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Effect of a school-based activity program on the motor skills, perceived physical competence, enjoyment and physical activity of adolescent girls: the Sport4Fun pilot randomised controlled trial

Jodie Elizabeth Andruschko

University of Wollongong

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Effect of a School-Based Activity Program on the Motor Skills, Perceived Physical Competence, Enjoyment and Physical Activity of Adolescent Girls: The Sport4Fun Pilot Randomised Controlled Trial

A thesis submitted in fulfillment of the requirements for the award of the degree

Doctor of Philosophy

From

The University of Wollongong

by

Jodie Elizabeth Andruschko
BEd (Hons)

Faculty of Education
2013
DECLARATION

I, Jodie E. Andruschko, declare that this thesis, submitted in fulfillment of the requirements for the award of Doctor of Philosophy, in the Faculty of Education, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualification at any other academic institution.

Jodie E. Andruschko

10 May 2013
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ABSTRACT

Recent findings indicate that the proportion of secondary female students meeting the Australian recommendations for physical activity is less than 10% (Morley et al, 2012). There are numerous benefits associated with physical activity participation and it is imperative efforts are directed towards promoting physical activity participation among adolescent females.

This thesis reports on two studies that were part of The Sport4Fun Program, a school- and home-based intervention designed to promote physical activity participation among adolescent females. These were a Proof-of-Concept trial (POC trial) followed by a Pilot Randomised Controlled Trial (Pilot RCT). The aim of both studies was to assess the feasibility (screening, recruitment and retention of participants, and collection of useable measurement data), acceptability (implementation of sessions, participant attendance and enjoyment of sessions) and potential efficacy (determined by a trend towards statistical significance for the outcome variables) of a multifaceted secondary school-based program (The Sport4Fun Program). In both trials, The Sport4Fun Program was designed to promote physical activity participation, fundamental movement skill proficiency, perceived physical competence and enjoyment of physical activity in secondary school students. The POC Trial targeted male and female students in Year 7 (ages 12 to 13 years) and the Pilot RCT targeted only female students in Years 7-9 (ages 12 to 15 years). Social Cognitive Theory and Competence Motivation Theory were the theoretical frameworks underpinning the intervention in both trials.

The POC Trial was conducted with single group of 17 students (mean age = 12.4 ± 0.3 years). Measurements were collected at baseline and follow-up (10 weeks), with the primary outcomes being objectively measured physical activity and fundamental movement skill proficiency and secondary outcomes perceived physical competence, enjoyment of physical activity, waist circumference and body mass index (BMI). The POC Trial was an eight-week intervention, designed to fit into one 10-week school term. It consisted of a 90-minute practical session, scheduled in school sport time and three 15-minute theory sessions during morning homeroom (or roll call) time per week. Results indicated that the POC Trial was feasible (appropriate collection measures), acceptable (implementation of The Sport4Fun Program, participant attendance and enjoyment) and potentially efficacious, with trends in desired direction for all outcomes. Recommendations were made for the Pilot RCT for aspects
of screening and recruitment processes, targeting participants, timing of intervention and delivery of sessions.

With a larger sample and a control group, the Pilot RCT aimed to more thoroughly test the potential efficacy of *The Sport4Fun Program* and implement the recommendations from the POC Trial. The sample for the Pilot RCT consisted of 20 females (mean age = 13.57 ± 0.77 years) who were randomized into intervention or control group following baseline measures. Measurements were collected at six-month follow-up with the primary and secondary outcomes the same as in the POC Trial. The Pilot RCT was a 20-week intervention, conducted over two school terms. It consisted of two practical sessions – a school sport session and an after-school sport session – and three 15-minute theory session completed in morning homeroom (or roll call) time per week. Students from older year groups (Year 11) provided peer support for the participants and parents were also involved through home challenges. Results indicated that the Pilot RCT was feasible, acceptable and potentially efficacious. Compared with the control group, adolescents in the intervention group had a significantly greater increase for total weekday physical activity (77.49 counts per minute [95%CI = 8.21 to 132.77] d=1.26 p=0.03), and a significantly smaller decrease in percentage of time spent in light physical activity (0.05 [95%CI = 0.01 to 0.09] d=1.45 p=0.02). There was also a significantly smaller increase in the intervention group for percentage of time spent in sedentary behaviour (-0.06 [95%CI = -0.10 to -0.01] d=-1.62 p=0.02). In addition, greater improvements were found in the intervention group for total fundamental movement skill proficiency (1.48 components [95%CI = -1.21 to 4.17] d=0.48 p=0.26).

The findings of the study reinforce the importance and potential schools have in promoting physical activity. Participants randomised to the *Sport4Fun program* showed medium to large beneficial effects on their weekday physical activity and motor skill proficiency. Compared with other school-based interventions, these results are particularly promising. In addition to this, the *Sport4Fun Program* shows a multi-component school-based intervention can be feasible and potentially efficacious in promoting physical activity and movement skills among low-fit adolescent girls. *The Sport4Fun program* was designed to address the gaps highlighted in recent systematic reviews and focus on aspects not yet targeted in school-based interventions. Findings from this study can provide an approach that could be integrated into other multi-component interventions to promote physical activity among young people and be tested among other groups.
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CHAPTER 1

INTRODUCTION

Current Australian physical activity recommendations suggest that adolescents should engage in at least 60 minutes of moderate to vigorous physical activity (MVPA) every day (Department of Ageing, 2004). In recent years, various studies have shown that a substantial proportion of adolescents are not meeting this recommendation. Findings from the 2009-10 Australian National Secondary Students’ Diet and Activity (NaSSDA) Survey indicate that the proportion of students meeting the recommendation was low, with only 15% of students engaging in at least 60 minutes of MVPA every day (Morley et al., 2012). However, what is more concerning is that this was even lower in certain demographic groups, especially females, with only 8% meeting the recommendation.

There are numerous benefits of participating in adequate levels of physical activity. A positive relationship has been shown between physical activity and cardiometabolic health, musculoskeletal health, mental health, prevention of unhealthy weight gain and cardiorespiratory fitness (Okely et al., 2012). Furthermore, there are suggestions that other health outcomes such as metabolic syndrome and behavioural conduct may show a positive relationship with participation in physical activity (Okely et al, 2012).

Lifestyle behaviours, such as physical activity participation, may be established early in life and parents, peers and schools predominantly shape the development of these behaviours among young people (Brett et al., 2004). Moreover, behaviours such as physical (in)activity ‘track’ from childhood into adulthood, meaning those who are currently not as active may continue in such behaviours as they get older (Uijtdewilligen et al., 2011). In considering these factors, it is important to intervene before adulthood and provide opportunities for young people to make healthy lifestyle behaviour changes. It seems appropriate that this ‘intervention’ takes place in one of the most influential environments for the young person, the school setting. It is the place where most adolescents spend their time and using this accessible environment is justified (Kriemler et al., 2011). However, much consideration is needed to the recruitment, design and implementation of such interventions so effective strategies can be found to increase physical activity in young people.
There have been many school-based interventions to promote physical activity among adolescent girls. These have targeted modifying the school environment (Robbins, Gretebeck, Kazanis, & Pender, 2006), curriculum components such as physical education classes (Young, Phillips, Yu, & Haythornthwaite, 2006; McKenzie et al., 2004), school sport (Dudley, Okely, Pearson, & Peat, 2010), community components (Webber et al., 2008) or a combination of these (Jamner, Spruljt-Metz, Bassin, & Cooper, 2004; Neumark-Sztainer, Story, Hannan, & Rex, 2003; Robinson et al., 2003; Pate et al., 2005).

Even though many interventions have showed encouraging results regarding the promotion of physical activity among adolescent girls, the following information can be synthesised. First, the delivery of the program by a key individual in the school community may be required to increase the effectiveness and sustainability of the program (Young et al., 2006). The use of existing teachers within the school environment, rather than someone hired to deliver the information may allow the program to be more effectively embedded into the school culture. Second, the use of theoretical frameworks when designing such interventions is important to help facilitate behaviour change (Robbins et al., 2006). Behaviour change is a complex process and therefore the integration of major theories is recommended (Prochaska, Redding, & Evers, 2002).

In an effort to promote physical activity in adolescent girls, previous interventions have focused on aspects such as goal-setting skills, physical activity knowledge, self-efficacy, attitudes, social independences, environmental factors, problem solving skills and behavioural skill development (van Sluijs, McMinn, & Griffin, 2008). Moreover, some interventions have targeted aspects such as motor skills, enjoyment of physical activity, perceived competence and behavioural skills, however these have not been included in the same intervention (Kriemler et al., 2011). These components are considered to be crucial when trying to promote physical activity behaviour change (Weiss, 2000; Bandura, 1986).

Furthermore, there appears to be a limited number of school-based interventions among adolescent girls to promote fundamental movement skills (Kriemler et al., 2011). Therefore this school-based study was designed to address these aspects not yet seen in previous interventions. That is, to design and implement a multi-component school-based intervention, focusing on fundamental motor skills, enjoyment of physical activity, perceived competence
and developing behavioural skills in female adolescents to promote physical activity participation and motor skill development.

1.1 Purpose of the Study

The aim of this study was to assess the feasibility, acceptability and potential efficacy of a secondary school-based motor skill development and physical activity program. The study comprised two sub-studies: A proof-of-concept or feasibility trial (POC Trial) and a pilot randomised controlled trial (Pilot RCT). In addition, the POC Trial (in 2006) was conducted to make recommendations for a Pilot RCT in 2008, in the same school environment. The Pilot RCT (The Sport4Fun Program) was designed to promote physical activity participation, improve fundamental movement skills, increase perceived physical competence and enjoyment of physical activity in the participants.

1.2 Research Questions and Hypotheses

The research questions and hypotheses below were relevant for the Pilot RCT study conducted in 2008. A Proof-of-Concept trial (POC trial) conducted in 2006 was guided by the same questions, however hypotheses were not included, as the primary aim of the POC trial was to provide feasibility and acceptability data and appropriate recommendations for the Pilot RCT.

1.2.1 Research Question One and Hypotheses

Is the program feasible, assessed by recruiting a sufficient number of participants, retaining these participants and collecting all measurements at baseline and follow-up?

It was deemed that the pilot RCT would be feasible if the following targets were met.

H1 – 30 girls could be recruited.

H2 – At least 80% of participants could be retained at six-month follow up.

H3 – 100% of baseline and follow-up data would be collectable and useable, except for objectively measured physical activity data (70% of baseline and follow-up data collected would be useable).
1.2.2 Research Question Two and Hypotheses

Is the program acceptable, determined by implementation of sessions, participant attendance, enjoyment of sessions, and acceptance of the program?

It was deemed that the pilot RCT would be acceptable if the following targets were met.

H4 - 100% of the planned school sport sessions, 80% of the planned after-school sessions and 100% of the morning theory sessions would be implemented.

H5 – An attendance rate of at least 90% amongst participants for the afternoon sport and morning theory sessions would be achieved and a minimum of 50% of participants would attend the after-school sessions.

H6 – A high level of enjoyment for each of the sessions would be reported by all participants. Specifically, scoring a mean greater than three on a five-point Likert scale.

1.2.3 Research Question Three and Hypotheses

Is the program potentially efficacious, determined by trends towards statistical significance for outcome variables such as fundamental movement skill proficiency, weight status, perceived physical competence, enjoyment and participation in physical activity?

At six-month follow-up, compared with participants allocated to the control group, it was hypothesised that participants in the intervention group would show:

H7 – A greater increase in fundamental movement skill proficiency (run, catch, overhand throw, two-handed strike and kick) and overall fundamental movement skill proficiency.

H8 – Less of a decline in time spent participating in moderate-to-vigorous physical activity; light physical activity and a greater decline in time spent in sedentary behaviour.
H9 – A greater increase in enjoyment of physical activity;

H10 – A greater increase in perceived physical competence;

H11 – A smaller increase in adiposity measures (body mass index and waist circumference.)

The Sport4Fun Program was a feasibility and pilot study, therefore was not adequately powered to detect statistically significant differences between groups. However, standardised effect sizes were reported to show effects and allow comparisons with other studies.

1.3 Overview of Methodologies used in the Study

The POC Trial was conducted in 2006 to assess the feasibility, acceptability and potential efficacy of a school-based program. The trial, conducted between May and June (School Term 2), used a single group pre-test/post-test design among Year 7 students (12 to 13 year olds). The POC Trial was conducted in the same school environment as the Pilot RCT with the methods of the POC Trial described in Chapter Three.

The Pilot RCT (The Sport4Fun Program) was a 20-week program, consisting of an intervention and control group, for Year 7, 8 and 9 girls. From the POC Trial, one area of recommendation was changing the targeted participants for the intervention as described in Chapter 5 (section 5.2.2.1). The Pilot RCT was conducted between April and September (School Terms 2 and 3). Methodological details are described in Chapter Five. Measurements were taken by trained assessors blinded to participants’ group allocation in order to minimise bias. Physical activity was measured objectively, which also reduced measurement bias. In addition, fundamental movement skills were videotaped and given to a trained blind assessor to code and score each participant’s performance.

1.4 Significance of the Study

Schools have always had an association with the promotion of healthy lifestyle behaviours but research has shown (Gortmaker et al., 1999a, Robinson, 1999) that well-designed and implemented programs can effectively promote behaviours such as physical activity
participation (Lee, Wechsler & Balling, 2006). Schools provide a ‘captive audience’ for an intervention program as students spend the majority of their daily waking time in this environment. There is also substantial evidence that school-based interventions can increase physical activity in young people and although this is important, it is equally important to ensure the sustainability of such school-based interventions (Kriemler et al., 2011).

With this in mind, The Sport4Fun Program focuses on aspects that have not yet been targeted in the one multi-component school-based intervention. Therefore, if shown to be efficacious, it may provide an approach that could be integrated into multi-component interventions to promote physical activity among young people and tested among other groups. Specifically, The Sport4Fun Program focuses on the following. First, the improvement of fundamental movement skills among high school students (middle school in the United States) through the use of fun, enjoyable and game-based activities. Systematic reviews (Kriemler et al., 2011; van Sluijs, et al., 2008) highlight this aspect has not been address in students of this age. Second, the program will use existing structures in the school environment such as school sport time and attempts to improve this. Thus, there is no need to find additional time or place extra requirements on teachers already within the school environment. Third, The Sport4Fun Program integrates theory and practical sessions linking content covered in all sessions, allowing participants to put these behaviours into practice with the encouragement and support from teachers within the school environment. In addition to this, peer helpers (students in Years 10, 11 and 12) were involved in the program to also act as role models and provide encouragement to the participants. Fourth, activities are designed to make connections between the school and home environment. Through the use of home challenges and communication with parents, participants will need to reflect on their behaviour in both environments. Finally, The Sport4Fun Program targets those students who are most in need; that is those with low-fitness levels. This makes the program different from physical education classes or regular school sport where such a ‘targeted approach’ is not used.

Sport4Fun is a school-based program targeted at young adolescent females. In addition to focusing on the aspects not yet targeted in school-based interventions, the program was also designed to address the gaps highlighted in recent systematic reviews (Kriemler et al., 2011; van Sluijs, et al., 2008) and attempt to provide further knowledge about multi-component school-based interventions. It is anticipated this study will provide further information in the following areas. First, the effectiveness of targeting components such as motor skills,
perceived competence, enjoyment of physical activity and behavioural skills in improving physical activity; second, the use of behaviour change theories such as Social Cognitive Theory in promoting physical activity; and third, provide further information about the implementation of a school-based program conducted by a teacher in the school environment, using existing school structures and routines.

1.5 Delimitations

The study was delimited in the following manner:

1. a) Participants for the POC Trial were adolescents from Year 7 (aged 12 to 13 years) from one Co-Educational Catholic Secondary School in the South-Western Suburbs of Sydney, New South Wales, Australia (school population approximately 1000 students);
   b) Participants for the Pilot RCT were adolescent females from Years 7-9 (aged 12 to 15 years) from one Co-Educational Catholic Secondary School in the South-Western Suburbs of Sydney, New South Wales, Australia (school population approximately 1000 students);

2. a) Participants were eligible for the POC Trial if they had the lowest scores for enjoyment of physical activity and perceived physical competence.
   b) Participants were eligible for the Pilot RCT if they had the lowest scores for cardiorespiratory fitness results (achievement of below level four in the Multistage Fitness Test). Participants scoring less than level four were classified as being in the lowest 30\textsuperscript{th} percentile for their age for cardiorespiratory fitness (Okely., 2010);

3. Physical activity was assessed by accelerometry over a school week (including weekend) at each measurement period;

4. Fundamental movement skill proficiency was assessed using five skills from “Get skilled, Get active” (NSW DET, 2000). These were the catch, overarm throw, kick and two-handed strike (object-control skills) and sprint run (locomotor skill).

5. Anthropometric measures of weight and height, (to calculate body mass index) and waist circumference were used;

6. Perceived physical competence was assessed using a modified version of Harter’s Perceived Competence Scale for Children (Harter, 1982).

7. Enjoyment of physical activity was assessed using a validated instrument among children and adolescents (Motl et al., 2001).
1.6 Limitations

All efforts were made to follow standardised research designs and consistent study protocols, however circumstances beyond the control of the Researcher may have influenced the results of the study. These included:

1. Actigraph accelerometers (Model 7164) were used to assess physical activity. While these have been shown to be valid and reliable, there are some limitations (see section 3.5.2). For example, the accelerometer may not record activity such as stair climbing and bicycling and must be removed for aquatic activities.

2. Parental written consent was required for involvement in the program and participants were allowed to decline participation in any of the tests or sessions of the program.

1.7 Definitions of Terms

The following definitions are provided to clearly define the terms in the context of this study.

- **Actual Physical Competence**: Actual physical competence or simply actual competence can be collectively termed fundamental movement skill proficiency. It is defined as the movement skill level of an individual (Gallahue, 1996, p.37).

- **Body Mass Index (BMI)**: Weight in kilograms divided by height in metres squared \((\text{weight}[\text{kg}] / \text{height}[\text{m}]^2)\).

- **Competence Motivation Theory (Harter 1978)**: This theory explains human behaviour through an individual’s desire to participate in activities which he or she can display competence. Harter views actual and perceived physical competence as being strong correlates to participation in physical activity (Ulrich, 1987).

- **Fundamental movement skills**: This is defined as “an organised series of basic movements involving a combination of movement patterns of two or more body segments” (Gallahue, 1996, p.37). Some examples include sprint run, catch, overarm throw, vertical jump, kick and two-hand strike (Ulrich, 2000, TGMD). Terms such as motor skills and actual physical competence have also been used throughout the thesis in reference to fundamental movement skills.

- **Homeroom time**: Allocated time in secondary school, where the roll is marked and notices are communicated to students. The length can vary from school to school, however relevant to this study it was 15-minutes and conducted before the first lesson of each school day.
• Light Physical Activity (LPA): “Light physical activity is defined as physical activity requiring between 1.0 and 2.9 METS. An example would be walking at a slow pace” (Australian Institute of Health and Welfare, 2003, p.18)

• Moderate PA (MPA): The World Health Organisation (2012) defines MPA as “requiring a moderate amount of effort and noticeably accelerates the heart rate. Moderate physical activity requires between 3.0 and 5.9 METS of energy expenditure and examples include brisk walking and dancing” (paragraph 3).

• Moderate to Vigorous Physical Activity (MVPA) – Physical activity requiring greater than three METs of energy expenditure (≥ 3 METS).

• Perceived physical competence: This is defined as “how children evaluate how adequate they are in sports, physical attractiveness and physical fitness” (Weiss, 2000, p.2)

• Personal Development, Health and Physical Education (PDHPE): This is one of the key learning areas of the NSW secondary school curriculum. It aims to develop students’ capacity to enhance personal health and wellbeing, enjoy an active lifestyle, maximize movement potential and advocate lifelong health and physical activity (NSW Board of Studies, 2001).

• Physical activity: Physical activity is “bodily movement that is produced by the contraction of skeletal muscle and that substantially increases energy expenditure” (U.S. Department of Health and Human Services, 1996, p.21). This definition makes ‘physical activity’ a broad term including not only organised and non-organised sport but activities such as walking, cycling and playground games (Booth et al., 2006).

• Social Cognitive Theory (Bandura 1986): The social cognitive model provides directives for the production of behaviour change and theorises that behaviour develops as a results of the reciprocal interplay between personal, behavioural and environmental factors.

• Sport Enjoyment: This is defined as a positive affective response to an activity that reflects feelings of pleasure, liking and fun. Enjoyment sources include positive social interactions, support and involvement from parents, coaches and peers (Weiss, 2000).

• Sport4Fun Program: The physical activity program directed at Year 7, 8 and 9 students in one secondary school.

• Sedentary Behaviour: Sedentary Behaviour Research Network (2012) defines Sedentary Behaviour as “any waking activity characterized by an energy expenditure ≤ 1.5 METs and a sitting or reclining posture. Common sedentary behaviours included
TV viewing, video game playing, computer use (collective termed “screen time”) driving automobiles and reading” (paragraph 1).

- School sport: Allocated time in secondary school, where students participate in various physical activities. For the purposes of this study, it was 90-minutes implemented between lunch and the end of the school day once a week.

- Total physical activity: Encompasses all participant physical activity (activity counts) recorded by an accelerometer, reported as a function of total monitoring time (counts/minute).

- Vigorous Physical Activity (VPA): The World Health Organisation (2012) defines VPA as “requiring a large amount of effort and causes rapid breathing and a substantial increase in heart rate. Vigorous physical activity requires greater than 5.9 METS of energy expenditure and examples include running, fast cycling and competitive sports and games” (paragraph 3).

- Waist circumference: Waist circumference is a marker for central body fat accumulation and a large waist circumference is linked to an increased risk of metabolic complications (McCarthy, Ellis & Cole, 2003). It is measured at the level of the mid point between the lower costal border and the iliac crest (Norton & Olds, 1996).

1.8 Overview of Thesis

This thesis provides details and findings of two trials (POC Trial and Pilot RCT) aimed at assessing the feasibility, acceptability and potential efficacy of a school-based physical activity program for adolescents. The initial study, POC trial, aimed at assessing the feasibility, acceptability and potential efficacy of the program to provide information and recommendations for the Pilot RCT, which was conducted in the same school environment.

This first chapter (Introduction) details the background to the research, outlines the purpose of the study and provides a brief overview of the methodologies used in the research. The chapter also outlines the significance of the study, as well as the delimitations and limitations of the research. Finally, specific terms of relevance to the research are defined.

Chapter Two (Literature Review) examines the prevalence, health benefits and relevant factors that influence adolescent physical activity behaviour. A detailed review of school-
based physical activity interventions is provided which is relevant to the rationale for the current study. Information on theoretical frameworks relevant to school-based physical activity programs is included. Social Cognitive Theory and Competence Motivation Theory are described and their relevance to the research study highlighted.

Chapter Three (Methods: Proof-of-Concept Trial) describes the methodology of the POC trial. This assessed the feasibility, acceptability and potential efficacy of a school-based physical activity program among Year 7 students. Details of the research setting, trial design, delivery, outcome measurements and instruments, data collection procedures, data management and analysis are provided.

Chapter Four (Results: Proof-of-Concept Trial) reports the findings of the POC trial. As the POC trial was a single group trial and was not designed to have sufficient statistical power, results of the POC trial relate to the study implementation, intervention process measures, process measures and statistical trends in primary and secondary outcomes.

Chapter Five (Methods: Pilot RCT) describes the methodology for the Pilot RCT, which was a multi-faceted secondary school-based physical activity program (Sport4fun) for girls in Years 7, 8 and 9. Even though it was similar to the POC trial, the Pilot RCT was designed and implemented to address several factors. These included to improve the methodological processes used in the POC Trial, to ensure a longer and more comprehensive program was delivered in a school setting and to involve a larger number of students and school staff in the program. Details of the research setting, design, delivery, outcomes measurements and instruments, data collection, data management and analysis are provided, following the guidelines in the Consolidated Standards of Reporting Trials (CONSORT) statement (Altman et al., 2001).

Chapter Six (Results: Pilot RCT) reports the findings of the Pilot RCT. Quantitative and process measurement data are presented following the CONSORT statement (Altman et al., 2001).

Chapter Seven (Discussion) summarises the key results of the study, compares these results with other similar studies and then provides possible explanations using current literature. Recommendations are also provided to inform future school-based physical activity
interventions. This information is set out following the format outlined in the CONSORT Statement (Moher et al., 2010).
CHAPTER 2

LITERATURE REVIEW

This chapter will examine the prevalence, health benefits and relevant factors that influence adolescent physical activity behaviour. The chapter will include a review of school-based physical activity interventions to provide evidence of approaches that promote an increase in physical activity among adolescents. School-based interventions can be defined as programs that are implemented in the school environment using existing school curriculum, staff and/or staff development and other infrastructures such as school sport or activity breaks. The final sections of the chapter will highlight key factors of school-based interventions and detail the important components of such interventions.

2.1 Health benefits of physical activity

There have been numerous papers reporting the health benefits of physical activity participation for young people, with the reported benefits being linked to the amount of time spent in physical activity and the intensity of the activity. In considering this, the above guidelines of 60-minutes of MVPA every day is very relevant to produce health benefits, however it is important to acknowledge that if children and youth are not participating in physical activity, all attempts should be made to progressively increase the physical activity to eventually achieve the guideline recommended (Strong et al., 2005).

2.1.1 Systematic reviews: Health benefits of physical activity

Health benefits have been recently reported in two systematic reviews; one by Okely and colleagues (2012) and another by Janssen and LeBlanc (2010). Okely and colleagues (2012) updated the evidence focusing on the relationship between physical activity and health outcome indicators, encompassing factors such as the risk and prevention of chronic disease and unhealthy weight gain/obesity in children and young people. A total of 127 articles were included in the review, providing an update on the evidence since 2010 examining the effect of physical activity on selected health outcomes in children (aged 5-12 years) and young people (aged 13-17 years). For inclusion in the systematic review, evidence needed to be from
an experimental or longitudinal study that used a valid and reliable measure of physical activity. Janssen and LeBlanc (2010) also reported associations between physical activity participation and areas of physical, mental and social health. A total of 86 articles were identified as eligible for review, with the review focusing on key indicators of different health outcomes hypothesised to be related to physical activity in school-aged children and youth. The reviews include findings for cardiometabolic health and metabolic syndrome, adiposity and unhealthy weight gain, skeletal health, muscular health, mental health (including depression as a measure of mental health), academic achievement and cognitive development, behavioural conduct, motor development and cardiorespiratory fitness.

Cardiometabolic health includes indicators such as plasma lipids, lipoprotein concentrations (such as HDL-cholesterol, triglycerides), hypertension and insulin resistance. Okely and colleagues (2012) included 23 studies examining the effect of physical activity on cardiometabolic health. Three of the experimental studies showed no effect of physical activity on cardiometabolic risk; however, of these only relatively low levels of physical activity were described during the intervention period. Of the studies that showed significant effects of physical activity on cardiometabolic risk, there was evidence of intra-study variability. However the evidence from the studies reporting significant changes in cardiometabolic risk indicate that for benefits to be observed, physical activity should be aerobic and of a moderate-to-vigorous intensity, be performed on a minimum of three days per week and be a minimum of 40-70 minutes on each occasion. Janssen and LeBlanc (2010) reported similar findings for cholesterol and blood lipids, with nine articles reviewed. The results were varied with five of the studies based on aerobic exercise indicating significant improvements in at least one lipid/lipoprotein variable and interventions based on resistance and/or circuit training reporting small or insignificant changes for all lipid/lipoprotein variables. In addition to this, 11 articles examined the effect of physical activity on high blood pressure (Janssen & LeBlanc, 2010), with intervention studies reporting significant reductions in systolic blood pressure in response to aerobic exercise training, with the effect sizes tending to be large. However, for these studies it must be noted that these were small sample sizes (between five and 88) and most of the studies focused on children and youth with high blood pressure or obesity.

Metabolic syndrome includes risk factors such as abdominal obesity, triglycerides, insulin, HDL-cholesterol and inflammatory markers (Janssen & LeBlanc, 2010). Janssen and LeBlanc
(2010) reported mixed results, suggesting more research is needed to detail the relationship between metabolic syndrome and physical activity or fitness. Of the 16 studies reviewed, four of the eight experimental studies that focused on aerobic exercise showed significant improvements in at least one of the variables examined. Only one of the four interventions that used resistance or circuit training observed any meaningful improvements. The cross-sectional studies, which used self-reported measures of physical activity, reported the relationship with metabolic syndrome to be either weak or modest in strength and all non-significant. The study using accelerometers and direct measures of cardiorespiratory fitness reported strong and significant relations with metabolic syndrome (Janssen & LeBlanc, 2010).

Adiposity and unhealthy weight gain include several measures of overweight, obesity and fat mass. These include body mass index, waist circumference, skin-folds and dual energy x-ray absorptiometry. Okely et al (2012) reviewed 61 studies, with slightly more than half showing a significant impact of physical activity on adiposity and weight gain. A variety of physical activities were shown to have a positive effect on measures of adiposity, including endurance activity, aerobic activity, sport-based games, sporting training, active play, plyometric exercise and resistance training. Similarly, Janssen and LeBlanc (2010) showed that approximately fifty percent of the interventions that were aerobic in nature observed significant changes in measures of body mass index (BMI), total fat and/or abdominal fat in response to training. Only three of the studies that employed other training modes (such as resistance training, circuit training, pilates and jumping exercise) observed significant improvements in measures of total fat, abdominal fat or BMI in response to training.

Skeletal health is determined using measures such as bone mineral density and bone mineral content and 13 studies were included which investigated the effect of physical activity (Okely et al., 2012). All of the studies included a measure of bone mineral content or bone mineral density, with 10 of the reviewed studies reporting significant benefits to skeletal health as a result of physical activity. These favourable benefits were also reported by Janssen and LeBlanc (2010), with results from reviewed studies indicating that as little as 10 minutes of moderate to high impact activities on 2-3 days of the week can have a modest effect on bone mineral density when combined with more general weight bearing aerobic activities that are also beneficial for cardiovascular risk factors and obesity prevention.
Muscular health includes outcomes encompassing muscle strength/power, muscle endurance and flexibility. A range of studies including 15 randomised controlled trials, eight non-randomised experimental studies, two quasi-experimental designs and one longitudinal study were reviewed relating to the effect on muscular health. Of these, significant changes were reported over three major outcomes; muscular strength, power and endurance; flexibility; and lean body mass, with only three showing no impact of physical activity on muscular health (Okely et al., 2012).

Mental health can be defined as the absence of mental illness (such as depression and anxiety) and the presence of wellbeing (Okely et al., 2012). Of the 18 studies examining the effect of physical activity on mental health, it was concluded that a minimum of moderate-to-vigorous physical activity is needed on 3 days per week for 60 minutes a day. Janssen and LeBlanc (2010) also found aerobic exercise to be beneficial for mental health with significant improvements in at least one depressive symptom measure in response to an 8-12 week exercise program observed. Different mental health outcomes such as depression, anxiety, self-esteem, physical self perceptions, anger and emotional problems and perceived stress were included in the review by Okely and Colleagues (2012), with varied results shown. A significant relationship was reported for seven studies, another six reporting some significant and non-significant results and four studies reporting no relationship between physical activity and mental health (Okely et al., 2012).

Academic achievement is normally associated and measured through school grades (Okely et al., 2012). Nine studies were reviewed focusing on academic and cognitive development and the effect of physical activity on children up to 13 years of age. Of these studies, all but one showed a positive association between increases in physical activity and academic achievement or cognitive development (Okely et al., 2012). In addition to this, Okely and Colleagues (2012) also reviewed behavioural conduct examined in four studies, with contrasting results shown. A small randomized controlled trial (RCT) showed that one daily activity break of 10 minutes duration was found to have an impact on directly observed on-task Behaviour, with the larger RCT showing no effect of up to thirty minutes of light and moderate-to-vigorous physical activity daily on work and social Behaviour in the classroom.

Motor development is associated with the development of motor skill proficiency, coordination and balance (Okely et al., 2012). Three of five studies reported a significant
increase in motor development as a result of a physical activity intervention while two did not. A wide range of physical activities were included in the studies such as impact-loading, weight-bearing activities (Serbescu et al., 2006), football (soccer training) (Faude et al., 2010), aerobic and endurance training (Walther et al., 2009) and strength training (Faigenbaum et al., 2002). It was shown that when strength training was conducted once or twice a week for 50-60 minutes there was no impact on motor development (Faigenbaum et al., 2002), however when this increased to three times per week, motor performance was increased (Lillegard, Brown, Wilson, Henderson & Lewis, 1997). Therefore, some evidence is shown for motor development, however further research is needed to make definite recommendations on the frequency, intensity, time and type of physical activity needed to improve motor development (Okely et al., 2012).

Finally, cardiorespiratory fitness or endurance is measured in a variety of ways, including measures of lung capacity (VO2 max), cardiac function (e.g. resting heart rate) and measures of physical fitness (such as the shuttle run) (Okely et al., 2012). Forty-five studies were reviewed (Okely et al., 2012), with 29 reporting a positive impact of physical activity on cardiorespiratory fitness. Studies that only included physical activity of a moderate intensity did not show any benefit, whilst studies that used vigorous intensity physical activity showed greater improvements in cardiorespiratory fitness than those that did not. Therefore, a combination of moderate and vigorous intensity physical activity was needed to bring about gains in cardiorespiratory fitness. A variety of physical activities were included in the studies that showed benefits to cardiorespiratory fitness, with most using aerobic activities, however sports training and active games as well as resistance and plyometric activities showed benefits to cardiorespiratory fitness (Okely et al., 2012).

2.1.2 Summary

The two recent systematic reviews of the literature highlight the positive relationship between physical activity and health. For some health outcomes notably cardiometabolic health, adiposity (including the prevention of unhealthy weight gain), skeletal health, mental health and cardiorespiratory fitness the evidence is consistent, while other health outcomes such as metabolic syndrome and behavioural conduct need to be investigated further.
The amount, intensity and type of physical activity has been debated, with the systematic reviews concluding for health benefits, children and young people should accumulate at least 60 minutes of moderate-to-vigorous intensity every day (Okely et al., 2012; Janssen and LeBlanc, 2010). There is also evidence to suggest that more activity, up to several hours per day, is associated with additional health benefits (Okely et al., 2012). Physical activities should include a variety of aerobic activities that stress the cardiovascular and respiratory systems, as these have the greatest health benefits. However, activities important for bone health such as high-impact, weight bearing activities are also important to produce health benefits (Okely et al., 2012; Janssen & LeBlanc, 2010).

2.2 Prevalence of physical activity in adolescents

Physical activity in adolescence has been the topic of much debate in the past decade. In previous years, the recommended level of physical activity for adolescents was 30 minutes per day of moderate-to-vigorous physical activity (Sallis & Patrick, 1994). Since then, Australia has developed its own recommendations for Physical Activity in relation to Children and Young People and these are consistent with those developed in the UK and the United States. Strong et al., (2005) recommends “school-age youth should participate in 60 minutes or more of moderate to vigorous physical activity (MVPA) that is developmentally appropriate, enjoyable and involves a variety of activities.” Australia’s Physical Activity Recommendations are that adolescents engage in at least 60 minutes of moderate-to-vigorous physical activity every day and spend no more than two hours per day using electronic media for entertainment (Department of Ageing, 2004).

The 2009-10 National Secondary Students’ Diet and Activity (NaSSDA) survey measured the proportion of students meeting the recommended 60 minutes of physical activity each day using the 60-minutes Moderate-to-Vigorous (MVPA) screening measure (Morley et al., 2012). The survey found that the proportion of students meeting the recommended physical activity guidelines was low, with only 15% of students engaging in at least 60 minutes of moderate-to-vigorous physical activity every day. The prevalence was even lower among females, with just 8% adhering to the physical activity guidelines (Morley et al., 2012).

The NSW Schools Physical Activity and Nutrition Survey 2010 (SPANS) (Hardy, King, Espinel, Cosgrove & Bauman, 2010) reported on the changes noted in physical activity
between 2004 and 2010 for students in Years 6, 8 and 10. It was found that between 2004 and 2010 there was a significant decline in students’ physical activity (with the exception of Year 10 girls), during both summer and winter school terms. The prevalence of meeting the guideline (that is 60 minutes per day of MVPA) for physical activity since 2004 had decreased at an annual rate of approximately 2.2% for boys and 1.2% for girls. In summer school terms from 2004 to 2010, the prevalence of 60 minutes or more per day of MVPA for Year 6 students decreased from 78.6% to 58.9%; for Year 8 students decreased from 75.5% to 63.7% and for Year 10 students decreased slightly from 62.3% to 62.2% (Hardy et al., 2010). In winter school terms, this decreased from 65.4% to 46.1% for Year 6 students; for Year 8 students decreased from 59.8% to 50.2% and for Year 10 students decreased from 56.7% to 55% (Hardy et al., 2010).

2.3 Health behaviour change in Adolescents

The previous sections have established the numerous health benefits to be gained from participating in physical activity (Okely et al., 2012; Janssen & LeBlanc 2010); and the proportion of adolescents meeting the recommended physical activity guidelines is low (Morley et al., 2012). Therefore, emphasis must be placed on how to promote physical activity in an innovative and attractive way for adolescents. It is crucial when designing interventions to improve or change health behaviour, that an understanding of relevant theories of behaviour change is incorporated. In addition to this, some interventions that combine several theories have larger effects (Glanz & Bishop, 2010). Two theoretical frameworks highly relevant to the behaviour change or promotion of physical activity in adolescents include Social Cognitive Theory (SCT) (Bandura, 1986) and Competence Motivation Theory (Harter, 1978).

2.3.1 Social Cognitive Theory

Social Cognitive Theory (Bandura, 1986) is one of the most widely used theoretical models of health behaviour (Glanz & Bishop, 2010). It is based on the notion that human behaviour is explained in terms of an interaction of Behavioural, personal and environmental factors. As shown in Figure 2.3, these factors operate interactively as determinants of each other and are referred to as ‘triadic reciprocality’ (Bandura, 1986, p.23).
When designing effective physical activity interventions, it is important to understand the interaction between these factors and how this influences participation in physical activity (Ramirez, Kulinna & Cothran, 2011). One of the key concepts of the SCT is that individuals learn through their own experiences and also through observing the actions of others and the results of those actions (Glanz & Bishop, 2010).

In addition to these interactions, Social Cognitive Theory suggests four processes are important in learning and adopting new behaviours: attention, retention, production and motivation (Bandura, 1986). These processes should be considered and embedded in key components of interventions and therefore, physical activity interventions must implement strategies to facilitate the Behaviour change.
2.3.2 Competence Motivation Theory

Competence Motivation Theory (Harter, 1978) was also of relevance to this study and has been applied to physical activity settings (Weiss, 2000). It is theorised that those who have high perceived physical competence will be more likely to enjoy activity and continue involvement in the activity than others who report lower levels of perceived physical competence (Weiss, 2000). Perceived competence refers to individuals’ judgments about their ability in a particular area such as physical activity (Weiss, 2000). In considering this theory suggested by Harter, the focus in physical activity and sport situations is generally on the improvement of actual skill levels. As a result of increasing a child’s skill level (actual competence), this raises the child’s desire to use those skills in physical activity and sport (perceived competence; Ulrich, 1987). Harter’s model of self-esteem (1987), which was adapted for the physical activity domain by Weiss and Ebbeck (1996) can be seen in Figure 2.2 (Weiss, 2000), with the relationship between actual competence, perceived competence and physical activity behavior shown.
Figure 2.2 – Harter’s (1987) mediational model of global self-worth customized for the physical domain.
The model represents the interaction between key factors such as perceived competence/adequacy, social support, self-esteem, enjoyment and physical activity behaviour. Research findings also indicate that interventions aimed at increasing physical activity behaviour need to enhance and develop perceptions of competence, social skills and enjoyment (Weiss, 2000). In addition to this, Weiss (2000) suggests three main factors for children and adolescents’ participation in physical activity. First, the development and demonstration of physical competence; second, relates to the gaining of social acceptance and support from friends, peer group and also encouragement by significant adults such as parents and teachers and third, the activities must be enjoyable as this allows positive experiences to be gained from physical activity participation.

