table>

7.7.6  **MAINTENANCE**

The focus group discussion conducted with the teachers nine months after the introduction of the LEAP intervention provided some insight into the maintenance dimension of the RE-AIM framework. Teachers were very supportive of the LEAP intervention during the focus group discussion quoting at nine months after baseline, “*I think the LEAP intervention worked really well, I’d like to see it stay*”; “*you still see them running out to play.***” A teacher also expanded on this by making a suggestion for the maintenance of such an intervention, “*the LEAP intervention has brought an enormous richness to the play...you can see continuing on for a very long time...I think you need to be open to continuously introducing new equipment as you go.***” Whilst comparisons were regularly made between conventional playgrounds and the LEAP intervention program, teachers suggested the concept could be feasibly transferred to other schools, “*I think the LEAP intervention is hugely beneficial... I don’t think it has to be this playground or a conventional playground...I think it can go hand in hand to cater for all children*”; “*I’m absolutely convinced that you could implement this into any school.***” Consequently, the LEAP intervention was independently maintained by the school beyond the initial 13-week intervention period.

The LEAP intervention was associated with an increase in the intensity of physical activity which was maintained for two and a half years. Similar to the seven week post-test (see efficacy section), children’s sedentary behaviour was 21.5% significantly lower at the eight-
month follow-up and 31% significantly lower at the two and a half year follow-up compared with baseline (Figure 7.1). The proportion of children participating in MPA (10.3% (8-months) and 14.9% (2 ½-years)) and VPA (11.2% (8-months) and 16.1% (2 ½-years)) was significantly higher than baseline (Figure 7.1).

Children’s play with the movable/recycled materials was maintained at eight-months and two and half years after baseline (Figure 7.7). Observation scans during the eight month follow-up also revealed that within 50% (26% construction and 24% imaginative play with the materials) and 44% of specified playground areas during the two and a half year follow-up (28% imaginative play and 16% construction with the materials) children were still engaged in play using the movable/recycled materials (Figure 7.7).

![Figure 7.7. The proportion of predominant activity types measured by SOPLAY within each specified target area at the 8-month follow-up phase 1 and 2-½-year follow-up phase 2.](image)

Consultation with teaching staff after two and a half years identified that the policy relating to the distribution of materials to children at the beginning of the school week and then packing
the materials up at the end of the week was still being maintained. An audit of the sustainability of the movable/recycled materials (Table 7.4) highlights that 23 of the 31 types of materials introduced (74%) still existed within the school playground after two and a half years.

Table 7.4. Overview of the sustainable and unsustainable movable/recycled materials identified during intervention phases.

<table>
<thead>
<tr>
<th>‘Sustainable’ materials still present during 2 ½-year follow-up phase 2</th>
<th>Materials not present during 2 ½-year follow-up phase 2</th>
<th>Additional materials introduced by the intervention school between follow-up phase 1 (8-months) and follow-up phase 2 (2 ½-years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycle tyres</td>
<td>Netting</td>
<td>Man-made cubby houses (fixed structure)</td>
</tr>
<tr>
<td>Wooden planks</td>
<td>Hoops</td>
<td>Australian Rules Football goal posts (fixed structure)</td>
</tr>
<tr>
<td>Milk crates</td>
<td>Exercise mats</td>
<td>Plastic cups (movable/recycled material)</td>
</tr>
<tr>
<td>Hay bales</td>
<td>Tennis balls</td>
<td>Plastic plates (movable/recycled material)</td>
</tr>
<tr>
<td>Water containers</td>
<td>Plastic buckets</td>
<td>Replacement hay bales</td>
</tr>
<tr>
<td>Plastic cylinders</td>
<td>Cardboard boxes</td>
<td>Replacement milk crates</td>
</tr>
<tr>
<td>Pipes</td>
<td>Baskets (plastic and wooden)</td>
<td></td>
</tr>
<tr>
<td>Plastic sheets</td>
<td>Frisbees</td>
<td></td>
</tr>
<tr>
<td>Motorcycle tyres</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastic walls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foam mats</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastic cones</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tractor tyres</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rope</td>
<td></td>
<td></td>
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<tr>
<td>Broom sticks</td>
<td></td>
<td></td>
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<tr>
<td>Plastic walls</td>
<td></td>
<td></td>
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<tr>
<td>Hessian sacks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Play balls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skipping ropes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tyre tubes</td>
<td></td>
<td></td>
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<tr>
<td>Swimming kick boards</td>
<td></td>
<td></td>
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<tr>
<td>Plastic sand shells</td>
<td></td>
<td></td>
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<tr>
<td>Swimming noodles</td>
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</tbody>
</table>