A critical step towards promoting physical activity among adolescents is to have a thorough understanding of some of the key factors involved in behaviour change. By investigating relevant behaviour change theories, such as Social Cognitive Theory (Bandura, 1986) and Competence Motivation Theory (1978) and embedding these within interventions, opportunities to improve health behaviour can be created. The next section will review school-based physical activity interventions and provide information on the crucial components of successful interventions.

2.4 School-based Physical Activity Interventions

As time progresses and we move into the 21st century, the traditional physical activity participation in the school day or walking to and from school has become less prevalent (Pate et al., 2006). There have been suggestions that the school must become more of a ‘central element in a community system’ that ensures adolescents participate in enough physical activity (Pate et al., 2006). The promotion of physical activity in children and adolescents is considered a key focus for efforts to promote and improve health. There is concern over the number of adolescents not meeting the physical activity recommendations and therefore the development and evaluation of interventions to promote physical activity in young people is a priority.
2.4.1 Systematic Reviews

Several systematic reviews on school-based interventions have been conducted in recent years, which highlight key features of effective school-based interventions. Kriemler and colleagues (2011) conducted a review of reviews and systematic update on school-based interventions on physical activity and motor skills and fitness in children and adolescents. Van Sluijs et al (2007) reviewed published literature on the effectiveness of interventions to promote physical activity in children and adolescents, with a total of 57 studies identified. Metcalfe and colleagues (2012) reviewed 30 studies and conducted a meta-analysis with the primary aim to determine whether and to what extent physical activity interventions increased the overall activity of children. Specifically, when reviewing the literature, information pertaining to outcome measures, intervention types, settings in adolescents, target populations in adolescents and theoretical frameworks used must be highlighted.

Metcalfe et al (2012) report findings from a meta-analysis of studies that together examined 30 interventions aimed at promoting physical activity in children up to the age of 16 years. Studies were only included in the review if they measured whole day physical activity using accelerometry, with outcomes measures of total physical activity and moderate and/or vigorous physical activity. Results indicate that the pooled analysis across all studies showed a statistically significant effect in favour of the intervention group for both total physical activity and moderate or vigorous physical activity. Yet, this was interpreted by the authors as being small to negligible in meaningfulness of the effect on overall total physical activity and small on moderate to vigorous physical activity (Metcalfe, Henley & Wilkin, 2012).

However, there are limitations associated with this review. First, several of the interventions demonstrated statistically significant improvements in physical activity levels when reported individually (Hughes et al., 2008; Weintraub et al., 2008). It does not provide any substantial evidence on which aspects of interventions might be the most effective in encouraging children to engage in physical activity (Hamer & Fisher, 2012). This information is important as this can guide future design of interventions to increase physical activity in adolescents. Third, the age of the participants at baseline in the studies ranged from 1.8 to 13.1 years (mean age 9.8 years) and therefore this suggests the majority of the studies focused on children, with limited studies targeting adolescents. Further investigation is warranted to draw conclusions about the effects of physical activity interventions on adolescents.
Kriemler and colleagues (2011) conducted a summary of recent systematic reviews from Dobbins et al (2009), De Meester et al (2009), Salmon et al (2009) and van Sluijs et al (2007). Dobbins et al (2009) found a positive impact on duration of physical activity (mainly for physical activity during school time), but there was no evidence that school-based trials also affected out-of-school physical activity in a positive way. However, only three of the 26 studies reviewed were conducted with adolescents. De Meester et al (2009) reported that two-thirds of studies reviewed showed positive effects on short-term improvements in physical activity levels, with physical activity improvements occurring mostly during the school day, with no conclusive transfer to leisure time physical activity. All studies reviewed were implemented with adolescents. Salmon et al (2009) found that half of the 76 studies reviewed were effective at increasing physical activity. This review included studies involving children and adolescents, however this was not specified in the results. Van Sluijs et al (2007) reported that half of the 57 studies included in their review showed a significant effect of the interventions on physical activity, involving children and adolescent studies. Even though reinforced in the review by Kriemler et al (2011), van Sluijs et al (2007) provides important detail on the evidence of the effect of interventions on physical activity in adolescents. Specifically, 38 studies reported a positive intervention effect, with this including 13 studies in adolescents. The interventions conducted with adolescents were shown to be more effective than in children. Overall, these reviews generally show that school-based physical activity promotion was effective at increasing physical activity during school, however the transfer of this to out-of-school or overall physical activity was not as clear (Kriemler et al., 2011).

In addition to the above and as part of the systematic review, Kriemler and colleagues (2011) conducted a review of relevant trials published between 2007 and December 2010. Twenty trials were identified, with the majority (15) involving children. Outcome measures reported on included physical activity (in-school, out-of-school, or overall) (16 studies), aerobic fitness (11 studies) and motor skills (6 studies). Results indicated that all studies had a positive effect on one aspect of physical activity, with most studies showing a positive effect on overall physical activity; six of the eleven studies showed a significant effect on fitness and four of the six studies reported a significant effect on motor skills. Therefore, the updated literature review by Kriemler et al (2011) provides stronger evidence that school-based physical activity interventions are able to increase physical activity and possibly fitness in healthy children and adolescents.
The review by Kriemler and colleagues (2011) also highlighted the limited number of interventions focusing on improving motor skills in adolescents. Fundamental movement skill proficiency has been thought to be a vital element in promoting physical activity participation (Weiss, 2000) and therefore important to include in such interventions. Only six of the 20 studies included in the current review by Kriemler et al (2011) reported effects on motor skills, with not all of these studies targeted at adolescents. Similarly, van Sluijs et al (2007) reported of few interventions including the development of motor skills in adolescents. There have been several interventions focusing on motor skill development in primary school aged students (van Beurden, Zask, Barnett & Dietrick, 2003; Salmon, Ball, Hume, Booth & Crawford, 2008; McKenzie, Alcaraz, Sallis & Faucette, 1998), yet this is lacking in adolescents.

Van Sluijs et al (2007) also report on the types of interventions that have been shown to be effective in adolescents, with these including education only, environmental and multicomponent interventions. Seventeen studies involved education only interventions, including 4 large high quality randomized controlled trials in adolescents. Results indicated that no evidence of an effect was found, with only one reporting statistically significant positive results. The one study evaluating the effect of an environmental intervention produced inconclusive evidence of an effect. Moreover, 6 studies evaluated multicomponent interventions, with 3 randomised controlled trials showing significant positive results. This provides strong evidence of an effect of multicomponent interventions (van Sluijs et al., 2007).

Similarly, Kriemler and colleagues’ review (2011) reinforces the positive effect of multicomponent interventions. De Meester et al (2009) found that multicomponent programs, specifically those focusing on physical activity rather than multiple health behaviours, were more effective. Salmon et al (2009) reports that interventions only focusing on curriculum change were much less effective than multicomponent interventions in adolescents. Kriemler et al (2011) findings confirm recommendations of the value of multicomponent intervention strategies for physical activity promotion.

There are numerous settings that have been used to target adolescent physical activity behaviour. These include school-based, community-based, family based, primary care based and a combination of these settings. Van Sluijs et al (2007) reported on 20 studies that
evaluated school based interventions for adolescents, with 14 exclusively in the school setting and six involving the school and family or community involvement. From the 14 school based studies, one reported a statistically significant intervention effect, representing inconclusive evidence. Of the six multi-setting studies, two of the three large, high quality trials showed statistically significant results indicating strong evidence of an effect of school based interventions with family or community involvement. Moreover, Kriemler et al (2011) reinforced the effectiveness school-based interventions, however the involvement of family components was debatable, with the findings from some reviews (De Meester et al., 2009) inconclusive or not evident.

Some studies reviewed by van Sluijs et al (2007) and Kriemler (2011) investigated the effectiveness of target populations for physical activity interventions for example, targeting interventions based on sex, socioeconomic status or cultural background. Van Sluijs et al (2007) found inconclusive evidence for the use of interventions specifically aimed at girls or boys, and those from low socioeconomic groups, while this was not well documented in Kriemler et al (2011). However, as trends in differences in physical activity for boys and girls begin to emerge (Hardy et al., 2010), it may be important to investigate the use of target population in adolescents for physical activity interventions.

Kriemler et al (2011) and van Sluijs et al (2007) provided limited information on the use of theoretical frameworks in the reviewed studies. However, several studies have detailed the use of Social Cognitive Theory as the framework for the intervention development. New Moves (Neumark-Sztainer et al., 2003) addressed socioenvironmental, personal and behavioural factors, as well as the interaction between these factors in the intervention. Stanford GEMS (Robinson et al., 2003) included the interaction between personal, behavioural and environment factors in the intervention design and in addition to this included the four processes – attention, retention, production and motivation in the development of the intervention content and delivery.
2.4.2 Gaps in current school-based interventions

As can be seen from the systematic reviews, important information is provided about the design and implementation of interventions to increase physical activity in adolescents. This in turn highlights areas that need attention and must be given thorough consideration when designing interventions.

First, there are limited physical activity interventions that have embedded theoretical frameworks, such as Social Cognitive Theory and Competence Motivation Theory, in the intervention development and implementation. Relating to Social Cognitive Theory, few have focused on the four process of attention, retention, production and motivation in attempting to initiate and maintain behaviour change, with Stanford GEMS (Robinson et al., 2003), highlighting the importance of motivations such as challenges, fun activities and material rewards for participants. Moreover, Competence Motivation Theory has also received limited focus in physical activity interventions. Key aspects of fundamental movement skills, perceived competence and enjoyment have been included in some interventions separately (Neumark-Sztainer et al., 2003; Kriemler et al., 2011) however not in the same intervention.

Second, Kriemler et al (2011) and van Sluijs et al (2007) have reviewed a wide range of articles on the effect of physical activity interventions on children and adolescents. However, there appears to be more interventions conducted with children and therefore a need to target adolescents. In addition to this, Kriemler and colleagues (2011) highlight in their updated review that only one of the 20 studies was Australian based, hence emphasizing the need to design and implement and evaluate interventions for adolescents in this country.

Finally, the recent systematic reviews (Kriemler et al., 2011; van Sluijs et al., 2007) highlight the few interventions including the development of motor skills and therefore there is a need to address this. Hardy and colleagues (2010) indicated that the level of mastery for fundamental movement skills was low among students, with only 50-60% of Year 6 and older students being proficient at these skills. Furthermore, girls were significantly less proficient than boys at skills such as kicking, throwing, catching, running and vertical jump than girls (Hardy et al., 2010). Thus, this warrants targeting adolescent girls’ motor skills in future interventions.
2.4.3 Components for effective physical activity interventions

Through the current systematic reviews (Kriemler et al., 2011 and van Sluijs et al., 2007), components that need to be included in the design and implementation of physical activity interventions have been highlighted. These include the setting for the intervention, the types of interventions that have been shown to be most effective and the use of theoretical frameworks as a foundation for the intervention.

2.4.3.1 School-based interventions

There are numerous settings that have been used to target adolescent physical activity Behaviour. These include school-based settings, community-based settings, family-based settings, primary-care settings and a combination of settings. Schools are an important setting for the promotion of participation in physical activity and an active lifestyle. In the past 30 to 40 years, there has been a strong call for an increase in physical activity, due to the rapid raise in the prevalence of childhood overweight and obesity (Booth & Okely, 2005). Debate has centred over the setting that would be most appropriate and influential in doing this, ranging from community settings, the home environment and the school environment. However, it has been confirmed that the school setting is the most consistent and promising setting for promoting physical activity (Kriemler et al., 2011 and van Sluijs et al., 2007).

Schools provide numerous opportunities for students to participate in physical activity including curriculum-based physical education (PE) classes, inter-school competitions, school-based sport and sport gala days. In addition to this, schools provide opportunities for students to be physically active in non-structured breaks (recess and lunch) and before and after school (McKenzie, 2005). With the recent recommendations that school-age children accumulate 60 minutes or more of moderate to vigorous physical activity daily (that is enjoyable and developmentally appropriate), the provisions of these opportunities are vitally important (Department of Health and Ageing, 2004).

In addition to the systematic reviews, many studies also support the use of the school setting for physical activity interventions. Flynn and colleagues (2006) support the notion of using the school setting to positively impact factors such as body composition and fitness. Gortmaker et al (1999a) emphasises the importance of the school setting for interventions as they provide access to large populations of students. Pate and colleagues (2006) support the notion of
schools being an important setting for the promotion of physical activity. There has been a call for schools to ‘renew and expand their role’ in the provision and promotion of physical activity (Pate et al., 2006). Even though schools have always been the central role in the provision of physical activity to young people, this role is now viewed more important due to the increase in overweight and obesity amongst children and adolescents. Schools are potentially attractive settings for the promotion of physical activity and positive health behaviours due to the amount of time youth spend in this setting (with the exception of their homes) and are exposed to school curriculum and activities of relevance to positive health behaviours (Pate et al, 2006).

2.4.3.2 Multi-component interventions

Multi-component interventions in school settings have been shown to be the most effective types of interventions (Kriemler et al., 2011; van Sluijs et al., 2007). Kriemler et al (2011) indicated that in the summary of reviews that multicomponent interventions combining educational, curricular and environmental elements seem to be more effective instead of isolated education or curricular changes. However, there is a need for this to be examined further in adolescents.

The view concerning the involvement of a parental or a family component has been debated in numerous studies. Flynn and colleagues (2006) report that it is important to involve the family in interventions, while Gortmaker et al (1999b) has shown that it is not imperative to have a parental component in an effective school-based intervention. This has been supported by Kriemler and colleagues (2011), who found the involvement of family components in school-based interventions for adolescents debatable. It may be possible that the influence of family on health behaviours becomes less important as adolescents are trying to become autonomous, however it is important parents are kept informed and given suggested ways that they can support their child at home.

2.4.3.3 Theoretical Frameworks

For interventions to improve health behaviour, there is increasing evidence to suggest that those based on social and behavioural science theories are more effective than those without such frameworks (Glanz & Bishop, 2010). Even though this was not evident in the systematic reviews (Kriemler et al., 2011 and van Sluijs et al., 2007), studies using theoretical
frameworks such as Social Cognitive Theory in adolescents have produced encouraging results (Robinson et al., 2003; Neumark-Sztainer et al., 2003). Glanz and Bishop (2010) maintain that having a broad understanding of the key factors and models for understanding behaviour and behaviour change can provide a framework for well-informed programs.

2.5 Chapter Summary and Further Research

The low prevalence of physical activity in Australian adolescents indicates the need to take action to promote physical activity. In particular, the number of adolescents not meeting the recommended guidelines and the lower prevalence among girls is of concern. Numerous health benefits have been reported for participation in physical activity and therefore the implementation of intervention programs to promote physical activity would be beneficial.

The literature clearly highlights factors to be considered when designing and implementing physical activity interventions for adolescents. These include the use of theoretical frameworks as the foundation for the intervention to promote behaviour change, the implementation of such interventions in the school setting and using a multicomponent approach when designing the intervention. As detailed in following chapters, these factors were focused on in the current study in an attempt to promote physical activity participation in adolescents.

The following chapters will describe methodologies and results of the proof of concept trial and randomized controlled trial. The final chapter will summarise the main findings of the randomized controlled trial and make recommendations for future school-based research.
CHAPTER 3

METHODOLOGY

(Sport4Fun Proof-of-Concept Trial)

3.1 Introduction

This chapter describes the methodology of the Proof-of-Concept (POC) trial assessing the feasibility, acceptability and potential efficacy of a school-based physical activity program among Year 7 students. The POC trial was conducted between May and June 2006 (School Term 2) in one school setting. The University of Wollongong’s Human Research Ethics Committee (HE05/206) approved the POC trial (see Appendix 1A).

3.2 Research Setting

The setting was a Catholic Co-Educational High School in Sydney, New South Wales. The school-based physical activity program was developed and implemented by a PDHPE teacher within the school (Coordinating Teacher), who was also the Researcher for the program.

Many school-based interventions use a model where the school personnel are trained by research staff to deliver interventions in the school setting (Caballero et al., 2003; Luepker et al., 1996; Lytle et al., 2004; Pate et al., 2005). This approach was not appropriate as the implementing teacher designed the program and had established a commitment to the intervention goals. Even though teacher-delivered approaches may be compromised by school policies and requirements or other factors within the school setting, it has been proven to be an effective model for maximising acceptability and fidelity of interventions (Young et al., 2008).
3.3 Proof-of-Concept (POC) Trial Design

The trial used a single group pre-test/post-test design examining the program’s feasibility, acceptability and potential efficacy. Dependent variables included body mass index (BMI), waist circumference, fundamental movement skills, objectively measured physical activity, perceived physical competence and enjoyment of physical activity, with the Sport4Fun program the independent variable. All eligible participants were measured at baseline and follow-up (16-week period) and process measurements were collected throughout the POC trial.

3.3.1 Aim

The aims of the POC trial were to: 1) determine the feasibility of implementing a school-based physical activity program, relating to aspects of recruitment, attendance rates and participation; 2) assess the acceptability of such a program among students and parents; 3) evaluate the short-term impact (potential efficacy) of the school-based program; and 4) make recommendations for a Pilot RCT in 2008.

3.3.2 Screening

The entire Year 7 population (12-13 years old), including boys and girls, were involved in the POC trial’s screening procedures. This age group was targeted for two reasons. First, the earlier in secondary school that changes can be made to lifestyle behaviours such as physical activity, the greater the chance these behaviours may carry over into adulthood (Telama et al., 2005). Second, Year 7 is the first year of high school, hence it is a time of change and the introduction of new activities for students, so it seemed an appropriate time to introduce such a program. This time was also considered crucial before social changes made it more challenging to introduce a new program.

Year 7 students were screened whilst still in Year 6 (last year of primary school) in School Term 4 (October) 2005 at the Year 7 orientation day, using an enjoyment of physical activity and perceived physical competence questionnaire. This was considered an ideal time to conduct these questionnaires, as all students could complete the questionnaires simultaneously.
These questionnaires were administered by supervising teachers when entry tests for numeracy and literacy were completed. For those students who had not returned their consent form, another unrelated activity was undertaken. These remaining students were screened in Term 1, Weeks 1 and 2 (February) 2006 during school time. A total of 136 students completed the screening process.

3.3.2.1 POC Trial Inclusion and Exclusion Criteria

Students were ranked on their perceived physical competence and enjoyment of physical activity results. However, the students who completed the screening process scored very high on the enjoyment of physical activity questionnaire. This is referred to as a ceiling effect with little variation in scores as such and only the perceived physical competence questionnaire was used. Students’ scores from the perceived physical competence questionnaire were summed and a total out of 72 (maximum score) was calculated. Students with the lowest perceived physical competence scores (deemed 50 and below), were invited to participate in the program.

3.3.3 Recruitment and Consent

An information package was sent out to the eligible students (n=51), via their homeroom or roll call classes, when students were in Year 7, 2006 (see Appendix 2 and 3). Students were required to return the signed consent forms to the Coordinating Teacher (Researcher) (see Appendix 4). In order to achieve a high response rate, parents were contacted via phone and notices placed in the weekly newsletter to enhance the follow-up of consent forms.

3.3.4 Sample Size

It was anticipated that enough students would be recruited to have students in an intervention group and control group. However, due limited number of students returning consent forms, there were only enough students for an intervention group (single group trial).
3.3.4 Timeline for POC trial

All baseline and follow up measurements were conducted and all theory and practical sessions were delivered in the school setting. The POC trial was conducted in Term 2 (May to June) 2006, every Tuesday afternoon in allocated school sport time and during three morning homeroom times (Monday, Thursday and Friday) each week, for 8 weeks. Baseline testing was completed in week 7 of Term 1 2006 to allow for participants to be included who did not return their consent forms on time. Follow-up measurements were collected on the last Tuesday afternoon session in Term 2, 2006. The timeline for the program is shown in Figure 3.1.

<table>
<thead>
<tr>
<th>Term and Week</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term 4: 2005</td>
<td>Screening using questionnaires</td>
</tr>
<tr>
<td>Term 1: Weeks 1-2, 2006</td>
<td>Selection of participants</td>
</tr>
<tr>
<td>Term 1: Weeks 4-5, 2006</td>
<td>Recruitment and consent</td>
</tr>
<tr>
<td>Term 1: Week 7, 2006</td>
<td>Baseline measurements</td>
</tr>
<tr>
<td>Term 2: Weeks 1-8, 2006</td>
<td>Intervention</td>
</tr>
<tr>
<td>Term 2: Week 9, 2006</td>
<td>Follow-up measurements</td>
</tr>
</tbody>
</table>

Figure 3.1 - Timeline for the POC trial.

3.4 Proof-of-Concept Trial Delivery

Harter’s Competence Motivation Theory (CMT) (1978), adapted for the physical activity domain (Weiss & Ebbeck, 1996) was the theoretical framework used in the design of the POC trial. Actual competence (or fundamental movement skill proficiency) and perceived physical competence are viewed as correlates to participation in physical activity (Ulrich, 1987). It is theorised that those who have high perceived physical competence will be more likely than others to participate in sport and physical activity. Harter views actual competence as being a correlate to participation in physical activity, but its effect is not as strong as perceived competence (Ulrich, 1987). Perceived physical competence has a more direct relationship with participation in physical activity. For example, an individual with a high skill level could
incorrectly perceive their ability as low and choose not to participate. Similarly, poorly skilled individuals may have high perceived competence and therefore be motivated to participate (Ulrich, 1987).

In considering this theory, the focus in physical activity and sport settings is generally on the improvement of actual skill levels. As a result of increasing a child’s skill level (actual competence), this raises the child’s desires to use those skills in physical activity and sport (perceived competence; Ulrich, 1987).

Fundamental movement skills are considered the building blocks to physical activity and it is thought that those who lack these skills are likely to experience frustration, thus reducing their enjoyment of sports and other activities (Booth et al., 1999). This is supported by CMT, which states that individuals are motivated to participate in particular domains, such as in the physical domain, in which their competence can be demonstrated.

To apply this to the “Sport4Fun” program, it was imperative that the program involved (i) activities that increased perceived and actual competence, whilst being fun and enjoyable at the same time; and (ii) activities that were developmentally appropriate to the participants’ skill and ability level, whilst being challenging. Feedback, reinforcement, rewards and support from teachers, peers and parents were also deemed important aspects to feature in the POC trial.

The POC trial was conducted in Term 2 (May and June) 2006 and involved weekly physical activity sessions (Tuesday) and 15-minute theory sessions, three times a week (Monday, Thursday and Friday). The Researcher was the Sport Coordinator and PDHPE teacher at the school who conducted all the sessions. Students not involved in the POC trial participated in regular homeroom and sport activities on these days.

### 3.4.1 Practical Component

The practical component was conducted during Tuesday afternoon school sport time. There were 6 sessions conducted (one per week), with each session lasting approximately 90 minutes. Due to the position of the teacher in the school (as Sports Coordinator), one week had to be cancelled due to the researcher having to supervise another group of students.
because of a high number of staff absences on the day (Week 5). Another week was also cancelled due to wet weather (Week 6). Both weeks were not re-scheduled due to limited time in the school term. Each session had a specific fundamental movement skill focus (for example, the kick) and this skill was developed using partner and small group skill work as well as modified games. The sessions aimed to develop the specific fundamental movement skills as well as increasing the participant’s perceived physical competence and enjoyment of physical activity. Activities included individual and partner challenges, ball tag (modified game, using passing and catching to tag the closest opposition), grip ball, modified T-ball and Kick-it rounders (See Table 3.1). For selected sessions, students were asked to choose the activities for their participation and this assisted in providing motivation and enthusiasm for the sessions. The POC Trial’s practical component sessions (n=6) are detailed in Table 3.1.

Table 3.1
Outline of the POC Trial’s Practical Sessions

<table>
<thead>
<tr>
<th>Focus/Week</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1 – Overarm and underhand throw</td>
<td>• Red rover</td>
</tr>
<tr>
<td></td>
<td>• Partner work and challenges using the underhand and overarm throw</td>
</tr>
<tr>
<td></td>
<td>• Grip ball partner work and game</td>
</tr>
<tr>
<td></td>
<td>• Ball Tag</td>
</tr>
<tr>
<td>Week 2 – Two-handed strike</td>
<td>• Cones up and cones down</td>
</tr>
<tr>
<td></td>
<td>• Group challenges for batting and fielding</td>
</tr>
<tr>
<td></td>
<td>• Modified game of T-ball</td>
</tr>
<tr>
<td>Week 3 – Catch</td>
<td>• Ball Tag</td>
</tr>
<tr>
<td></td>
<td>• Partner challenges using tennis balls, agility balls and frisbees</td>
</tr>
<tr>
<td></td>
<td>• Ball Tag with progressions</td>
</tr>
<tr>
<td>Week 4</td>
<td>Cancelled due to limited teachers for school sport</td>
</tr>
<tr>
<td>Week 5</td>
<td>Cancelled due to wet weather</td>
</tr>
<tr>
<td>Week 6 – Kick</td>
<td>• Individual dribbling activities.</td>
</tr>
<tr>
<td></td>
<td>• Partner challenges using kicking.</td>
</tr>
<tr>
<td></td>
<td>• Team relays</td>
</tr>
<tr>
<td></td>
<td>• Kick-it rounders</td>
</tr>
</tbody>
</table>
Week 7 – Skills
Circuit
  • Ball Tag
  • Partner challenges using vortexes
  • Partner challenges using striking
  • Partner challenges using kicking.
  • Kick-it rounders

Week 8 – Revising Skills
  • Ball Tag
  • Modified T-ball
  • Group challenges – kicking for distance.

3.4.2 Theoretical Component

The theoretical component was conducted on Monday, Thursday and Friday mornings, for 15 minutes in scheduled homeroom or roll call time. Content focused on two central components – promoting students’ physical activity participation and specific behaviour modification strategies. Participants completed a range of activities including individual reflection and goal setting activities, question and answer activities, group work including discussion and responding to scenarios and challenge-based activities.

3.4.2.1 Physical Activity

The content for the physical activity component of the theory sessions required students to identify their current level of physical activity and ways to improve this. Participants engaged in activities including determining how much physical activity they completed in the previous holidays, identifying activities they enjoyed participating in, brainstorming ways to become more physically active and benefits for becoming more physically active. An important aspect of this section of the theory component was for students to identify barriers to physical activity. Using group discussion and self-reflection activities, participants were encouraged to devise strategies to overcome these barriers to physical activity participation. Through the process, participants identified places and people who could help them and provide extrinsic motivation.
3.4.2.2 Behaviour Modification

Behaviour modification is of high importance when focusing on promoting behaviours such as physical activity. Skills such as self-management, goal setting and decision-making need to be developed to assist in this process and were incorporated into the theory lessons. Activities such as goal setting challenges (using the SMART principle – specific, measurable, achievable, realistic and targeted) (Locke & Latham, 2002), time management, reflection and decision-making scenarios were used. It was important to ensure scenarios and examples given were relevant and applicable to the students and time was provided to reflect on the changes needed. An outline of the theory sessions is shown in Table 3.2.

Table 3.2
Outline of the POC Trial’s Theory Sessions

<table>
<thead>
<tr>
<th>Week</th>
<th>Focus</th>
<th>Lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Introduction</td>
<td>1) In my last holidays….</td>
</tr>
<tr>
<td></td>
<td>“How active are you?”</td>
<td>2) In my free time, what do I enjoy doing?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) How to become more physically active</td>
</tr>
<tr>
<td>Week 2</td>
<td>Goal Setting, time management and rewards</td>
<td>1) Goal setting, SMART principles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Time Management – “A typical afternoon”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) So what’s in it for me?</td>
</tr>
<tr>
<td>Week 3</td>
<td>Motivation and role models</td>
<td>1) Goals and evaluation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Time management revisited</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) Decision making options</td>
</tr>
<tr>
<td>Week 4</td>
<td>Barriers</td>
<td>1) What stops us from participating in physical activity?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Overcoming barriers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) Who can help you do this?</td>
</tr>
<tr>
<td>Week 5</td>
<td>People and places to help us become more</td>
<td>1) Facilities in the local area</td>
</tr>
<tr>
<td></td>
<td>physically active</td>
<td>2) What facilities can I used?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) What have I learnt so far? A lifestyle change.</td>
</tr>
<tr>
<td>Week 6</td>
<td>A Lifestyle change</td>
<td>1) Developing and implementing lifestyle change</td>
</tr>
</tbody>
</table>
2) Developing and implementing lifestyle change
3) Physical Activity

Week 7
Am I on Track? (Making decisions and evaluation)
1) Am I on track?
2) Decision making
3) Effect of our decisions

Week 8
Evaluation of behaviour
1) Questionnaire – Behaviour change
2) Evaluation of practical component
3) Conclusion – goal setting and physical activity

* In lesson 2 for all weeks, reflection on the practical session completed.

### 3.5 Proof-of-Concept Trial Outcome Measurements

All outcome measurements were taken at baseline and follow-up. The baseline measurements were taken in week 7 of Term 1 2006, with follow up measurements collected on the last Tuesday afternoon session in Term 2, 2006, by trained assessors. The primary outcomes were fundamental movement skills and physical activity, and the secondary outcomes were waist circumference and BMI, perceived physical competence and enjoyment of physical activity.

### 3.5.1 Fundamental Movement Skills

Fundamental movement skill proficiency (FMSP) was measured using “Get skilled, Get active checklist” (NSW DET, 2000) (see Appendix 5). A total of 12 skills are included in the instrument, with five skills these being assessed in this study. Four of these were object-control skills – catch, overarm throw, kick and two-handed strike and one was a locomotor skill – sprint run. Students performed each skill three times and were videotaped for each attempt, stating their name before performing the skill.

A trained assessor, using process-oriented checklists with five to seven components for each skill, coded the each student’s performance after these skills were completed at pre and post test. For each of the three attempts, each component needed to be demonstrated by the student for them to be judged as possessing that component. The only exception to this was the run, where the component needed to be performed consistently throughout to be awarded as competent. In addition to this, special consideration was noted when assessing the catch as the
ball needed to thrown to the side, right and left of the participant. The skill components for each skill were summed to give a total score for that skill and an overall fundamental movement skill proficiency score.

“Get skilled, Get active” is primarily aimed as a Kindergarten to Year 6 resource, with recommendations for use in the early secondary years (Okely & Booth, 2004). It has also been used with similar age students in previous studies. Booth and colleagues (2005) used the “Get skilled, Get active” resources when assessing fundamental movement skills of students in Year 2, 4, 6, 8 and 10, as well as the NSW Schools Physical Activity and Nutrition Survey (SPANS) 2004 and 2010 (Booth et al., 2005; Hardy et al., 2010).

Validity and reliability of the Get Skilled: Get Active instrument has been established through the examination of the instrument’s content validity, criterion validity, construct validity, convergent validity and instructional sensitivity.

3.5.1.1 Construct Validity

The ability to detect age-related differences in proficiency of the four skills (an indicator of construct validity) was examined in approximately 5,500 children and youth in Years 2, 4, 6, 8 and 10 as part of the Schools Physical Activity and Nutrition Survey (SPANS) (2004). The prevalence of advanced skills (defined as mastery [proficiency in all components of a skill] or near mastery [proficiency in all but one component of a skill]) was found to increase with chronological age for the run, kick, throw, and catch (strike was not assessed, see Table 3.3).

Table 3.3
The proportion of boys and girls in Years 2, 4, 6, 8, and 10 (%) exhibiting advanced skills in SPANS (2004).

<table>
<thead>
<tr>
<th></th>
<th>Year 2</th>
<th>Year 4</th>
<th>Year 6</th>
<th>Year 8</th>
<th>Year 10</th>
<th>Year 2</th>
<th>Year 4</th>
<th>Year 6</th>
<th>Year 8</th>
<th>Year 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run</td>
<td>26.2</td>
<td>39.0</td>
<td>43.7</td>
<td>55.3</td>
<td>63.1</td>
<td>21.0</td>
<td>28.2</td>
<td>35.9</td>
<td>47.7</td>
<td>49.1</td>
</tr>
<tr>
<td>Kick</td>
<td>20.0</td>
<td>37.8</td>
<td>60.4</td>
<td>73.0</td>
<td>78.8</td>
<td>2.7</td>
<td>6.3</td>
<td>14.0</td>
<td>17.2</td>
<td>20.0</td>
</tr>
<tr>
<td>Throw</td>
<td>24.7</td>
<td>48.8</td>
<td>65.2</td>
<td>76.4</td>
<td>79.3</td>
<td>6.5</td>
<td>11.5</td>
<td>26.1</td>
<td>32.0</td>
<td>33.9</td>
</tr>
<tr>
<td>Catch</td>
<td>28.7</td>
<td>57.4</td>
<td>73.2</td>
<td>80.3</td>
<td>85.9</td>
<td>14.2</td>
<td>39.2</td>
<td>55.8</td>
<td>62.2</td>
<td>72.3</td>
</tr>
</tbody>
</table>
3.5.1.2 Convergent validity

The convergent validity of the five skills was examined using data from children and their parents in the Gold Medal Fitness Study (Okely, Booth, Wright, Hearne & Konza, 2003). Student scores for each skill were compared with parents’ perceptions of their child’s proficiency for each skill. Pearson correlations between the two scores are reported in Table 3.4. All correlations were statistically significant.

Table 3.4
Convergent validity of the strike, run, catch, throw and kick

<table>
<thead>
<tr>
<th>Skill</th>
<th>n</th>
<th>r</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strike (Grade 2)</td>
<td>418</td>
<td>0.36</td>
<td>0.0001</td>
</tr>
<tr>
<td>Run (Grade 6)</td>
<td>537</td>
<td>0.36</td>
<td>0.0001</td>
</tr>
<tr>
<td>Throw (Grade 6)</td>
<td>490</td>
<td>0.28</td>
<td>0.0001</td>
</tr>
<tr>
<td>Catch (Grade 6)</td>
<td>534</td>
<td>0.23</td>
<td>0.0001</td>
</tr>
<tr>
<td>Strike (Grade 6)</td>
<td>518</td>
<td>0.26</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

3.5.1.3 Criterion Validity

To examine the criterion validity of the five skills, children’s scores were compared with the Test of Gross Motor Development-2 (TGMD-2) (Ulrich, 2000). The TGMD-2 has established validity and reliability (Ulrich, 2000) and as such, is a suitable test to examine the criterion validity of these skills. A group of 13 overweight and obese children were filmed performing the skills from each checklist. One trained person assessed the skills using both the Get skilled: Get active checklist and the TGMD-2. Correlations were then calculated between individual skill scores from the two checklists. The correlations between the scores for the five skills are presented in Table 3.5. All were statistically significant except the catch.
Table 3.5
Association between the Test of Gross Motor Development-2 (Ulrich, 2000) and the five relevant skills from the Get skilled: Get active checklist (NSW DET, 2000).

<table>
<thead>
<tr>
<th>Run</th>
<th>Strike</th>
<th>Catch</th>
<th>Kick</th>
<th>Throw</th>
</tr>
</thead>
<tbody>
<tr>
<td>r=0.86*</td>
<td>r=0.66*</td>
<td>r=0.38</td>
<td>r=0.56*</td>
<td>r=0.67*</td>
</tr>
</tbody>
</table>

*p <0.05

3.5.1.4 Test-retest

Test-retest reliability data were collected two weeks after initial data collection for FMS proficiency assessments from SPANS (Okely & Booth, 2004). A subset of participants in Year 6 (n=94 from four schools), Year 8 (n=33 from two schools) and from Year 10 (n=47 from four schools) from the original sample of 5500 children and adolescents were assessed. For a student's data to be included in the analyses, they needed to have two scores (one for the test and one for the retest). In some cases, all seven skills were not completed during the retest for all students and schools. Table 3.6 reports the Spearman Correlation coefficient for the number of components mastered at each time point. The correlations were statistically significant for all four skills assessed (Strike was not assessed as part of this study).

Table 3.6
Test-retest reliability of the run, catch, kick, and throw.

<table>
<thead>
<tr>
<th>FMS</th>
<th>N</th>
<th>(r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run</td>
<td>149</td>
<td>r=0.26*</td>
</tr>
<tr>
<td>Catch</td>
<td>141</td>
<td>r=0.34*</td>
</tr>
<tr>
<td>Kick</td>
<td>141</td>
<td>r=0.57*</td>
</tr>
<tr>
<td>Throw</td>
<td>150</td>
<td>r=0.50*</td>
</tr>
</tbody>
</table>

*p<0.01
3.5.2 Objectively Measured Physical Activity

Physical activity was measured using MTI Actigraphs accelerometers (Manufacturing Technologies Inc., Fort Walton Beach, Florida, USA, Model 7164). This is a popular uniaxial accelerometer designed to measure and record accelerometers in the vertical plane (Esliger, Copeland, Barnes, & Tremblay, 2005). The accelerometer is small and lightweight (45g), with dimensions of 5.1 x 3.8 x 1.5cm (Trost et al., 1998). It is worn over the right hip, using an adjustable elastic belt and is unobtrusive, which allows it to be worn underneath clothing and does not limit participation in activities such as dance lessons or sports (Trost, 2001). Studies comparing the different sites for placement of the accelerometer indicate that accelerometers are best placed on the hip or the lower back (Trost, McIver, & Pate, 2005). These considerations and being a relatively cost-effective device, makes it highly suitable for use with children and adolescents.

The accelerometer is designed to detect acceleration ranging in magnitude from 0.05 to 2.00 G and frequency response from 0.25 to 2.50 Hz (Trost et al., 1998). This allows for the detection of normal human movement, with the filtered acceleration signal being digitised and the magnitude summed over a user-specified epoch interval (Trost et al., 1998). At the end of each epoch, the summed value is stored in memory and the integrator reset (Trost et al., 1998). Due to the ease of converting activity counts into minutes of activity, the majority of studies using accelerometers to estimate physical activity intensity or energy expenditure have used cut points based on one-minute epochs (Trost et al., 2005). For the Proof-of-Concept Trial, a one-minute epoch was used.

Various studies have reported on the validity and reliability of the use of accelerometers for objectively measured physical activity in children and adolescents. Trost (2001) proposes that objective activity measures, such as accelerometers are being used with “increasing regularity” as many children and adolescents have difficulty accurately recalling their past physical activity behaviour (p.32). Trost and colleagues (1998) evaluated the validity of CSA activity monitors as a measure of children’s physical activity using energy expenditure as a criterion measure. Thirty participants, aged 10 to 14 years, performed walking and running on a treadmill and it was concluded that the CSA monitor is a valid and reliable tool for these activities for this age group (Trost et al., 1998). Puyau and colleague (2002) also conducted a study to validate accelerometer-based activity monitors against energy expenditure in children.
and also to establish sedentary, light, moderate and vigorous threshold counts. Twenty-six children aged 6 to 16 years performed structured activities including aerobic warm-ups, Tae Bo, treadmill walking and running and games, with accelerometers shown to be valid, useful devices for the assessment of physical activity in children.

The participants in this study were requested to wear their accelerometer during all waking hours and only take them off for sleeping and during activities in which the accelerometer would get wet (for example swimming, bathing or showering). Participants also kept activity monitoring log sheets indicating when they took the accelerometer off and the reason for doing so. In addition to this, accelerometer may be insensitive to forms of physical activity such as stair climbing and bicycling (Trost, 2001). Therefore, activity monitoring log sheets were used in an attempt to overcome the above limitation, and also used as a strategy to minimise noncompliance (Trost, 2001).

Participants were required to wear the accelerometers for seven consecutive days. The number of monitoring days needed to achieve a reliability of 0.80 ranges from 4 to 9 days and therefore for adolescents a 7-day monitoring period is recommended (Trost et al., 2005). Participant accelerometer data was included for those who had worn the monitor for more than 600mins (10h) and for a minimum of four days, with one day being a weekend day (Trost, Pater, Freedson, Sallis, & Taylor, 2000). To be consistent with previous research recommendations, it was important that monitoring was performed either continuously or intermittently over an entire day and that both weekdays and weekends were included (Trost et al., 2000). The data were then downloaded to a computer and reported as counts per minute (CPM).

### 3.5.3 Anthropometric Measures

Collection procedures that were suitable and sensitive to the school environment were used to ensure confidentiality of measurements. Trained assessors collected and recorded each measure and these assessors had previous experience in data collection for participants of a similar age. Weight and height, subsequent BMI and waist circumference are viewed as accurate anthropometric measures when taken by trained assessors (Lobstein, Baur & Uauy, 2004).
Consideration was given to use the measures that could be taken with the participant in light clothing. Any heavy jumpers or sports jackets were removed, as well as the shoes participants were wearing. In addition to this, consideration was needed to use measures they were simple, offer good reliability and validity and use low-cost equipment. Waist circumference, height and weight and BMI have been suggested to fulfil these requirements (Lobstein, Baur & Uauy, 2004).

The anthropometric measures were included as secondary outcomes for the study to examine the impact the intervention had on these measures. The procedures used as well as validity and reliability are reported in the following sections for waist circumference, height, weight and BMI.

Waist Circumference

The National Health and Medical Research Council (2003) suggests that ‘waist circumference appears to be the best clinical determinant of truncal obesity” (p.15) and that waist circumference measures in childhood track into adulthood (Goran, 1998). However, the accuracy of anthropometric measurements depends on the skill of the measurer and the accuracy of the measuring equipment (NHMRC, 2003). Two trained assessors were used to collect the waist circumference measurements. One assessor positioned the measuring tape around the participant, then reading the measurement to the other assessor, who checked this and entered on the recording sheet. All assessors were trained using the Advancement of Kinanthropometry procedures (Eston & Reilly, 2001).

Non-extensible steel tapes were used to assess waist circumference which was measured to the nearest millimetre. This was measured at the level of the mid point between the lower costal border and the iliac crest (Norton & Olds, 1996). Participants were asked to stand on a chair, facing away from the assessor, to ensure their waist was at the assessor’s eye level. Heavy clothing was removed and the measurement taken over the participant’s sports shirt. Same-sex assessors were used to measure and record the readings, with two measures being taken. The final value was the average of these two measures. If there was a difference of more than 10%, a third measurement was taken to determine which value was more correct.
**Height**

Height was measured using a portable stadiometer (PE87, Mentone Education Centre, Victoria) and the stretch stature method, which is the recommended procedure for this measurement (NHMRC, 2003; Booth et al., 2005). Measurements were recorded in centimetres, to the nearest millimetre. Participants were asked to remove their shoes and stand tall against the stadiometer, with heels on the ground. After inhaling deeply, the first assessor gently stretched the participant to their maximum height, whilst maintaining the body position. The second same-sex assessor recorded the measurement. Two measures were taken, with the final value being the average of the two. If there was a difference of more than 10%, a third measurement was taken to determine which value was more correct.

**Weight**

Weight was measured using portable electronic scales (Tanita HD646; Mentone Educational Centre, Victoria), which were calibrated before the testing period. Measurements were taken with shoes and heavy clothing removed and recorded to the nearest 0.1 kilogram, as recommended (NHMRC, 2003; Booth et al., 2005). Two measurements were taken, with the final value being the average of the two and recorded by a trained, same-sex assessor. If there was a difference of more than 10%, a third measurement was taken to determine which value was more correct.

**Body Mass Index (BMI)**

BMI is significantly associated with body fatness in children and adolescents (NHMRC, 2003). However, the major limitation for this measure is that it may not be a sensitive measure of body fatness in those who are particularly short or tall for their age, have an unusual body-fat distribution or those who have highly developed muscles (NHMRC, 2003). In considering this, BMI has been shown to be a ‘reasonable index of adiposity in children and adolescents’ (Dietz & Robinson, 1998). Pietrobelli and colleagues (1998) found that correlations between BMI and more established methods generally exceeded 0.50 and were frequently higher, with the results of their study supporting the validity of BMI. Furthermore, BMI is commonly used because it is straightforward and relatively cost effective, which is of importance when conducting data collection in the school setting (Moreno et al., 2006).
BMI for this study was calculated using the height and weight data entered. The formula BMI = weight (kg) / height (m)², where height measurements were converted into metres, was used. BMI is more accurate when a trained assessor measures height and weight, with low observer and measurement error and good reliability and validity (Lobstein et al., 2004). As detailed for weight and height measurements, trained assessors conducted these measurements with all steps taken to ensure accurate and reliable results.

### 3.5.4 Questionnaires

**Perceived physical competence**

Perceived physical competence was assessed using Harter’s Perceived Competence Scale for Children (Harter, 1982) (see Appendix 6). Separate questionnaires for each child were administered and participants sat at individual desks. Before commencing the questionnaire, the instructions for the questionnaire were explained and participants and completed an example question. The questionnaire uses a structured-alternative format, where each item was scored from 1 to 4, with a score of 1 indicating low perceived physical competence and a score of 4 indicating high-perceived physical competence. Scores were then summed to provide an overall representation of perceived physical competence. The primary purpose of using this scale was to assess perceived physical competence. Twelve items were added to increase the reliability of the subscale and to provide perceived-physical competence items specifically related to the skills assessed. The modified scale was considered valid based on the established validity of pre-existing items together with personal communication with the author of the original scale (Harter, January 2001), who confirmed logical validity of the new scale items. The modified scale has reported reliability for this age group (Southall, Okely & Steele, 2004).

**Enjoyment of Physical Activity**

Enjoyment of physical activity was assessed using a validated instrument among children and adolescents (Motl et al., 2001) (see Appendix 7). Separate questionnaires for each child were administered and participants sat at individual desks. Before commencing the questionnaire, participants were given an explanation on how to complete the questionnaire. Participants responded to each statement (16 in total) regarding how they feel when they are active. The response scale ranged from ‘disagree a lot’ to ‘agree a lot’, with five responses to choose
from. Scores were then summed to provide an overall representation of enjoyment of physical activity.

3.5.5 Process Evaluation Measures

Process evaluation is an important aspect of intervention research and it is important to learn from decisions for future design considerations for interventions (Young et al., 2008). This includes evaluation of the intervention by measuring the amount of intervention that was delivered, the number of those intended who received the intervention and the fidelity of the intervention that was delivered (Young et al., 2008). The process evaluation measures took the form of participant attendance rates, recording the implementation of the theory and practical sessions, teacher/researcher evaluations and student reflections.

Specifically, process evaluation measures were collected throughout the intervention to assess the feasibility and acceptability of the POC trial. Information was provided concerning:

(i) Activities that were effective and were well received by participants.
(ii) Participants’ enjoyment
(iii) Considerations for implementation within the school environment (such as time restrictions).
(iv) Demands on teaching staff to implement such a program
(v) Stigma associated with the program; and
(vi) Recommendations for future programs in the school setting

Attendance

Attendance at the morning theory sessions and Tuesday practical sessions were collected for two reasons. First, this was a school requirement for morning homeroom time, as well as recording students who were present for sport afternoon. Second, student attendance is an important measure of the acceptability of the program. The higher the attendance rates for the sessions, the more likely the program has been accepted by the participants and will have an influence on the outcome measures of the program. Attendance rates for the morning theory and Tuesday practical sessions were calculated and are reported in Chapter 4.
Implementation of Sessions

Implementation of theory and practical sessions were recorded to determine the fidelity of the program in the school environment. This process measure provided valuable information relating to the scheduling of sessions on certain days throughout the week as well as the position the teacher held when conducting the program. Implementation rates for theory and practical sessions were calculated and are reported on in Chapter 4.

Researcher Evaluations

The researcher completed evaluations at the end of each session. Session evaluations focused on the success of activities implemented, the responses and attitudes of participants to assess the level of understanding of the content by participants, level of participation of participants and enjoyment and interest of participants.

These researcher evaluations were analysed with the participant evaluations to match common areas of enjoyment of the sessions. This in turn indicated the success of the activity and guided the implementation and planning of future sessions.

Participant Evaluations

Participant evaluations were completed using two methods. First, participants individually completed a ‘practical reflection’ sheet on the Thursday morning, after the Tuesday afternoon practical session. For each activity in the practical session, participants recorded how they felt, using options from ‘disagree a lot’ to ‘agree a lot’. Visual representations accompanied the phrases and assisted in determining the degree of success of the activities used in the practical sessions (see Appendix 8).

The average enjoyment for the practical sessions was determined by assigning values to students’ responses on a 5-point Likert scale, with number 1 = disagree a lot, number 2 = disagree a little, number 3 = neither agree nor disagree, number 4 = agree a little and number 5 = agree a lot.

Second, time was allocated each week in theory sessions to conduct focus groups, where participants could share their thoughts and opinions on the activities they enjoyed or did not enjoy and reasons for this. It was important this information was received to cater for
individual differences and to modify the activities to ensure they were engaging and appropriate to participant needs (see Appendix 9).

Parental Feedback

Parental feedback was assessed through informal measures. Due to the researcher being a teacher at the school, parents would make contact with the researcher on various occasions such as parent teacher nights. Communication with the parents was conducted through the school newsletter or student diary when required.

3.6 *Sport4Fun* Proof-of-Concept Trial Data Analyses

3.6.1 Data Handling and Management

Recording forms were used for all data, with participants assigned identification codes and checked for completion of all measures. Participant names were removed or blacked out on questionnaires and the identification code included to ensure confidentiality of participant data. All data were stored in a secure location, with only the researcher and her supervisors able to access this. All data were entered into Microsoft Excel, with the researcher checking for incorrect or missing records in the data. Data analyses were completed using SPSS (SPSS Inc, Chicago).

3.6.2 Paired Sample T-Tests

Data were analysed using SPSS for Mac Version 13 (SPSS Inc, Chicago). Those participants who completed pre-test and post-test measurements were included in the analysis. Paired sample t-tests were conducted on the outcomes measures to test for an intervention effect. As this was a single POC trial, with a small sample size, it was not adequately powered to detect statistically significant differences.
CHAPTER 4

RESULTS

(Sport4Fun Proof-of-Concept Trial)

A Proof-of-Concept (POC) trial was conducted to determine the feasibility, acceptability and potential efficacy of a school-based physical activity program (Sport4Fun) for students in Year 7. The POC trial was a single group trial and was not designed to have sufficient statistical power to detect changes in fundamental movement skill proficiency (FMSP) and physical activity (primary outcomes) or anthropometric measures, perceived physical competence and enjoyment of physical activity (secondary outcomes). Therefore, the results of the POC trial relate to the study implementation, intervention process measures and statistical trends in primary and secondary outcomes.

This chapter details the feasibility, acceptability and potential efficacy of the POC trial, concluding with a summary of results table, relating to each research area.

4.1 Participants

The sample for the POC trial consisted of 17 secondary school students, boys and girls, with low levels of perceived physical competence. Ten of the 17 students completed the Sport4Fun Program over an 8-week intervention period, designed to fit into one school term. Only those participants who completed the Sport4Fun Program and for whom there was baseline and follow-up data were included in the data analyses.
4.2 Research Questions

The purpose of the POC trial was to determine if an 8-week intervention was feasible, acceptable and potentially efficacious. Three research questions were relevant to this purpose:

1. Is the program feasible, assessed by screening and recruiting a sufficient number of participants, retaining these participants and collecting all measurements at baseline and follow-up?

2. Is the program acceptable, determined by the implementation of sessions, participant attendance and enjoyment of sessions?

3. Is the program potentially efficacious, determined by a trend towards statistical significance in the outcome variables?

4.3 Implementation of Intervention and Process Outcomes

4.3.1 Feasibility

Is the program feasible, assessed by screening and recruiting a sufficient number of participants, retaining these participants and collecting all measurements at baseline and follow-up?

The flow chart for screening, recruitment and retention for the POC trial is shown in Figure 4.1.
Figure 4.1 - Participant flow in the POC Trial

* Two questionnaires were proposed for use in the screening process, however due to high scores being recorded for the enjoyment questionnaire, only the perceived physical competence questionnaire was used (see section 3.5.4).

** Other sporting options included competitive sport and indoor sport elective.
4.3.1.1 Screening and Recruitment

Two screening phases were completed with the first at the Year 7 2006 orientation day in Term 4 2005 and the second in Term 1 2006. This was to allow more time for consent forms to be returned, so as many students could be screened as possible. Results from the questionnaires were recorded and students with the lowest perceived physical competence scores were invited to participate in the POC trial (n= 49). It was anticipated that enough students would be recruited to have students in an intervention group and control group. However, due to the small number of students who returned consent forms, there were only enough students for an intervention group (single group trial). Seventeen consent forms were returned (35% response rate) from the 49 invitations sent home via homeroom (or roll call) classes. In total, 17 students were recruited for the 8-week feasibility trial.

4.3.1.2 Baseline Characteristics

For the 17 students recruited, the mean age was 12.4 years (SD = ± 0.3 years) and 82% were girls. Baseline characteristics were collected on 15 students and are reported in Table 4.4.

4.3.1.3 Retention

Seventeen students began the POC trial (Term 2, May, 2006). However, there were seven students who withdrew from the program for various reasons. First, even though their consent form was returned, one student dropped out of the program to participate in school sport. Second, at the end of Week 1, two students dropped out and chose to attend scheduled school sport and homeroom activities, which were conducted at the same time as the POC trial sessions. Third, four more students dropped out in the following weeks, with reasons including students did not want to miss out on other sporting activities (n=3) and not wanting to wear the accelerometer again at follow-up (n=1). The remaining 10 participants completed the POC trial (67% retention rate) and baseline and follow-up measures at the completion of the 8-week program.

4.3.1.4 Data Collection

Table 4.1 shows the number and percentage of participants who completed measurements at baseline and follow-up.
Table 4.1
Useable Data Collected at Baseline and Follow-up

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Baseline (/15)</th>
<th>Percentage (%)</th>
<th>Follow-up (/10)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>15</td>
<td>100</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Weight</td>
<td>15</td>
<td>100</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>BMI</td>
<td>15</td>
<td>100</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Waist Circumference</td>
<td>15</td>
<td>100</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Fundamental movement skills</td>
<td>15</td>
<td>100</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Physical activity (Accelerometer)</td>
<td>15</td>
<td>100</td>
<td>8</td>
<td>80</td>
</tr>
<tr>
<td>Enjoyment of physical activity</td>
<td>15</td>
<td>100</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Perceived physical competence</td>
<td>15</td>
<td>100</td>
<td>10</td>
<td>100</td>
</tr>
</tbody>
</table>

There were two participants who did not complete baseline measures. The first participant returned the consent form, however did not attend any baseline measures or sessions in the program, preferring to participate in regular school sport. The second participant started the program, however did not have baseline data due to the late return of his consent form. However, this student dropped out of the program in week 2. Of the 10 remaining participants, the feasibility of collecting all measurements at baseline and follow-up was acceptable. All participants completed measurements for fundamental movement skills, height, weight and waist circumference, as well as enjoyment and perceived physical competence questionnaires; with these data being useable for analysis. The only exception was accelerometer data, where 2 out of 10 (20%) accelerometers failed to provide adequate data, due to accelerometer malfunction.
4.3.1.5 Process Measures Related to Feasibility

The researcher, who was also a PDHPE teacher and Sports Coordinator at the participating school, kept evaluations to determine the feasibility of the POC trial. These related specifically to the screening, recruitment and retention of participants.

**Screening**
The screening procedure used to select students for the POC trial was not as appropriate as initially thought. This was due to two main reasons: 1) when the screening procedures were conducted; and 2) the questionnaires used to screen students. First, consent forms to participate in the screening questionnaires were given out at the students’ primary school, as the testing was to take place at the Year Seven orientation day. This approach was used as it was thought this would allow the intervention to start as soon as possible in Year Seven. Yet, even though these schools were contacted via phone and in person, there was still a delay in receiving adequate consent for screening questionnaires. This led to a second screening held in term one of the following year. For future recommendations, it would be more appropriate to conduct screening measures when students are attending the school.

Second, the measures used to screen students did not target adequate numbers or the ‘intended’ group of students. The scores on the enjoyment questionnaire were very high and the lowest 60 scores were not useable. This can be described as a ceiling effect and the instrument was not able to identify students with a low level of enjoyment of physical activity, which were trying to be targeted. In addition to this and upon reflection, some students may have needed further instructions to complete the questionnaires to demonstrate an accurate reflection of their enjoyment of physical activity and perceived physical competence.

**Recruitment**
The recruitment of only a small number of students for the POC trial was a concern as this meant there were inadequate numbers for a control and intervention group. As a result, strategies were modified to increase recruitment numbers for the Pilot Randomised Controlled Trial (RCT) (see section 5.2.3).

This involved considering the methods used to communicate to parents and students about the program, which needed to take place in a larger and more universal way. For example, greater communication through school newsletters and daily notices to inform parents and students.
about the program was recommended, as well as using physical education classes to promote and screen students. A follow-up process for the returning of consent forms, such as contacting parents, was also recommended for the Pilot RCT.

**Retention**

To ensure a higher retention rate, the scheduling of the program would need to be considered in conjunction with the other sporting options offered to students as part of regular schooling. This meant implementing the program in school terms where the least favourable sports (such as swimming) were offered to the year group, to encourage students’ continued participation. School sport at the school was structured using a traditional approach, where all students from each year group participated in a scheduled sporting activity at the same time of the day. In most cases, students participated with their year group and rotated through different sporting activities each term (consisting of approximately 10 weeks).

**4.3.2 Acceptability**

Is the program acceptable, determined by the implementation of sessions, participant attendance and enjoyment of sessions?

**4.3.2.1 Implementation of Sessions**

**Morning Theory Sessions**

Implementation of the theory sessions was high, with 20 out of a possible 22 delivered (implementation rate of 91%). Reasons for two of the sessions not being implemented were: 1) teacher/student meetings that were arranged on the morning and all students were required to attend and 2) school photos were scheduled for a day, however it was originally thought this would not impact the implementation of the theory session. The content for these sessions were re-scheduled and “caught up” in the subsequent weeks. Therefore, 91% of pre-planned content was delivered.

**Practical Sessions**

Six of the eight practical sessions were delivered as intended. Due to the teacher’s role in the school as Sports Coordinator, there were added responsibilities on Tuesday afternoon for sport, with one of these being the organising of staff to run sporting activities. In week four of the
program, there were limited staff for scheduled school sport and therefore a practical session needed to be cancelled due to staffing issues. Participants were sent to their Year group’s scheduled sporting activity. In week five of the program, wet weather prevented the practical session from being conducted and there were no suitable indoor spaces in the school to conduct a practical session. In the following weeks, the content and activities of the practical sessions were modified to ensure missed content was “caught-up” in the following weeks.

In summary, the implementation of the theory sessions (91%) and practical sessions (75%) for the eight-week POC trial was deemed acceptable. Recommendations were made to further assist in the implementation of sessions for the pilot RCT (see section 4.6).

4.3.2.2 Participant Attendance

Attendance rates for the morning theory sessions are shown in Table 4.2. The average attendance rate for the theory sessions was 94%.

Table 4.2
Morning Theory Sessions Attendance Rates

<table>
<thead>
<tr>
<th>TERM 2</th>
<th>ATTENDANCE</th>
<th>REASONS FOR ABSENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>n = 15 (%) Wks 1-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 11 (%) Wks 4-7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n = 10 (%) Wk 8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monday</td>
<td>Thursday</td>
<td>Friday</td>
</tr>
<tr>
<td>Week 1</td>
<td>15 (100)</td>
<td>14 (93)</td>
</tr>
<tr>
<td>Week 2</td>
<td>14 (93)</td>
<td>11 (73)</td>
</tr>
<tr>
<td>Week 3</td>
<td>11 (73)</td>
<td>11 (73)</td>
</tr>
<tr>
<td>Week 4</td>
<td>11 (100)</td>
<td>11 (100)</td>
</tr>
<tr>
<td>Week 5</td>
<td>11 (100)</td>
<td>11 (100)</td>
</tr>
<tr>
<td>Week 6</td>
<td>11 (100)</td>
<td>11 (100)</td>
</tr>
</tbody>
</table>

Week 3 - Six students dropped out of the POC trial, with the last student doing so at the end of Week 3. This left 11 participants in the POC trial. Another student dropped out at the end of Week 7, as he didn’t want to wear the accelerometer for follow-up testing, leaving 10 participants in the POC trial.
Week 7  +  ^ 8 (73)  Forgetting to attend session, absent from school

Week 8  10 (100)  10 (100)  10 (100)

* Pupil Free Day  Δ School Photos  + Long Weekend  ^Year Meetings

Reasons for participants not attending sessions included absence from school (due to illness or other reason), late coming to school, needing to hand in notes at the front office and forgetting to attend the session.

Attendance rates for the practical sessions are shown in Table 4.3. The average attendance rate for the practical sessions was 91%.

Table 4.3
Practical Sessions Attendance Rates

<table>
<thead>
<tr>
<th>TERM 2</th>
<th>ATTENDANCE</th>
<th>REASON FOR ABSENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 15 (%) Wks 1-3</td>
<td>Absent from school</td>
</tr>
<tr>
<td></td>
<td>n = 11 (%) Wks 4-7</td>
<td>Absent from school, attending regular school sport.</td>
</tr>
<tr>
<td></td>
<td>n = 10 (%) Wk 8</td>
<td>Not conducted</td>
</tr>
<tr>
<td>Week 1</td>
<td>15 (100)</td>
<td></td>
</tr>
<tr>
<td>Week 2</td>
<td>12 (80)</td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td>11 (73)</td>
<td></td>
</tr>
<tr>
<td>Week 4</td>
<td>Not conducted</td>
<td></td>
</tr>
<tr>
<td>Week 5</td>
<td>Not conducted</td>
<td></td>
</tr>
<tr>
<td>Week 6</td>
<td>11 (100)</td>
<td></td>
</tr>
<tr>
<td>Week 7</td>
<td>10 (91)</td>
<td>Absent from school</td>
</tr>
<tr>
<td>Week 8</td>
<td>10 (100)</td>
<td></td>
</tr>
</tbody>
</table>
### 4.3.2.3 Enjoyment of Sessions

Participants were asked to complete an enjoyment scale either at the completion of the practical session or in the theory session the following morning. This was completed for each practical session \((n = 6)\) and all students who were present and had participated in the practical session completed the enjoyment scale.

Table 4.4 shows the mean score for the activities in each session and the overall mean score for all sessions.

#### Table 4.4

<table>
<thead>
<tr>
<th>Term 2</th>
<th>Practical session – Enjoyment</th>
<th>Activities*</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>4.14 4.36 4.5 4.31 4.79 4.00</td>
<td>4.35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 2</td>
<td>3.18 4.36 4.64 4.64 - -</td>
<td>4.20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td>4.73 4.55 4.45 4.18 4.50 -</td>
<td>4.48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 4</td>
<td>4.67 5.00 4.67 4.33 5.00 -</td>
<td>4.73</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 7</td>
<td>3.67 3.67 4.17 4.67 5.00 -</td>
<td>4.23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 8</td>
<td>4.88 4.75 3.88 4.50 4.63 5.00</td>
<td>4.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There were no enjoyment scores for Week five and six as practical sessions were not held.

* There were a maximum of six activities held in each practical session, depending on the focus for the week. Students scored the activities from one to five, with five indicating the highest level of enjoyment.

The mean scores of the activities from the six implemented practical sessions ranged from 3.18 to 5.00, with mean for each week ranging from 4.20 to 4.73. The enjoyment scores were relatively stable, with only small variations. The overall mean for the entire practical POC sessions being 4.43, with this indicating a high level of enjoyment, suggesting the participants ‘enjoyed’ the POC trial’s activities and sessions.

Participants were also asked questions focusing on the content and activities used in the practical sessions with some comments including “It was a really fun time today, especially
the grip ball. I can’t wait til next week.” (Participant C) and “I really liked this and hope to do it again” (Participant E). When group discussions at the morning theory sessions were conducted, students revealed that the types of activities they enjoyed the most were games.

4.3.2.4 Teacher’s Evaluation

The Researcher’s evaluations also included important information relating to the acceptability of the program. Aspects such as responsibilities of the teacher, use of rewards for participants and greater involvement of parents and the broader school community in the program were noted as needing further consideration and are expanded on in the following pages.

Responsibilities of the Teacher

As noted throughout Chapter Three and Four, the Researcher was the PDHPE teacher and Sports Coordinator at the school. The knowledge of the school community, including students and the daily running of the school is vital information the teacher had access to, however the role of Sports Coordinator was a demanding one. At times, and particularly during practical sessions of the POC trial (when Tuesday Sport was being conducted), the teacher was required to check on other sports and assist some teachers. It was important to note that for the implementation of the Pilot RCT, to ensure the implementation of more practical sessions, that the teacher in charge of implementing the Pilot RCT should not have any additional whole-school administrative responsibilities.

Use of Rewards

The use of rewards to promote the continuation of positive behaviours and encourage student participation is important when considering behaviour change (reference needed). Even though the school’s merit system was used to reward participant behaviour and achievements throughout the POC trial, it was suggested that this take place on a more regular basis for the Pilot RCT.
Greater involvement from parents and the broader school community

Parent involvement in the POC trial was through newsletter or student diary communication. Identifying and using strategies to increase parental involvement in the Pilot RCT was considered important to assist with behaviour modification. Suggested strategies included a program newsletter and students discussing and getting their completion of achievements signed by parents for challenges completed throughout the program. Parental evaluation of the POC trial was undertaken through informal conversations with parents and some at parent teacher interviews with time permitting. Parents did indicate that the POC trial had brought about a positive change in their child’s physical activity behaviour and also an increase in confidence. However, it was important to receive feedback from all parents and a parental questionnaire was considered for the Pilot RCT.

Furthermore, the involvement of other members of the school community such as older students and other staff members was an area identified for improvement for the Pilot RCT. This would assist in creating a larger support network for participants and also allow more opportunities for individuals to be involved in the program, creating greater acceptability of the program in the school setting.

In summary, the POC trial was acceptable in aspects of implementation, attendance and participant enjoyment of practical sessions. Recommendations were identified for the implementation of the Pilot RCT. Their implementation will be discussed in Chapter 6.

4.4 Behavioural Outcomes

4.4.1 Potential Efficacy

Is the program potentially efficacious, determined by a trend towards statistical significance for outcome variables?

The size of this POC trial was not designed to detect statistically significant changes; however, several encouraging trends were found. Table 4.4 shows the baseline and follow-up means and t- and P-values for the primary and secondary outcomes.
### Table 4.5
Primary and Secondary Outcome Measurements at Baseline and Follow-up

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Baseline Mean (SD)</th>
<th>Follow-up Mean (SD)</th>
<th>Difference Mean (95% CI)</th>
<th>t-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMS Total</td>
<td>19.80 (5.3)</td>
<td>23.40 (5.7)</td>
<td>3.6 (1.60 to 5.60)</td>
<td>4.07</td>
<td>0.003</td>
</tr>
<tr>
<td>Two-handed Strike</td>
<td>3.9 (1.4)</td>
<td>5.3 (1.5)</td>
<td>1.33 (0.32 to 2.35)</td>
<td>3.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Kick</td>
<td>3.2 (1.0)</td>
<td>4 (1.2)</td>
<td>0.80 (0.06 to 1.54)</td>
<td>2.45</td>
<td>0.04</td>
</tr>
<tr>
<td>Catch</td>
<td>4.3 (1.6)</td>
<td>5.5 (1.0)</td>
<td>1.20 (0.46 to 1.94)</td>
<td>3.67</td>
<td>0.01</td>
</tr>
<tr>
<td>Overhand Throw</td>
<td>3.6 (1.8)</td>
<td>4.7 (1.1)</td>
<td>1.10 (0.18 to 2.02)</td>
<td>2.70</td>
<td>0.02</td>
</tr>
<tr>
<td>Run</td>
<td>4.8 (1.5)</td>
<td>4.4 (1.6)</td>
<td>-0.40 (-1.48 to 0.68)</td>
<td>-0.84</td>
<td>0.42</td>
</tr>
<tr>
<td>Physical Activity</td>
<td>517.53 (-175.99 to 209.79)</td>
<td>534.43 (-175.99 to 209.79)</td>
<td>16.90 (-0.13 to 5.16)</td>
<td>0.38</td>
<td>0.74</td>
</tr>
<tr>
<td>BMI</td>
<td>20.6 (0.37 to 0.79)</td>
<td>21.2 (0.37 to 0.79)</td>
<td>0.58 (0.37 to 0.79)</td>
<td>6.28</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>WC</td>
<td>71.8 (-0.13 to 5.16)</td>
<td>74.3 (1.24 to 9.56)</td>
<td>2.52 (1.24 to 9.56)</td>
<td>2.15</td>
<td>0.06</td>
</tr>
<tr>
<td>PPC</td>
<td>42.90 (1.24 to 9.56)</td>
<td>48.30 (1.24 to 9.56)</td>
<td>5.40 (1.24 to 9.56)</td>
<td>2.94</td>
<td>0.02</td>
</tr>
<tr>
<td>Enjoyment</td>
<td>65.70 (-0.17 to 12.68)</td>
<td>72.00 (-0.17 to 12.68)</td>
<td>6.26 (-0.17 to 12.68)</td>
<td>2.20</td>
<td>0.06</td>
</tr>
</tbody>
</table>
4.4.1.1 Primary Outcomes

The primary outcomes were fundamental movement skill proficiency and objectively measured physical activity.

Paired samples t-tests found statistically significant improvements from baseline to follow-up for four out of the five fundamental movement skills. These included the strike (1.33 [CI = 0.32 to 2.35], P=0.02), kick (0.80 [CI = 0.06 to 1.54], P=0.04), catch (1.20 [CI = 0.46 to 1.94], P=0.01), and throw (1.10 [CI = 0.18 to 2.02], P=0.02). The run was the only skill where significant improvements did not occur from baseline to follow-up (-0.04 [CI = -1.48 to 0.68], P=0.42). In addition to this, a statistically significant improvement from baseline to follow-up was shown for total fundamental movement skills (3.6 [CI = 1.60 to 5.60], P=0.003).

Physical activity was measured over a period of seven days, including weekend days. There was a slight increase in counts per minute, however this was not statistically significant (16.90 [CI = -175.99 to 209.79], P=0.74).

4.4.1.2 Secondary Outcomes

No changes were shown for BMI from baseline to follow-up (0.58 [95% CI = 0.37 to 0.79], P=<0.001). Slight increases in waist circumference were experienced from baseline to follow-up (2.52 [95% CI = -0.13 to 5.16], P=0.06). However this is consistent with normal growth experienced during adolescence. Cole and colleagues (2000) established cut off points for body mass index for overweight and obesity between 2 and 18 years. Increases are seen from ages 12.0 years to 12.5 years and 12.5 years to 13.0 years of at least 0.3kg/m².

4.4.1.2.1 Perceived physical competence

Paired samples t-test found statistically significant improvements from baseline to follow-up for perceived physical competence (5.40 [95% CI = 1.24 to 9.56], P=0.02).

4.4.1.2.2 Enjoyment of Physical Activity

There was an increase in enjoyment from baseline to follow-up, showing a positive trend towards significance (6.26 [95% CI = 0.17 to 12.68], P=0.06).
In summary, results that were encouraging in determining the potential efficacy of the POC trial among secondary students were the statistically significant increase in 4 of the 5 fundamental movement skills (catch, throw, strike and kick) and perceived physical competence and an increase in enjoyment of physical activity.

### 4.5 Summary of Results

This POC trial aimed to determine the feasibility, acceptability and potential efficacy of a school-based physical activity program for secondary students. Data were collected from 10 participants and the results obtained are summarised in Table 4.5.

**Table 4.6**

**Summary of Results from POC trial**

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is the program feasible, assessed by screening and recruiting a sufficient number of participants, retaining these participants and collecting all measurements at baseline and follow-up?</td>
<td><strong>Screening</strong> 136 out of a possible 180 students (76%) were screened over two phases – Term 4 2005 and Term 1 2006. <strong>Recruitment</strong> 17 out of 49 (35%) students and parents consented to be involved in the program. <strong>Retention</strong> 10 out of 15 (67% retention rate) completed the POC trial, including baseline and follow-up measurements <strong>Collection of measurements</strong> All measurements were collected on the 10 participants at baseline and follow-up, with 20% (2 out of 10) of accelerometry data not useable, due to accelerometer malfunction.</td>
</tr>
</tbody>
</table>
2. Is the program acceptable, determined by the implementation of sessions, participant attendance and enjoyment of sessions?

**Implementation**
20 out of 24 (83%) theory sessions were implemented.
6 out of 8 (75%) practical sessions were implemented.

**Attendance**
Average attendance for theory sessions was 94% and was 91% for practical sessions.

**Enjoyment**
The overall average enjoyment for the practical sessions was 4.43 out of five.

3. Is the program potentially efficacious, determined by a trend towards statistical significance for outcome variables?

**Primary outcomes**
Statistically significant improvements from baseline to follow-up for four out of the five fundamental movement skills, as well as total fundamental movement skills.
There was a small increase in physical activity over a 7-day period.

**Secondary outcomes**
An increase in BMI from baseline to follow-up.
An increase in waist circumference from baseline to follow-up.
Statistically significant improvements from baseline to follow-up for perceived physical competence.
There was an increase in enjoyment of physical activity from baseline to follow-up (P=0.06).
4.6 Recommendations

Based on the findings from the POC Trial, several recommendations were made for the larger scale Pilot RCT to be conducted in 2008. The aspects that were identified for modification involve the screening process, recruitment processes, targeted participants, timing of intervention and delivery of sessions. These are described in more detail in section 5.1, however are summarised in Table 4.7.

Table 4.7
Recommendations for Pilot RCT

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screening Process</td>
<td>o Complete screening at a different time period to ensure all eligible participants are included.</td>
</tr>
<tr>
<td></td>
<td>o Use of a different screening measure to target participants in most need of the program.</td>
</tr>
<tr>
<td>Recruitment</td>
<td>o Greater information delivered to staff to ensure support and awareness of the program.</td>
</tr>
<tr>
<td></td>
<td>o In addition to this, information packages to be mailed home and greater correspondence with parents.</td>
</tr>
<tr>
<td>Targeted participants</td>
<td>o Focus on girls in Years 7, 8 and 9 as research (Hardy et al., 2008) suggested there is a need for this.</td>
</tr>
<tr>
<td></td>
<td>In addition to this, in the POC Trial the recruitment of boys was not as successful so the intervention may be more suitable to girls.</td>
</tr>
<tr>
<td>Timing of intervention</td>
<td>Schedule intervention in the school term when the least favourable alternative sport options are available (such as swimming), to reduce the number of participants dropping out of the intervention.</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>A longer timeframe for the Pilot RCT, over two school terms to allow greater chance for behaviour modification.</td>
</tr>
<tr>
<td>Delivery of Sessions</td>
<td>Another session to be added to the intervention, an after-school component to provide opportunities for participants to increase physical activity participation in the important after-school period.</td>
</tr>
<tr>
<td></td>
<td>Ensuring links are made with the Social Cognitive Theory to assist with behaviour change or modification.</td>
</tr>
<tr>
<td>Linking with the Social Cognitive Theory (Bandura, 1986)</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 5

METHODOLOGY

(Sport4Fun RCT)

This chapter describes the methodology of the Pilot Randomised Control Trial (RCT) assessing the feasibility, acceptability and potential efficacy of a multi-faceted secondary school-based physical activity program (Sport4Fun) for girls in Years 7, 8 and 9. The Pilot RCT was designed and implemented to address several factors. First, to improve the methodological processes used in the Proof-Of-Concept trial (POC Trial); second, to ensure a longer and more comprehensive program was delivered in the school setting and third, to involve a larger number of students and school staff in the program.

The Pilot RCT was conducted throughout Term 2 (April) 2008 and Term 3 (September) 2008 at a Co-Educational Catholic High School, as was the POC Trial. The University of Wollongong’s Human Research Ethics Committee (HE05/206) approved the Pilot RCT (see Appendix 1B).

5.1 Proof-of-concept Trial (2006)

The results from the POC trial conducted in 2006 were promising, in particular for fundamental movement skill proficiency and perceived physical competence. However, aspects were identified throughout the screening process, recruitment, retention and implementation that needed modification. These included:

1. Screening procedures
2. Recruitment processes
3. Targeted participants
4. Timing of the intervention
5. Delivery of sessions
These six aspects were recognised as needing modification for the Pilot RCT. These modifications are described in greater detail in this chapter.

5.2 Pilot RCT Design

An experimental design was used to examine the impact of the Sport4Fun intervention. Participants were randomly assigned to either the intervention or control group. The intervention group received the Sport4Fun Program and the control group attended regular sport and school activities, and did not attend the afternoon physical activity sessions.

The use of two theoretical frameworks for the Sport4Fun program was considered appropriate when designing the Pilot RCT. Competence Motivation Theory (Harter, 1978), which was the theoretical framework for the POC Trial (See Chapter 3), and Social Cognitive Theory (Bandura, 1986) were relevant to the intervention. These will be detailed later in the chapter.

5.2.1 Aim

The aims of the Pilot RCT were similar to the POC trial. However, with a control group, the Pilot RCT aimed to test the potential efficacy of the Sport4Fun program. In addition to this, the pilot RCT endeavoured to address the aspects identified from the POC trial that could be improved. Specifically the aims were to:

1. Determine the feasibility of implementing the revised Sport4Fun program (in terms of screening, recruitment, retention and collection of all measurements).
2. Determine the acceptability of the program among participants, researcher and parents (in terms of implementation of sessions, participant attendance, enjoyment of sessions and acceptance of the program).
3. Determine the potential efficacy of the program (by evaluating the short term impact of the program on outcome measurements).
5.2.2 Screening

The pilot RCT used a different screening procedure, based on results from the POC trial (see Chapter 3). Screening was performed in Term one of the same year as the intervention (2008), with the aim to recruit more participants to the pilot RCT. The Multistage Fitness Test (MSFT) was used to screen all girls from Year 7, 8 and 9 (n = 319) in physical education classes, conducted by the Researcher and PDHPE Faculty members. This screening procedure was used as it was anticipated to more likely identify low fit and less active girls to whom the program was targeted for.

5.2.2.1 Pilot RCT Inclusion and Exclusion Criteria

The Pilot RCT used a different screening procedure than the POC trial. Girls in Years 7, 8 and 9 were screened, rather than all students in Year 7 as was used in the POC trial. The reasons for changing the targeted group were two-fold. First, research highlights a greater decline in physical activity in adolescent girls (Hardy, Okely, Dobbins, & Booth, 2008). In addition to this, there is also evidence suggesting fundamental movement skills are lower in girls than boys (Hardy et al., 2010). Therefore, there is a greater importance to shift the focus to an all-girl screening process. Second, based from the POC trial, only one boy was recruited. Therefore, it was thought that more success would be gained from screening girls, rather than both genders. In addition to this and as encountered in the POC trial, a greater number of participants needed to be screened for an intervention and control group.

The students’ cardiorespiratory fitness scores were ranked from highest to lowest. Students with the lowest cardiorespiratory fitness results (less than level 4 in the Multistage Fitness Test) were invited to participate in the pilot RCT. This cut-off was chosen as students scoring less than level 4 are classified as being in the lowest 30th percentile for their age for cardiorespiratory fitness. This is also below the criterion reference standard for cardiorespiratory fitness (Okely et al., 2010). Therefore, the selected 70 students placed them in the lowest 30th percentile among girls of the same age.
5.2.3 Recruitment and Consent

To increase the participant numbers for the Pilot RCT, alternate recruitment procedures were used from POC trial (see Chapter 3). The recruitment process was initiated in the same year as the intervention, with different screening methods and additional strategies used.

In the first faculty meeting of 2008, PDHPE (personal development, health and physical education) teachers were informed that the purpose of conducting the Multistage Fitness Test, in addition to curriculum requirements, was to screen potential participants for the Sport4Fun program. Therefore, this test was conducted early in 2008 (Term 1, Weeks 1 to 4) in physical education lessons, results recorded and then given to the Researcher for collation.