Field notes collected at the two and a half year follow-up suggest children would use the movable/recycled materials to play around the ‘man made’ cubby houses that were
introduced after the 8-month follow-up, around the trees and bushes or create a structure to play around along the fence line of the field (Figure 7.8).

Figure 7.8. Images of structures children would use the movable/recycled materials to play around.

Children engaged with the movable/recycled materials around the outside of the field, whilst children participated in games of soccer in the centre of the field. Additionally, if children preferred to establish their own soccer game, milk crates were often utilised as soccer goals. Children would build and construct materials at the beginning of the school week such as ‘cubby houses’, ‘shops’ and ‘space ships’ and then for the remainder of the week participate in imaginative play around the station of constructed materials (Figure 7.9). The original supervision arrangements of one teacher on the grass field and one teacher on the hard surfaced area were still maintained after two and a half years.

Figure 7.9. Images of an example of a shop constructed by the children with the movable/recycled materials.

7.8 Discussion

The aim of this mixed methods process evaluation was to evaluate the reach, efficacy, adoption, implementation and maintenance (RE-AIM) of the LEAP intervention. The use of
movable/recycled materials are an innovative option for teachers (21), as research indicates that conventional school playgrounds have limitations affecting the engagement of children not interested or physically able to participate in vigorous intensity and more structured activities (e.g. soccer, basketball) (289).

The ‘reach’ of the LEAP intervention program within the targeted Catholic Primary School was high with a 90% response rate of children during participant recruitment and 100% of teachers (n=9) participating in the focus group evaluation. The high response rate could be due to the school being recently built and the options provided by the LEAP intervention stimulated interest from the teachers and motivation for the children to participate.

The ‘efficacy’ of the introduction of movable/recycled materials was illustrated by the increase in the proportion of children engaging in higher intensity physical activity after the intervention was introduced. Consistent with physical activity intensity increases from the LEAP intervention, a previous 13-week movable/recycled materials intervention (n=12 schools) also demonstrated significant increases in 5-7-year-old children’s MVPA during school breaks (23). Teachers in the present study reported that the intervention was essential for the children and had a positive impact on their productivity and purpose during play activities.

In relation to the RE-AIM framework ‘adoption’ dimension, teachers were receptive to the LEAP intervention because the intervention was offered to the school as a complete package including implementation, support and evaluation. Although the school community did donate some materials (milk crates, tractor tyres) after an advertisement in the school newsletter, the low donation of movable/recycled materials from the school community could demonstrate that schools are busy places with a major goal of ‘classroom’ learning (390). Interest to adopt the LEAP intervention from the principal resulted in a briefing session.
outlining potential benefits of the intervention and the subsequent research. The briefing session was seen as highly important for the adoption (or buy-in) of teachers (391). The intra-personal (individual level), inter-personal (social level) and physical environment development and adoption by the children from the outset of the LEAP intervention was seen as a key factor in the teachers’ and school’s adoption of the intervention and on-going maintenance.

Reflecting previous studies of 5-7-year-olds (12, 21, 23), teachers highlighted many intra-personal developmental benefits in primary school children of all ages that included children’s engagement in play, excitement, creativity, problem solving and physical activity. The level of children’s engagement was seen to reflect positively within the wider school community with teachers stating that many parents highlighted how engaged the children were with the materials. As children appeared engaged and excited to be moving the materials to different locations, this may have developed a greater sense of ownership and place for the children within the playground (392). Consistent with previous research (12), children’s engagement in resistance type physical activities of pushing, lifting and dragging materials around the field were perceived to have increased since the introduction of the movable/recycled materials. Although, muscular resistance is an area of physical activity that was not objectively measured, multiple domains of physical activity were accounted for in the development of the LEAP intervention (13). The present study has the potential to inform teachers that fixed structures, structured games and sports equipment aren’t the only method to develop children’s physical and motor activities during school breaks (194).