Following this, an information package was mailed to 70 students (and their parents), inviting the student to participate in the program (see Appendix 10 and 11). Phone correspondence was made with some parents, due to special cases (such as uncharacteristic performance of the student or injuries) associated with the student.

Parents and students were asked to return the consent form by Term 1, Week 7 (2008), to allow arrangements to be made for baseline testing in that term (see Appendix 12). Additional phone calls to parents, as well as advertising the program in the weekly newsletter were arranged, to increase recruitment numbers from the POC trial.

5.2.4 Randomisation

The bias coin method of allocation, using a computer-based random number producing algorithm, was used to randomly allocate students to either the intervention or control group. This was performed after baseline measurements were taken and by the Researcher’s supervisor, as the researcher was responsible for participant recruitment, enrolment and delivery of the intervention.
5.2.5 Timeline for Intervention and Comparison Groups

All measurements and sessions were conducted in the school setting, with the exception of two after-school sessions (conducted at a nearby bike track). The pilot RCT had a different timeline than the POC trial for several reasons. First, the pilot RCT was conducted over two terms to increase the number of sessions and amount of content to be delivered to participants. This greater time period also allowed the observation of behaviour modification and support to be provided to participants. In addition to this, a longer intervention has a greater chance of being potentially efficacious (Robinson et al., 2003). Second, the pilot RCT was scheduled in School Terms when other sporting options were not as favourable, to increase participant recruitment and retention numbers. The timeline for the program is shown in Figure 5.1

<table>
<thead>
<tr>
<th>Term and Week</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term 1: Weeks 1-4, 2008</td>
<td>Screening using MSFT</td>
</tr>
<tr>
<td>Term 1: Weeks 5-8, 2008</td>
<td>Recruitment and consent</td>
</tr>
<tr>
<td>Term 1: Weeks 9-10, 2008</td>
<td>Baseline measurements</td>
</tr>
<tr>
<td>Term 1: Week 11, 2008</td>
<td>Randomisation</td>
</tr>
<tr>
<td>Term 2: Weeks 1-10, 2008</td>
<td>Intervention</td>
</tr>
<tr>
<td>Term 3: Weeks 1-8, 2008</td>
<td>Intervention</td>
</tr>
<tr>
<td>Term 3: Weeks 9-10, 2008</td>
<td>Follow-up measurements</td>
</tr>
</tbody>
</table>

Figure 5.1 – Timeline for Pilot RCT

5.3 Pilot RCT Delivery

Bandura’s (1986) Social Cognitive theory provided the theoretical framework relevant to the Sport4Fun intervention. Social Cognitive Theory posits that behaviour occurs through an interaction of personal, behavioural and environmental factors (Bandura, 1986). This has been demonstrated in various interventions targeting health behaviours of children and adolescents, in particular New Moves (Neumark-Sztainer et al., 2003). New Moves addressed personal factors such as self-efficacy and attitudes regarding physical activity through participation in a
variety of activities. Socioenvironmental factors such as a supportive environment and different opportunities for physical activity were offered in the program, with behavioural factors such as goal-setting and skills being addressed through the physical activity, nutrition and social support sessions (Neumark-Sztainer et al., 2003).

Similar to the above studies, the Sport4Fun Program included a number of strategies relating to targeting personal, environmental and behavioural factors. Personal factors (e.g. knowledge, perceived competence, enjoyment of physical activity and perceived self-efficacy) were addressed through educational and interactive activities and participation in developmentally appropriate and fun activities to increase perceived physical competence and enjoyment. Strategies aimed at behavioural factors (e.g. skills and goal-setting) were also embedded in the Sport4Fun Program. These included: participation in challenges requiring participants to set short and long term goals, the use of external rewards and incentives for achieving these goals and practical activities to develop and improve fundamental movement skills. Environment factors were considered in the Sport4Fun Program and strategies to enhance problem-solving skills in relation to barriers to physical activity and support (from people and places) were used. Schools are important environmental settings and support from peers can greatly influence physical activity behaviour change (Davison, 2004); therefore developing skills to overcome barriers and seek support from family and friends, as well as using resources in the environment were emphasised.

Within SCT, four key processes influence the development of new behaviours, with these being attention, retention, production and motivation. These four processes are vital in designing behavioural change interventions and Social Cognitive Theory has been used successfully in determining the feasibility of school-based and after-school obesity prevention interventions (Neumark-Sztainer et al., 2003, Gortmaker et al., 1999b, Robinson et al., 2003., Weintraub et al., 2008).

The processes of attention, retention, production and motivation are important in learning and adopting new behaviours and were embedded in the theoretical and practical components of the Sport4Fun intervention. Attention relates to exploration and perception and is influenced by factors such as attractiveness to the intervention. Retention or termed memory, is influenced by the organisation of information, cognitive or imagined rehearsal and active rehearsal. Production is the practice of putting these representations into actions and is highly
influenced by intrinsic and extrinsic feedback. Motivation is strongly influenced by external and internal incentives (Robinson et al., 2003).

Behaviour change or modification occurs as a result of an interaction between personal, behavioural and environmental factors. To affirm the relationship between these factors, the ‘Sport4Fun’ program provided:

i. Opportunities for participants to set goals, problem-solve and monitor behaviour in relation to increased physical activity.

ii. Opportunities for progressive positive behaviour change and the maintenance of this behaviour.

iii. A supportive environment through the reinforcement of positive behaviour through internal and external rewards from self, teacher and peers.

iv. Participation in fun and enjoyment-centred physical activity to encourage participation in similar activities when in the home environment.

v. Evaluation of situations to engage in behaviour that is physically active.

Competence Motivation Theory (Harter, 1978) was also of relevance to this study, particularly guiding the inclusion of outcome measures (such as fundamental movement skills, perceived competence and enjoyment) that influence physical activity behaviour. The practical components (school sport and after-school sessions) of the intervention provided opportunities for participants to develop and improve their fundamental movement skills and experience success. In addition to this, the focus of these practical sessions was on activities that were fun and enjoyable for the participants. The theoretical component of the intervention focused on various aspects including goal-setting, problem solving activities and importantly sources of social support for the participants. Even though this was not measured at baseline and follow-up, the sessions in the Sport4Fun program involved teachers, peers and parents providing social support to the participants through their feedback, reinforcement and participation in activities. Specific examples of this can be seen in the challenges (Pedometer and Olympic) participants were involved with and the use of ‘Student helpers’ in the practical sessions. Further detail can be found in Section 2.3.2.
5.3.1 Pilot RCT Intervention Group

The same teacher (researcher) who conducted the POC trial also conducted the Pilot RCT. The teacher was no longer in the position of Sports Coordinator at the school, as was the case in Chapter Three. This allowed sessions to be conducted free from staff and student interruptions to attend to the weekly running of school sport. The morning theory sessions, school sport sessions and after-school practical sessions were all instructed by the same teacher. The only exception was the second practical session of the intervention, where another PDHPE teacher instructed the session, due to the Researcher attending an offsite professional development course. Peer facilitators were present and assisted with the implementation of the school sport sessions. The Pilot RCT was conducted in Term 2 (April to June) and Term 3 (July to September) 2008 and included 15-minute theory sessions three times a week (Wednesday, Thursday and Friday), one 90-minute afternoon sport session (Tuesday afternoon sport time) and one 75-minute after-school physical activity session.

5.3.1.1 Theoretical Component

As with the POC trial (see section 3.4.2), the morning theory sessions were conducted during scheduled homeroom or roll call time. Each session lasted 15 minutes and was conducted 3 times a week on Wednesday, Thursday and Friday mornings. Content focused on two central themes – physical activity and behaviour modification. Participants completed a range of activities involving group discussion and personal reflection and included questionnaires, worksheets, scenarios and computer-based activities.

Physical Activity

Similar to the POC trial, the theory based sessions focused on ways for participants to improve their level of physical activity participation. However due to the increased length of the Pilot RCT, greater detail and time was allocated to this component. Specifically, participants engaged in theory-based activities focusing on: 1) their current and future level of participation in physical activity and thoughts towards physical activity participation; 2) self-monitoring their physical activity levels and examining ways for improvement (goal setting); 3) barriers to physical activity participation and ways to overcome this; and 4) places and people who support their participation in physical activity.
One of the underlying goals for the theory-based physical activity sessions was Australia’s Physical Activity Recommendations for 12-18 year olds. Participants were encouraged to meet the recommended guidelines of at least 60 minutes of moderate to vigorous physical activity per day (Department of Health and Ageing, 2004), using challenge activities as motivation. These two challenge activities were used throughout the program to allow participants to apply what they had learnt in the theory and practical sessions.

**Behaviour Modification**

A recommendation from the POC trial was that theory sessions should include the four processes – attention, retention, production and motivation to enhance behaviour modification (Bandura, 1986). Theory sessions for behaviour modification included goal setting, time management skills, self-monitoring activities (such as challenges), decision-making skills, motivation and planning for change. To focus on the four processes, sessions were adjusted to ensure: 1) Attention – the use of an all-girl program in this school setting, with the use of resources different to scheduled school sport and PE classes. It also included incentives and content that was relevant and meaningful to each participant and was directed to focus attention; 2) Retention – Students were given clear instructions, demonstrations and explanations in all sessions so information and content could be remembered to help in the behaviour change process, including visual prompts and reminders students could use at home; 3) Production – for the behavioural change to be successful, students were provided with opportunities to practice the skills and apply the knowledge through the Pedometer Challenge (Term 2) and the Olympic Challenge (Term 3). Through this time, it was emphasised to participants that it was acceptable if they were not completely successful in achieving their goals, however they needed to analyse and evaluate what might have prevented them from being physically active; 4) Motivation – This took many forms and it was emphasised to participants that motivation should relate to the health benefits received from participation in physical activity, as well as materialistic incentives awarded. These included drink bottle, sports equipment and stationery items (pens, post-it notes) as well as rewarding participants using the school’s merit system. An outline of the theory sessions is shown in Table 5.1.
Table 5.1
Outline of the Pilot RCT’s Theory Sessions

Term 2 (April – June)

<table>
<thead>
<tr>
<th>Week</th>
<th>Focus</th>
<th>Lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Physical Activity</td>
<td>What is physical activity? Examples and reflection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Counting physical activity – How much are you doing?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical Activity Guidelines for Adolescents</td>
</tr>
<tr>
<td>Week 2</td>
<td>Physical Activity</td>
<td>Discussion of physical activity log</td>
</tr>
<tr>
<td></td>
<td>Log</td>
<td>Discussion of physical activity log</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recording physical activity for week 3</td>
</tr>
<tr>
<td>Week 3</td>
<td>Physical Activity</td>
<td>Activities I enjoy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Benefits of participating in physical activity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Making choices for physical activity</td>
</tr>
<tr>
<td>Week 4</td>
<td>Discussion and</td>
<td>How did we go?</td>
</tr>
<tr>
<td></td>
<td>evaluation of</td>
<td>Let’s get movin’</td>
</tr>
<tr>
<td></td>
<td>physical activity log</td>
<td>PUPIL FREE DAY</td>
</tr>
<tr>
<td>Week 5</td>
<td>The Great</td>
<td>Introduction/aim</td>
</tr>
<tr>
<td></td>
<td>Pedometer Challenge</td>
<td>How the challenge works</td>
</tr>
<tr>
<td></td>
<td></td>
<td>How the challenge works</td>
</tr>
<tr>
<td>Week 6</td>
<td>The Great</td>
<td>Let’s get movin’</td>
</tr>
<tr>
<td></td>
<td>Pedometer Challenge</td>
<td>How can we be active – motivation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>How can we be active - activities</td>
</tr>
<tr>
<td>Week 7</td>
<td>Making Choices</td>
<td>Barriers on the challenge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Barriers on the challenge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ATHLETICS CARNIVAL</td>
</tr>
<tr>
<td>Week 8</td>
<td>Overcoming barriers</td>
<td>What can help? (facilities)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Who can help? (people)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pedometer Challenge Finale</td>
</tr>
<tr>
<td>Week 9</td>
<td>Making Choices</td>
<td>Setting Goals – What are they and how can they help?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Setting Goals – The Principles</td>
</tr>
</tbody>
</table>
### Setting Goals – Let’s do it

### Week 10
| A Physical Activity plan for the holidays | The Holidays |
| Setting a plan for the holidays |
| Setting a plan for the holidays |

#### Term 3 (July - September)

<table>
<thead>
<tr>
<th>Week</th>
<th>Focus</th>
<th>Lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>The Plan and Obstacles</td>
<td>How did we go with our plan?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>What were some obstacles to being physically active?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>How did you manage?</td>
</tr>
<tr>
<td>Week 2</td>
<td>Physical Activity</td>
<td>The effects of not doing physical activity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The effects of not doing physical activity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Why is physical activity so important?</td>
</tr>
<tr>
<td>Week 3</td>
<td>Making Tough Decisions</td>
<td>Making tough decisions – strategies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Making tough decisions – other options</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Making tough decisions</td>
</tr>
<tr>
<td>Week 4</td>
<td>Investigating options</td>
<td>Investigating options</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Investigating options</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Summary lesson</td>
</tr>
<tr>
<td>Week 5</td>
<td>Motivation</td>
<td>Motivation – what is it and why is it important?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motivation – The Pedometer Challenge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motivation – A real life story</td>
</tr>
<tr>
<td>Week 6</td>
<td>Motivation</td>
<td>Motivation – You have to want to do it</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motivation – A sports captain’s story</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Summary lesson</td>
</tr>
<tr>
<td>Week 7</td>
<td>Planning for a lifestyle change</td>
<td>Planning for a lifestyle change</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Planning for a lifestyle change</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Making a plan</td>
</tr>
<tr>
<td>Week 8</td>
<td>The Individual Challenge</td>
<td>An individual challenge – Making a plan and setting goals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>An individual challenge – Motivation</td>
</tr>
</tbody>
</table>
5.3.1.1 Challenges

Two challenges were used in the Sport4Fun Program including The Great Pedometer Challenge (see Appendix 14) and The Olympic Challenge (see Appendix 15). These challenges provided participants with the opportunities to practice the skills and apply the knowledge from the theory and practical sessions using motivational strategies as encouragement.

The Great Pedometer Challenge was conducted in Term 2 2008 and challenged participants to participate in as much physical activity in a three-week period. Each participant wore a pedometer daily and recorded their steps using the pedometer recording sheet (see Appendix 14). Individual and group goals were set prior to the challenge commencing in theory sessions and incentives such as ‘beating the teachers’ were used tomotivate participants. This involved participants nominating teachers they wanted to be involved in The Great Pedometer Challenge and aiming to take more steps daily and at the end of the challenge.

The Olympic Challenge was conducted in Term 3 2008 and encouraged participants to participate in as much physical activity and healthy behaviours to score points. Participants recorded their activities in a small diary over a two-week period (see Appendix 15). As in the Great Pedometer Challenge, goals were set prior to the challenge commencing in theory and sessions and similar incentives, such as ‘beating the teachers’ were used. This challenge focused other behaviours in addition to physical activity such as healthy eating and sedentary behaviours and therefore, participants were encouraged to set goals that would be easy to maintain after the conclusion of the program.
5.3.1.2 Practical Components

For the intervention group, two practical sessions each week were conducted. This consisted of an afternoon sport session and an after-school session, which was a recommendation from the POC trial.

5.3.1.2.1 School Sport Session

Similar to the POC trial, the weekly afternoon sport session was held in scheduled Tuesday school sport time, lasting approximately 90 minutes. A variety of activities were included in the sport sessions, with the focus on modified sports and games, appropriate to participants’ age and gender. Emphasis was on fun and enjoyment, as well as improvement of fundamental movement skills, with peer helpers assisting in the motivation of students.

Some of these activities included cricket and grip ball, ball tag and netball, endzone, relays, paddle tennis, orienteering and speedminton (modified game of badminton). These activities were different to activities offered in the scheduled school sport program and PE classes. Based on participant evaluation, activities for the afternoon sport session were flexible, with participants rewarded with a tenpin bowling activity session at the end of Term 2. An outline of the practical sessions is shown in Table 5.2.

5.3.1.2.2 After-School Session

The after-school physical activity sessions were an addition from the POC trial, as this would provide more opportunities for participants to increase physical activity participation. These were held one afternoon a week, lasting approximately 75-minutes. As parental transport and after-school commitments of students were barriers to attendance for this session, they were not compulsory for students to attend. However, attendance rates are reported in Chapter 6.

The activities included in the after-school session were related to the afternoon sport session, however there was a greater degree of flexibility and participant choice demonstrated. Activities included tennis, fitness circuits, boxing, aerobics, powerwalking, skipping and modified games of gripball and vortex. Where available, peer helpers attended to provide motivation and encouragement for the activities (see Appendix 13). An outline of the practical sessions is shown in Table 5.2.
### Table 5.2

**Outline of the Pilot RCT’s Practical Sessions**

<table>
<thead>
<tr>
<th>Term 2</th>
<th>Afternoon Sport Session</th>
<th>After-School Session</th>
<th>Physical Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Modified Games – Cricket and Grip Ball</td>
<td>Tennis</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Volleyball</td>
<td>Fitness Circuit/Boxing</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Soccer</td>
<td>Softball</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Endzone and touch football</td>
<td>Hockey</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Basketball and relays</td>
<td>Powerwalking</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>(wet weather)</td>
<td>Aerobics</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Paddle Tennis</td>
<td>Touch football</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Netball</td>
<td>Skipping and Fitness</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Speedminton</td>
<td>Grip ball/Vortex</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Tenpin Bowling</td>
<td>Free Choice</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term 3</th>
<th>Afternoon Sport Session</th>
<th>After-School Session</th>
<th>Physical Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(Pupil Free Day)</td>
<td>Hockey</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Volleyball/Newcombe Ball</td>
<td>Tennis</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Touch Football</td>
<td>Boxing/Dodgeball</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Orienteering</td>
<td>T-ball</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Paddle Tennis</td>
<td>Powerwalking</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Boxing</td>
<td>(Inter-school athletics)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Netball</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Basketball and relays</td>
<td>Tennis</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>FMS Testing</td>
<td>Tennis</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Free Choice</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
5.3.1.2.3 Peer Helpers

Peer helpers were students in Years 10, 11 and 12 from the participating school who were approached to assist during the practical sessions of the program (see Appendix 13). The researcher selected these peer helpers based on her knowledge and observations of these students in physical education classes, sporting activities and overall conduct in the school environment. The role of the peer helpers in the program was two-fold. First, to act as role models for the younger students (participants of the program) for physical activity behaviour. Second, to take on an active role in the practical sessions by provide encouragement and support to the participants.

5.3.1.2.4 Parental Communication

From the evaluation of the POC trial, recommendations such as greater parental communication and involvement to assist in support of behaviour change were highlighted. This was included in several ways:

1) For the Pedometer Challenge and Olympic Challenge, parents had to sign the participants’ logs, to verify the activities completed by their child (see Appendix 13 and 14).

2) Newsletters were sent home each term informing parents of the activities completed by their child in the practical and theory components of the program. This allowed opportunities for parents to contact the researcher to discuss their child’s progress (see Appendix 15 and 16).

3) At the conclusion of the program in Term 3, parents were asked to complete an evaluation form and comment on the effectiveness of the program (see Appendix 17).

4) At various stages throughout the program, parents were asked to transport their child to different venues (such as for powerwalking) or pick up their child from school for the after-school sessions. This facilitated informal discussions and feedback from parents on the program.

5.3.2 Pilot RCT Control Group

The participants in the control group attended regular homeroom classes, Tuesday afternoon sport but did not attend any after-school physical activity sessions. Tuesday afternoon sport options for participants in the control group consisted of a range of activities, with some of
these being school sport (volleyball, touch football, soccer, netball and/or basketball), indoor sport (volleyball, indoor cricket, indoor soccer, basketball and gymnastics) or dance.

5.4 Pilot RCT Outcome Measurements

Outcome measurements were taken at baseline (prior to randomisation, March/April 2008) and at follow-up (September 2008) on participants in the intervention and control groups. The researcher organised the data collection sessions, however trained assessors, who were blind to group allocation conducted the measurements. The same primary and secondary outcomes measured in the POC trial were measured in the Pilot RCT (see section 3.5), with some slight modifications made to the measurements, as described below.

5.4.1 Fundamental Movement Skills

Fundamental movement skills were collected using the same procedures as detailed in section 3.5.1. An independent, trained assessor was given the videotapes to code and score the participants’ performance for the five fundamental movement skills.

5.4.2 Objectively Measured Physical Activity

Physical activity was measured using MTI Actigraphs (Model 7164), worn for seven consecutive days during the school term. The criterion for use was the same as the POC Trial and is described in section 3.5.2. In addition to this and to increase the number of days for wear, students were offered merits (based on the school’s merit system) for each day they wore the accelerometer. This was indicated by the completion of the physical activity log for that day.

Two methods were used for reducing the accelerometer data. The comparison method was used for weekdays and the composite method was used for weekend days, as there was incomplete data for some of the participants. If the comparison method were to be used for the weekend days, then some of the participants would have been excluded. These methods are described below.
5.4.2.1 Comparison method for weekdays

For the comparison method, the guidelines recommended by Trost and colleagues (2000) were initially followed for the inclusion of weekday accelerometer data and as followed in the POC trial (≥ 10 hours, ≥ 4 days, see section 3.5.2). However, when reviewing the accelerometer data, at baseline four of the 18 participant’s data had days marginally below 600 minutes, whilst at follow-up a similar trend was observed in 10 of the 18 participants for three days or less. Therefore, to include these days the minimum hours of monitoring was set at nine hours. As weekdays and weekend days were included in separate analyses, to be included in the weekday analysis, participants needed at least 3 weekdays with nine hours (540 minutes) of monitoring. Similar guidelines have been used in other studies (Troiano et al., 2008; Robinson et al., 2003).

5.4.2.2 Composite method for weekend days

For weekend days, an alternative method of reducing the accelerometer data was used. The composite method devised by Alhassan and colleagues (2008), is a data-driven approach for reducing accelerometer data, which uses all available data. This method was used to analyse weekend data, as there was incomplete weekend data for some of the participants. If the original method (comparison method) of reducing accelerometer data were used (Trost et al., 2000), then some participants would have been excluded. Alhassan and colleagues (2008) recommend against excluding participants as bias can be produced, as well as reducing statistical power, altering results and conclusions. In addition to this, the composite method has been used in other school-based interventions (Webber et al., 2008; Peralta, Jones & Okely., 2009) to retain as much data as possible to produce the most accurate estimates of physical activity.

The composite method involved a series of steps where the participants’ weekend-day data were averaged across days. To average the data, the total counts for each minute of the day were calculated by averaging the counts/min for each day with data for that minute. For each participant, this created a composite estimate for each minute of the day, where at least one day of data was available (Alhassan, Sirard, Spencer, Varady & Robinson, 2008).

The composite data were then used to define a day, instead of using an a priori definition of a day (as used in the comparison method). A frequency distribution was performed on each
waking minute (approximately 6.00am to 11.59pm) to determine the percentage of participants with accelerometer data for each minute of the day. From the frequency distribution, the start and end times for a day were defined by the approximate times when no more than 5% of participants were missing data (Alhassan et al., 2008). Based on the frequency distribution ≥95% of the participants had data from 12.00pm to 7.30pm at baseline (n=18) and 11.30am to 8.00pm at followup (n = 18) for weekend days.

The next step involved determining the minimum number of minutes needed to represent a day, as some participants did not have data for part of a day. To do this, the average counts/min of randomly selected 30, 60, 90, 120 up to 450 minutes were correlated with the average counts/min for the entire day (as previously defined as 12.00pm to 7.30pm) for baseline and up to 510 minutes (as previously defined as 11.30am to 8.00pm) for follow-up. A Spearman correlation of 0.8 was obtained at approximately 210 minutes for weekend day at baseline (Figure 5.2) and approximately 240 minutes for weekend day at follow up (Figure 5.3).

Figure 5.2 - Baseline Weekend Correlation
The final step was to calculate the average number of minutes during a day (or part of) spent in sedentary, light, moderate and vigorous intensity levels. Each minute was classified and coded according to four categories, sedentary (4), light (3), moderate (2) and vigorous (1). These intensities were determined from Freedson et al (1997), using the age-specific cut-points. The percentage of time spent in these intensities was then calculated.

5.4.3 Anthropometric Measures

5.4.3.1 Waist Circumference

Waist circumference measurements were collected using the same procedures detailed in section 3.5.3.
5.4.3.2 BMI

Height was collected using the same procedures detailed in section 3.5.3. Weight was measured using portable body fat monitor (Tanita BF – 681, Tanita Corp., Tokyo, Japan), which was calibrated before testing. Participants took off their shoes, socks and any heavy clothing such as tracksuit jackets. They were instructed to stand on the metal sole plate, look straight ahead and stand still until the measurement was taken.

5.4.4 Questionnaires

5.4.4.1 Perceived Physical Competence

Perceived physical competence was assessed using the same instrument as in the POC Trial (see section 3.5.4). Participants completed the questionnaire during the baseline and follow-up testing sessions, administered by the Researcher, and given an explanation and example before completing the questionnaire. Participants were seated at individual desks to complete the questionnaire.

5.4.4.2 Enjoyment of Physical Activity

Enjoyment of physical activity was assessed using the same instrument as in the POC trial (see section 3.5.4). Participants completed the questionnaire during the baseline and follow-up testing sessions, administered by the Researcher, and given an explanation before completing the questionnaire. Participants were seated at individual desks to complete the questionnaire.

5.5 Pilot RCT Data Analyses

5.5.1 Data Handling and Management

Data was recorded using the same procedures as the POC trial (See section 3.6.1), however data were analysed using intention-to-treat principles (p<0.05). There were missing values for accelerometer data and these were imputed as carrying the last observation forward or backwards where appropriate.
Accelerometer data were managed using the steps recommended by Alhassan and colleagues (2008). This is referred to as “accelerometer–data clean”, where minute-by-minute accelerometer data were reviewed to determine the following:

1) whether the number of days with accelerometer data appeared sufficient and match study protocol;
2) sleep and awake times were logical (i.e., periods of high and low counts matched normal sleep and awake times;
3) if there were error codes indicating a monitor malfunction. Esliger and colleagues (2005) suggest that count values of 32,767 are likely to be a result of faulty units or components and have been found to sporadically occur.
4) If there were any counts/mins values ≥ 15,000 and these were investigated using the activity log sheet as well as correspondence with the student. If verified, these counts/mins were included in the analysis or otherwise were changed to missing data (Alhassan et al., 2008).

In addition to this, data were scanned to find periods of at least 20 consecutive minutes during which the accelerometer recorded zeros. These were considered periods when the monitor was not being worn and were changed to missing data (Alhassan et al., 2008). If there was a minute of nonzero data flanked by 2 periods of ≥20 consecutive zeros, the nonzereo data point was also considered part of the nonworn period and set to missing. This was to exclude any periods in which movement was recorded likely due to vibrations or incidental movements (Alhassan et al., 2008). Counts that were registered before and/or after the set time period for wear were also excluded. Once the mentioned procedures were carried out, all remaining data were classified as useable for analysis.

5.5.2 Statistical Analyses

Data were analysed using SPSS 16 (SPSS for MAC, 16.0). Intervention effect were assessed by comparing the follow-up values of the intervention and control groups using one-way analysis of covariance (ANCOVA), adjusting for baseline values. The majority of the data were normally distributed with the exception of one score for perceived physical competence. As the researcher was a teacher at the school and knew the learning characteristics of the participants, this outlier was redistributed to the next highest value scored on the perceived physical competence questionnaire.
This study was a pilot randomised control trial and therefore was not sufficiently powered to detect statistically significant differences between the control and intervention groups. Effect size was calculated as the adjusted difference between treatment and control groups, divided by the pooled within group standard deviation (Robinson et al., 2003). Effect sizes of 0.2, 0.5 and 0.8 are considered small, medium and large effects, respectively (Cohen, 1988).

### 5.6 Summary

This chapter detailed the methods used to in the Pilot RCT. A table summarising the methods used is outlined in Table 5.3. The following chapter will report the findings of the Pilot RCT to determine the trial’s feasibility, acceptability and potential efficacy.

**Table 5.3**

**Methods used in the Pilot RCT**

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Method used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundamental Movement Skills</td>
<td>o “Get Skilled, Get Active” (NSW DET, 2000).</td>
</tr>
<tr>
<td></td>
<td>o Five skills assessed – catch, overarm throw, kick, two-handed strike and sprint run.</td>
</tr>
<tr>
<td></td>
<td>o Skill performed three times and videotaped.</td>
</tr>
<tr>
<td>Objectively Measured Physical Activity</td>
<td>o MTI Actigraphs (Model 7164) worn for seven consecutive days during the school term.</td>
</tr>
<tr>
<td></td>
<td>o Comparison method used for weekdays.</td>
</tr>
<tr>
<td></td>
<td>o Composite method used for weekend days.</td>
</tr>
<tr>
<td>Anthropometric Measures</td>
<td>o Waist circumference measurements were taken using non-extensible tapes in centimetres to the nearest</td>
</tr>
</tbody>
</table>
- Height was calculated using a portable stadiometer, using the stretch stature method.
- Weight was measured using portable electronic scales.
- Body Mass Index (BMI) was calculated using the above measures of height and weight, using the formula $\text{BMI} = \frac{\text{weight (kg)}}{\text{height (m)}^2}$.

<table>
<thead>
<tr>
<th>Perceived Physical Competence</th>
<th>Perceived physical competence was measured using Harter’s Perceived Competence Scale for Children (Harter, 1982).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enjoyment of Physical Activity</td>
<td>Enjoyment of physical activity was assessed using a validated instrument among children and adolescents (Motl et al., 2001).</td>
</tr>
</tbody>
</table>
A school-based pilot randomised controlled trial (RCT) was implemented to promote physical activity and motor development among girls in Year 7, 8 and 9. Altman and colleagues (2001) highlight the importance of randomisation and acknowledge the importance of conducting randomised controlled trials. The advantages of randomisation includes eliminating bias in the assigning of participants to groups, facilitating blinding and strengthening the conclusions drawn from the outcome results (Altman et al., 2001).

The Pilot RCT was designed taking into consideration the feasibility and acceptability findings from the proof-of-concept (POC) trial (see Chapter 4). The sample for the study was not designed to be adequately powered to detect statistically significant differences, therefore the aim was to determine and report on the feasibility, acceptability and potential efficacy of the pilot RCT.

6.1 Participants

The sample for the pilot RCT consisted of 20 secondary school girls, ranging in age from 12.01 to 14.79 years old (mean = 13.20 years). The participants were identified as having low levels of cardiorespiratory fitness, assessed using the Multistage Fitness Test (MSFT). The 20 participants were randomised into two groups – intervention and control. Nineteen of the 20 girls completed follow-up measurements, however all participants with baseline data (n = 20) were included in analyses.

The progression of the participants through each stage of the pilot RCT is shown in Figure 6.1. This graphical representation has been included based on recommendations from the Revised Consolidated Standards of Reporting Trials (CONSORT) Statement for Reporting
Randomised Trials, to ensure participant progression is accurately reported (Altman et al., 2001).

As shown in Figure 6.1, 319 secondary school girls from Years 7, 8 and 9 were eligible to participate in the screening process in physical education (PE) classes, in Term One 2008. Twenty-seven of the 319 girls (8.5%) did not participate in the screening measure, the multistage fitness test, due to absence from PE class, injury or illness. Due to time constraints and the timeline for the screening process, these students were not assessed on the Multistage Fitness Test.
Grade 7, 8 & 9 Girls (n = 319)

Completed Multi-stage Fitness Test in PE classes (n=292) (91.5%)

Did not participate (n = 27) due to absence or injury

Eligible (n = 78) due to lowest level of cardiorespiratory fitness (achievement of below level 4 in the MSFT*)

Ineligible (n = 8) due to sensitive exclusion reasons** or had left the school

Information and consent forms sent to parents (n = 70)

Consent form not returned (n=50). Reasons include:
1) reluctance to be involved in the program
2) other sporting commitments
3) Parents not seeing the reason for child's involvement

Consent form returned (n = 20; 29% response rate)

Baseline measurements (n=20)

Randomisation (n=20)

Intervention (n=10)

Withdrawn student (n=1) due to other sport options

Completed Intervention (n=9)

Follow-up Measurement (n=9)

Analysis conducted (n=10)

Control (n=10)

Participated in Scheduled school sport (n=10)

Follow-up Measurement (n=10)

Analysis conducted (n=10)

Figure 6.1 - Participant flow in the Pilot RCT

* MSFT – Multistage Fitness Test

** Some parents had expressed reluctance in their child participating in the program due to social issues their child was currently experiencing at school and the performance in the
MSFT on the day was not characteristic of the child. This was able to be determined as the researcher had taught these students previously and was aware of their ability. In addition to the above reasons, several students were undergoing surgery from the time screening was completed to the commencement of the program, therefore preventing their participation in screening for the pilot RCT.

***Other sport options were activities scheduled in regular school sport afternoon time and included inter-school competition and school-based round robin competition involving sports such as touch football, basketball, netball, volleyball).

### 6.2 The Research Questions and Hypotheses

The purpose of the pilot RCT was to determine whether the 20-week school-based program would be feasible, acceptable and potentially efficacious. Whilst this was similar to the POC trial, modifications were made that necessitated further testing in this study. They included aspects such as recruitment, design and implementation of the pilot RCT, as well as the addition of a control group to overcome threats to internal validity of the study. The three research questions and related hypotheses were:

1. Is the *Sport4Fun* program feasible, assessed by recruiting a sufficient number of participants, retaining these participants and collecting all measurements at baseline and follow-up?

It was deemed *a priori* that the pilot RCT would be feasible if the following targets were met.

T1 – Thirty girls could be recruited.

T2 – At least 80% of participants could be retained at 6-month follow up.

T3 – 100% of baseline and follow-up data would be collectable and useable, except for objectively measured physical activity data (70% of baseline and follow-up data collected would be useable).
2. Is the program acceptable, determined by implementation of sessions, participant attendance, enjoyment of sessions, and acceptance of the program?

It was deemed that the pilot RCT would be acceptable if the following targets were met.

T4 - 100% of the planned school sport sessions, 80% of the planned after-school sessions and 100% of the morning theory sessions would be implemented.

T5 – An attendance rate of at least 90% amongst participants for the afternoon sport and morning theory sessions would be achieved and a minimum of 50% of participants would attend the after-school sessions.

T6 – A high level of enjoyment for each of the sessions would be reported by all participants. Specifically, scoring a mean greater than 3 on a 5-point Likert scale.

3. Is the program potentially efficacious, determined by trends towards statistical significance for outcome variables such as fundamental movement skill proficiency, weight status, perceived physical competence, enjoyment of and participation in physical activity?

At six-month follow-up, compared with participants allocated to the control group, it was hypothesised that, when compared with participants in the control group, participants in the intervention group would show:

H1 – A greater increase in fundamental movement skill proficiency (run, catch, overhand throw, two-handed strike and kick) and overall fundamental movement skill proficiency.

H2 – Less of a decline in time spent participating in moderate-to-vigorous physical activity; light physical activity and a greater decline in time spent in sedentary behaviour.

H3 – A greater increase in enjoyment of physical activity;

H4 – A greater increase in perceived physical competence;
H5 – A smaller increase in adiposity measures (body mass index (BMI) and waist circumference.)

6.3 Implementation of Intervention and Process Measures

6.3.1 Feasibility

The feasibility of the Sport4Fun program was determined by recruitment, retention of participants and collection of measurements at baseline and follow-up. The following sections detail the results for these measures.

6.3.1.1 Screening and Recruitment

Target 1 – To recruit 30 girls from Year 7, 8 and 9.

The pilot RCT used different screening procedures to the POC trial (see section 3.3.2). Students participated in the 20-metre Multistage Fitness Test in scheduled physical education classes and scores were ranked from lowest to highest. Students scoring less than Level 4 on the Multistage Fitness Test were classified as being below the 30th percentile for their age for cardiorespiratory fitness (Okely et al., 2010). These students were sent an information package and invited to participate in the Pilot RCT.

Seventy information packages were sent out with 20 students and their parents consenting to participate in the pilot RCT (29% return rate). Despite several attempts, only 20 (students) were successfully recruited.

6.3.1.2 Baseline Characteristics

Baseline descriptive statistics for the intervention and control groups are reported in Table 6.1. Of the total sample, the mean age of participants was 13.20 ± 0.85 (± SD) years, with 30% considered non-overweight and 70% either overweight or obese (Cole et al., 2000). This is approximately three times the population prevalence among adolescent girls (Booth, 2008). As indicated in Table 6.1, the intervention group had a larger mean waist circumference, body mass index (BMI) and achieved lower mean scores on fundamental movement skills total and counts per minute of physical activity, than did the control group.
Table 6.1
Baseline Descriptive Characteristics

<table>
<thead>
<tr>
<th>Baseline Characteristics</th>
<th>Intervention (n = 10) Mean (SD)</th>
<th>Control (n = 10) Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>13.57 (0.77)</td>
<td>12.84 (0.81)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>26.49 (6.11)</td>
<td>25.32 (4.53)</td>
</tr>
<tr>
<td>BMI category:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-overweight n (%)</td>
<td>4 (40%)</td>
<td>5 (50%)</td>
</tr>
<tr>
<td>Overweight n (%)</td>
<td>2 (20%)</td>
<td>3 (30%)</td>
</tr>
<tr>
<td>Obese n (%)</td>
<td>4 (40%)</td>
<td>2 (20%)</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>85.03 (16.13)</td>
<td>80.04 (10.67)</td>
</tr>
<tr>
<td>Enjoyment of physical activity (/80)</td>
<td>60.12 (19.03)</td>
<td>63.07 (14.42)</td>
</tr>
<tr>
<td>Perceived physical competence (/72)</td>
<td>47.64 (9.53)</td>
<td>44.85 (7.61)</td>
</tr>
<tr>
<td>Fundamental Movement Skills Total (/30)</td>
<td>17.19 (2.79)</td>
<td>18.71 (3.12)</td>
</tr>
<tr>
<td>Catch (/6)</td>
<td>4.80 (0.63)</td>
<td>4.50 (0.97)</td>
</tr>
<tr>
<td>Overhand Throw (/6)</td>
<td>2.60 (1.27)</td>
<td>3.60 (1.71)</td>
</tr>
<tr>
<td>Run (/6)</td>
<td>2.80 (0.92)</td>
<td>3.00 (0.82)</td>
</tr>
<tr>
<td>Strike (/6)</td>
<td>4.00 (1.76)</td>
<td>4.10 (1.60)</td>
</tr>
<tr>
<td>Kick (/6)</td>
<td>3.00 (0.67)</td>
<td>3.50 (0.97)</td>
</tr>
<tr>
<td>Weekday physical activity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time in Sedentary (%)</td>
<td>54.35 (7.81)</td>
<td>51.06 (7.93)</td>
</tr>
<tr>
<td>Time in LPA* (%)</td>
<td>42.24 (7.30)</td>
<td>44.58 (6.89)</td>
</tr>
<tr>
<td>Time in MPA** (%)</td>
<td>3.20 (1.54)</td>
<td>3.97 (1.86)</td>
</tr>
<tr>
<td>Time in VPA*** (%)</td>
<td>0.22 (0.21)</td>
<td>0.38 (0.29)</td>
</tr>
<tr>
<td>Time in MVPA**** (%)</td>
<td>3.41 (1.73)</td>
<td>4.36 (2.10)</td>
</tr>
<tr>
<td>Total Physical Activity (Counts per minute)</td>
<td>404.21 (104.66)</td>
<td>437.21 (101.17)</td>
</tr>
</tbody>
</table>

* Light Physical Activity : ** Moderate Physical Activity : *** Vigorous Physical Activity : **** Moderate to Vigorous Physical Activity
6.3.1.3 Retention Rates

Target 2 - To retain 80% of intervention and control participants.

The POC trial showed that some participants withdrew (n= 7) from the program to participate in the other sport activities being offered during Tuesday afternoon sport time. Other activities included an inter-school sporting competition, elective sports (including tenpin bowling, beach soccer and powerwalking) and an indoor sport program option. In addition to this, students who withdrew from the POC trial wanted to participate in other sport activities with their friends. As these considerations were present in the school environment when the pilot RCT was conducted, an a priori retention rate of 80% was considered achievable for the Pilot RCT.