An interesting finding identified by the teachers was the level of adoption from girls within the study. Many studies of school breaks have identified the challenges to engage girls in adequate physical activity (8). The findings from the present study may highlight an effective strategy teachers could use to engage girls in physical activity at an early age may assist with
the prevention of transitional declines of physical activity into secondary school reported (321). Playing with ‘movable equipment’ has previously been associated with girls’ activity within the school playground and providing further play options with unfixed equipment may encourage girls’ physical activity participation (393). As it has been reported that girls prefer engaging in social behaviour during school breaks (393) it is possible that the social opportunities associated with introducing the intervention could be a key strategy to developing the physical activity of girls.

The inter-personal (social) themes identified within Bundy and colleagues’ earlier studies (2008, 2009) (12, 21) were evident among children of all age groups during this intervention. Many of the teachers reported that children were using the LEAP intervention materials to play with children they wouldn’t generally associate with. Providing equipment to include children of all abilities and backgrounds within school breaks provides an effective strategy for schools to prevent social isolation, bullying, conflict, injury and peer victimisation that are major barriers to children’s physical activity (208). The development of social skills like those identified in the intervention are important for children to learn about societal expectations and enable them to interact with people in a safe and meaningful manner, (394-396), learn conflict resolution skills and to engage in healthy behaviours (397). Providing a diversity of play options can also break down social hierarchies (398) to ensure all children have an opportunity to experience the health benefits of play, not just those physically able or popular (399). The many intra-personal and inter-personal benefits identified by the teachers could encourage both principals, teachers and teacher educators (academics) to re-think policy changes to eliminate school break time to focus on classroom learning (400) and consider implementing equipment from a student’s perspective (201, 202).

As all teaching staff supervised the intervention program, the teachers were able to provide insightful suggestions regarding the ‘implementation’ of the physical environment and policy
changes for the school playground. Within the physical environment all materials added to
the array of play options except cardboard boxes (didn’t last long and their use would require
regular replacement) and water containers (no play purpose). Despite ‘ball associated’ games
being regularly seen as popular by school children (393) when play balls were introduced to
the field during the LEAP intervention program, children used them as part of imaginary play
and construction (e.g. cannon balls) rather than ball sports. There were also some comments
from the teachers about the twine from the hay bales as these could be tied to things around
the playground and hay bales deteriorated after wet weather. Wrapping hay bales in bubble
wrap (12) is an effective idea to also prevent rain damaging the hay bales and to minimise
allergic reactions to grasses. Furthermore, despite tractor tyres being a great base for children
to play around, there were some concerns about the large size of the tyres if children were to
attempt to move them or as a potential home to snakes. Wet weather was only seen to be a
concern for cardboard boxes and for the appearance of the playground when materials
became wet. Plastic materials can weather quickly and become brittle and therefore need to
be regularly checked in case they become cracked and tyre tubes need valves to be covered
effectively to avoid potential injury.

The school policy of allowing children the use of equipment for an entire week before
returning the materials to the storage area at the conclusion of the week was a success. This
weekly policy reduced staff and student demands to pack up regularly and was used to
counteract ownership issues that could develop with the materials, as a number of children
may want the same material for an extended period. Although teachers in a previous study
perceived movable/recycled materials as a safety risk (12), the only policies the intervention
school had to introduce were to prevent the stacking of hay bales and crates to unsafe heights,
prevent moving tractor tyres and striking each other with the foam swimming noodles.
After the initial intervention period of seven-weeks had concluded, most elements of the program were ‘maintained’ by the teachers, potentially due to the children’s observed enjoyment, enthusiasm, perceived health benefits, cost-effectiveness and sustainability of the movable/recycled materials. All materials were accessible for the children, being found around most home or community settings (12). Funding underpinning any intervention program is important for schools (198, 401) to facilitate the adoption and maintenance of interventions (402). A total of 23 simple, cost-effective, movable/recycled materials from the original 31 materials (74%) introduced were still present within the school playground during a playground audit two and a half years after baseline. The most sustainable materials were solid and resistant to damage such as treated pine wooden planks, milk crates, pipes and large tyres. Many of the light plastic materials such as buckets and baskets became damaged quite easily and had been removed from the playground. As maintenance of playground materials is a common problem within Australian schools (198), using plastic, wooden or rubber materials that aren’t light or brittle are an important consideration for future replication of the LEAP intervention by teachers in other schools. This durability of the movable/recycled materials over two and a half year period was a major contributor in the provision of play benefits to the primary school children for an extended period of time (maintenance). The wide use of hay bales and milk crates meant the school replaced these materials at the commencement of each school term after the initial 13-week intervention phase.

Direct observation revealed children’s adoption of the movable/recycled materials and increased physical activity intensity during the intervention were maintained during both the eight-month and two and a half year follow-up periods. This finding is comparable to a similar 13-week movable/recycled materials intervention that revealed initial physical activity intensity increases from the intervention in 5-7-year-old children could be maintained for two years (23). This suggests that a large proportion of the children preferred to engage in
physical activity and play that is less competitive during school breaks, an emerging consideration for teachers (25) when offering activities and equipment for use during school break periods. Strategies to further enhance the successful maintenance of the LEAP intervention could be to include a co-ordinator or key teacher to advocate for the intervention and to monitor the condition of the materials (403-405). As the LEAP intervention builds upon previous research (12, 21-23) by examining additional health outcomes and a larger age range, future research could investigate the implementation of movable/recycled materials across multiple school environments to complement or replace conventional school playgrounds.

Importantly, the LEAP intervention provided children with the four elements children desire within a playground, a place for ‘doing’, ‘thinking’, ‘feeling’ and ‘being’ (374). If children fail to engage in high quality childhood play, a capacity to develop a range of key life skills (e.g. cognitive, spatial awareness) could be diminished. Implementing movable/recycled materials is an important consideration for teachers, as many children can become bored of fixed playground equipment and may prefer to create their own play areas. Teachers are the gate-keepers to school playground planning (198), therefore this study provides insight for teachers into implementing an effective school playground intervention. Teachers need to be aware that conventional, fixed equipment within school playgrounds may not be the only answer to providing opportunities for play and physical activity during school break periods and may not cater to the diverse needs of all children.

Originally, the LEAP intervention was planned for 13-weeks with a mid-intervention data collection after seven-weeks. However, during the winter of 2010 the region experienced the highest rainfall on record (361) when the post-testing window was originally scheduled (after 13-weeks). This resulted in children being able to play outdoors for fewer days and thus all data was not able to be collected. Due to the wet weather and reduced outdoor play,
investigators had to examine the data seven-weeks after the commencement of the intervention (as the post-test) and then during two additional follow-up data collection time points.

Although a high proportion of children engaging with the movable/recycled materials was identified, a limitation of the study was that the data collection methods were not sensitive enough to distinguish which individual materials influenced physical activity. However, the qualitative focus groups and field notes were able to provide insight into children’s use of the movable/recycled materials. Given the sporadic nature of children’s play during school lunch breaks it is possible that some misclassification of activity or intensity type occurred however, to try and address this potential limitation the number of scans were increased from the traditional SOPLAY protocol (15 and 25 minutes into the lunch break) to scans every five minutes to capture more detailed physical activity data. It should be noted that sex was unable to be identified via direct observation due to the school’s ‘no hat, no play’ sun-smart policy, although qualitative insight was gained from the teachers.

A different cohort of children were present in the school playground during the two and a half year follow-up however, the purpose of this follow-up was to assess the sustainability and play benefits of the movable/recycled materials over a long-term. The scope of measurements undertaken was already quite comprehensive however, further insight may have been elicited by interviewing the children, parents and non-teaching staff about the LEAP intervention throughout the school year. Investigation into teachers’ impressions of children’s classroom attentiveness immediately after lunch breaks may also have provided further insight into the developmental effects of the intervention. In addition, any generalising of the findings should be done so with caution as the intervention was conducted within a single catholic primary school.
Playing and learning outdoors can inspire children (406), yet teachers often perceive play and learning as differing concepts and find combining them difficult to integrate conceptually and in practice (198, 407). Findings from this study could be used to improve teachers’ understanding of the benefits of the ‘informal curriculum’ of school break periods and to consolidate understanding of school breaks as an opportunity for children to develop skills beyond the classroom, rather than viewing school breaks as having little impact on children’s health, learning and development. Rather than a period for children to ‘let off steam and energy’ (200), the present study can enhance teachers’ understanding of the value of introducing low cost materials to a school playground for children’s educational development.