At the completion of baseline measurements, 20 participants were successfully randomised to the intervention (n = 10) or the control group (n = 10). However, three weeks into the intervention, one participant withdrew from the intervention group, leaving 9 participants in this group. The reason for the participant withdrawing was because she did not want to participate in the program and preferred to participate with her friends in the other sports offered in the scheduled school sport time, with her friends. These included inter-school competition and school-based round robin competition.

For the Pilot RCT, of the 10 participants randomised to the intervention group, 9 completed the program and follow-up measures (90% retention rate). The participant who withdrew from the intervention group completed baseline measures, and only one of the Tuesday school sport sessions before withdrawing. Of the 10 participants randomised to the control group, all completed follow-up measures (100% retention rate).

Of the total sample, an overall retention rate of 95% (19/20) was achieved and therefore the aim of retaining least 80% of participants was met.
6.3.1.4 Collection of measurements

Target 3 - That 100% of baseline and follow-up data would be collectable and useable, except for objectively measured physical activity data (70% of baseline and follow-up data collected would be useable).

Table 6.2 indicates the number and percentage of participants with useable data at baseline and follow-up. The majority of outcome measurement data were successfully collected at baseline, however not the 100% as hoped for. The exception was the enjoyment of physical activity and perceived physical competence questionnaires for one participant, who returned the permission note after scheduled testing had been performed. Action was taken to collect as many baseline measurements for this student in the possible timeframe. All participants received accelerometers at baseline, however two participants did not provide data that were useable for weekday physical activity. For weekend physical activity, this was below the target set down (of 70%) and an alternate method of analysis, the composite method, was employed (see section 5.4.2.2).

The student who withdrew several weeks into the program, did not return for the follow-up testing. Apart from this student, all other students’ measurements were collected at follow-up. One student in the control group was late to the testing session and needed to return to her scheduled sport at a certain time. Another time was organised to collect this measurement and this was completed, however the measurements for waist circumference were misplaced and therefore, could not be used in data analysis.
Table 6.2
Useable Data Collected at Baseline and Follow-up

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Baseline: (20)</th>
<th>Percentage (%)</th>
<th>Follow-up: (19)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>20</td>
<td>100</td>
<td>19</td>
<td>100</td>
</tr>
<tr>
<td>Weight</td>
<td>20</td>
<td>100</td>
<td>19</td>
<td>100</td>
</tr>
<tr>
<td>BMI</td>
<td>20</td>
<td>100</td>
<td>19</td>
<td>100</td>
</tr>
<tr>
<td>Waist circumference</td>
<td>20</td>
<td>100</td>
<td>18</td>
<td>95</td>
</tr>
<tr>
<td>Enjoyment of Physical activity questionnaire</td>
<td>19</td>
<td>95</td>
<td>19</td>
<td>100</td>
</tr>
<tr>
<td>Perceived physical competence questionnaire</td>
<td>19</td>
<td>95</td>
<td>19</td>
<td>100</td>
</tr>
<tr>
<td>Fundamental movement skills</td>
<td>20</td>
<td>100</td>
<td>19</td>
<td>100</td>
</tr>
<tr>
<td>Physical Activity – Weekday</td>
<td>18</td>
<td>90</td>
<td>18</td>
<td>90</td>
</tr>
<tr>
<td>(Comparison method)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Activity – Weekend</td>
<td>12</td>
<td>60</td>
<td>11</td>
<td>55</td>
</tr>
<tr>
<td>(Composite method)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.3.2 Acceptability

The acceptability of the Sport4Fun program was determined by implementation of sessions, participant attendance, enjoyment of intervention sessions and acceptance of the program by students and parents. The following sections detail the results for these measures.

6.3.2.1 Implementation of Sessions

Target 4 - To implement 100% of the planned school sport sessions, 80% of the planned after-school sessions and 100% of the morning theory sessions.

School sport sessions
In Term 2, all of the scheduled school sport sessions were implemented. However, there was one week (Week 6 – 3rd June) that the practical session was not implemented due to wet
weather. In place of this, a theory session was held to cover the theory required for the upcoming ‘pedometer challenge.’ In Week 2 (6th May), the practical session was taken by another physical education teacher, as the regular teacher was required to attend a meeting. The regular teacher ensured the relieving teacher was briefed on the planned activities to be implemented for the session.

Throughout Term 2, peer helpers from Years 10, 11 and 12 assisted with the school sport sessions. This had a positive impact on the students’ motivation through reinforcement of activities, with students requesting that the helpers come every sport afternoon. However in Term 3 the peer helpers’ attendance decreased due to senior schooling commitments and other competitive sport requirements. Teacher reflections of the sessions when Year 11 helpers were in attendance demonstrated the positive impact these helpers had on the participants. An example is shown below.

“Year 11 helpers of Sarah, Kelly and Jennifer worked very well with the students to motivate and encourage. These 3 students are rostered on every three weeks. The girls participated and played very well today and seemed to enjoy themselves.”

Term 3 was a 10-week term, however with two weeks of post-testing at the end of the term, eight weeks of practical sessions were scheduled. However, due to World Youth Day Celebrations, the first Tuesday of term (22nd July) was a pupil free day. Therefore, all of the possible seven practical sessions were implemented.

After-school sessions
In Term two, nine of the ten after-school sessions were implemented. The session scheduled for the last week of term was not held due to teacher illness and could not be re-scheduled.

In Term three, six of the ten after-school sessions were held. Three of the four sessions had no students attending due to illness or travel arrangements. The other after-school session was not held, as students could not arrange travel home after the session. These sessions were not compulsory to attend and participant numbers varied throughout the two terms.

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*World Youth Day is a youth-oriented Roman Catholic Church Event, held every 2-3 years. It was held in Sydney from 15th to 20th July 2008*
Peer helpers from Years 10 and 11 were also organised to attend the after-school sessions and this was successful to a certain degree in term 2. However due to travel arrangements, after-school work commitments and homework commitments, these helpers did not attend in Term three.

**Morning Theory Sessions**

Term two was a 10-week term, and a possible 22 morning theory sessions were scheduled. Of these, all sessions were implemented and content delivered.

Similar to Term two, Term three was a 10-week term, allowing potentially 25 morning sessions to be scheduled for Term three. All of these sessions were implemented.

In some weeks, less than three morning sessions were implemented. Due to the nature of the school environment, there were events on certain days which restricted the implementation of all three morning sessions. Some of these events such as school assemblies and year meetings were unplanned, however scheduled events such as the National Assessment Program – Literacy and Numeracy, half yearly exams and the school athletics carnival were not anticipated to cause the interruptions that occurred to the morning theory sessions.

In summary, the implementation of the school sport sessions (100%) throughout the 20-week intervention was successful and high, achieving the target percentage. Similarly, the implementation of the morning theory sessions (100%) achieved the target percentage. The implementation of the after-school sessions (75%) was slightly less than expected, and largely a result of minimal participant numbers or illness, which resulted in some sessions being cancelled. These factors were beyond the control of the teacher.
6.3.2.2 Participant Attendance

Target 5 – An attendance rate of at least 90% amongst participants for the afternoon sport and morning theory sessions could be achieved and a minimum of 50% of participants would attend the after-school sessions.

School sport sessions

Attendance rates for each afternoon sport session for Term 2 and Term 3 are shown in Tables 6.3 and 6.4, respectively. The average afternoon sport session attendance was 91% (range 44% to 100%). Ten sessions had 100% attendance, six of the 17 sessions had an attendance rate above 75% and one session had an attendance rate of 44%. The sole reason for non-attendance was students being absent from the school on the day. When this was investigated, the reason given for being absent on the day was due to illness and not related to having to attend the afternoon sport session. The overall average afternoon sport session attendance rate was slightly higher than the target rate (90%) at 91%.

Table 6.3
Afternoon Sport Session – Term 2

<table>
<thead>
<tr>
<th>TERM 2 (April – June)</th>
<th>ATTENDANCE n=9 (%)</th>
<th>REASONS FOR ABSENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>7 (78)</td>
<td>Absent from school</td>
</tr>
<tr>
<td>Week 2</td>
<td>9 (100)</td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td>7 (78)</td>
<td>Absent from school</td>
</tr>
<tr>
<td>Week 4</td>
<td>7 (78)</td>
<td>Absent from school</td>
</tr>
<tr>
<td>Week 5</td>
<td>9 (100)</td>
<td></td>
</tr>
<tr>
<td>Week 6</td>
<td>9 (100)</td>
<td></td>
</tr>
<tr>
<td>Week 7</td>
<td>9 (100)</td>
<td></td>
</tr>
<tr>
<td>Week 8</td>
<td>8 (89)</td>
<td>Absent from school</td>
</tr>
<tr>
<td>Week 9</td>
<td>9 (100)</td>
<td></td>
</tr>
<tr>
<td>Week 10</td>
<td>9 (100)</td>
<td></td>
</tr>
</tbody>
</table>
Table 6.4
Afternoon Sport Session – Term 3

<table>
<thead>
<tr>
<th>TERM 3 (July – September)</th>
<th>ATTENDANCE</th>
<th>REASONS FOR ABSENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 9 (%)</td>
<td></td>
</tr>
<tr>
<td>Week 11</td>
<td>Not held</td>
<td>Pupil Free day</td>
</tr>
<tr>
<td>Week 12</td>
<td>8 (89)</td>
<td>Absent from school</td>
</tr>
<tr>
<td>Week 13</td>
<td>9 (100)</td>
<td></td>
</tr>
<tr>
<td>Week 14</td>
<td>9 (100)</td>
<td></td>
</tr>
<tr>
<td>Week 15</td>
<td>8 (89)</td>
<td>Absent from school</td>
</tr>
<tr>
<td>Week 16</td>
<td>4 (44)</td>
<td>Absent from school /</td>
</tr>
<tr>
<td>Week 17</td>
<td>9 (100)</td>
<td>holidays</td>
</tr>
<tr>
<td>Week 18</td>
<td>9 (100)</td>
<td></td>
</tr>
<tr>
<td>Week 19</td>
<td>Testing</td>
<td></td>
</tr>
<tr>
<td>Week 20</td>
<td>Testing</td>
<td></td>
</tr>
</tbody>
</table>

Morning Theory Sessions

Attendance rates for each morning theory session for Term 2 and Term 3 are shown in Tables 6.5 and 6.6, respectively. The average morning attendance was 80% (range 22% to 100%). Nine sessions had 100% attendance, 27 of the 46 sessions had an attendance rate above 75% and the rates for 10 of the 46 sessions were below 75%. The reasons for absences included students being absent from school, arriving at school late (after the homeroom time had finished), maths tutoring every Thursday morning in Term 2, NAPLAN, forgetting to attend the morning session and half-yearly exams, where students were required to attend their (regular) homeroom class. The average morning attendance rate was slightly below the target rate (90%) at 80%.

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1 NAPLAN – National Assessment Program in Literacy and Numeracy was conducted May 13th to May 16th 2008, for students in Year 7 and 9 in Secondary Schools. Students in these Year groups were required to complete tests on Reading, Writing, Language Conventions (Spelling, Grammar and Punctuation) and Numeracy.
Table 6.5  
Morning Theory Sessions – Term 2

<table>
<thead>
<tr>
<th>TERM 2 (April – June)</th>
<th>ATTENDANCE</th>
<th>REASONS FOR ABSENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 9 (%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wednesday</td>
<td>Thursday</td>
</tr>
<tr>
<td>Week 1</td>
<td>9 (100)</td>
<td>8 (89)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 (89)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Absent from school / Maths Tutoring</td>
</tr>
<tr>
<td>Week 2</td>
<td>9 (100)</td>
<td>8 (89)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9 (100)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maths Tutoring</td>
</tr>
<tr>
<td>Week 3</td>
<td>9 (100)</td>
<td>8 (89)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9 (100)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NAPLAN</td>
</tr>
<tr>
<td>Week 4</td>
<td>8 (89)</td>
<td>5 (56)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pupil Free</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Absent from school</td>
</tr>
<tr>
<td>Week 5</td>
<td>8 (89)</td>
<td>5 (56)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 (78)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Absent from school / half yearly exams</td>
</tr>
<tr>
<td>Week 6</td>
<td>6 (67)</td>
<td>7 (78)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meetings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Absent from school, maths tutoring, late to school</td>
</tr>
<tr>
<td>Week 7</td>
<td>6 (67)</td>
<td>6 (67)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 (67)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Absent from school, maths tutoring, late to school</td>
</tr>
<tr>
<td>Week 8</td>
<td>6 (67)</td>
<td>8 (89)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9 (100)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Absent from school, maths tutoring, late to school</td>
</tr>
<tr>
<td>Week 9</td>
<td>9 (100)</td>
<td>7 (78)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Late to school, maths tutoring, carnival</td>
</tr>
<tr>
<td>Week 10</td>
<td>2 (22)</td>
<td>7 (78)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-attendance, absent from school</td>
</tr>
</tbody>
</table>
### Table 6.6

**Morning Theory Sessions – Term 3**

<table>
<thead>
<tr>
<th>TERM 3</th>
<th>ATTENDANCE N = 9 (%)</th>
<th>REASONS FOR ABSENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(July - September)</td>
<td>Wednesday</td>
<td>Thursday</td>
</tr>
<tr>
<td>Week 11</td>
<td>8 (89)</td>
<td>7 (78)</td>
</tr>
<tr>
<td>Week 12</td>
<td>8 (89)</td>
<td>8 (89)</td>
</tr>
<tr>
<td>Week 13</td>
<td>8 (89)</td>
<td>9 (100)</td>
</tr>
<tr>
<td>Week 14</td>
<td>8 (89)</td>
<td>7 (78)</td>
</tr>
<tr>
<td>Week 15</td>
<td>7 (78)</td>
<td>5 (56)</td>
</tr>
<tr>
<td>Week 16</td>
<td>8 (89)</td>
<td>8 (89)</td>
</tr>
<tr>
<td>Week 17</td>
<td>8 (89)</td>
<td>8 (89)</td>
</tr>
<tr>
<td>Week 18</td>
<td>5 (56)</td>
<td>7 (78)</td>
</tr>
<tr>
<td>Week 19</td>
<td>8 (89)</td>
<td>6 (67)</td>
</tr>
<tr>
<td>Week 20</td>
<td>9 (100)</td>
<td>9 (100)</td>
</tr>
</tbody>
</table>

**After-school sessions**

Attendance rates at the after-school session were also recorded to determine the acceptability of the session and are shown for Term 2 and Term 3 in Tables 6.7 and 6.8, respectively. The average attendance rate for the after-school session was 33%, which was lower than the target rate (50%). The attendance rate was much lower than for the afternoon sport session, primarily because the after-school session was not compulsory for students to attend. Reasons why students were not able to attend these sessions included inability to find transport home and limited public transport to get home when the session concluded, other after-school...
commitments, illness and homework commitments. Despite this, some students commented that they enjoyed the after-session more when there were less students in attendance as they got “more turns” at some of the sports (for example tennis). As the teacher, it was often difficult to implement the activities planned when small numbers were in attendance.

Table 6.7
After-school Sessions – Term 2

<table>
<thead>
<tr>
<th>TERM 2</th>
<th>ATTENDANCE</th>
<th>REASONS FOR ABSENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(April – June)</td>
<td>n = 9 (%)</td>
<td></td>
</tr>
<tr>
<td>Week 1</td>
<td>7 (78)</td>
<td>Lack of transport</td>
</tr>
<tr>
<td>Week 2</td>
<td>6 (67)</td>
<td>Lack of transport</td>
</tr>
<tr>
<td>Week 3</td>
<td>3 (33)</td>
<td>Lack of transport/other after-school commitments</td>
</tr>
<tr>
<td>Week 4</td>
<td>4 (44)</td>
<td>Lack of transport</td>
</tr>
<tr>
<td>Week 5</td>
<td>6 (67)</td>
<td>Lack of transport/other after-school commitments</td>
</tr>
<tr>
<td>Week 6</td>
<td>4 (44)</td>
<td>Lack of transport/other after-school commitments</td>
</tr>
<tr>
<td>Week 7</td>
<td>3 (33)</td>
<td>Lack of transport/other after-school commitments / Illness</td>
</tr>
<tr>
<td>Week 8</td>
<td>5 (56)</td>
<td>Illness</td>
</tr>
<tr>
<td>Week 9</td>
<td>2 (22)</td>
<td>Lack of transport/other after-school commitments</td>
</tr>
<tr>
<td>Week 10</td>
<td>Cancelled</td>
<td>Teacher Illness</td>
</tr>
</tbody>
</table>
### Table 6.8

**After-school Sessions – Term 3**

<table>
<thead>
<tr>
<th>TERM 3 (July - September)</th>
<th>ATTENDANCE N = 9 (%)</th>
<th>REASONS FOR ABSENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 11</td>
<td>Cancelled* 0 (0)</td>
<td></td>
</tr>
<tr>
<td>Week 12</td>
<td>5 (56)</td>
<td>Lack of transport/other after-school commitments</td>
</tr>
<tr>
<td>Week 13</td>
<td>3 (33)</td>
<td>Lack of transport/other after-school commitments</td>
</tr>
<tr>
<td>Week 14</td>
<td>3 (33)</td>
<td>Lack of transport/other after-school commitments</td>
</tr>
<tr>
<td>Week 15</td>
<td>2 (22)</td>
<td>Lack of transport/other after-school commitments / Illness</td>
</tr>
<tr>
<td>Week 16</td>
<td>Cancelled* 0 (0)</td>
<td></td>
</tr>
<tr>
<td>Week 17</td>
<td>Cancelled* 0 (0)</td>
<td></td>
</tr>
<tr>
<td>Week 18</td>
<td>2 (22)</td>
<td>Lack of transport/other after-school commitments / Illness</td>
</tr>
<tr>
<td>Week 19</td>
<td>2 (22)</td>
<td>Lack of transport/other after-school commitments / Illness</td>
</tr>
<tr>
<td>Week 20</td>
<td>Cancelled* 0 (0)</td>
<td></td>
</tr>
</tbody>
</table>

* Cancelled due to limited participant numbers.
6.3.2.3 Enjoyment of Sessions

Target 6 – A high level of enjoyment for each of the sessions could be demonstrated by all participants. (Specifically, scoring a mean greater than 3 on the 5-point enjoyment Likert scale).

In each theory session following the practical sessions, participants completed enjoyment scales based on the activities completed in each session. Tables 6.9 and 6.10 show the mean scores for each activity implemented in these sessions for Term 2 and Term 3, respectively. The mean of means for the school sport sessions for Term 2 was 4.2 and for Term 3 was 3.8. Therefore, the total mean of means for the school sport sessions was 4.0. The mean of means for the after-school sessions for Term 2 was 4.7 and for Term 3 was 4.7, with a total mean of means for the after-school sessions of 4.7. Overall, a very high level of enjoyment for the practical sessions was achieved.

Table 6.9
Participant Enjoyment Scale – Term 2

<table>
<thead>
<tr>
<th></th>
<th>School Sport Session</th>
<th>After-school Session</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enjoyment 1 2 3 4 5</td>
<td>Enjoyment 1 2 3 4 5</td>
</tr>
<tr>
<td>Activity</td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td>Week 1</td>
<td>4 4.7 4.2 - -</td>
<td>4.3 4.1 4.6 4.4 4.7</td>
</tr>
<tr>
<td>Week 2</td>
<td>3.4 3.3 3.7 4.4 4.4</td>
<td>3.8 4.3 4.7 4.8 4.7</td>
</tr>
<tr>
<td>Week 3</td>
<td>- - - - -</td>
<td>4 5 5 5 5</td>
</tr>
<tr>
<td>Week 4</td>
<td>3.9 3.4 3.9 4.6 -</td>
<td>4.0 5 - - - - -</td>
</tr>
<tr>
<td>Week 5</td>
<td>3.6 4.2 4.5 4.3 -</td>
<td>4.2 4.8 - - - - -</td>
</tr>
<tr>
<td>Week 6</td>
<td>- - - - -</td>
<td>4 4.3 4.3 4.5 - 4.3</td>
</tr>
<tr>
<td>Week 7</td>
<td>3.8 - - - - -</td>
<td>3.8 5 4.7 5 5 - 4.9</td>
</tr>
<tr>
<td>Week 8</td>
<td>4.3 4.0 4.3 4.7 -</td>
<td>4.3 4 4.6 5 4.6 - 4.6</td>
</tr>
<tr>
<td>Week 9</td>
<td>4 4.6 - - -</td>
<td>4.3 - - - - - -</td>
</tr>
<tr>
<td>Week 10</td>
<td>5 - - - - -</td>
<td>5 - - - - - -</td>
</tr>
<tr>
<td>Overall Mean</td>
<td></td>
<td>4.2</td>
</tr>
</tbody>
</table>

The number of activities for each session varied from week to week. For each week there were a maximum of five activities, depending on the focus for the session.
Table 6.10
Participant Enjoyment Scale – Term 3

<table>
<thead>
<tr>
<th>TERM 3 (July - September)</th>
<th>School Sport Session Enjoyment</th>
<th>After-school Session Enjoyment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Week 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 2</td>
<td>3.4</td>
<td>4.4</td>
</tr>
<tr>
<td>Week 3</td>
<td>3.5</td>
<td>4</td>
</tr>
<tr>
<td>Week 4</td>
<td>4</td>
<td>4.3</td>
</tr>
<tr>
<td>Week 5</td>
<td>3.2</td>
<td>3.8</td>
</tr>
<tr>
<td>Week 6</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Week 7</td>
<td>4.1</td>
<td>3.9</td>
</tr>
<tr>
<td>Week 8</td>
<td>3.9</td>
<td>4</td>
</tr>
<tr>
<td>Week 9</td>
<td>3.5</td>
<td>3.8</td>
</tr>
<tr>
<td>Week 10</td>
<td>3.7</td>
<td>3.6</td>
</tr>
<tr>
<td>Overall Mean</td>
<td>3.8</td>
<td>3.8</td>
</tr>
</tbody>
</table>

The number of activities for each session varied from week to week. For each week there were a maximum of five activities, depending on the focus for the session.

6.3.2.4 Acceptance of the Program

6.3.2.4.1 Student responses

In addition to ranking their enjoyment of each activity, participants were encouraged to write comments about the session. From these comments, specific themes emerged regarding factors influencing the level of enjoyment of the practical sessions. These included the notion of fun, participating with friends and perceived level of competence.

**Notion of Fun**

The students’ enjoyment of the practical sessions reflected the ‘level of fun’ experienced whilst participating in the activity. There were a variety of comments from the students, however, the majority felt that they enjoyed the activities because they were fun. For example,
Participant T commented on several sessions, “I liked it a lot and it was fun” and “it was fun and I want to do it again.” Participant B, M and W’s comments reflect this notion of fun by stating “the games we played were really fun to play”, “I liked what we did on Tuesday it was fun” and “it was fun and I really enjoyed it”, respectively.

In other comments, students were more specific and included their reason for ‘fun’. This included how well they were able to perform the activity, as participant B stated “the two activities that were done were (were) fun because it was just an easy game to play.” The type of activity for the session also influenced the ‘notion of fun’, as participant M commented “I liked ball tag it was fun” and participant B stated “the reason why I liked paddle tennis was because it was fun to do.” Furthermore, the fun students experienced from the activities was also associated with what they gained from participating in the sessions. Participant T reflected “it was really fun and I learnt some new things” whilst participant K commented “it was fun and I enjoyed it because it was good exercise and involved teamwork.”

The reason for fun was also related to if the activity was performed individually and the number of participants in the activity. In reference to an orienteering activity, where a combination of partner and individual work was used, participant K commented “I liked the yellow course better because it was more fun individually.”

For the after-school sessions, there were a limited number of students in attendance, however for some activities this increased the level of fun and enjoyment as students had more opportunities to participate. Participant T referred to a session where the activities were focused on tennis and stated “it was fun cause there were not many people.”

There were examples where students did not find some of the activities fun and this had a negative impact on their enjoyment of the practical session. For Participant N, activities involving running decreased the enjoyment and fun experienced in the sessions and she commented on several sessions “I hate running, it’s even harder when you’re dribbling a ball” and “Speedminton is really fun, but I hate running in crows and cranes.” Participant M also commented “I found pateka and paddle tennis challenge boring and not fun.”
Participating with Friends

The students’ level of enjoyment of the activities was influenced by whom they participated with. Generally, students experienced a high level of enjoyment when participating with friends. This also contributed to the ‘fun’ students experienced in the activity. Participant B commented on the sport and after-school sessions that “these activities were fun because we could spend more time with my friends, the games were fun to play” and “the reason why I liked powerwalking is because I could spend time with my friend.” The theme of participating with friends was also valued by Participant T who said “it was ok cause I got to use my friends.”

Level of Competence

The students’ perception of how well they participated in an activity, or whether it was challenging, influenced their level of enjoyment. Generally, if students thought the activity was hard, or if it was boring, it resulted in a low level of enjoyment being recorded. This was supported by comments such as “the pateka game was hard because it was very hard to get in the air, because of the wind” (Participant B) and “it was not that fun. It was very hard” (Participant M). Participant N’s comment reflects the idea that when level of competence is low, the activity is boring, “table tennis is better and I’m really bad at paddle tennis and it’s really boring.”

However, when the activities were challenging, some of the students enjoyed it. For example, participant B commented “I liked the drill game because it was the most challenging game out of all.” There were requests from some students to perform more fitness based activities, as participant K suggested “I would like to do more sit-ups and push-ups”, however, this was met with mixed opinions from the other students.

6.3.2.4.2 Parent responses

At the completion of the 20-week program, a survey was sent home for Parents/Guardians to complete. Parents were asked to respond to statements using a scale ranging from “strongly disagree” to “strongly agree”. Seven out of the nine surveys were completed and returned (response rate 78%), with 2 students either forgetting to return or losing the surveys. The results from the survey are shown in Table 6.11.
Table 6.11
Results from Parent Surveys

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>My daughter talked to me about the <em>Sport4Fun</em> program.*</td>
<td>83%</td>
<td>17%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The feedback from my daughter about the program was positive.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The <em>Sport4Fun</em> program has had a positive impact on my daughter’s enjoyment of physical activity.</td>
<td>57%</td>
<td>43%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The <em>Sport4Fun</em> program has had a positive impact on my daughter’s physical activity levels.</td>
<td>29%</td>
<td>57%</td>
<td>14%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The <em>Sport4Fun</em> program has had a positive impact on my daughter’s perceived physical competence, that is, how good she thinks she is at physical activities compared with other girls her age.</td>
<td>14%</td>
<td>57%</td>
<td>29%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The <em>Sport4Fun</em> program has had a positive impact on my daughter’s time watching TV, DVDs, playing computer games, PlayStation and Internet surfing.</td>
<td>43%</td>
<td>57%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The <em>Sport4Fun</em> program has had a positive impact on how my daughter feels about herself.</td>
<td>14%</td>
<td>71%</td>
<td>14%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My daughter has enjoyed participating in Tuesday afternoon sport for Terms 2 and 3 due to the program.</td>
<td>86%</td>
<td>14%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The <em>Sport4Fun</em> program has provided my daughter with opportunities to experience other sports and physical activities.</td>
<td>43%</td>
<td>57%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The <em>Sport4Fun</em> program developed other skills in my daughter such as decision making skills, time management skills and goal setting skills.</td>
<td>57%</td>
<td>14%</td>
<td>29%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SD – Strongly Disagree, D - Disagree, N – Neither, A – Agree, SA – Strongly Agree

* One parent did not respond to this statement
All seven parents either agreed or strongly agreed that the *Sport4Fun* program had a positive impact on their daughter’s physical activity levels and that their daughter enjoyed participating in Tuesday afternoon sport. Similarly, responses from the parent surveys indicated that the participants talked with their parents about the *Sport4Fun* program and that this feedback was positive. The majority of parents (57%) agreed that the program had a positive impact on their daughter’s physical activity levels and perceived physical competence, with 14% and 29% respectively strongly agreeing with the above. There were a small percentage (29%) of parents who indicated that the program had neither a positive or negative impact on their daughter’s physical activity levels and an even smaller percentage (14% = to one parent) who strongly disagreed that the program had a positive impact on their daughter’s perceived physical competence. Even though the majority of parents (57%) agreed the program had a positive impact on their daughter’s time watching TV, DVDs, playing computer game, PlayStation and Internet surfing, and provided opportunities for their daughter to experience other sports and physical activities, 43% indicated that the program had neither a positive or negative impact on the previously mentioned aspects. The majority of parents either agreed (71%) or strongly agreed (14%) that the program had a positive impact on how their daughter felt about herself, with one parent (14%) strongly disagreeing with this. A small percentage of parents either agreed (14%) or strongly agreed (29%) that the program developed skills such as decision making, time management and goal setting in their daughter, whilst 57% neither agreed or disagreed with this statement. These parent responses provide valuable information concerning the acceptability of the program within the school community.

Throughout the intervention, several parents did comment on their child’s perception of the program via verbal communication with the teacher facilitator. Three parents commented on how much their daughter enjoyed participating in the program. It was anticipated that the after-school session would be continued into Term 4, however one parent indicated that other after-school commitments would make it difficult for regular attendance. This highlighted other competing factors for high student attendance at the after-school sessions.

In summary, the majority of responses from students and parents were positive concerning the *Sport4Fun* program. In addition, a high level of enjoyment was reported by students for the sport and after-school sessions.
6.4 Physical and Behavioural Outcomes

6.4.1 Potential Efficacy

The potential efficacy of the pilot RCT was determined by trends towards statistical significance for outcome variables. The primary outcomes were fundamental movement skill proficiency and time spent in physical activity, while secondary outcomes were enjoyment of physical activity, perceived physical competence and adiposity (BMI and waist circumference). Table 6.12 shows results for the intervention and control groups for the primary and secondary outcome variables.
Table 6.12
Primary and Secondary Outcome Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Intervention Group Baseline</th>
<th>6-months</th>
<th>Control Group Baseline</th>
<th>6-months</th>
<th>Adjusted Int-Ctl Difference (95% CI)</th>
<th>P Value</th>
<th>Effect Size (Cohen’s d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMS Total</td>
<td>17.19</td>
<td>19.52</td>
<td>18.71</td>
<td>18.87</td>
<td>1.48</td>
<td>0.26</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>(2.79)</td>
<td>(3.42)</td>
<td>(3.12)</td>
<td>(2.78)</td>
<td>(-1.21 to 4.17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two-Handed Strike</td>
<td>4.00</td>
<td>4.50</td>
<td>4.10</td>
<td>4.40</td>
<td>0.14</td>
<td>0.76</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>(1.76)</td>
<td>(1.51)</td>
<td>(1.60)</td>
<td>(0.84)</td>
<td>(-0.82 to 1.11)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kick</td>
<td>3.00</td>
<td>3.80</td>
<td>3.50</td>
<td>4.10</td>
<td>-0.20</td>
<td>0.62</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>(0.67)</td>
<td>(0.92)</td>
<td>(0.97)</td>
<td>(0.74)</td>
<td>(-1.03 to 0.63)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catch</td>
<td>4.80</td>
<td>4.80</td>
<td>4.50</td>
<td>4.30</td>
<td>0.45</td>
<td>0.39</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>(0.63)</td>
<td>(1.23)</td>
<td>(0.97)</td>
<td>(0.95)</td>
<td>(-0.63 to 1.52)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overhand Throw</td>
<td>2.60</td>
<td>3.10</td>
<td>3.60</td>
<td>3.10</td>
<td>0.34</td>
<td>0.66</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>(1.27)</td>
<td>(1.66)</td>
<td>(1.71)</td>
<td>(1.60)</td>
<td>(-1.25 to 1.93)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Run</td>
<td>2.80</td>
<td>3.30</td>
<td>3.00</td>
<td>3.00</td>
<td>0.35</td>
<td>0.30</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>(0.92)</td>
<td>(0.82)</td>
<td>(0.81)</td>
<td>(0.67)</td>
<td>(-0.34 to 1.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variables</td>
<td>Intervention Group</td>
<td>Control Group</td>
<td>Adjusted Int-Ctl Difference (95% CI)</td>
<td>P Value</td>
<td>Effect Size (Cohen’s d)</td>
<td></td>
<td></td>
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<tr>
<td>-------------------------------</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Week day physical activity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total physical activity</td>
<td>404.21 (104.66)</td>
<td>436.44 (131.05)</td>
<td>77.49 (8.21 to 132.77)</td>
<td>0.03</td>
<td>1.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Counts per minute)</td>
<td>437.21 (101.17)</td>
<td>387.09 (79.94)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage time Sedentary</td>
<td>54.55 (8.02)</td>
<td>50.99 (7.69)</td>
<td>-0.06 (-0.10 to -0.01)</td>
<td>0.02</td>
<td>-1.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage time in LPA</td>
<td>42.06 (7.46)</td>
<td>48.58 (6.60)</td>
<td>0.05 (0.01 to 0.09)</td>
<td>0.02</td>
<td>1.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage time in MPA</td>
<td>3.18 (1.57)</td>
<td>3.80 (1.91)</td>
<td>0.01 (-0.01 to 0.02)</td>
<td>0.34</td>
<td>0.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage time in VPA</td>
<td>0.22 (0.21)</td>
<td>0.35 (0.27)</td>
<td>0.002 (0.000 to 0.001)</td>
<td>0.54</td>
<td>0.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage time in MVPA</td>
<td>3.39 (1.76)</td>
<td>4.15 (2.23)</td>
<td>0.01 (-0.01 to 0.02)</td>
<td>0.34</td>
<td>0.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weekend day physical activity</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total physical activity</td>
<td>445.61 (140.32)</td>
<td>388.48 (163.47)</td>
<td>-74.80 (-178.35 to 28.74)</td>
<td>0.14</td>
<td>-0.82</td>
<td></td>
<td></td>
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<tr>
<td>(Counts per minute)</td>
<td>380.30 (136.28)</td>
<td>399.95 (163.25)</td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Percentage time Sedentary</td>
<td>35.48 (9.68)</td>
<td>38.84 (18.05)</td>
<td>2.40 (-15.35 to 20.16)</td>
<td>0.78</td>
<td>0.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage time in LPA</td>
<td>41.86 (17.52)</td>
<td>41.22 (18.41)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage time in MPA</td>
<td>3.85 (2.23)</td>
<td>3.93 (2.23)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage time in VPA</td>
<td>0.35 (0.27)</td>
<td>0.20 (0.14)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage time in MVPA</td>
<td>1.76 (1.23)</td>
<td>1.62 (1.23)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variables</td>
<td>Intervention Group</td>
<td>Control Group</td>
<td>Adjusted Int-Ctl Difference (95% CI)</td>
<td>P Value</td>
<td>Effect Size (Cohen’s d)</td>
<td></td>
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<tr>
<td>-----------------</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Percentage time in LPA</td>
<td>62.68 (11.65)</td>
<td>59.58 (18.63)</td>
<td>-1.09 (-19.17 to 16.99)</td>
<td>0.90</td>
<td>-0.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage time in MPA</td>
<td>1.69 (2.94)</td>
<td>1.52 (2.05)</td>
<td>-0.68 (-1.73 to 0.37)</td>
<td>0.19</td>
<td>-0.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage time in VPA</td>
<td>0.14 (0.24)</td>
<td>0.06 (0.10)</td>
<td>-0.24 (-0.88 to 0.41)</td>
<td>0.45</td>
<td>-0.49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage time in MVPA</td>
<td>1.83 (3.06)</td>
<td>1.58 (2.12)</td>
<td>-0.92 (-2.37 to 0.53)</td>
<td>0.20</td>
<td>-0.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>26.49 (6.11)</td>
<td>25.32 (4.53)</td>
<td>0.24 (-0.52 to 1.00)</td>
<td>0.52</td>
<td>0.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WC</td>
<td>85.03 (16.13)</td>
<td>80.04 (10.67)</td>
<td>0.17 (-1.79 to 2.12)</td>
<td>0.86</td>
<td>0.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPC</td>
<td>47.64 (9.35)</td>
<td>44.85 (7.61)</td>
<td>-3.34 (-5.86 to -0.82)</td>
<td>0.01</td>
<td>-1.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enjoyment</td>
<td>60.12 (19.03)</td>
<td>63.07 (14.42)</td>
<td>-4.26 (-11.87 to 3.35)</td>
<td>0.25</td>
<td>-0.47</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

⊕ Adjusted for baseline values

* Standardised effect size (Cohen’s d) expressed in standard deviation multiples to allow comparisons of effect size across different measures and studies, calculated as the adjusted difference between treatment control groups divided by the pooled within group standard deviation.
6.4.1.1 Primary Outcome Variables

The Sport4Fun feasibility trial was not designed to have adequate power to detect statistically significant differences between the intervention and control groups for any of the outcome variables (primary or secondary) measured. However, the majority of the results in Table 6.12, were encouraging.

H1 – Increase in fundamental movement skill proficiency (run, catch, overhand throw, two-handed strike and kick):

The results indicated that participants in the intervention group had a greater increase in fundamental movement skills from baseline to follow up (1.48 [95% CI = -1.21 to 4.17], p= 0.26, d= 0.48). A small to medium effect size for total FMS score suggested that the intervention participants had greater improvements in FMS from baseline to follow up.

For individual fundamental movement skills, a slightly greater increase in the intervention group was found for the two-handed strike (0.14 [95% CI = -0.82 to 1.11] p=0.76), catch (0.45 [95% CI = -0.63 to 1.52] p=0.39), overhand throw (0.34 [95% CI = -1.25 to 1.93] p=0.66) and run (0.35 [95% CI = -0.34 to 1.05] p=0.30). Small effect sizes were reported for the two-handed strike (d=0.12), kick (d=0.24) and overhand throw (d=0.21) and small to medium effect sizes for the catch (d=0.41) and run (d=0.47).

H2 - Slow the decline in time spent participating in moderate-to-vigorous physical activity; light physical activity and a greater decline in time spent in sedentary behaviour.

The means, 95% confidence intervals, p value and standardised effect sizes for total physical activity (counts per minute – CPM) and percentage of time spent in sedentary, light, moderate, vigorous and moderate to vigorous intensity physical activity are displayed in Table 6.12.

The results for weekday physical activity show that the intervention participants, compared with the control participants, had a significantly greater increase in total physical activity (CPM) (adjusted difference = 77.49 [95% CI = 8.21 to 132.77], p = 0.03, d = 1.26). A large effect size (d=1.26) was found.
Sedentary behaviour for the intervention participants remained constant from baseline to follow up but increased sharply in the control group. A significantly greater increase in percentage of time spent in sedentary behaviour (adjusted difference = -0.06 [95% CI = -0.10 to -0.01], p = 0.02, d=-1.62). This resulted in a large effect size (d=-1.62) being recorded.

There was a significant intervention effect for percentage of time spent in light physical activity (adjusted difference = 0.05 [95% CI = 0.01 to 0.09], p = 0.02, d=1.45), with this explained by a precipitous decline among control group participants. This resulted in a large effect size being recorded.

There was less of a decline in percentage of time spent in moderate physical activity (adjusted difference = 0.01 [95% CI = -0.01 to 0.02], p = 0.34, d = 0.57) in the intervention group compared with the control group. A medium effect size was found.

There was also less of a decline in percentage of time spent in vigorous physical activity (adjusted difference = 0.002 [95% CI = 0.000 to 0.001], p = 0.54, d = 0.88) in the intervention group compared with the control group. This resulted in a large effect size.

Similarly, there was less of a decline in percentage of time spent in moderate-to-vigorous physical activity (adjusted difference = 0.01 [95% CI = -0.01 to 0.02], p = 0.34, d = 0.66) in the intervention group compared with the control group. This resulted in a medium effect size.

The results for weekend physical activity showed no significant intervention effects for either group, with the trends reported below.

For total physical activity (CPM), the results for weekend physical activity showed that the intervention participants, compared with the control participants, had a larger decrease in total physical activity (CPM) (adjusted difference = -74.80 [95% CI = -178.85 to 28.74], p = 0.14, d = -0.82).

Percentage of time spent in sedentary behaviour for the intervention participants showed a slightly larger increase than the control group, with the sedentary behaviour for the latter group also increasing. However, this was not significant (adjusted difference = 2.40 [95% CI = -15.35 to 20.16], p = 0.78, d=0.23), with a small effect size evident.
For percentage of time spent in light physical activity, there were decreases shown in both groups, with this being slightly larger in the intervention group (adjusted difference = -1.09 [95% CI = -19.17 to 16.99], p = 0.090, d=- 0.16). A small effect size was recorded.

There was a decline in percentage of time spent in moderate physical activity (adjusted difference = -0.68 [95% CI = -1.73 to 0.37], p = 0.19, d = - 0.51), for the intervention group; with a slight increase in the control group. A small to medium effect size was found.

Percentage of time spent in vigorous physical activity for the intervention group remained constant, with a slight increase for the control group (adjusted difference = -0.24 [95% CI = -0.88 to 0.41], p=0.45, d=- 0.49). A small to medium effect size was reported.

A slight decline was found in percentage of time spent in moderate to vigorous physical activity in the intervention group, with a slight increase for the control group (adjusted difference = -0.92 [95% CI = -2.37 to 0.53], p=0.20, d=-0.53). A medium effect size was reported.

6.4.1.2 Secondary Outcome Variables

The secondary outcome variables included enjoyment of physical activity, perceived physical competence and adiposity measures such as body mass index and waist circumference.

**H3 – Increase in enjoyment of physical activity:**

There was a greater increase in the control group compared with the intervention group. That is, the difference was not in the hypothesised direction (-4.26 [95% CI = -11.87 to 3.35], p=0.25, d = -0.47), with a small effect size found.

**H4 – Increase in perceived physical competence:**

There was a significantly greater increase in control group compared with the intervention group (-3.34 [95% CI = -5.86 to -0.82], p = 0.01, d = -1.02). This difference was also not in the hypothesised direction and a large effect size was recorded.
H5 - Reduction or stabilisation in adiposity measures (body mass index (BMI) and waist circumference.)

There was no difference in BMI (0.24 [95% CI = -0.52 to 1.00], p = 0.52, d=0.27) and waist circumference (0.17 [95% CI = -1.79 to 2.12], p = 0.86, d = 0.02) among girls in the intervention group compared with those in the control group. This resulted in only small effect sizes being found for both measures.

6.5 Summary of Results

The Pilot RCT aimed to determine the feasibility, acceptability and potential efficacy of a secondary school-based program in promoting physical activity and motor development in Year 7, 8 and 9 girls. Data were collected from 20 girls from the same Catholic Co-education Secondary School as the POC Trial. The results obtained are summarised in Table 6.13.

Table 6.13
Summary of Results

<table>
<thead>
<tr>
<th>Research Question 1</th>
<th>Results</th>
</tr>
</thead>
</table>
| 1. Is the Sport4Fun program feasible, assessed by recruiting a sufficient number of participants, maintaining these participants and collecting all measurements at baseline and follow-up? | Screening: Completed during physical education classes, using the Multistage Fitness Test (MSFT).
Recruitment: Students who scored less than Level 4 on the MSFT received information packages inviting them to participate in the program.
- 70 information packages were sent out, 20 students consented (29% return rate).
Randomisation: The 20 students were randomised into either the intervention or control group.
- 10 students randomised into the intervention group. |
- 10 students randomised into the control group.

Retention: 20 students were screened and recruited to complete the trial. One participant from the intervention group withdrew consent after completing one practical session.

Collection of measurements: All measurements were collected as proposed except for waist circumference and weekend physical activity.

<table>
<thead>
<tr>
<th>Research Question 2</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Is the program acceptable, determined by implementation of sessions, participant attendance, enjoyment of sessions, and acceptance of the program?</td>
<td>Implementation: Tuesday sport sessions - 16 / 16 sessions implemented.</td>
</tr>
<tr>
<td></td>
<td>Implementation: Morning theory sessions - 47/47 sessions implemented.</td>
</tr>
<tr>
<td></td>
<td>Implementation: Thursday after-school sessions. - 15/20 sessions implemented</td>
</tr>
<tr>
<td></td>
<td>Attendance: Tuesday sport sessions - 91% attendance.</td>
</tr>
<tr>
<td></td>
<td>Attendance: Morning theory sessions - 80% attendance</td>
</tr>
<tr>
<td></td>
<td>Attendance: Thursday after-school sessions. - 33% attendance</td>
</tr>
<tr>
<td></td>
<td>Enjoyment: Tuesday sport sessions - Mean enjoyment of 4.00</td>
</tr>
<tr>
<td></td>
<td>Enjoyment: Thursday after-school sessions - Mean enjoyment of 4.7.</td>
</tr>
<tr>
<td></td>
<td>Participant perception of program - Positive comments from participants with common themes identified including notion of fun, participating with friends and level of competence. These themes were linked to participant enjoyment of</td>
</tr>
</tbody>
</table>
the program.

Parent feedback:
- Majority of parental feedback was positive, as attained through parental surveys. This was mainly in aspects such as participant communication and feedback with parents about the program, positive impact on participant’s enjoyment and perceived physical competence and participation in sport sessions.

<table>
<thead>
<tr>
<th>Research Question 3</th>
<th>Results</th>
</tr>
</thead>
</table>
| 3. Is the program potentially efficacious, determined by trends towards statistical significance for outcome variables such as fundamental movement skill proficiency, perceived physical competence, enjoyment and participation in physical activity? | FMS
- Total Intervention group had greater improvements in total FMS score. (1.48 [95% CI = -1.21 to 4.17], p= 0.26, d= 0.48).
- Two-handed Strike Intervention group had greater improvements in the two-handed strike. (0.14 [95% CI = -0.82 to 1.11] p=0.76, d=0.12)
- Kick Intervention group had smaller improvements in the kick. (-0.20 [95% CI = -1.03 to 0.63] p=0.62, d=0.24)
- Catch Intervention group had greater improvements in the catch. (0.45 [95% CI = -0.63 to 1.52] p=0.39, d=0.41)
- Overhand Throw Intervention group had greater improvements in the overhand throw. |
- **Run**
  Intervention group had greater improvements in the run.

(0.34 [95% CI = -1.25 to 1.93] \(p=0.66, d=0.21\))

- **Weekday Physical Activity**

  - **Total physical activity (CPM)**
    Significantly greater increase in the intervention group than the control for total weekday physical activity.
    (77.49 [95% CI = 8.21 to 132.77, \(p=0.03, d=1.26\))

  - **% Time in Sedentary Activity**
    A significantly greater increase shown in the control group for percentage of time spent in sedentary behaviour, which remained constant in the intervention group.
    (-0.06 [95% CI = -0.10 to -0.01], \(p = 0.02, d=-1.62\))

  - **% Time in Light Physical Activity**
    A significantly greater decrease shown in the control group for percentage of time spent in light physical activity, with a smaller decrease shown in the intervention group.
    (0.05 [95% CI = 0.01 to 0.09], \(p = 0.02, d=1.45\))

  - **% Time in Moderate Physical Activity**
    Intervention group had slightly greater increase in percentage of time spent in moderate physical activity.
    (0.01 [95% CI = -0.01 to 0.02], \(p = 0.34, d = 0.57\))

  - **% Time in Vigorous Physical Activity**
    There was less of a decline in percentage of time spent in vigorous physical activity in the intervention group compared with the control
group. This resulted in a large effect size.
(0.002 [95% CI 0.000 to 0.001], p = 0.54, d = 0.88)

- % Time in MVPA

Intervention group had slightly greater increase in percentage of time spent in moderate to vigorous physical activity.
(0.01 [95% CI -0.01 to 0.02], p = 0.34, d=0.66)

Weekend Physical Activity
- Total physical activity (CPM)

The results for weekend physical activity show that the intervention participants, compared with the control participants, had a larger decrease in total physical activity (CPM) (-74.80 [95% CI = -178.85 to 28.74], p = 0.14, d = - 0.82).

- % Time in Sedentary Activity

Percentage of time spent in sedentary behaviour for the intervention participants showed a slightly larger increase than the control group, with the sedentary behaviour for the latter group also increasing (2.40 [95% CI = -15.35 to 20.16], p = 0.78, d=0.23).

- % Time in Light Physical Activity

For percentage of time spent in light physical activity, there were decreases shown in both groups, with this being slightly larger in the intervention group (-1.09 [95% CI = -19.17 to 16.99], p = 0.090, d=-- 0.16).

- % Time in Moderate Physical Activity

There was a decline in percentage of time spent in moderate physical activity (-0.68 [95% CI = -1.73 to 0.37], p = 0.19, d = - 0.51), for the intervention group; with a slight increase in the control group.
- **% Time in Vigorous Physical Activity**
  Percentage of time spent in vigorous physical activity for the intervention group remained constant, with a slight increase for the control group (-0.24 [95% CI = -0.88 to 0.41], p=0.45, d=0.49).

- **% Time in MVPA**
  A slight decline is shown in percentage of time spent in moderate to vigorous physical activity in the intervention group, with a slight increase for the control group (-0.92 [95% CI = -2.37 to 0.53], p=0.20, d=-0.53).

**Enjoyment**
Intervention group had smaller increases in enjoyment of physical activity.
(-4.26 [95% CI = -11.87 to 3.35], p=0.25, d=-0.47)

**Perceived physical competence**
Intervention group had smaller increases in perceived physical competence.
(-3.34 [95% CI = -5.86 to -0.82], p = 0.01, d = -1.02)

**BMI:**
No difference in BMI.
(0.24 [95% CI = -0.52 to 1.00], p = 0.52, d=0.27).

**Waist circumference**
No difference in waist circumference.
(0.17 [95% CI = -1.79 to 2.12], p = 0.86, d=0.02).
CHAPTER 7

DISCUSSION

The findings from the Pilot RCT demonstrate the feasibility, acceptability and potential efficacy of a multi-faceted secondary school-based physical activity program (Sport4Fun) for girls in Years 7, 8 and 9 (ages 12 to 14 years). The Sport4Fun program was designed to have the following effects on primary outcomes: increase fundamental movement skill proficiency, increase time spent participating in moderate-to-vigorous physical activity; light intensity physical activity; and decrease the time spent in sedentary behaviour; and have the following effects on secondary outcomes: increase enjoyment of physical activity and perceived physical competence; and decrease the adiposity measures of BMI and waist circumference. A POC trial was conducted at the same secondary school, which identified strategies that improved the screening process, recruitment and retention of participants and the implementation of the Pilot RCT.

The Pilot RCT was designed to inform subsequent larger-scale efficacy trials. Further, the findings of the Pilot RCT can be used by other researchers and members of the wider school community to provide insight and examination of current strategies used in school curriculum and extra-curricular interventions, relating to adolescent girls.

This chapter will summarise key results, compare these results with other similar studies and then provide possible explanations using current literature. Recommendations will be provided after each research question, to inform future school-based physical activity interventions. The discussion chapter will follow the format outlined in the CONSORT Statement (Moher et al., 2010).
7.1 Research Question One and Targets: Feasibility

Is the Sport4Fun program feasible, assessed by recruiting a sufficient number of participants, retaining these participants and collecting all measurements at baseline and follow-up?

The first research question investigated whether the Sport4Fun program was feasible. The following targets were set relevant to feasibility:

Target 1 – 30 girls could be recruited.

Target 2 – At least 80% of participants could be retained at 6-month follow-up.

Target 3 – 100% of baseline and follow-up data would be collectable and useable, except for objectively measured physical activity data (70% of baseline and follow-up data collected would be useable).

7.1.1 Target One – Recruitment of 30 girls

7.1.1.1 Summary of results

The Pilot RCT used different screening procedures to the POC Trial (see sections 3.3.2 and 6.3.1.1). Girls in Years seven, eight or nine, who were classified as being below the 30th percentile for their age for cardiorespiratory fitness were invited to participate in the Pilot RCT.

Seventy information packages were sent out with 20 students being recruited and randomly allocated (10 girls in the intervention group and 10 girls in the control group). Therefore, the recruitment goal of 30 students was not achieved.

7.1.1.2 Comparison with other studies

The recruitment process for the Pilot RCT was more effective than methods used in the POC Trial (see section 3.3.3), even though the target of 30 participants was not reached. Warren et al (2007) highlight that the recruitment process can be the most challenging aspect to any trial.
Although other Pilot RCTs have reported slightly higher recruitment figures, they are still comparable with the current study.

Weintraub et al (2008) conducted a six-month Pilot RCT to evaluate the feasibility, acceptability and efficacy of an after-school team sports program for reducing weight gain in low-income overweight children. BMI, objectively measured physical activity using accelerometers, screen time, self-esteem and depressive symptoms were assessed at baseline and 3 and 6 months after randomisation. Twenty-one participants from Grades four and five, with a BMI at or above the 85th percentile, were successfully recruited; almost identical to the current study. Various recruitment methods such as the delivery of flyers to homes and physician referrals were used, with these strategies designed to minimise stigmatisation (Weintraub et al., 2008).

Robinson et al (2003) recruited 61 girls (8-10 year-olds) for a 12-week Pilot RCT “Stanford GEMS”, which aimed to test the feasibility, acceptability and potential efficacy of after-school dance classes and family-based intervention. Outcome measures included implementation and process measures, body mass index, waist circumference, physical activity measured by accelerometry, self-reported media use and meals eaten with television. Robinson et al (2003) exceeded recruitment goals (of 50 participants) and used various methods for recruitment including the use of community centres and after-school programs, community youth leaders, presentations at schools, community events and churches and posting flyers. The success of the “Stanford GEMS” reinforced the importance of using various methods to recruit sufficient participants (Robinson et al., 2003).

Dudley et al (2010) conducted a Pilot RCT to determine the feasibility, acceptability and potential efficacy of a school-based physical activity program delivered during school time among adolescent girls. The program involved Year 11 girls in one school setting, who had low level of enjoyment of physical activity. Thirty-eight girls were recruited, with 17 in the intervention group and 21 in the control group. Measures such as The Physical Activity Enjoyment Scale (PACES), The Physical Self-Perception Profile (PSPP), The Family and Peer Support Index and accelerometers used to measure physical activity were used.

Another school-based Pilot RCT, “The FILA Program” (Peralta, Jones & Okely, 2009), recruited 33 Grade 7 boys from one school setting to determine the feasibility, acceptability
and potential efficacy of a school-based obesity prevention program. Boys with sub-optimal cardiorespiratory fitness were recruited, with outcome measures of BMI, waist circumference, percent body fat, cardiorespiratory fitness, objectively measured physical activity and small screen recreation time.

The studies by Dudley et al (2010) and Peralta et al (2009), both had recruitment rates slightly higher than the current study, however unlike the studies by Weintraub et al (2008) and Robinson et al (2003), only one method of recruitment was used, as with the Sport4Fun program. Therefore, in light of the current study, specific considerations may be needed to recruit more participants, as outlined below.

7.1.1.3 Possible explanations

The increase in the number of participants recruited from the POC Trial to the Pilot RCT can be attributed to various reasons. First, different and improved screening procedures were used in the Pilot RCT. All Girls in Years 7, 8 and 9 were screened rather than all students in Year 7 as was used in the POC. Screening was also conducted in the same year as the Pilot RCT, not the last term of the previous year as completed with the POC trial (see section 5.2.2). Second, follow-up procedures and parental contact with selected participants took place to inform parents about the program and to provide further information and clarification for aspects of the program. Third, active promotion of the program in the school, through school newsletters and year assemblies was completed on a larger scale than in the POC trial to encourage participants to the program. In addition to this, the opportunity was provided at a Parents and Friends Meeting (during the recruitment period) for parents to come and receive additional information about the program and ask questions.

Even with the above improvements and modifications, the target recruitment figure was still not achieved. Possible explanations may be:

1) Multiple recruitment methods may have been more effective. Studies by Weintraub et al (2008), and Robinson et al (2003) used more than one method to recruit participants. Whilst this is possible with community-based programs, it is not possible with school-based programs. Therefore, greater focus on informing parents about the program, and providing incentives to attend such information nights may have been effective.

2) The presence of limitations specific to a single-school site. The current study targeted girls with low levels of cardiorespiratory fitness and screening was completed during
PE lessons. Great consideration was taken to avoid and limit any adverse labelling or stigma associated with such a program. The title “Sport4Fun”, was created to channel the focus of the program, which was to improve the participants’ level of physical activity participation. Parents were well informed of the study through newsletters and the information night and recruitment numbers did increase from the POC Trial. However, there still was present some misconceptions about the program such as students not wanting to participate as they would not be with friends and they didn’t want to be seen to be participating in something different from the rest of their year group. In addition to this, some parents, thought that the after-school sessions were compulsory and therefore if they could not arrange transport, their child could not participate. Once contacted, this misconception was corrected, however it was not possible for all parents to be contacted. Of the targeted participants, approximately 10 out of the 70 were contacted.

3) Low fitness and physical activity levels may not have been perceived as an important enough area for both parents and girls to motivate them to participate in the program. This therefore would have influenced the number of parents and girls consenting to be involved in the program.

7.1.2 Target Two – Retain 80% of participants at six-month follow-up

7.1.2.1 Summary of results

The POC Trial showed that some participants withdrew from the program to participate in the other sport activities being offered during school sport time. Therefore, when the Pilot RCT was conducted an a priori retention rate of 80% was considered achievable for the Pilot RCT.

This target was exceeded with only one participant withdrawing from the program, and therefore 19 of 20 participants were retained (95%). One participant, who was randomised to the intervention group, withdrew after completing baseline measures and one of the school sport sessions. After this, there were 9 participants in the intervention group and 10 participants in the control group. The retention rate of 95% supports the feasibility of the procedures used.
7.1.2.2 Comparison with other studies

Of the studies identified, retention rates are comparable with the current study (95%). Weintraub et al (2008), conducted assessments at 3 and 6-months after randomisation for the 21 participants (intervention = 9; control = 12). All participants (100%) were retained at follow-up.

The Stanford GEMS Pilot RCT (Robinson et al., 2003) reported a high retention rate for the 61 participants in the program. Follow-up assessments were conducted 12-weeks after randomisation, with 28 girls in the intervention group and 33 girls in the active placebo (control) group. One participant who was assigned to the intervention group was lost to follow-up, therefore 60 of the 61 participants were retained at follow-up (98%). This is comparable with the current study where only one participant was lost at follow-up, however the Stanford GEMS program had a larger sample size.

Dudley et al (2010) reported less than anticipated retention goals for his study for engaging adolescent girls in school sport. Thirty-eight adolescent girls were assigned to intervention (n=17) and control (n=21) groups, with follow-up assessments occurring 12-weeks after randomisation. Twenty-six of these participants were retained at follow-up (63%), with possible reasons for this specific to the secondary school environment (for example, students leaving school in Year 11, first year of post-compulsory schooling).

Peralta et al (2009) reported a similar retention rate for the school-based Pilot RCT targeting adolescent boys. Thirty-three participants were recruited, with 16 in the intervention group and 17 in the active comparison group. One participant was lost at 6-month follow-up, resulting in a retention rate of 97%. As with the current study, only one participant was lost at follow-up, however “The FILA Program” had a slightly larger sample size.

7.1.2.3 Possible explanations

There are several explanations for the high retention rate in the current study. First, all measures were low-risk and relatively non-invasive. The only exception for this was waist circumference and wearing the accelerometers. However, considerations such as same-sex assessors being used for the measurement of waist circumference and sensitivity to individual measurements were implemented. Regarding accelerometers, participants were offered
incentives to wear the accelerometers at baseline and follow-up to ensure the minimum days of monitoring were adhered to. These incentives were based on the school’s merit award system and were a recommendation from the POC Trial.

Secondly, the Pilot RCT was guided by information provided from the POC Trial, performed in the same school setting, two years earlier. Other intervention programs targeting physical activity and adolescent girls, highly value the importance of pilot testing and a comprehensive needs assessment to determine key features of the intervention (Robinson et al., 2008; Neumark-Sztainer et al., 2003). From the POC Trial, several key aspects (see Chapter 5.1) were recommended to strengthen the recruitment, retention and intervention of the Pilot RCT.

7.1.3 Target Three – Successful collection of 100% useable baseline and follow-up data from all participants, except for objectively measured physical activity (successfully collect 70% of useable physical activity data at baseline and follow-up)

7.1.3.1 Summary of results

The majority of outcome measurement data were successfully collected at baseline and follow-up, however not the 100% as proposed. 100% of height, weight, BMI and fundamental movement skills assessment data were collected and useable and 95% or more of waist circumference, enjoyment of physical activity and perceived physical competence data were collected and useable at baseline and follow-up. For weekday physical activity data, 90% were collected and useable at baseline and follow-up, therefore exceeding the target proposed. However, for weekend physical activity data, this was below the set target. Therefore, to ensure all possible physical activity data could be used, a second data reduction and analysis method was employed for weekend physical activity (referred to as the composite method, Alhassan et al., 2008; see section 5.4.2.2).

7.1.3.2 Comparison with other studies

Several studies also report on feasibility measures such as the amount of useable data collected at baseline and follow-up. Robinson et al (2003) for Stanford GEMS, reports a successful level of data useable at baseline and follow-up. As detailed earlier, only one
participant was lost at follow-up and in addition to this another participant’s follow-up data could not be used in analysis due to a measurement error. However all other anthropometric measures, 24-hour dietary recalls and surveys of girls and parents/guardians were obtained from the remaining 60 participants. In addition to this, physical activity monitoring data were obtained from 59 girls (97%). However, it was not reported if all these data were useable nor the method used for accelerometer data reduction.

In the school setting, Dudley et al (2010) report that accelerometry data were collected from, 79% of participants at baseline and 47% at follow-up. One of the main reasons reported for not being able to collect data from participants was them being absent from school on the day of testing, as they only wore accelerometers during school sport (Dudley et al., 2010). It was vital that the researcher followed up students who were absent in the current study so all measurements were collected.

Another Pilot RCT implemented in the school setting, ‘The FILA Program’ (Peralta et al., 2009), reports successful and useable data collection methods. One hundred percent of data were collected at baseline and follow-up for all measures, with the exception of objectively measured physical activity, where 72% of accelerometer data collected were useable. Peralta et al (2009) used the composite method to reduce the accelerometer data.

The above three studies support the results found in the current study for the successful collection of useable data. The Stanford GEMS program (Robinson et al., 2003) used the home environment for all data collection procedures, therefore making this more convenient than the school environment, as being absent from school of the day of testing is not a factor. In considering this, the current study demonstrates similar results for collection of data, with slightly lower rates of physical activity accelerometry data. For other school-based settings where data were collected, the current study is comparable with The FILA program, where one hundred percent of measures were collected and useable, with the exception of physical activity accelerometry data. The current study reports a higher percent of collected and useable physical activity accelerometry data, however this is a challenging area for compliance. Finally, as mentioned earlier (Dudley et al., 2010), the school environment can be a difficult setting to collect data, due to student absenteeism and other variables out of the control of data collectors. All possible methods were employed in the current study to follow-up students to ensure the maximum amount of useable data was collected.
7.1.3.3 Possible explanations

Possible reasons for a high degree of success in this area of feasibility can be attributed to a number of factors. First the researcher was a teacher in the school setting, making it possible to follow-up and access students to arrange an alternative testing time if required. Second, participants were well informed of the procedure and timeline for data collection at baseline and follow-up. This ensured participants attended when they were expected to and were aware of their responsibilities. Third, incentives were used to ensure participants followed the guidelines for accelerometer compliance. Participants responded well to this, as it was set within the school merit award system.

For the measures such as waist circumference, perceived physical competence and enjoyment of physical activity, where only 95% of the data were collected and useable, factors beyond the researcher’s control contributed to this. For perceived physical competence and enjoyment of physical activity, consent was received later from the participant and time to collect the data was limited as it was immediately before the school holidays. The waist circumference measurement was not recorded accurately at follow-up and therefore was not included in data analysis. This was performed at a different time to the other participants, as the student was absent on the day of testing.

7.1.4 Feasibility Limitations

The feasibility limitations of this study relate to areas of recruitment, retention and collection of physical activity data.

7.1.4.1 Recruitment

Not achieving the proposed recruitment target may have been due to several factors in the school environment. First, some students may have been reluctant to participate as it did not involve their friends and in secondary school this may be a determining factor influencing their recruitment. Second, from correspondence with parents, they were reluctant to commit to the program as they could not arrange transport for the after-school component of the intervention. Parents believed that if transport could not be arranged for this session, their child could not participate.
7.1.4.2 Retention

High retention rates may be partly attributed to the presence of the researcher of the program being a teacher in the school. This teacher had been a staff member of the school for more than five years and was familiar with the daily procedures of the school. Therefore, this may not be replicable in a larger scale RCT.

7.1.5 Feasibility Recommendations

The findings from this study highlights a number of recommendations for future interventions including:

1. Using several methods to recruit participants is likely to be more successful than using one setting only. This may be more likely to increase recruitment rates, however may not be achievable in the school setting. A more realistic approach may be to try and keep friendship groups together. This would mean having participants in the program that may not be targeted, however may increase recruitment.

2. Conducting a POC trial or smaller trial is effective for informing procedures for a Pilot RCT.

3. It is beneficial to have a contact or teacher in the school environment to assist in data follow-up and checking of compliance. This ensures knowledge of the school environment is present when conducting the program.

7.2 Research Question Two and Targets: Acceptability

Is the program acceptable, determined by implementation of sessions, participant attendance, enjoyment of sessions, and acceptance of the program?

The second research question investigated whether The Sport4Fun program was acceptable. The following targets were set relevant to acceptability:

Target 4 – 100% of the planned school sport sessions, 80% of the planned after-school sessions and 100% of the morning theory sessions would be implemented;
Target 5 – An attendance rate of at least 90% amongst participants for the afternoon sport and morning theory sessions would be achieved and a minimum of 50% of participants would attend the after-school sessions.

Target 6 – A high level of enjoyment for each of the sessions would be reported by all participants. Specifically, scoring a mean greater than 3 on a 5-point Likert scale.

7.2.1 Target Four – Implement 100% of the planned school sport sessions, 80% of the planned after-school sessions and 100% of the morning theory sessions

7.2.1.1 Summary of results

In the Pilot RCT, all the school sport sessions (100%) were implemented, achieving this aspect of the proposed target. However, of the possible 20-planned after-school sessions, 15 were implemented (75%). All morning theory sessions were implemented (100%), achieving the proposed target.

7.2.1.2 Comparison with other studies

The number of intervention studies reporting implementation rates is limited, however these are discussed below and have similar components to the current study. ‘The Fila Program’ (Peralta et al., 2009) consisted of one 60-minutes curriculum session and two 20-minutes physical activity sessions per week, all conducted in the school setting. The curriculum session consisted of theory and practical components and the researcher facilitated these sessions. Of these curriculum sessions, all except two were implemented as planned. For the practical sessions, in the first half of the program 13 of the 14 planned lunchtime sessions were implemented (93%) and in the second half of the program all eight planned lunchtime sessions (100%) were implemented (Peralta et al, 2009).

Another school-based program focusing on adolescent girls was implemented over an 11-week school term (Dudley et al., 2010). The intervention consisted of six fortnightly sessions, lasting 90 minutes, delivered during school sport time. All six (100%) were implemented, which is comparable to the implementation of the practical sessions for the current study.
The ‘Stanford Gems’ pilot study consisted of after-school dance classes and the 5-lesson intervention was designed to reduce television, videotape and video game use (Robinson et al., 2003). For the 5-lesson intervention, 82% of treatment group families received all 5 lessons, with an additional follow-up visit being completed. Dance classes were conducted on 96.6% of the days on which they could have occurred.

Two other studies have reported implementation rates, however these were health behaviour interventions embedded within the school curriculum. These are comparable to the theory and school sport sessions implemented in the current study. The ‘Eat Well and Keep Moving’ program was a classroom-based intervention for children in grades 4 and 5 (Gortmaker et al., 1999a). The intervention focused on behaviour changes such as decreasing consumption of foods high in total and saturated fats; increasing consumption of fruits and vegetables to 5 or more a day, reducing TV viewing to less than 2 hours per day and increasing moderate and vigorous physical activity. The intervention was implemented by the classroom teacher and intervention content was developed to fit into maths, science, language arts and social studies, in addition to providing links to physical education. From the survey data collected from teachers, 22 of a possible 31 (71%) nutrition and physical activity lessons, on average were completed during the intervention (Gortmaker et al., 1999a).

‘Planet Health’ was a school-based intervention for boys and girls in Grades 6 and 8, lasting 2 years (Gortmaker et al., 1999b). The sessions were included within the existing curricula for the major subjects (language arts, maths, science and social studies) and physical education. The lessons were delivered by the classroom teacher and the physical education teacher, who received the Planet Health training workshops. Classroom lessons addressed a key theme in one lesson per subject for language arts, maths, science and social studies, with a total of 16 core lessons to be taught in Year 1 and 16 in Year 2 (total of 32). These lessons were designed for one or two 45-minute periods, depending on the level of detail chosen by the teacher. Results showed classroom teachers completed on average of 3.5 lessons for the year, with a minimum of four lessons to be completed (Gortmaker et al., 1999b).

Physical education lessons were organised into 30, 5-minute ‘microunits’ that were designed to be repeated in Year 2, with extension activities. Results indicated that physical education teachers completed on average 8.2 microunits during the year (Gortmaker et al., 1999b).
7.2.1.3 Possible explanations

The implementation rates of the sessions for the afternoon sport session and morning theory sessions were an improvement from the POC Trial (see section 4.3.2.1). The proposed target of implementing 100% of the school sport sessions is comparable with similar school-based studies (Peralta et al., 2009; Dudley et al., 2010). Possible reasons such as teacher absence and wet weather were overcome with practical and relevant strategies in place. This included using theory content when wet weather prevented the practical sessions from being implemented and catching up on missed content in subsequent theory sessions. For the morning theory sessions, the proposed target of implementing 100% of the morning theory sessions is also comparable with another school-based study (Peralta et al., 2009). Factors attributing to the achievement of this target include the presence of the teacher in the school environment where the program was implemented and being able to use all available time to deliver the content.

Finally, the implementation rate for the after-school sessions (75%) was slightly below the proposed target (80%). ‘The Stanford GEMS’ program is the only reviewed intervention with implementation rates for an after-school component, which was higher than those reported in the current study. For this component of the current study, there needed to be greater consideration and consultation with parents concerning the ability to arrange transport and the availability for attendance. Robinson et al (2003), cites transportation being a barrier to the after-school component for the ‘Stanford GEMS’ program and in considering this, a more realistic target needed to be proposed for the current study.

7.2.2 Target Five – An attendance rate of at least 90% amongst participants for the afternoon sport and morning theory sessions would be achieved and a minimum of 50% of participants would attend the after-school sessions.

7.2.2.1 Summary of results

The average attendance for participants at the school sport sessions was 91%, which was slightly higher than the target rate of 90% (see section 6.3.2.2).
The average attendance for participants at the morning theory sessions was 80%, which was slightly below the target rate of 90% (see section 6.3.2.2).

Attendance rates at the non-compulsory after-school sessions were also recorded to determine the acceptability of the session. This after-school component was not included in the POC Trial and was thought to be an important inclusion to provide opportunities for participants to engage in physical activity outside the structured school day. The average attendance rate for the after-school sessions was much lower than the proposed target (50%), with this being 33%. Possible explanations can be found in section 7.2.2.3.

7.2.2.2 Comparison with other studies

Many of the studies reviewed and compared were curriculum-based studies, therefore students were required to be at school. Even though this was the case with some of the components of the current study, it was important to determine the acceptability of the program to report on attendance rates for all components of the program.

Peralta et al (2009), report on the attendance rates for the ‘FILA Program’, with these being comparable with the current study. For the afternoon 60-minute curriculum sessions, the average attendance was 89% and for the lunchtime sessions, an average attendance of 40% for the first half and 44% for the second half.

Dudley et al (2010) implemented six sessions, during school sport time, which were of a practical nature. The average attendance for participants in the intervention group was 4.3 sessions out of a possible 6 (72%). The attendance rates for the current study, for a comparable component of the intervention - the school sport sessions (conducted in school sport time) - is higher than what was reported here.

Robinson et al (2003) reported the attendance rates for the ‘Stanford GEMS’ program. The after-school dance classes were offered after school at three neighborhood centres. The overall attendance rates for the treatment group was 46% attending at least two days per week, however there were differences at two of the individual sites. For one site, 70% attended an average of at least two days per week, whereas for another site 33% attended. This difference was largely explained by transportation opportunities, which will be further explored in section 7.2.2.3 (Robinson et al., 2003).
The Stanford Sports to Prevent Obesity Randomised Trial (SPORT) also reported the attendance rates for their program (Weintraub et al., 2008). The treatment intervention consisted of an after-school team sports program and the “active placebo” control group consisted of an after-school health education program. The mean attendance (range) for the intervention (after-school soccer) group was reported for all possible days, first 3 months and second 3 months, with this being 42% (14%-86%); 53% (13%-85%) and 35% (0%-88%) respectively. The mean attendance (range) for the control (after-school health education) group was reported for all possible days, first 3 months and second 3 months, with this being 46% (3%-94%); 45% (0%-100%) and 49% (0%-100%) respectively.

Finally, another study to report attendance rates was the ‘Trial of Activity for Adolescent Girls’ (TAAG) (Webber et al., 2008). The 2-year intervention (conducted between 2003 and 2005) targeted schools, community agencies and girls in Grade 6 to 8, to increase opportunities, support and incentives for increased physical activity. The aim of the intervention was to reduce the decline in moderate-to-vigorous physical activity in adolescent girls and included health education classes (six delivered in Year 7 and Six in Year 8), as well as activities to increase physical activity performed before and after school. Across the 36 schools involved in TAAG, health education lessons were taught to 91% of 7th and 8th grade girls in the first year of the intervention and 77% of 7th and 8th grade girls in the second year of the intervention.

7.2.2.3 Possible explanations

Even though the morning sessions were compulsory as students were required to attend homeroom, the attendance rates still fell before the proposed target of 90%. Upon reflection, greater consideration was needed towards those students who did come to school late and students who ‘forgot’ to attend the morning sessions in the library. Furthermore, it may have been more realistic to set the target attendance rate for these sessions lower, to account for these reasons. A similar study with adolescent boys (Peralta et al., 2009) used a target of 80% attendance, which may have been more achievable.

In contrast, the school sport sessions were compulsory, and slightly exceeded the proposed target attendance. A possible explanation for this was that this session was during the school day, so unless students signed out (or left school early), they were in attendance.
The after-school sessions were not compulsory and did not meet the proposed target of 50% attendance. The non-compulsory nature is a possible explanation for the lower attendance rates, as well as the availability of transport options upon the conclusion of the after-school session proved to be a limiting factor for attendance at the after-school session. This is similar to the lower attendance rates recorded for Stanford GEMS intervention for the after-school dance classes, where the provision of transport was considered a barrier for attendance and suggestions from participants and parental feedback was to provide this for future interventions (Robinson et al., 2003). This factor together with the other after-school commitments students have, are major considerations when including an after-school component in an intervention.

7.2.3 Target Six – Participant enjoyment of intervention sessions (by indicating 3 or above on the 5-point enjoyment Likert scale)

7.2.3.1 Summary of results

As with the POC Trial, participants completed enjoyment scales for the activities completed in the practical sessions. For the school sport sessions, the mean for Term 2 was 4.2 and for Term 3 was 3.8 of out 5. Therefore, the overall mean for the school sport sessions was 4.0. For the after-school sport sessions, the mean for Term 2 was 4.7 and for Term 3 was 4.7, making an overall mean 4.7. The proposed target for this aspect of acceptability was exceeded.

With the greater number of theory sessions, time was limited to complete enjoyment scales for each session. Therefore, participants were encouraged to write comments about the sessions and several themes emerged. These included the notion of fun, participating with friends and perceived level of competence (see section 6.3.2.4).

7.2.3.2 Comparison with other studies

Similar to implementation rates, levels of enjoyment for intervention sessions were not widely reported in similar studies. However, the FILA Program and the Stanford GEMS report levels of enjoyment for certain sessions of the intervention (Peralta et al., 2009; Robinson et al., 2003).
For the curriculum sessions in the FILA program (Peralta et al., 2009), the average enjoyment rating out of 5 was 3.48. These curriculum sessions included a combination of theory and practical components and this is comparable with the enjoyment rating of the school sport sessions for the current study. Even though for the current study this does not include a theoretical component, it is still relevant to make this comparison.

Robinson et al (2003) reported on three aspects indicating the level of enjoyment and/or how helpful sessions were in the Stanford GEMS intervention. On a scale of 1 (very helpful) to 4 (not at all helpful), the participants rated the health education lessons (START lessons) an average of 1.9. For the after-school dance classes, on a scale of 1 (very fun) to 4 (not at all fun), the participants rated the hip-hop classes an average of 1.5; the step classes 1.7 and the Africa dance classes 1.5. In addition to this, when asked a common question at follow up “I enjoyed participating in the Stanford GEMS project”, 91.8% of the participants answered ‘yes’.

7.2.3.3 Possible explanations

The high levels of enjoyment reported from the participants of the Sport4Fun intervention may be due to several factors. These relate to the nature of the activities included in the practical sessions of the intervention.

First, the focus of the activities in the practical sessions was on fun and enjoyment. Participants’ fundamental movement skills were developed through modified games and activities, rather than a ‘skill-drill’ approach to encourage participation. Second, many of the activities included in the school sport sessions and the after-school sessions were new to the participants and not normally participated in during regular school sport or PE lessons. This not only encouraged participation, but motivated students as these were new and different activities that they could experience. Third, the use of incentives throughout the intervention may also be linked to the high levels of enjoyment. These incentives included merits from the school’s merit award system, where participants accumulated a particular number of merits in order to gain a merit certificate. Participants were also set challenges such as the ‘Pedometer Challenge’ and the ‘Olympic Challenge’, where they earned points for their participation in physical activity or the number of steps recorded. Participants were working together as a group, as well as trying to achieve a ‘personal best result’ and beat teachers in these challenges. Fourth, for both practical sessions, peer helpers from Years 10 and 11 were
present at the sessions to encourage students and assist with the running of the activities. Participants appeared to enjoy the help and participation from these older students and commented on this in their practical session evaluations. In addition to the mentioned factors, the intervention involved girls only and some of these participants formed good friendships, which may have contributed to the high levels of enjoyment.

7.2.4 Acceptability Limitations

The acceptability limitations of this study relate to areas of implementation and attendance.

7.2.4.1 Implementation

Two of the targets were achieved for implementation, with this being implementation of the school sport sessions and morning theory sessions. Possible explanations may include:

1. After-school sessions were not compulsory. These were not included in the POC trial, however many parents/guardians expressed the difficulty in picking up their child at the conclusion of the session and this was the main reason for non-attendance. The area in which the school is located is not readily serviced by bus companies after the school day is finished, leaving only parental transport. This makes it difficult if there was more than one sibling in the family completing after-school activities. Therefore, with limited attendance, it was difficult to conduct sessions with just one participant.

7.2.4.2 Attendance

Only one of the targets were achieved for attendance, with this being attendance at the school sport sessions. Reasons why students were not able to attend the after-school sessions are mentioned above and others include, other after-school commitments, illness and homework commitments.
7.2.5 Acceptability Recommendations

The findings from this study highlights a number of recommendations for future interventions including:

1. Use the existing structures of the school environment (for example, within school time), when conducting sessions. This is more likely to result in higher attendance rates than non-curricula sessions.

2. Consider all possible influences if including after-school (or non-curricula sessions), such as transportation options and other after-school commitments. To increase attendance rates, the future program may need to offer after-school transport options and include aspects such as homework and tutoring.

3. Activities included in interventions should focus on promoting fun and enjoyment. This assists with increasing participation, motivation and enjoyment of participants, as well as developing skills at the same time. These activities are recommended to a ‘skill-based’ approach as not only does this promote enjoyment and fun through modified games, but also encourages maximum involvement for all.