The multiple level developmental benefits of children’s play from the LEAP intervention suggest supervised play with movable/recycled materials should be further explored and replicated by teachers within the educational context. The present study provides impetus for teacher training programs to provide units of study to develop pre-service teachers’ awareness of intervention strategies such as the LEAP intervention to lead changes in school playground planning, organisation and implementation of cost-effective equipment. Although teachers often identify play as teacher driven and miss potential scaffolding opportunities (407), the movable/recycled materials in the present study demonstrate the potential opportunity for children to develop health behaviours without increasing the demands on already burdened teaching staff.

7.9 Conclusion

This research addresses an important gap in the literature by providing useful information for teachers of the external validity of the LEAP intervention to ensure the benefits associated with different social-ecological levels within the school environment can be replicated on a
wider scale. Results of this study provide insight for teachers that the LEAP intervention can be consistently implemented and maintained for at least a two and a half year period. Reach, efficacy, adoption, implementation and maintenance of the LEAP intervention were established to be successful. The LEAP intervention provides a model teachers could adopt as a successful alternative to conventional school playgrounds that could be implemented in any school. Cost-effectiveness, diversity, sustainability and positive individual and social engagement were major factors facilitating the success of the LEAP intervention.

As movable/recycled materials are readily accessible within the home and neighbourhood, teachers could encourage children to play with these items at home to enhance the transfer of physical activity behaviour from school to home settings. Further co-operation between teachers, educational leaders, designers, researchers and play professionals could further develop the benefits identified in this study on a wider scale in schools to enhance the ‘informal curriculum’ during school breaks.
Chapter 8

General Conclusions,
Limitations/Delimitations,
Recommendations
8 General Conclusions, Limitations/Delimitations, Recommendations

8.1 General Conclusions

The studies in this thesis set out to understand the social-ecological influences within school playgrounds on children’s quality of life, enjoyment and physical activity during school lunch breaks.

Overall, from this series of studies the following conclusions were drawn:

i. Literature – what is known

- Multiple level facilitators and barriers need to be identified within the context of school breaks in order to tailor school playground interventions effectively.
- The introduction of variety, choice and ‘non-fixed’ playground items during school break periods show promise to develop children’s physical activity and cater for the physical activity preferences of children of all ages, sex and physical abilities.
- The limitations of measuring children’s physical activity with single measures emphasise a need to measure children’s intermittent and sporadic physical activity with multiple measures.
- The health and developmental benefits of school playground interventions that encourage ‘unstructured’ type physical activity provide merit for further research examining this concept within school break periods.
- There is a need to evaluate the effects of school-based interventions on mediators of children’s physical activity (e.g. enjoyment), within the multiple social-ecological levels of influence, the long-term of effects of interventions on children’s physical activity and to examine the translatability and feasibility for the application of school-based interventions to other school settings.
ii. Study one key findings

- Many children had a desire for new features within their school playgrounds to facilitate physical activity that contrasted with features in their existing school playground.

- There were several key factors within the social-ecological levels of influence including; Intra-personal: task goals, outcome goals; Inter-personal: peers, teacher role models; Physical environment: natural environmental features, built environmental features, safe surfaces and structures; Policy: Play area access, supervision, access to sports equipment.

- The identification of facilitators and barriers across all four social-ecological levels of influence to children and adolescent’s physical activity during school breaks can inform the development of future school-based physical activity interventions and the development of self-report instruments to measure the influences on children’s physical activity within the context of school break periods.

iii. Study two key findings

- The study confirms the Lunchtime Enjoyment of Activity and Play (LEAP) questionnaire as a reliable, context-specific instrument with sound content and face validity.