7.3 Research Question Three and Hypotheses: Potential Efficacy

Is the program potentially efficacious, determined by trends towards statistical significance for outcome variables such as fundamental movement skill proficiency, weight status, perceived physical competence, enjoyment and participation in physical activity?

The third research question investigated whether The Sport4Fun program was potentially efficacious. It was hypothesised that:

H1 – A greater increase in fundamental movement skill proficiency (run, catch, overhand throw, two-handed strike and kick) and overall fundamental movement skill proficiency.

H2 – Less of a decline in time spent participating in moderate-to-vigorous physical activity; light physical activity and a greater decline in time spent in sedentary behaviour.
H3 – A greater increase in enjoyment of physical activity;

H4 – A greater increase in perceived physical competence;

H5 – A smaller increase in adiposity measures (body mass index (BMI) and waist circumference).

7.3.1 Hypothesis One: An increase in fundamental movement skill proficiency for the skills of run, catch, overhand throw, two-handed strike and kick; and fundamental movement skill proficiency

7.3.1.1 Summary of results

Compared with participants in the control group, those in the intervention group had a greater increase in fundamental movement skills from baseline to follow up, resulting in an adjusted difference of 1.48 ([95% CI = -1.21 to 4.17], P = 0.50), equating to a small to medium effect size (d=0.48).

There was also a slightly greater increase in the intervention group compared with the control group for four of the five individual fundamental movement skills including the two-handed strike (0.14 [95% CI = -0.82 to 1.11] p=0.76), catch (0.45 [95% CI = -0.63 to 1.52] p=0.39), overhand throw (0.34 [95% CI = -1.25 to 1.93] p=0.66) and run (0.35 [95% CI = -0.34 to 1.05] p=0.30).

Small effect sizes were reported for the two-handed strike (d=0.12), kick (d=0.24) and overhand throw (d=0.21) and small to medium effect sizes for the catch (d=0.41) and run (d=0.47).

7.3.1.2 Comparison with other studies

There have been no studies that report on the development and focus of fundamental movement skills in secondary schools, however some work has been completed with primary and elementary age students. The following three studies report on the findings.
Van Beurden and colleagues (2003) implemented a school-based approach in physical education (PE) lessons to increase fundamental movement skills (FMS) and physical activity in children in Years 3 and 4 (aged 7-10 years). This involved nine control and nine intervention schools, with testing completed at pre and post intervention. The intervention included the establishment of school project teams, a teacher ‘buddy’ system, project website and teacher training workshops, with strategies focusing on supportive teachers and creating supportive environments and health school policies. Eight fundamental movement tests were completed including the static balance, sprint run, vertical jump, kick, hop, catch, overhand throw and side gallop. Results at follow-up indicated improvements in the intervention group compared with the control in every FMS for both boys and girls, with most of the improvements (13 of 16) significant (van Beurden, Zask, Barnett, & Dietrich., 2003).

Salmon and colleagues (2008) recruited 311 Grade 5 children (10-11 years old) from three government schools and implemented a school-based intervention focusing on behaviour modification and fundamental movement skills. There were four conditions to which participants were randomised including a behaviour modification (BM) group, a fundamental movement skill (FMS) group, a combined BM and FMS group and a control group, receiving the usual curriculum. Results indicated no significant intervention effects on FMS z scores between baseline and post intervention or at other time points, including 6-month and 12-month follow up. However, when compared with girls in the control group, girls in the BM and FMS groups recorded significantly higher average FMS z-scores over time (Salmon et al., 2008).

McKenzie and colleagues (1998) investigated the effects of a physical education program on children’s manipulative skills (of throwing, catching and kicking). Participants in Grade 4 and 5 were assigned to three treatment conditions including physical education specialists (PES), trained classroom teachers (TT) and control group (CO). Results indicated that effect sizes (for TT relative to CO) on the catch and throw were small to medium (d = 0.29, d = 0.27 respectively) (McKenzie et al., 1998).

7.3.1.3 Possible explanations

The results achieved in the Sport4Fun program for FMS are comparable with the above studies, even though the participants were older than the reviewed studies. When comparing effect sizes, such comparisons can be made with McKenzie and colleagues (1998), where
Small to medium effect sizes were found for two of the skills, which involved a much larger sample size and younger participants. For the current study, small to medium effect sizes for the catch (d=0.41) and run (d=0.47) were shown, with a much smaller sample size and older participants, where it may be harder to initiate change in fundamental movement skills. This may be as habits have already developed when participants are older, therefore making changes difficult to correct.

These results are encouraging and there are several possible explanations. First, childhood is considered an important time for the development of FMS and therefore, every attempt must be made to provide opportunities in primary school for these skills to be developed. Even though the results for FMS from the current study are important, by the time students enter high school, students may have developed poor technique for some of these skills or lack the confidence to perform these skills. The Sport4Fun intervention provided opportunities and appropriate activities for high school students to develop these skills, resulting in a greater increase in FMS from baseline to followup. This is in addition to the opportunities provided in PE lessons and sport.

Second, the nature of the activities focused on the development of FMS through the use of modified games and activities. This provided opportunities for participants to practise and develop these skills, receiving encouragement and specific feedback. Even though FMS were not practised with traditional skill-based drills, the activities were appropriate to their skill level and were more relevant and engaging for high school students. Each practical session included a specific skill focus (such as catch, two-handed strike, run, kick or overarm throw) and the importance of this focus is demonstrated in the results relating to the run from the POC Trial and Pilot RCT. In the POC Trial, there was not a specific week where the run was the focus. Changes were made to the Pilot RCT and improvements were seen in the run for those in the intervention group.
7.3.2 Hypothesis Two: Less of a decline in time spent participating in moderate-to-vigorous physical activity; light physical activity and a greater decline in time spent in sedentary behaviour.

7.3.2.1 Summary of results

For weekday physical activity, the intervention participants, compared with the control participants, had a significantly greater increase in total physical activity (CPM) (adjusted difference = 77.49 [95% CI = 8.21 to 132.77] P = 0.03) and a large effect size (d=1.26) was found.

There was also a significant intervention effect for percentage of time spent in light physical activity (adjusted difference = 0.05 [95% CI = 0.01 to 0.09], p = 0.02, d=1.45), with a large effect size being recorded.

For percentage of time spent in sedentary behaviour, the intervention participants remained constant from baseline to follow-up, however percentage of time spent in sedentary behaviour increased sharply in the control group (adjusted difference = -0.06 [95% CI = -0.10 to -0.01] P = 0.02) and a large to large effect size (d= -1.62) was found.

There was less of decline in percentage of time spent in moderate physical activity (adjusted difference = 0.01 [95% CI = -0.01 to 0.02], p = 0.34, d = 0.57), vigorous physical activity (adjusted difference = 0.0002 [95% CI 0.000 to 0.001], p = 0.54, d = 0.88) and moderate to vigorous physical activity (adjusted difference = 0.01 [95% CI -0.01 to 0.02], p = 0.34, d=0.66) in the intervention group compared with the control group. Small effect sizes were reported for percentage of time spent in moderate physical activity and percentage of time spent in moderate to vigorous physical activity.

In the Pilot RCT for weekend physical activity, there were no favourable trends for the intervention group for total physical activity (CPM), percentage of time spent in sedentary behaviour, percentage of time spent in light physical activity, percentage of time spent in moderate physical activity or percentage of time spent in moderate to vigorous physical activity. Possible explanations are included in section 7.3.2.3.
7.3.2.2 Comparison with other studies

There have been numerous interventions measuring physical activity levels, using self-reported measures and accelerometers. As the current study used accelerometers to measure physical activity levels, only interventions using such measures will be discussed.

The first study, Stanford GEMS (Robinson et al., 2003) assessed average counts per minute and moderate-to-vigorous physical activity between noon and 6pm. For physical activity (average CSA counts/min) there was a greater increase in the intervention group when compared with the active placebo group (adjusted difference = 55.1 [95% CI = -115.6 to 225.8] effect size = 0.21). A slightly larger increase was shown in the intervention group when compared with the active control group for moderate-to-vigorous physical activity (average minutes) (adjusted difference = 7.3 [95% CI = -25.8 to 40.4] effect size = 0.14) (Robinson et al., 2003).

The second study, Weintraub and colleagues (2008) assessed physical activity for six consecutive days using accelerometers between the hours of 7am and 10pm. Baseline and 6-month follow-up results are reported for total physical activity (mean, counts/min), moderate physical activity (counts/min, min) and vigorous physical activity (counts/min, min) for the soccer intervention group and the health intervention group (which was the ‘active placebo’ control intervention group). For total physical activity, there was a greater increase in the intervention group when compared with the active placebo group (adjusted difference = 44.29 [95% CI = -41.65 to 130.23] effect size = 0.61). A slightly larger increase was shown in the intervention group when compared with the active placebo group for moderate physical activity (adjusted difference = 3.02 [95% CI = -3.68 to 9.72] effect size = 0.48) and vigorous physical activity (adjusted difference = 1.25 [95% CI = -1.48 to 3.99] effect size = 0.43) (Weintraub et al., 2008).

The third study, TAAG (Trial of Activity for Adolescent Girls) (Webber et al., 2008) measured physical activity using accelerometers for seven consecutive days. Webber and colleagues (2008) report results for intervention and control groups after the first two years of the intervention (2005) and during the third year of the intervention (2006). It was found that after the first two years of intervention, there was no difference between groups for any variables. However after three years of intervention, there was a significant difference shown
between the intervention and control groups for moderate-to-vigorous physical activity and sedentary Behaviour (Webber et al., 2008).

The fourth study assessed physical activity with questionnaires and physical activity, in a subsample of 258 children in the 7th and 8th grade (Haerens et al., 2006). Accelerometers were worn for six consecutive days, with the intervention focusing on increasing levels of MVPA to at least 60 minutes a day, which was conducted over a 2-year period. For girls, significant 2-year post-baseline intervention effects were found for physical activity. The physical activity intervention was effective in preventing decreases in light physical activity, with time spent in light physical activity decreasing significantly less in the intervention group, when compared with the control group. Small effect sizes were found for sedentary behaviour (d = 0.01), light physical activity (d = 0.19) and moderate-to-vigorous physical activity (d = 0.01) (Haerens et al., 2006).

The final study assessed physical activity using accelerometers, during school sport time, during a 90-minute time period (Dudley et al., 2010). Results indicate that when compared with the control group, there was less of a decline in the intervention group for participation in physical activity (mean/1000) during school sport time (adjusted difference = 13.6 [95% CI = -21.8, 48.9] P = 0.45) and a small effect size (d = 0.24) (Dudley et al., 2010).

In summary, for the majority of studies reviewed, comparable and favourable effect sizes are reported for the current study for total physical activity, sedentary behaviour, light physical activity, moderate physical activity and moderate-to-vigorous physical activity. However it must be highlighted that the effect sizes reported for the current study do not include weekend physical activity, which may be reported in the reviewed studies.

The Sport4Fun intervention showed medium to large effect sizes for weekday total physical activity (CPM) and percentage of time spent in weekday sedentary behaviour and medium effect sizes for percentage of time spent in weekday light physical activity, percentage of time spent in weekday moderate physical activity and percentage of time spent in weekday moderate-to-vigorous physical activity. These results are encouraging for producing changes in physical activity behaviours and show larger effect sizes than studies reviewed, which is promising given the small sample size in the Sport4Fun intervention compared with some of the other studies cited.
7.3.2.3 Possible explanations

The increase in weekday physical activity can be explained by the focus of the sessions – sport sessions and after-school sessions that were conducted during the week. Students were provided with these opportunities during the weekday to be physically active. There were no increases found in weekend physical activity and this could be explained by several factors. First, students having to complete physical activity opportunities in their own time on the weekend and perhaps the home environment may not have been as conducive to physical activity as the school environment. Second, the theory sessions did focus on using space, time and opportunities in the home environment, however there was no one to remind/encourage participants to do this on the weekend days. Third, on the weekend, participants may not have socialised with friends to provide social support for participation in physical activity. Finally, as there were encouraging results for weekday physical activity, there could have been a compensatory effect on weekend days. Therefore, participants may have been more physically active during the week and used the weekend days for other activities.

7.3.3 Hypothesis Three: A greater increase in enjoyment of physical activity

7.3.3.1 Summary of results

There was a greater increase in the control group when compared with the intervention group. This resulted in an adjusted difference of -4.26 ([95% CI = -11.87 to 3.35], P = 0.25), equating to a small effect size (d= -0.47).

7.3.3.2 Comparison with other studies

Various instruments are used to assess the enjoyment of physical activity and several studies have been reviewed and report on the results.

Neumark-Sztainer and colleagues (2003) assessed enjoyment of physical activity in the New Moves intervention using four questions, using Likert response categories to assess the degree
of agreement with a statement. Results indicate this increased slightly in the intervention group and in the hypothesised direction.

Girls on the move program (Robbins et al., 2006) used an instrument validated by Motl et al., (2000) for use with adolescent girls. The intervention targeted sedentary girls in Grades 6, 7 and 8, using individual, computerised feedback, counselling from the school’s pediatric nurse practitioner (PNP), telephone calls and mailings from a trained research assistant. There were no significant differences found in enjoyment of physical activity between intervention and control groups (Robbins et al., 2006).

Jamner and colleagues (2004) assessed enjoyment of physical activity using the 18-item Physical Activity Enjoyment Scales (PACES). The intervention, Project FAB, was targeted at adolescent girls, designed to increase physical activity among sedentary adolescent females. Those in the intervention group attended special physical education classes, which met 5 days a week for 60 minutes. Activities included aerobic dance, basketball, swimming and Tae Bo, with 1 day being allocated to discussions focusing on the health benefits of physical activity and strategies for becoming physically active. The overall mean for enjoyment of activity increased from 3.51 at baseline to 3.77 at four months, with this being a larger increase than in the control group (Jamner et al., 2004).

Dudley et al (2010) reports on the enjoyment of physical activity for adolescent girls during school sport time. Using the Physical Activity Enjoyment Scale (PACES), greater increases in enjoyment of physical activity among the intervention group compared with the control group was found.

In summary, the results for the current study are comparable to the studies reviewed. Even though there was a larger increase in enjoyment of physical activity for the control group, increases in enjoyment of physical activity from baseline to follow-up were still seen in the intervention group (see section 6.4.1, Table 6.12).

**7.3.3.3 Possible explanations**

There are several possible explanations for the results relating to enjoyment. First, for some students in the intervention group they were not with their friends, as they participated in the scheduled school sport. Even though the participants in the intervention group seemed to get
along well with each other, this may have not been the same as with their usual friendship group. The control group reported a higher level of enjoyment and this may have been because for the scheduled school sport they were participating with their friends.

Second, students in the control group got to select some of their sports throughout the year. This may have attributed to the greater amount of enjoyment recorded at follow-up. However, the intervention participants recorded a high level of enjoyment for the practical activities they participated in throughout the program, yet this did not result in as much of an increase in enjoyment of physical activity when compared to the control group.

7.3.4 Hypothesis Four: A greater increase in perceived physical competence

7.3.4.1 Summary of results

As with enjoyment of physical activity, there was a greater increase in the control group compared with the intervention group, however this resulted in a significantly greater increase (adjusted difference = -3.34 [95% CI = -5.86 to -0.82], p = 0.01, d = -1.02).

7.3.4.2 Comparison with other studies

The New Moves intervention for adolescent girls assessed athletic competence, using Harter’s self-perception subscale. Even though this is not the same as what was used in the current study, it asked participants questions regarding one’s perceived abilities at sports as compared to other teenagers. Results indicate that there was a slight increase in intervention group, however not statistically significant, with a similar increase observed in the control group (Neumark-Sztainer et al., 2003).

Dudley et al (2010) assessed physical self-perception using a validated self-report questionnaire, consisting of five subscales of perceived bodily attractiveness, sport competence, physical strength, physical conditioning and general physical self-worth. Even though this reports on different items than in the current study, results are still relevant to report due to the nature of the setting. Results showed greater improvement in all domains, with changes in perceived body image reporting a moderate effect size between groups.
7.3.4.3 Possible explanations

There was a greater increase in the control group compared to the intervention group for perceived physical competence. Even though every effort was made to avoid stigmatisation for those in the group, it may be possible this may have had an influence on the participants in the intervention group. Participants in the intervention group did not report any comments from other students about their participation in the program, however as all three sessions were different to the scheduled school activities, this may have been influential. In addition to this, intervention participants reported higher levels of perceived physical competence than those in the control group at baseline which may have created a ‘ceiling effect’ reducing the potential for improvement among this group.

Perceived physical competence increased in the POC Trial (2006) and also increased in the intervention group in the Pilot RCT (2008), even though this was less than the control group. Another possible reason for this may be that being part of the intervention group may have sent a message to the participants that they are not skilled and this may have led them to perceive their ability more critically.

7.3.5 Hypothesis Five: A smaller increase in adiposity measures (body mass index (BMI) and waist circumference.)

7.3.5.1 Summary of results

There were no differences in BMI and waist circumference among the participants of the intervention and control group. For BMI, this resulted in an adjusted difference of 0.24 ([95% CI = -0.52 to 1.00], P = 0.52, d=0.27) and for waist circumference an adjusted difference of 0.17 ([95% CI = -1.79 to 2.12], P= 0.86, d = <0.001).

7.3.5.2 Comparison with other studies

Of the reviewed studies, some report on body mass index (BMI) and waist circumference or one of these adiposity measures. These are included below.

The ‘Stanford Gems’ program used measures of BMI and waist circumference (Robinson et al., 2003). Results showed that compared to girls in the active control group, girls in the
treatment group tended to have both lower BMI and waist circumference, however these were not statistically significant (Robinson et al., 2003).

However, two other studies targeting sedentary adolescent girls and physical activity report there were no differences in BMI between the intervention and control participants at postintervention (Neumark-Sztainer et al., 2003; Robbins et al., 2006). Possible explanations from these studies suggest that such physical outcomes (as BMI) are ‘hard-to-change’ and may need a greater time to effect the change (such as a longer intervention) (Neumark-Sztainer et al., 2003).

7.3.5.3 Possible explanations

Throughout the intervention, there was no focus on the dietary behaviours that are related to weight status. Studies compared have specific nutritional components and also a focus on reducing sedentary behaviours such as television viewing and computer games. The current study discussed this briefly in the morning theory sessions, however not with the same amount of time as devoted in the reviewed studies.

7.3.6 Potential Efficacy Limitations

The Pilot RCT demonstrates potential efficacy of the Sport4Fun program for the primary outcomes of physical activity and fundamental movement skill proficiency in the secondary school setting. Secondary outcomes such as enjoyment of physical activity, perceived physical competence and adiposity measures need refinement for future research studies. However, modifications made from the POC Trial contributed to the changes in the hypothesised direction for the Pilot RCT for the primary outcomes.

Potential efficacy limitations have been outlined below:

1. The purpose of the Pilot RCT was to report on trends in outcomes and the sample size was not large enough to detect statistically significance differences.

2. The stigmatisation by peers for participation in a school-based program to increase physical activity.
3. Completion of enjoyment of physical activity and perceived physical competence questionnaires. Due to students’ responses, it can be questioned whether they accurately understood what was being asked and therefore impacts on how this is reported on.

4. No inclusion of follow-up measures, so therefore it is hard to determine whether the behaviour modifications continued for the intervention participants. This is needed to support and ensure the change is sustained.

5. Larger sample size, allowing for greater numbers in the intervention and control groups.

### 7.3.7 Potential Efficacy Recommendations

The findings from this study highlights a number of recommendations for future interventions including:

1. A larger staff support base within the school environment, instead of just one teacher.
2. An adequately powered study to detect statistically significant differences between intervention and control groups,

### 7.4 Study Strengths

There are several strengths of this study:

1. Setting of the study: The study was implemented in the secondary school setting, which has been a setting not commonly used for targeted interventions. However, this setting is ideal to target behaviours such as improving fundamental movement skills and increasing participating in physical activity as this is where adolescents spend the majority of their waking time and they are exposed to specialist physical education teachers unlike primary school.
2. Study Framework: The study used Social Cognitive Theory (Bandura, 1986) and Competence Motivation Theory (Harter, 1978) to guide the behaviour change intervention. Both theoretical models have been used in other studies and in the school setting.
3. Use of the CONSORT statement: The study was implemented and reported according to the updated CONSORT statement (Moher et al., 2010).

4. Study Design: The Pilot RCT was designed using the results and recommendations from the POC Trial conducted in 2006. This proved to be beneficial as the Pilot RCT was conducted in the same school setting and results from the POC Trial were encouraging for the measures to be assessed in the Pilot RCT.

7.5 Study Limitations

Although this study design was based on previous research including the POC Trial and other studies, there were a number of limitations identified when reporting conclusions on the targets and hypotheses. These can be found in sections 7.1.4, 7.2.4 and 7.3.6.

7.6 Sources of Bias

It is important to identified sources of potential bias in the current study and therefore will assist in the design, delivery and analysis of future school-based interventions.

Three sources of potential bias were identified in the current study:

1. Researcher’s position within the school: The Researcher was a full time teaching member of the school where the study was implemented. Due to this position, greater time and interaction was possible with participants in the intervention and the researcher taught some of these participants in regular curricular classes.

2. Sample size: The sample size was not adequately powered to detect significant changes in outcome measurements and therefore was an identified source of bias. For future interventions, a larger sample size for future pilot RCTs is recommended as this would provide statistical power to detect between group differences.
7.7 Study Generalisability

Estabrooks and colleagues (2003) highlighted the importance of reporting on elements of internal validity in a review of school-based behaviour change interventions. Aspects associated with external validity such as students, schools and resources available were also important to report on to allow the strategies used in the interventions to be translated into sustained programs or general practice (Estabrooks, Dzewaltowski, Glasgow, & Klesges, 2003).

7.7.1 Internal validity

The current Pilot RCT’s internal validity was achieved through the following aspects: 1) outlining the feasibility and acceptability aspects of the study (see section 6.2); 2) a process evaluation from the POC Trial (see section 3.5.5); 3) adherence to clearly defined study procedures (see Chapter 5). Generalisability of the study was also assisted by the clear description of eligibility criteria (see section 5.2) and the intervention and control group protocols. In considering this, generalising the findings of the current Pilot RCT to other school-based interventions targeting adolescent girls with similar characteristics would be appropriate. However, generalising the Pilot RCT’s findings to male adolescents, and adolescents with different characteristics would be less appropriate.

7.7.2 External validity

It cannot be assumed that the Sport4Fun Program would produce similar results if implemented in a different school environment. There are several factors that need to be taken into account when considering external validity.

First, the program may not be generalizable to adolescents with different demographics such as cultural and socioeconomic backgrounds. In the Pilot RCT, the cultural background and socioeconomic status of the school were not measured, however factors such as the school’s location and the researcher’s extensive knowledge and time spent in this school environment suggest that the majority of participants were Anglo-Saxon and medium socioeconomic backgrounds. Even though the program did not require students to have a high literacy level to
understand the messages conveyed in the program, scenarios and examples delivered to participants were relevant to their backgrounds. In addition to this, there were no costs associated with the program (during school time or after school) and all resources and incentives used in the program were provided by the researcher. Therefore, further investigation would be required for generalising these findings to adolescent girls (and school) from different cultural and socioeconomic backgrounds.

Second, the researcher was a PDHPE teacher for a number of years at the school and implemented all sessions of the program. The knowledge of the school environment and the students was considered a critical element in the success of the program and it is not known whether the program would have similar results if implemented by another regular teacher, physical education teacher or researcher.

In considering the above, it would be beneficial for the Sport4Fun program to be implemented in coming years under the guidance of another teacher and evaluated.

### 7.8 Study Summary, Recommendations and Conclusions

#### 7.8.1 Summary

The POC Trial aimed to assess the feasibility, acceptability and potential efficacy of a school-based physical activity program among Year 7 students. Based on recommendations from the POC trial, the Pilot RCT aimed to assess the feasibility, acceptability and potential efficacy of a multi-faceted secondary school-based physical activity program (Sport4Fun) for girls in Years 7, 8 and 9. It was also designed and implemented to address several factors: 1) to improve the methodological processes used in the Proof-Of-Concept trial (POC Trial); 2) ensure a longer and more comprehensive program was delivered in the school setting; and 3) to involve a larger number of students and school staff in the program. The primary outcomes were fundamental movement skills and physical activity, with secondary outcomes of enjoyment of physical activity, perceived physical competence, body mass index and waist circumference.
The Pilot RCT indicated that the Sport4Fun Program was feasible for aspects of retention of participants and collection of measurements at baseline and follow-up. However, specific considerations for recruitment of participants have been highlighted (see section 7.1.5). The results from the Pilot RCT also indicate the Sport4Fun program was acceptable for the school setting, with recommendations provided for the after-school sessions (see section 7.2.5). Furthermore, the program was found to be potentially efficacious, with findings indicating medium to large effect sizes in favour of the intervention group for weekday total physical activity and sedentary behaviour; medium effect sizes for light, moderate and moderate-to-vigorous weekday physical activity; and small to medium effect size for total fundamental movement skills. These changes occurred with no adverse effect on the participants’ physical, emotional and psychosocial functioning. Despite these positive results, small effect sizes were demonstrated in BMI, waist circumference and small to medium effect sizes for weekend physical activity. For enjoyment of physical activity and perceived physical competence, small to medium effect sizes were demonstrated in favour of the control group.

7.7.2 Recommendations

In considering the study findings and identified limitations (7.1.5, 7.2.5 and 7.3.5), study strengths (7.4) and the specific recommendation for feasibility, acceptability and potential efficacy (7.1.7, 7.2.7, 7.3.7), the following broader recommendations are made:

1. As the current Pilot RCT was not powered to statistically detect significant changes in outcome measures standardised effect sizes were reported to allow comparisons to be made with other school-based studies. Therefore, the implementation of the Sport4Fun program on a larger scale would be beneficial.

2. When reviewing the available school-based studies, there were limited intervention studies focusing on fundamental movement skills in adolescents or high-school aged students. To better determine the effectiveness and impact of such interventions on adolescents’ physical activity behaviour, it would be important to include this in future research.
3. The Pilot RCT included specific and successful behaviour modification strategies, which supported change in the intervention participants. However, it was not known if these changes in behaviour were sustained after the conclusion of the intervention. Therefore, more investigation is recommended for behaviour modification strategies in future studies.

7.7.3 Conclusion

The Pilot RCT confirmed that the Sport4Fun program was feasible, acceptable and potentially efficacious as indicated by the majority of targets and hypotheses set. Targets for retention rates, collection of measurements, implementation of sessions and participant attendance at school sport sessions were achieved. Potential efficacy findings reported medium to large effect sizes in favour of the intervention group for weekday total physical activity and sedentary behaviour; medium effect sizes for light, moderate and moderate-to-vigorous weekday physical activity; small to medium effect size for total fundamental movement skills. These changes occurred with no adverse effect on the participants’ physical, emotional and psychosocial functioning. However, only small effect sizes were found for BMI, waist circumference and small to medium effect sizes for weekend physical activity. These results indicate that the Sport4Fun program was not as effective in modifying these outcomes, as well as enjoyment and perceived physical competence of physical activity.

The findings from the Sport4Fun program indicate the crucial role schools have in improving adolescents’ fundamental movement skills and physical activity behaviour. To contribute to these findings, larger scale efficacy studies designed to detect statistically significant changes in outcomes, need to be implemented in the future.
REFERENCE LIST


APPENDIX 1

UOW HUMAN RESEARCH ETHICS COMMITTEE APPROVAL - POC TRIAL (HE05/206) (1A)

UOW HUMAN RESEARCH ETHICS COMMITTEE APPROVAL – PILOT RCT (HE05/206) (1B)
INITIAL APPLICATION APPROVAL

In reply please quote: HE05/206
Further Enquiries Phone: 4221 4437

26 September 2005

Ms Jodie Southall
6 Thames St
West Wollongong 2500

Dear Ms Southall

I am pleased to advise that the Human Research Ethics application referred to below has been approved.

Ethics Number: HE05/206
Project Title: Effect of a school-based movement skills program on the actual physical competence, perceived physical competence, enjoyment and participation in class-based physical activity.
Name of Researchers: Ms Jodie Southall, Dr Anthony Okely
Approval Date: 23 September 2005
Expiry Date: 22 September 2006

This certificate relates to the research protocol submitted in your original application as modified in your letter of date. As a condition of approval, the Human Research Ethics Committee requires that researchers immediately report:

- proposed changes to the protocol including changes to investigators involved
- serious or unexpected adverse effects on participants
- unforeseen events that might affect continued ethical acceptability of the project.

You are also required to complete monitoring reports annually and at the end of your project. These reports are sent out approximately 6 weeks prior to the date your ethics approval expires. The reports must be completed, signed by the appropriate Head of School, and returned to the Research Services Office prior to the expiry date.

Yours Sincerely,

Dr Garry Hoban
Chairperson
Human Research Ethics Committee

cc: Dr Tony Okely, Education
RENEWAL APPROVED
In reply please quote: HE05/206
Further Enquiries Phone: 4221 4457

18th December, 2007

Ms Jodie Southall
6 Thames St
West Wollongong 2500

Dear Ms Southall,

I am pleased to advise that renewal and amendments to the following Human Research Ethics application as detailed below have been approved.

Ethics Number: HE05/206

Project Title: Effect of a school-based movement skills program on the actual physical competence, perceived physical competence, enjoyment and participation in class-based physical activity.

Researchers: Ms Jodie Southall, Dr Anthony Okely

Amendments: - participants now include Years 8 & 9 students, as well as Year 7 students
- students will now be recruited using the multi-stage fitness test
- program is to be lengthened to 20 weeks

Amendment Approval Date: 13th December, 2007
Renewed from: 22 September 2007
Expiry Date: 01st October, 2008

This certificate relates to the research protocol submitted in your original application and all approved amendments to date. Please remember that in addition to completing an annual report the Human Research Ethics Committee requires that researchers immediately report:

• proposed changes to the protocol including changes to investigators involved
• serious or unexpected adverse effects on participants
• unforeseen events that might affect continued ethical acceptability of the project.

You are also required to complete a monitoring report at the end of your project. This report will be sent out approximately 6 weeks prior to the date your ethics approval expires. The report must be completed, signed by the appropriate Head of School, and returned to the Research Services Office.

Sincerely,

A/Professor Garry Hoban
Chairperson
Human Research Ethics Committee
APPENDIX 2

PARENT INFORMATION SHEET - POC TRIAL
PARTICIPATION INFORMATION SHEET FOR PARENTS/GUARDIANS

TITLE: Effect of a School-Based Movement Skills Program on the Actual Physical Competence, Perceived Physical Competence, Enjoyment and Participation in Class-Based Physical Activity.

PURPOSE
This is an invitation for your child to participate in a study conducted by Miss Jodie Southall, a PDHPE teacher at Magdalene Catholic High School and researchers at the University of Wollongong. The purpose of this research is to determine the effect of a school-based physical activity program on students’ level of actual physical competence, perceived physical competence, enjoyment and participation in class-based physical activity.

INVESTIGATORS
Jodie Southall
PDHPE Teacher
Magdalene Catholic High School
(02) 4647 7055
jsouthal@magdalene.woll.catholic.edu.au

Dr Tony Okely
Senior Lecturer
Faculty of Education
(02) 4221 4641
tokely@uow.edu.au

METHODS
For this study, your child will be randomly assigned to either:
   a) School-sport intervention program OR
   b) Tuesday afternoon sport (as the normal integrated sport program)

As we would like to know how effective the intervention program is in promoting the enjoyment and participation, we cannot place participants in the group of their choice. To ensure the results of the study are not affected by participation motivation to either program, participants will be randomly placed into either one of the above two groups. Both programs will be conducted at Magdalene Catholic High School during timetabled school sport, with the intervention program being conducted also in homeroom time.

The School-Sport Intervention Program
The program aims to:
   a) Increase perceived physical competence in sport and physical activity.
   b) Increase enjoyment of sport across a range of learning and participation activities.
   c) Increase levels of participation in physical activity.

The practical component will be conducted during timetabled Tuesday Afternoon Sport Time, whilst the theory component will be conducted in homeroom time (8.15 – 8.30am), three mornings a week.

The Tuesday Afternoon School-Sport Program
This program will be the sports currently offered (with modifications to the new school year) by Magdalene Catholic High School.
What will participants be asked to do?

There are two key requirements for involvement in this project:

1. **Assessment** – a range of measurements will need to be taken on all participants, regardless of which program they are participating in.
2. **Participation in either program (School-sport intervention program or Tuesday Afternoon Sport Program)** – the level of involvement required by the participants will depend upon which program they have been randomly allocated to.

**Assessment**

To test how effective the intervention program is, we would like to take some assessments before and after the program. As changes in enjoyment of physical activity take time to influence physical activity participation, this will allow us to determine how effective the program is in the long-term. All assessments will take place in Tuesday Afternoon Sport or PDHPE class time. None of the assessments can hurt your child, the results may be of some interest to you.

Your child will be asked to once again complete the enjoyment and perceived physical competence questionnaire, to enable us to have a baseline measure. He/she will also have their height, weight and waist circumference measured by an assessor of the same gender, with results being kept confidential from other participants.

Your child will be asked to perform specific physical skills such as the sprint run, static balance, vertical jump, catch, hop, side gallop, skip, overarm throw, leap, kick, two-hand strike and the dodge. Following this, he/she will be asked to wear a small ‘activity monitor’ called an accelerometer (approximately 5.1 x 4.1 x 1.5cm, 43 grams) that is worn like a belt under their clothing. The monitor will automatically record body movement, and we would like this to be worn during week 1 of Term 1 2006.

**RISKS AND INCONVENIENCES**

Apart participating in the program in sport time and homeroom time, we see no foreseeable risks for your child. The activities are very similar to those that your child would do as part of PDHPE. Results to the measurements will be kept in strict confidence, with only Miss Southall having access to the results. Your child’s involvement in the study is voluntary and he/she may withdraw from the study at any time.

**POSSIBLE OUTCOMES OF THE STUDY**

The aim of conducting the school-based physical activity program is to improve students’ participation in physical activity. By focusing on improving movement skills, enjoyment of physical activity and perceived physical competence, it is anticipated that students’ enjoyment of and participation in physical activity will improve. This program is part of a PhD research project being conducted by Miss Southall in association with the University of Wollongong. Further information concerning this program will be provided after the questionnaires have been completed.

**ETHICS REVIEW AND COMPLAINTS**

This study has been reviewed by the Human Research Ethics Committee (Social Science, Humanities and Behavioural Science) of the University of Wollongong. If you have any concerns or complaints regarding the way the research about the conduct of this research, you can tell your parents who can contact the Ethics Officer of the University on (02) 4221 4457.
If you allow your child to participate in the physical activity program, please read and sign the attached consent form. Please have your child return these forms to their Year 6 class teacher. If you have any questions regarding the study, please contact me at Magdalene Catholic High School on (02) 4647 7055. Your cooperation in the study will be greatly appreciated and will assist us in working with students to promote physically active lifestyles.

Thank you for your interest in this study.
PARTICIPATION INFORMATION SHEET FOR CHILDREN

TITLE: Effect of a School-Based Movement Skills Program on the Actual Physical Competence, Perceived Physical Competence, Enjoyment and Participation in Class-Based Physical Activity.

PURPOSE
This is an invitation for you to participate in a study conducted by a PDHPE teacher at Magdalene Catholic High School and researchers at the University of Wollongong. The purpose of this research is to determine the impact of a school-based physical activity program conducted during school sport and homeroom time, on participant’s physical activity levels, perceived physical competence and enjoyment of Year 7 Students.

INVESTIGATORS
Jodie Southall
PDHPE Teacher
Magdalene Catholic High School
(02) 4647 7055
dsouthal@magdalene.woll.catholic.edu.au

Dr Tony Okely
Senior Lecturer
Faculty of Education
(02) 4221 4641
tokely@uow.edu.au

METHODS
To test this program, participants will be randomly assigned to either:
  c) school-sport intervention program OR
  d) Tuesday afternoon sport (as the normal integrated sport program)

As we would like to know how effective the intervention program is in promoting the enjoyment and participation, we cannot place participants in the group of their choice. To ensure the results of the study are not affected by participation motivation to either program, or by our control of who participates in each program, participants will be randomly placed into either one of the above two groups.

Both programs will be conducted at Magdalene Catholic High School during timetabled school sport and homeroom time.

The School-Sport Intervention Program
The program aims to:
  d) Increase perceived physical competence in sport and physical activity.
  e) Increase enjoyment of sport across a range of learning and participation activities.
  f) Increase levels of participation in physical activity.

The Tuesday Afternoon School-Sport Program
This program will be the sports currently offered (with modifications to the new school year) by Magdalene Catholic High School.
What will participants be asked to do?

There are two key requirements for involvement in this project:

3. Assessment – a range of measurements will need to be taken on all participants, regardless of which program they are participating in.

4. Participation in either program (School-sport intervention program or Tuesday Afternoon Sport Program) – the level of involvement required by the participants will depend upon which program they have been randomly allocated.

Assessment

To test how effective the programs are, we would like to take some assessments before and after the program. As changes in enjoyment of physical activity take time to influence physical activity participation, this will allow us to determine how effective the program is in the long-term. All assessments will take place in Tuesday Afternoon Sport or PDHPE class time. None of the assessments can hurt participants – in fact, you may be interested in the results.

All participants will be asked to once again complete the enjoyment and perceived physical competence questionnaire, to enable us to have a baseline measure. Participants will also have their height, weight and waist circumference measured by an assessor of the same gender, with results being kept confidential from other participants.

Participants will asked to perform specific physical skills such as the sprint run, static balance, vertical jump, catch, hop, side gallop, skip, overarm throw, leap, kick, two-hand strike and the dodge. Following this, all participants will be asked to wear a small ‘activity monitor’ called an accelerometer (approximately 5.1 x 4.1 x 1.5cm, 43 grams) that is worn like a belt under their clothing. The monitor will automatically record body movement, and we would like this to be worn during week 1 of Term 1 2006.

RISKS AND INCONVENIENCES

Apart from participating in the program on Tuesday afternoons and theory activities during the week, there are no foreseeable risks for you. All measurements will be taken and kept confidential, meaning other students will not know the results of these measurements. All you are asked to do is participate in the activities to the best of your ability. Your involvement in the study is voluntary and you may withdraw from the study at any time.

POSSIBLE OUTCOMES OF THE STUDY

If you decide the participate in the study, you will help provide information as to how to promote physical activity to Year 7 Students.

ETHICS REVIEW AND COMPLAINTS

This study has been reviewed by the Human Research Ethics Committee (Social Science, Humanities and Behavioural Science) of the University of Wollongong. If you have any concerns or complaints regarding the way the research about the conduct of this research, you can tell your parents who can contact the Ethics Officer of the University on (02) 4221 4457.

Thank you for your interest in this study.
APPENDIX 4

PARENT AND PARTICIPANT CONSENT FORMS – POC TRIAL
CONSENT FORM FOR PARENTS/GUARDIANS & CHILDREN

TITLE: Effect of a School-Based Movement Skills Program on the Actual Physical Competence, Perceived Physical Competence, Enjoyment and Participation in Class-Based Physical Activity.

The implementation of the school-based physical activity program is part of a PhD research project in association with the University of Wollongong. The accompanying Parent and Student Information Sheet explain what is involved in the completion of the questionnaires. Your signature indicates:

1. You have read the information provided about this project;
2. You have been given the opportunity to discuss the procedures with those involved.
3. You agree for your child to complete a questionnaire about Enjoyment of physical activity and perceived physical competence, to have their weight, height, waist circumference and physical skills assessed and to have their physical skills videotaped (Parents).
4. You agree to complete a questionnaire about Enjoyment of physical activity and perceived physical competence, to have your weight, height, waist circumference and physical skills assessed and to have your physical skills videotaped (child).
5. You voluntarily agree for your child to participate in the school-based physical activity program to be conducted in Tuesday Afternoon Sport time and in Homeroom time (Parent).
6. You voluntarily agree to participate in the school-based physical activity program to be conducted in Tuesday Afternoon Sport time and in Homeroom time (Child).