- The study addressed the need to develop a measurement tool which addressed the multiple faceted nature of the social-ecological model when assessing children’s enjoyment of play and lunchtime activities and targeting interventions during school breaks.
A reliable measurement tool was developed to measure children’s enjoyment of school play and lunchtime activities, including the number and type of school play activities children enjoy during lunchtime and the extent of his/her enjoyment.

iv. Study three key findings

- The study addresses a significant gap in the literature by examining the variability and stability of children’s enjoyment of lunchtime play within and across multiple days.
- Children’s enjoyment of lunchtime play appears to be more consistent within days than between days, suggesting that assessment of children’s enjoyment of lunchtime play once on a single day would be representative of a particular day, but not necessarily that particular school week.
- Children expected to enjoy lunchtime play in greater proportions than they actually did, indicating children expect to have a positive experience during their school lunchtime play.

v. Study four key findings

- The study demonstrated that the introduction of movable/recycled materials via the Lunchtime Enjoyment Activity and Play (LEAP) intervention had significant overall interaction effects on children’s pedometer-determined steps and distance per minute.
- Short-term treatment effects from the intervention were evident during post-test for children’s physical health scale of quality of life, enjoyment of physical activity and enjoyment of intra-personal play activities.
- The intervention school children spent significantly higher proportions within specified playground target areas in more vigorous physical activity intensities than the control school children at both the post-test and follow-up.
Direct observation of the school playground throughout the school year revealed that the intervention school’s predominant physical activity type evolved over time from imaginative play with the movable/recycled materials during post-test to building and construction during follow-up.

vi. Study five key findings

- The RE-AIM evaluation of the LEAP intervention revealed that movable/recycled materials could be feasibly implemented and maintained for at least a two and a half year period in a primary school.
- The cost-effectiveness, diversity and sustainability of the movable/recycled materials were seen as major factors contributing to the success of the LEAP intervention.
- The multiple intra-personal (e.g. creativity, problem solving) and inter-personal (e.g. teamwork, negotiation) social-ecological level health developments and engagement of the children from the intervention warrant further replication to other school settings using a representative sample.
- The findings from the study provide a guide for schools to implement the LEAP intervention to school playgrounds on a wider public health scale.

8.2 Limitations and Delimitations

Limitations and delimitations of these studies include:

i. Study one

- As the findings from study one are only representative of the perceptions of the participants from two primary and two secondary schools in two regional areas of Victoria, the findings are not generalisable to wider populations.
The validity of the findings is reliant on children being able to understand the tasks and accurately report their responses. However, having staff available to assist children when required helped to minimise potential problems such as distractions from other children and confusion of interview questions.

It should be acknowledged that the mapping task may have been cognitively challenging for some of the younger primary school children. However, previous studies have utilised mapping techniques with children of similar age (141, 145), suggesting the method was appropriate for children and adolescents aged 7-13 years in this study.

ii. Study two

Due to tight curricular schedules of the participating school within the LEAP questionnaire development study (e.g. are, library, sport, music) and other classroom constraints (e.g. assignments, teaching/learning goals), the LEAP questionnaire was administered to individual classes during varying times of the day, rather than children completing the questionnaire simultaneously.

Due to the research being conducted within a single primary school, any generalising of the findings are not necessarily representative of the wider population.

iii. Study three

Concerns have previously been raised about using self-report instruments with primary school children however, children above eight years old have been established to reliably self-report on their health (99, 118, 378). This concern was
further minimised by ensuring the format of the survey cards was developmentally appropriate and piloting the survey cards prior to the study.

- There were a high number of missing responses across the five days however, as the research was conducted within a usual school environment, children were absent from school throughout the week for a variety of reasons.

- It should be noted that because the research was conducted within a single primary school, therefore generalising of the findings to the wider population is not appropriate.

iv. Study four

- Originally, the LEAP intervention was planned for 13-weeks with a mid-intervention data collection after seven-weeks. However, during the winter of 2010 the region experienced the highest rainfall on record when the post-testing window was originally scheduled (after 13-weeks). This resulted in students being able to play outdoors for fewer days and thus all data was not able to be collected. Due to the wet weather and reduced outdoor play, investigators had to examine the data seven-weeks after the commencement of the intervention (as the post-test) and then during two additional follow-up data collection time points (8-months and 2 ½-years).

- It should also be acknowledged that as the data was conducted during school lunch breaks of two matched catholic primary schools, the findings may not be reflective of physical activity during morning or afternoon break periods or of other school populations.

- With the intervention school children not being exposed to the regular fixed playground equipment, it is a possibility that children may have embraced the
movable/recycled materials more readily than a school with a conventional, fixed playground.

- Due to both schools’ Sun-Smart policy, the identification of children’s sex was unable to be determined via direct observation from the video recordings.
- The resistance benefits of lifting, dragging and carrying movable/recycled materials around the playground were unable to objectively measured in the present study, despite multiple domains of physical activity being accounted for.

v. Study five

- Although the proportion of children engaging with the movable/recycled materials was identified, a limitation of the study was that the data was not sensitive enough to distinguish which individual movable/recycled materials influenced physical activity. However, the qualitative focus groups and field notes were able to provide insight into children’s use of the movable/recycled materials.

- Given the sporadic and intermittent nature of children’s play during school lunch breaks it is possible that some misclassification of activity or intensity type could exist. However, the number of scans from traditional SOPLAY observation protocol to increase observation sensitivity and the analysis was undertaken by trained personnel.

- The teacher focus group was limited to a single recruitment phase, potentially restricting evolving teacher perspectives throughout the study. Although interviewing the teachers at the end of the initial school year allowed teachers to recollect their evolving perceptions throughout the school year.

- The scope of measurements undertaken was already quite comprehensive however, it may also have elicited more valuable information and further insight by interviewing the children, parents and non-teaching staff of their perceptions of the
intervention throughout the school year. However, participant and school burden were a factor in deciding not to undertake this.

- Any generalising of the findings should be done so with caution as the intervention was conducted within a single catholic primary school.

8.3 Recommendations

At the conclusion of these studies, several directions for future research are recommended:

i. Study one

- Across all four social-ecological levels of influence facilitators and barriers to children and adolescents’ school-based physical activity were identified and could be used when designing future research targeting school playground interventions.

- The facilitators and barriers identified to children and adolescent’s school-based physical activity could be used to inform the development of questionnaires aiming to evaluate the multiple level influences on children and adolescent’s physical activity within the school playground context during school breaks.

- Knowledge and philosophies of teachers and pre-service teachers in relation to planning, promoting and providing physical activity for children and adolescent’s during school breaks could be examined.

ii. Study two

- The LEAP questionnaire could be used to identify and target areas of low enjoyment within children’s school lunchtime play activities.

- Identifying the external validity and suitability of the LEAP questionnaire as a research tool is warranted.
Further investigation of the sex-specific influences on children’s behaviour during school breaks will allow researchers and practitioners to address these differences when developing tools to examine school play and lunchtime activities.

The correlation between children’s enjoyment of school play, lunchtime activities and physical activity participation within a representative sample could be investigated.

Given the concerns regarding the declining levels of physical activity in adolescents the LEAP questionnaire could be used to examine adolescents’ enjoyment of play during school lunch breaks within a secondary school-context.

The LEAP questionnaire could be used to investigate the mediators of physical activity such as enjoyment and their association with children’s play during school lunch breaks.

iii. Study three

Future research examining children’s enjoyment of lunchtime play activities should consider spacing out the measurement of children’s enjoyment across multiple days of the week.

A greater understanding of children’s enjoyment of play within the school-context is an important consideration in the evaluation of future interventions designed to improve or change school play environments during break periods.

iv. Study four

Further exploration is needed into the influence of school playground interventions during lunch breaks on children’s quality of life, enjoyment of physical activity and policy social-ecological levels of influence.
When using pedometers, as was undertaken during the LEAP intervention, children’s distances should be examined to minimise potential stride length differences on children’s step counts (e.g. smaller stride length = higher amount of steps).

As long-term physical activity interventions examining multiple time points are relatively unexplored during school break periods, the sustainability of movable/recycled materials interventions and the evolving play behaviour of children over prolonged periods should be examined in diverse settings.

Process evaluations should examine the potential for interventions encouraging unstructured physical activities during school lunch breaks such as movable/recycled materials that can be replicated and implemented on a wider public health scale.

v. Study five

The LEAP intervention framework can be used as a model to be replicated by teachers, educational leaders, designers, researchers and play professionals to complement or replace conventional school playgrounds on a wider public health scale.

Interventions such as the LEAP intervention could trial a key person or intervention program co-ordinator (champion) to reinforce, advocate for the intervention program and monitor the condition of the movable/recycled materials.
The evaluation of children’s ability to transfer the developmental and physical activity benefits of engaging with movable/recycled materials from the school to the home settings.

In Summary, from this series of studies, it is possible to suggest that researchers are better informed about targeting children’s physical activity during school breaks. Factors within multiple social-ecological levels of influence have been highlighted as key factors influencing children and adolescent’s physical activity during school breaks. Further, the facilitators and barriers identified from the first study provided the framework to develop a reliable self-report measure in study two to examine the multiple levels of influence on primary school children’s enjoyment of lunchtime play activities. The LEAP questionnaire development study addresses an important gap in the literature to provide an instrument to measure enjoyment, a key mediator of children’s school-based physical activity. Prior to administering an enjoyment self-report instrument, it was important to determine when to measure children’s enjoyment of lunchtime play for future school-based interventions targeting children’s enjoyment in study three. Intra-day variability and inter-day reliability measurements suggested that measuring children’s enjoyment of lunchtime play on one occasion would be representative of that particular day, but not necessarily that school week.

Addressing a need to evaluate an ‘unstructured’, cost-effective, long-term school playground intervention, a variety of movable/recycled materials were introduced into a school playground. The effects of the ‘LEAP intervention’ school playground intervention were evaluated on multiple physical activity dimensions (frequency, intensity, duration, steps/distance, activity type), a key mediator of children’s physical activity (enjoyment), multiple social-ecological levels and quality of life. The findings indicate the LEAP intervention had a significant overall interaction effect (group x time) for children’s mean steps and distance (pedometers) in the intervention school compared with the control school.
A short-term treatment effect was revealed after seven-weeks for children’s physical health scale quality of life, enjoyment of physical activity and enjoyment of intra-personal play activities. In contrast, no significant effects from the intervention on children’s enjoyment of inter-personal level play activities, enjoyment of physical environment/policy level play activities, psychosocial scale quality of life and overall quality of life were identified. The intervention school children spent significantly higher proportions within specified playground target areas in more vigorous physical activity intensities and were engaged in evolving play opportunities compared with the control school children at both seven-weeks and eight-months after baseline. The positive quality of life, enjoyment and physical activity outcomes from this simple, low-cost intervention could be used to inform the development of future intervention programs using movable/recycled materials on a wider scale within primary school settings.

In order to evaluate the transferability and feasibility of implementing the movable/recycled materials intervention for use in other schools, a RE-AIM framework (Reach, Effectiveness, Adoption, Implementation and Maintenance) was applied to the LEAP intervention. The RE-AIM framework identified that due to the cost-effectiveness, diversity and sustainability of the movable/recycled materials, the LEAP intervention was able to be feasibly implemented and maintained for at least two and a half years. The positive, multiple level health and learning outcomes associated with the LEAP intervention identify that the implementation of a simple movable/recycled materials program can challenge the concept of conventional, fixed school playgrounds during school breaks. The final study of this thesis provided a comprehensive process evaluation for teachers, educational leaders, designers, researchers and play professionals to implement the concept of movable/recycled materials within school playgrounds on a wider public health scale.
There are a number of challenges in the promotion of children’s physical activity in our modern, urbanised society. Growing parental safety concerns of children walking the streets (155), increased opportunities for electronic screen time and excess energy consumption (4), economic pressures on families to encourage physical activity opportunities (131, 156, 157), a failure to develop girls’ physical activity (8) and multiple institutional and teacher related barriers to the effective delivery of school Physical Education (160) have made it difficult to promote children’s physical activity for long lasting health outcomes. The present thesis builds upon previous literature to provide a range of multiple level strategies to ensure that schools can take an active role in providing their children with a variety of daily physical activity opportunities within the crucial setting of school breaks. Optimising children’s health is the key to society’s long-term health and as confirmed by a world leader:

“There can be no keener revelation of a society’s soul than the way it treats its children.” – Nelson Mandela (1997)
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Appendices
Appendix 1. Baseline correlations between mean overall quality of life, enjoyment and pedometers (steps/min).
Appendix 2. Post-test correlations between mean overall quality of life, enjoyment and pedometers (steps/min).
Appendix 3. Follow-up correlations between mean overall quality of life, enjoyment and pedometers (steps/min).