If you have any enquiries about the research, please contact Jodie Southall on (02) 4647 7055 or her supervisor Dr Tony Okely on (02) 4221 4641. If you have any concerns or complaints regarding the way the research is or has been conducted, please contact the Complaints Officer, Human Research Ethics Committee, University of Wollongong on (02) 4221 4457.

Please complete the attachment below and return to your child’s Year 6 class teacher.

------------------------------------------------------------------------------------------------------------------------------

I ____________________________________________ (parent/guardian) give permission for my child ____________________________________________ (child’s name) to participate in the school-based physical activity program.

Parent/Guardian Signature ____________________________ Date ____________________________

Child’s Signature ____________________________ Date ____________________________
APPENDIX 5

GET SKILLED, GET ACTIVE CHECKLISTS –
FUNDAMENTAL MOVEMENT SKILL PROFICIENCY
POC TRIAL AND PILOT RCT
Height (centimetres): ___________  Weight (kilograms): ___________  Waist girth: ___________

Footwear while completing tests:  □ Sport shoes  □ Bare foot  □ leather shoes  □ sandals

**SPRINT RUN:** 'Run as fast as you can from one end to another'
1. Lands on ball of the foot ................................................................. 1 □
2. Non-support knee bent at least 90 degrees during the recovery phase .......... 2 □
3. Head and trunk stable, eyes focused forward .................................... 3 □
4. Elbows bent at 90 degrees ................................................................. 4 □
5. Arms drive forward and back in opposition to legs............................ 5 □

**CATCH:** ‘Catch the bean bag with two hands’
1. Eyes focused on the object throughout the catch............................... 1 □
2. Feet move to place the body in line with the object ......................... 2 □
3. Hands move to meet the object ......................................................... 3 □
4. Hands and fingers relaxed and slightly cupped to catch the object ...... 4 □
5. Catch and control object with hands only (well-timed closure) .......... 5 □
6. Elbows bend to absorb the force of the object.................................. 6 □

**OVERARM THROW:** ‘Throw the object as far as you can’ Student may take 2-3 steps
1. Eyes focused on target throughout the throw..................................... 1 □
2. Stands side-on to target area ............................................................ 2 □
3. Throwing arm moves in a downward and backward arc .................... 3 □
4. Step towards target area with foot opposite throwing arm ............... 4 □
5. Hips then shoulders rotate forward ............................................... 5 □
6. Throwing arm follows through down and across the body............... 6 □
# KICK (stationary ball): ‘Run up to the ball and kick it as hard as you can’

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Icon</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Eyes focused on the ball throughout the kick</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Forward and sideward swing of arm opposite kicking</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Non-kicking foot placed beside the ball</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Bend knee of kicking leg at least 90 degrees during the back swing</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Contact ball with top of the foot (a “shoelace” kick) or instep</td>
<td>5</td>
</tr>
<tr>
<td>6.</td>
<td>Kicking leg follows through high towards the target area</td>
<td>6</td>
</tr>
</tbody>
</table>

# TWO-HAND STRIKE: ‘Hold the bat in two hands and hit the ball as hard as you can’

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Icon</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Stands side-on to target area</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Eyes focused on the ball throughout the strike</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Hands next to each other, bottom hand matches the front foot</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Step towards target area with front foot</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Hips then shoulders rotate forward</td>
<td>5</td>
</tr>
<tr>
<td>6.</td>
<td>Ball contact made on front foot with straight arms</td>
<td>6</td>
</tr>
<tr>
<td>7.</td>
<td>Follow through with bat around the body</td>
<td>7</td>
</tr>
</tbody>
</table>
APPENDIX 5

HARter’s perceived competence scale for children
POC trial and pilot RCT
**What I Am Like**

- There are 18 questions you need to answer.
- Place a **tick** in the square that best describes you.
- Questions are printed on both sides of the page.
- For each question, there are 4 boxes. **Tick 1 box only.**

Name ___________________________  Date of Birth _______________________

**SAMPLE SENTENCE**

<table>
<thead>
<tr>
<th>(a) Really True For me</th>
<th>Sort of true for me</th>
<th>Some kids would rather at play outdoors in their spare time.</th>
<th>Other kids would rather watch T.V.</th>
<th>BUT</th>
<th>Really true for me</th>
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</thead>
<tbody>
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<td></td>
<td></td>
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</tbody>
</table>

1. Really True For me | Sort of true for me | Some kids do very well at all kinds of sports | Other kids don’t feel that they are very good when it comes to sports. | BUT | Really true for me |
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</tbody>
</table>

2. Really True For me | Sort of true for me | Some kids wish they could be alot better at sports | Other kids feel they are good enough at sports. | BUT | Really true for me |
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</tbody>
</table>

3. Really True For me | Sort of true for me | Some kids think they could do well at just about any new sports activity they haven’t tried before. | Other kids are afraid they might not do well at sports they haven’t ever tried. | BUT | Really true for me |
<table>
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<tr>
<td></td>
<td>Really True For me</td>
<td>Sort of true for me</td>
<td>Sort of true for me</td>
<td>Really true for me</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>Some kids feel that they are better than others their age at sports. <strong>BUT</strong> Other kids don’t feel they can play as well.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Really True For me</td>
<td>In games and sports some kids usually watch instead of play. <strong>BUT</strong> Other kids usually play rather than just watch.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Really True For me</td>
<td>Some kids don’t do well at new outdoors game. <strong>BUT</strong> Other kids are good at new games right away.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Really True For me</td>
<td>Some kids do well at games that involve kicking balls. <strong>BUT</strong> Other kids don’t feel that they do well at games involving kicking balls.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Really True For me</td>
<td>Some kids do well at games that involve catching balls. <strong>BUT</strong> Other kids don’t feel that they do well at games involving catching balls.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2
<table>
<thead>
<tr>
<th></th>
<th>Really True For me</th>
<th>Sort of true for me</th>
<th>Sort of true for me</th>
<th>Really true for me</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td></td>
<td></td>
<td>Some kids wish they were able to run fast</td>
<td>BUT Other kids feel they are able to run fast.</td>
</tr>
<tr>
<td>10</td>
<td>Really True For me</td>
<td></td>
<td>Some kids do well at games that involve overhand throwing.</td>
<td>BUT Other kids don’t feel that they do well at games that involve overhand throwing.</td>
</tr>
<tr>
<td>11</td>
<td>Really True For me</td>
<td></td>
<td>Some kids don’t feel that they do well at games that involve underhand throwing.</td>
<td>BUT Other kids do well at games that involve underhand throwing.</td>
</tr>
<tr>
<td>12</td>
<td>Really True For me</td>
<td></td>
<td>Some kids feel they are not able to jump far.</td>
<td>BUT Other kids feel they are able to jump far.</td>
</tr>
<tr>
<td>13</td>
<td>Really True For me</td>
<td></td>
<td>Some kids are good at dribbling or bouncing balls.</td>
<td>BUT Other kids don’t feel they are good at dribbling or bouncing balls.</td>
</tr>
<tr>
<td></td>
<td>Really True For me</td>
<td>Sort of true for me</td>
<td>Sort of true for me</td>
<td>Really true for me</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>14.</td>
<td>Some kids do well at games that involve striking (hitting) a ball.</td>
<td>BUT Other kids don’t feel that they do well at games that involve striking (hitting) a ball.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Some kids don’t feel they are able to gallop well.</td>
<td>BUT Other kids feel they are able to gallop well.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Some kids can leap far.</td>
<td>BUT Other kids don’t feel they are able to leap far.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Some kids don’t feel they are able to hop well.</td>
<td>BUT Other kids feel they are able to hop well.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Some kids can side gallop well.</td>
<td>BUT Other kids don’t feel they are able to side gallop well.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

You have finished!
APPENDIX 7

ENJOYMENT OF PHYSICAL ACTIVITY QUESTIONNAIRE
POC TRIAL AND PILOT RCT


## PHYSICAL ACTIVITY ENJOYMENT SCALE

For each statement below, select the response which best represents how much you “disagree” or “agree” with the statement. Mark your response by ticking in the box in the correct column.

<table>
<thead>
<tr>
<th>When I am active...</th>
<th>Disagree a lot</th>
<th>Disagree a little</th>
<th>Neither agree nor disagree</th>
<th>Agree a little</th>
<th>Agree a lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. …I enjoy it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. …I feel bored.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. …I dislike it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. …I find it fun.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. …it’s not fun at all.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. …it gives me energy.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. …it makes me depressed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. …it’s very pleasant.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. …my body feels good.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. …I get something out of it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. …it’s very exciting.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>12. …it frustrates me.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. …it’s not at all interesting.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. …it gives me a strong feeling of success.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. …it feels good.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. … I feel as though I would rather be doing something else.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 8

PARTICIPANT PRACTICAL SESSION EVALUATIONS
POC TRIAL AND PILOT RCT
TUESDAY AFTERNOON REFLECTION

WEEK:   DATE:

- List the activities you completed in the afternoon in the left column.
- Next to each activity, tick the face that best describes how you liked each activity.

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>Disliked a lot</th>
<th>Disliked a little</th>
<th>Neither liked nor disliked</th>
<th>Liked a little</th>
<th>Liked a lot</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

- Any other comments:
TUESDAY’S REFLECTION

Date: ________________________

What did I enjoy from this week’s Tuesday sport?

What wasn’t so good from this week’s Tuesday Sport?

Activities I would like to do again include…
APPENDIX 10

PARENT INFORMATION SHEET - POC TRIAL
Dear Parent/Guardian,

Please find enclosed an information package consisting of an information sheet for parents, an information sheet for children and a consent form for parents and children about the Sport4Fun program.

As outlined in last week’s newsletter, Sport4Fun is a physical activity program commencing in Term 2 for girls in Years 7, 8 and 9. Students have been selected based on their achievement in the Multistage Fitness Test (or Beep Test), completed in physical education classes during Term 1 this year. Girls who scored below level 4 in the test have been given an invitation to participate in the program, as their score in the test indicates they are in the lowest 30th percentile for physical fitness for their age group.

There is specific information contained in this package concerning the program, however if there are any questions, please do not hesitate to contact me on 4647 7055 or by email jandruschko@magdalene.woll.catholic.edu.au.

If you would like your child to participate in the program, please complete the consent form for parents/guardians and children and return this to school by the 13th March. However, if your child is unable to participate in the program, please complete the slip below and return this to school by the 13th March. If possible, could you please indicate a reason for the non-participation, so this can be considered for the future.

Thank you for your anticipated support,
Jodie Andruschko

IF YOUR CHILD IS UNABLE TO PARTICIPATE IN THE PROGRAM, PLEASE COMPLETE THE SLIP BELOW AND RETURN TO MRS ANDRUSCHKO BY THE 13TH MARCH.

-------------------------------------------------------------------------------------------------------------------------------

I ___________________________________________ (parent/guardian) do not give permission for my child ___________________________________ (child’s name) to participate in the school-based physical activity program.

______________________________
Parent/Guardian Signature

______________________________
Date

REASONS INCLUDE: (Please tick or write a comment)

☐ Unable to attend Thursday after school session
☐ Reluctance to be involved in program
☐ Other: ______________________________ ______________________________
PARTICIPATION INFORMATION SHEET FOR PARENTS/GUARDIANS

The Sport4Fun Program at Magdalene Catholic High School

PURPOSE
This is an invitation for your child to participate in a study conducted by Mrs Jodie Andruschko, a PDHPE teacher at Magdalene Catholic High School and researchers at the University of Wollongong. The purpose of this research is to determine the effect of a school-based physical activity program on students’ level of actual physical competence, perceived physical competence, enjoyment and participation in physical activity.

INVESTIGATORS
Jodie Andruschko
PDHPE Teacher
Magdalene Catholic High School
(02) 4647 7055
jandruschko@magdalene.woll.catholic.edu.au

Dr Tony Okely
Senior Lecturer
Faculty of Education
(02) 4221 4641
tokely@uow.edu.au

METHODS
For this study, your child will be randomly assigned to either:
   e) The Sport for Fun Program OR
   f) The Comparison Group (This group will receive normal integrated sport program)

As we would like to know how effective the intervention program is in promoting the enjoyment and participation, we cannot place participants in the group of their choice. To ensure the results of the study are not affected by participation motivation to either program, participants will be randomly placed into either one of the above two groups. Both programs will be conducted at Magdalene Catholic High School during timetabled school sport, with the intervention program being conducted also in homeroom time and one afternoon each week.

The Sport for Fun Program
The program aims to:
   g) Increase perceived physical competence in sport and physical activity.
   h) Increase enjoyment of sport across a range of learning and participation activities.
   i) Increase levels of participation in physical activity.

The intervention program consists of two components – a practical and theory component. The practical component will be conducted during timetabled Tuesday Afternoon Sport Time and after school on Thursday Afternoon, 2.45pm to 4.00pm. The theory component will be conducted in homeroom time (8.15 – 8.30am), three mornings a week.
The Comparison Group
This program will be the sports currently offered (with modifications to the new school year) by Magdalene Catholic High School and students in this group will attend their normal homeroom. However, if the school-sport intervention program is shown to be effective, it will be offered to the “Tuesday Afternoon School-Sport” group in Term 4. This prevents these students missing out on the program.

What will participants be asked to do?
There are two key requirements for involvement in this project:

5. Assessment – a range of measurements will need to be taken on all participants, regardless of which program they are participating in.
6. Participation in either program (School-sport intervention program or Comparison Group) – the level of involvement required by the participants will depend upon which program they have been randomly allocated to.

Assessment
To test how effective the intervention program is, we would like to take some assessments before and after the program. As changes in enjoyment of physical activity take time to influence physical activity participation, this will allow us to determine how effective the program is in the long-term. All assessments will take place in Tuesday Afternoon Sport or PDHPE class time. None of the assessments can hurt your child; the results may be of some interest to you.

In Term 1, she will be asked to wear a small ‘activity monitor’ called an accelerometer (approximately 5.1 x 4.1 x 1.5cm, 43 grams) that is worn like a belt under their clothing. The monitor will automatically record body movement, and a sheet will be used to record physical activity participated in throughout the week.

Your child will have their height, weight and waist circumference measured by an assessor of the same gender, with results being kept confidential from other participants. She will also be asked to perform specific movement skills such as the sprint run, catch, overarm throw, kick, and the two-hand strike.

RISKS AND INCONVENIENCES
Apart from participating in the program in sport time, after school and homeroom time, we see no foreseeable risks for your child. The activities are very similar to those that your child would do as part of PDHPE. Results to the measurements will be kept in strict confidence, with only Mrs Andruschko having access to the results. Your child’s involvement in the study is voluntary and she may withdraw from the study at any time.

POSSIBLE OUTCOMES OF THE STUDY
The aim of conducting the school-based physical activity program is to improve students’ participation in physical activity. By focusing on improving movement skills, enjoyment of physical activity and perceived physical competence, it is anticipated that students’ enjoyment of and participation in physical activity will improve. This program is part of a PhD research project being conducted by Mrs Andruscho in association with the University of Wollongong. Further information concerning this program will be provided after the questionnaires have been completed.
ETHICS REVIEW AND COMPLAINTS
This study has been reviewed by the Human Research Ethics Committee (Social Science, Humanities and Behavioural Science) of the University of Wollongong. If you have any concerns or complaints regarding the way the research about the conduct of this research, you can tell your parents who can contact the Ethics Officer of the University on (02) 4221 4457.

If you allow your child to participate in the physical activity program, please read and sign the attached consent form. Please have your child return these forms to Mrs Andruschko at Magdalene Catholic High School. If you have any questions regarding the study, please contact Mrs Andruschko at Magdalene Catholic High School on (02) 4647 7055. Your cooperation in the study will be greatly appreciated and will assist us in working with students to promote physically active lifestyles.

Thank you for your interest in this study.
APPENDIX 11

PARTICIPANT INFORMATION SHEET - POC TRIAL
PURPOSE
This is an invitation for you to participate in a study conducted by a PDHPE teacher at Magdalene Catholic High School and researchers at the University of Wollongong. The purpose of this research is to determine the impact of a school-based physical activity program conducted during school sport, after school and homeroom time, on participant’s physical activity levels, perceived physical competence and enjoyment of physical activity for Year 7, 8 and 9 girls.

INVESTIGATORS
Jodie Andruschko
PDHPE Teacher
Magdalene Catholic High School
(02) 4647 7055
jandruschko@magdalene.woll.catholic.edu.au

Dr Tony Okely
Senior Lecturer
Faculty of Education
(02) 4221 4641
tokely@uow.edu.au

METHODS
To test this program, participants will be randomly assigned to either:
    g) School-sport intervention program OR
    h) The Comparison Group (This group will receive normal integrated sport program)

As we would like to know how effective the intervention program is in promoting the enjoyment and participation, we cannot place participants in the group of their choice. To ensure the results of the study are not affected by participation motivation to either program, or by our control of who participates in each program, participants will be randomly placed into either one of the above two groups.

Both programs will be conducted at Magdalene Catholic High School during timetabled school sport and homeroom time.

The School-Sport Intervention Program
The program aims to:
    j) Increase perceived physical competence in sport and physical activity.
    k) Increase enjoyment of sport across a range of learning and participation activities.
    l) Increase levels of participation in physical activity.

The Comparison Group
This program will be the sports currently offered (with modifications to the new school year) by Magdalene Catholic High School.

However, if the school-sport intervention program is shown to be effective, it will be offered to the “Tuesday Afternoon School-Sport” group in Term 4. This prevents a group of students missing out on the program.

What will participants be asked to do?
There are two key requirements for involvement in this project:

7. Assessment – a range of measurements will need to be taken on all participants, regardless of which program they are participating in.

8. Participation in either program (School-sport intervention program or Comparison Group) – the level of involvement required by the participants will depend upon which program they have been randomly allocated.

Assessment
To test how effective the programs are, we would like to take some assessments before and after the program. As changes in enjoyment of physical activity take time to influence physical activity participation, this will allow us to determine how effective the program is in the long-term. All assessments will take place in Tuesday Afternoon Sport or PDHPE class time. None of the assessments can hurt participants – in fact, you may be interested in the results.

In Term 1, all participants will be asked to wear a small ‘activity monitor’ called an accelerometer (approximately 5.1 x 4.1 x 1.5cm, 43 grams) that is worn like a belt under their clothing. The monitor will automatically record body movement, and a sheet will be used to record physical activity participated in throughout the week.

You will have your height, weight and waist circumference measured by an assessor of the same gender, with results being kept confidential from other participants. You will also be asked to perform specific movement skills such as the sprint run, overarm throw, catch, kick, two-hand strike and the dodge.

RISKS AND INCONVENIENCES
Apart from participating in the program on Tuesday and Thursday afternoons and theory activities during the week, there are no foreseeable risks for you. All measurements will be taken and kept confidential, meaning other students will not know the results of these measurements. All you are asked to do is participate in the activities to the best of your ability.

Your involvement in the study is voluntary and you may withdraw from the study at any time.

POSSIBLE OUTCOMES OF THE STUDY
If you decide to participate in the study, you will help provide information as to how to promote physical activity to Year 7, 8 and 9 girls.

ETHICS REVIEW AND COMPLAINTS
This study has been reviewed by the Human Research Ethics Committee (Social Science, Humanities and Behavioural Science) of the University of Wollongong. If you have any concerns or complaints regarding the way the research about the conduct of this research, you can tell your parents who can contact the Ethics Officer of the University on (02) 4221 4457.

Thank you for your interest in this study.
APPENDIX 12

CONSENT FORMS – PARENT AND PARTICIPANT
POC TRIAL
CONSENT FORM FOR PARENTS/GUARDIANS & CHILDREN

The Sport4Fun Program at Magdalene Catholic High School

The implementation of the school-based physical activity program is part of a PhD research project in association with the University of Wollongong. The accompanying Parent and Student Information Sheet explain what is involved in the completion of the questionnaires. Your signature indicates:

7. You have read the information provided about this project;
8. You have been given the opportunity to discuss the procedures with those involved.
9. You agree for your child to complete a questionnaire about Enjoyment of physical activity and perceived physical competence, to have their weight, height, waist circumference and fundamental movement skills assessed and to have movement physical skills videotaped (Parents).
10. You agree to complete a questionnaire about Enjoyment of physical activity and perceived physical competence, to have your weight, height, waist circumference and fundamental movement skills assessed and to have your physical skills videotaped (child).
11. You voluntarily agree for your child to participate in the school-based physical activity program to be conducted in Tuesday Afternoon Sport time, Thursday Afternoon from 2.45 to 4.00pm and in Homeroom time (Parent).
12. You voluntarily agree to participate in the school-based physical activity program to be conducted in Tuesday Afternoon Sport time, Thursday Afternoon from 2.45 to 4.00pm and in Homeroom time (Child).

If you have any enquiries about the research, please contact Jodie Andruschko on (02) 4647 7055 or her supervisor Dr Tony Okely on (02) 4221 4641. If you have any concerns or complaints regarding the way the research is or has been conducted, please contact the Complaints Officer, Human Research Ethics Committee, University of Wollongong on (02) 4221 4457.

If your child is able to participate in the program, please complete the attachment below and return to Mrs Andruschko by Tuesday 18th March.

I ___________________________________________ (parent/guardian) give permission for my child ___________________________________ (child’s name) to participate in the school-based physical activity program.

Parent/Guardian Signature ______________________________________________ Date __________________________
If your child is unable to participate in the program, please complete the attachment below and return to Mrs Andruschko by Tuesday 18th March.

I ___________________________________________ (parent/guardian) do not give permission for my child ___________________________________ (child’s name) to participate in the school-based physical activity program.

______________________________
Parent/Guardian Signature

____________________________________________
Date

REASONS INCLUDE: (Please tick or write a comment)

☐ Unable to attend Thursday after school session
☐ Reluctance to be involved in program
☐ Other: ____________________________________________
APPENDIX 13

PEER HELPER INFORMATION FORM
PILOT RCT
SPORT4FUN PROGRAM
Magdalene Catholic High School
2008

• Overview

Sport for Fun is a 20-week program aimed at increasing students’ fundamental movement skills, enjoyment, perceived physical competence and participation in physical activity. The participants in the “Sport for Fun” program will be Year Seven, Eight and Nine High School Girls from Magdalene Catholic High School. This age group has been selected for several reasons. First, being the early years of high school, this is the opportune time to target their physical activity behaviours. Second, statistics show that girls’ participation rates in physical activity declines between Year 8 and 10. Therefore, it is important to promote participation in physical activity in these early high school years, to help avoid this decline in physical activity in later years.

• Timeline

* Theory sessions – These will be conducted in homeroom time on Wednesday, Thursday and Friday mornings, from 8.15am to 8.30am. During these sessions, students will participate in activities focusing on motivation, goal setting and behaviour modification in relation to physical activity.

* Practical sessions – These will be conducted during Tuesday Afternoon Sport time (1.00pm to 2.30pm) and Thursday afternoons (2.45pm to 4.00pm).

• Students involved
Girls from Magdalene Catholic High School in Years 7, 8 and 9.

• Peer Helpers

It is hoped that girls in years 10, 11 and 12 who already enjoy physical activity and participate regularly in physical activity, may volunteer to help out during some of the practical sessions of the program. This is viewed as important as the younger students can look up to role models already in the Magdalene School Community.

Please complete the details below and return to Mrs Andruschko by Tuesday 11th March. If you are willing to help out, there will be a meeting on Wednesday 12th March, in Room 20 during recess time.

* Name: ________________________________  * Homeroom: _____________

* Please tick below:

☐ Yes, I am willing to help out with the Sport4Fun Program (Meeting 12th March, Room 20 Recess)
☐ No, I cannot help out with the Sport4Fun program.
APPENDIX 14

PEDOMETER CHALLENGE INFORMATION - PILOT RCT
THE GREAT PEDOMETER CHALLENGE

Let's Get Movin’

• What is the Great Pedometer challenge? This is an activity that challenges you to participate in as much physical activity as you can in a 3 week time period.

• How is this done? You will wear a pedometer, which will record the number of steps taken in a day. At the end of each day, you will record your steps either via the myclasses page or the pedometer recording sheet.

• When will it start? The Great Pedometer Challenge will start Wednesday 4th June and finish on Friday 21st June.

• The Aim of the Great Pedometer Challenge The aim of the Great Pedometer Challenge is to get you moving and participating in physical activity.

• What will you get out of this?
  □ Fun
  □ Enjoyment
  □ Learn other ways to be physically active
  □ Achieve goals and receive rewards
  □ Beating the teachers at the pedometer challenge.
# Pedometer Log

<table>
<thead>
<tr>
<th>DATE</th>
<th>DAY</th>
<th>STEPS - At the end of the day (Reset Pedometer for tomorrow)</th>
<th>PARENT SIGNATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th June</td>
<td>Wednesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5th June</td>
<td>Thursday</td>
<td>TOTAL STEPS: (4^{TH} + 5^{TH})</td>
<td></td>
</tr>
<tr>
<td>6th June</td>
<td>Friday</td>
<td>TOTAL STEPS: (4^{TH} + 5^{TH} + 6^{TH} + 7^{TH})</td>
<td></td>
</tr>
<tr>
<td>7th June</td>
<td>Saturday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8th June</td>
<td>Sunday</td>
<td>TOTAL STEPS: (4^{TH} + 5^{TH} + 6^{TH} + 7^{TH} + 8^{TH} + 9^{TH})</td>
<td></td>
</tr>
<tr>
<td>9th June</td>
<td>Monday</td>
<td>TOTAL STEPS: (4^{TH} + 5^{TH} + 6^{TH} + 7^{TH} + 8^{TH} + 9^{TH} + 10^{TH} + 11^{TH})</td>
<td></td>
</tr>
<tr>
<td>10th June</td>
<td>Tuesday</td>
<td>TOTAL STEPS: (4^{TH} + 5^{TH} + 6^{TH} + 7^{TH} + 8^{TH} + 9^{TH} + 10^{TH} + 11^{TH} + 12^{TH} + 13^{TH})</td>
<td></td>
</tr>
<tr>
<td>11th June</td>
<td>Wednesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12th June</td>
<td>Thursday</td>
<td>TOTAL STEPS: (4^{TH} + 5^{TH} + 6^{TH} + 7^{TH} + 8^{TH} + 9^{TH} + 10^{TH} + 11^{TH} + 12^{TH} + 13^{TH} + 14^{TH})</td>
<td></td>
</tr>
<tr>
<td>13th June</td>
<td>Friday</td>
<td>TOTAL STEPS: (4^{TH} + 5^{TH} + 6^{TH} + 7^{TH} + 8^{TH} + 9^{TH} + 10^{TH} + 11^{TH} + 12^{TH} + 13^{TH} + 14^{TH} + 15^{TH})</td>
<td></td>
</tr>
<tr>
<td>14th June</td>
<td>Saturday</td>
<td>TOTAL STEPS: (4^{TH} + 5^{TH} + 6^{TH} + 7^{TH} + 8^{TH} + 9^{TH} + 10^{TH} + 11^{TH} + 12^{TH} + 13^{TH} + 14^{TH} + 15^{TH} + 16^{TH} + 17^{TH})</td>
<td></td>
</tr>
<tr>
<td>15th June</td>
<td>Sunday</td>
<td>TOTAL STEPS: (4^{TH} + 5^{TH} + 6^{TH} + 7^{TH} + 8^{TH} + 9^{TH} + 10^{TH} + 11^{TH} + 12^{TH} + 13^{TH} + 14^{TH} + 15^{TH} + 16^{TH} + 17^{TH})</td>
<td></td>
</tr>
<tr>
<td>16th June</td>
<td>Monday</td>
<td>TOTAL STEPS: (4^{TH} + 5^{TH} + 6^{TH} + 7^{TH} + 8^{TH} + 9^{TH} + 10^{TH} + 11^{TH} + 12^{TH} + 13^{TH} + 14^{TH} + 15^{TH} + 16^{TH} + 17^{TH})</td>
<td></td>
</tr>
<tr>
<td>17th June</td>
<td>Tuesday</td>
<td>TOTAL STEPS: (4^{TH} + 5^{TH} + 6^{TH} + 7^{TH} + 8^{TH} + 9^{TH} + 10^{TH} + 11^{TH} + 12^{TH} + 13^{TH} + 14^{TH} + 15^{TH} + 16^{TH} + 17^{TH})</td>
<td></td>
</tr>
<tr>
<td>18th June</td>
<td>Wednesday</td>
<td>TOTAL STEPS: (4^{TH} + 5^{TH} + 6^{TH} + 7^{TH} + 8^{TH} + 9^{TH} + 10^{TH} + 11^{TH} + 12^{TH} + 13^{TH} + 14^{TH} + 15^{TH} + 16^{TH} + 17^{TH} + 18^{TH} + 19^{TH})</td>
<td></td>
</tr>
<tr>
<td>19th June</td>
<td>Thursday</td>
<td>TOTAL STEPS: (4^{TH} + 5^{TH} + 6^{TH} + 7^{TH} + 8^{TH} + 9^{TH} + 10^{TH} + 11^{TH} + 12^{TH} + 13^{TH} + 14^{TH} + 15^{TH} + 16^{TH} + 17^{TH} + 18^{TH} + 19^{TH})</td>
<td></td>
</tr>
</tbody>
</table>
THE OLYMPIC CHALLENGE

QUICK QUIZ

1. Where are the Olympics being held this year?

2. When do they start and finish?

3. Name an Australian Olympian.

• What is the Olympic Challenge?
This is an activity that starts and finished during the 2008 Olympic Games and encourages students to participate in healthy lifestyle behaviours, focusing on physical activity participation.

• How is this done?
Students will record their activities in a small diary for the two-week time period, with activities scoring students points. Activities focusing on physical activity score more points, with the aim to score as many points as possible.

• When will it start?
The Olympic Challenge will start Tuesday 12th August and conclude Friday 22nd August.

• The Aim of the Olympic Challenge
The aim of the Olympic Challenge is to participate in as much physical activity and healthy behaviours to score points.

• What will you get out of this?
☐ Fun
☐ Enjoyment
☐ Learn other ways to be physically active
☐ Achieve goals and receive rewards
☐ Beating the teachers.

• Double points days
Your teacher will nominate some days that will be double points days. This means if you scored 10 points, this will be doubled to 20 points for the day.

• Points
The points for activities and behaviours are listed below. We will add in other activities and discuss these.
<table>
<thead>
<tr>
<th>BEHAVIOUR</th>
<th>POINTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 minutes of PA or more a day</td>
<td>5</td>
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<tr>
<td>Walking to places where and when possible</td>
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<tr>
<td>Eating a healthy diet, including 5 vegetables and 2 fruits a day</td>
<td>4</td>
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<tr>
<td>Choosing to participate in PA when I get home in the afternoon</td>
<td>5</td>
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<tr>
<td>Participating in Tuesday afternoon sport</td>
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<td>Participating in Thursday afternoon sport</td>
<td>3</td>
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<tr>
<td>Getting at least 8 hours of sleep a night</td>
<td>3</td>
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<tr>
<td>Spending less than 2 hours watching TV, surfing the net or playing video/computer games (unless it is educational!!)</td>
<td>4</td>
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THE OLYMPIC CHALLENGE

DIARY

NAME: ____________________________________________

• For the given day, write the points from the healthy lifestyle behaviours you have scored. The table is shown below:

<table>
<thead>
<tr>
<th>BEHAVIOUR</th>
<th>POINTS</th>
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<tbody>
<tr>
<td>60 minutes of PA or more a day</td>
<td>5</td>
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DAY: ___________________________  DATE: ___________________________

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Parent/Guardian Signature: ____________________________________________
The Sport4Fun Program at Magdalene Catholic High School

1st August 2008
Dear Parent/Guardian,

Throughout Term 2, your daughter has participated in the Sport4Fun program conducted at Magdalene Catholic High School. This letter is to provide you with details on the progress of the program and the students involved.

The program is conducted Wednesday, Thursday and Friday mornings from 8.15 – 8.30am (homeroom time) each week for the theory component, Tuesday afternoon during school sport time (1.00 – 2.35pm) and an optional practical session Thursday afternoon (2.45 – 4.00pm). All students involved in the program have attended and participated in the sessions with great enthusiasm and should be congratulated on their efforts throughout Term 2.

The past term has seen students participate in a range of practical activities such as gripball, cricket, tennis, netball, fitness activities, soccer, softball, touch football, dance, basketball, powerwalking, volleyball, hockey, paddle tennis and tenpin bowling. Students have been working from booklets in the theory component of the program, with activities focusing on setting goals for physical activity, motivation, barriers to physical activity participation and trying to overcome these barriers to increase physical activity participation. These booklets will be brought home in the coming week for parents to look through.

There have been several ‘special events’ for students involved in the program throughout Term 2. The first being the “The Great Pedometer Challenge”, where students were encouraged to take as many steps as possible each day, recorded by the pedometer, in the aim of becoming more physically active. During this challenge, students were rewarded when they achieved their goal step for the week and all students involved made excellent progress. It is hoped that students will continue this focus on increasing their physical activity participation.

The second special event was in Week 10, where students were rewarded for their efforts throughout the term by attending tenpin bowling for Tuesday Afternoon Sport. Once again, students participated well and it is anticipated such an activity can be arranged at the end of Term 3.

Sport4Fun continues in Term 3 for theory and practical components. Please find attached the outline for the practical sessions for this term. Thank you for your support with the program and anticipate this term will be as successful as the previous. If there are any questions, please do not hesitate to contact me at school.

Yours Sincerely,
Jodie Andruschko
APPENDIX 17

PARENT NEWSLETTER TERM 3 - PILOT RCT
The Sport4Fun Program at Magdalene Catholic High School

24th July 2008
Dear Parent/Guardian,

Throughout Term 2, your daughter has participated in the Sport4Fun program conducted at Magdalene Catholic High School. This letter is to provide you with details on the progress of the program and the students involved.

The program is conducted Wednesday, Thursday and Friday mornings from 8.15 – 8.30am (homeroom time) each week for the theory component, Tuesday afternoon during school sport time (1.00 – 2.35pm) and an optional practical session Thursday afternoon (2.45 – 4.00pm). All students involved in the program have attended and participated in the sessions with great enthusiasm and should be congratulated on their efforts throughout Term 2.

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Yours Sincerely,
Jodie Andruschko
APPENDIX 18

PARENT EVALUATION - PILOT RCT
Dear Parent/Guardian,

Throughout Term 2 and 3, your daughter has participated in the Sport4Fun program conducted at Magdalene Catholic High School. A progress letter was sent out at the start of Term 3, informing parents about the program. As in Term 2, during Term 3, students’ level of participation in all sessions of the program has been commendable and all girls should be congratulated on their efforts.

Term 3 has seen students participate in activities such as tennis, newcombe ball, touch football, orienteering, softball, paddle tennis, boxing, speedminton, netball and gripball. Students have been working from their workbooks in the theory component of the program, with activities focusing on the benefits of physical activity, setting goals for lifelong physical activity, motivation and barriers to physical activity participation. Students have been encouraged to look at the activities they participate in and make changes to involve more physical activity. It is anticipated the coming term will challenge students to put these changes in place.

Students also participated in the “Olympic Challenge” in August, where they were encouraged to participate in health lifestyle behaviours to accumulate as many points as possible each day. Once again, students took on this challenge and achieved their own individual goals.

Sport4Fun concludes at the end of Term 3 for the theory and practical sessions, however students have the option of participating in the practical sessions (Tuesday and Thursday) in Term 4. Students have had measurements taken to determine the effectiveness of the program at the end of Term 1 and Term 3 and these results will be sent home during Term 4.

Thank you for your support with the program and it has been very rewarding working with all students. If there are any questions, please contact me at school on 4647 7055.

Yours Sincerely,

Jodie Andruschko
Please indicate how much you agree with the following statements by placing an X for the most appropriate response. (Please note - this survey is double sided)

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<tr>
<th></th>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither</th>
<th>Agree</th>
<th>Strongly Agree</th>
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<tbody>
<tr>
<td>1)</td>
<td>My daughter talked to me about the Sport4Fun program.</td>
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<td>2)</td>
<td>The feedback from my daughter about the program was positive.</td>
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<td>3)</td>
<td>The feedback from my daughter about the program was negative.</td>
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<td>4)</td>
<td>The Sport4Fun program has had a positive impact on my daughter’s enjoyment of physical activity.</td>
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<td>5)</td>
<td>The Sport4Fun program has had a positive impact on my daughter’s physical activity levels.</td>
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<td>6)</td>
<td>The Sport4Fun program has had a positive impact on my daughter’s perceived physical competence.</td>
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<td>7)</td>
<td>The Sport4Fun has had a positive impact on my daughter’s time watching TV, DVDs, playing computer games, PlayStation and Internet surfing</td>
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<td>8)</td>
<td>The Sport4Fun program has had a positive impact on how my daughter feels about herself.</td>
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<td>9)</td>
<td>My daughter has enjoyed participating in Tuesday afternoon sport for Terms 2 and 3 due to the program.</td>
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<td>10)</td>
<td>The Sport 4 Fun program has provided my daughter with opportunities to experience other sports and physical activities.</td>
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<td>11)</td>
<td>The Sport 4 Fun program developed other skills in my daughter such as decision making skills, time management skills and goal setting skills.</td>
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Please make any suggestions to improve the *Sport4Fun* Program, or any other comments.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Thank you for your time in completing the survey.
APPENDIX 19

SAMPLES OF WORKSHEETS SPORT4FUN WORKBOOKS - PILOT RCT
**ACTION PLAN**

When writing your action plan, it must include:

1. What you are going to do
2. How much you are going to do
3. When you are going to do it
4. How many days a week you are going to do it
5. What/who can help you do it

For example: This week, I will walk (what) around the block (how much) before lunch (when) three times (how many), with support from my sister (who).

**MY ACTION PLAN…..**

This week I will ______________________ (what)  
_____________________________ (how much)  
_____________________________ (when)  
_____________________________ (how many)  
and factors that can help me are _______________________ (what/who)

* How confident are you to complete the above? __________  
(0 = not at all confident; 10 = totally confident)

<table>
<thead>
<tr>
<th>DAY</th>
<th>CHECK OFF – TICK</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Sunday</td>
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</table>
THE HOLIDAYS

* List the obstacles to your physical activity participation below.

* List some things that encouraged you to participate in physical activity.
Was it easy or hard to participate in physical activity in the holidays? Write a reason for your response.

Choose some obstacles from the holidays and suggest how these can be overcome in the future.
APPENDIX 20

PEER REVIEWED JOURNAL ARTICLE

(Figures and tables are not included as these appear throughout the chapters.)
Title: A school-based physical activity and motor development program for low-fit adolescent females: The Sport4Fun pilot randomized controlled trial.

ABSTRACT

Objectives: The aim of this study was to assess the feasibility, acceptability and potential efficacy of a school-based intervention targeting improvement of motor skills to promote physical activity among low-fit adolescent females.

Design: A six-month, 2-arm parallel-group, pilot randomised controlled trial was conducted in a co-educational high school in Sydney, Australia.

Methods: Twenty secondary-school girls in Grades 7, 8, and 9, with a cardiorespiratory fitness in the lowest 30th percentile, were randomized to intervention or control group. The intervention comprised sex-specific motor skill activities delivered during school sport and sports- and fitness-based activities delivered after school. In addition, theory-based behaviour modification lessons were conducted during homeroom (roll call lessons). The control group received regular school sport and personal development lessons. Primary outcomes were accelerometer-measured physical activity and fundamental movement skill proficiency.

Results: Compared with girls in the control group, girls in the intervention group showed a significantly greater increase in total weekday physical activity, a significantly smaller increase in weekday sedentary time and a non-significant greater improvement in fundamental movement skill proficiency.

Conclusions: A multi-component school-based intervention can be feasible and potentially efficacious in promoting physical activity and movement skills among low-fit adolescent girls.

Key words: middle school, secondary school, intervention, motor skills, perceived competence.
Introduction

Systematic reviews of school-based interventions targeting promotion of physical activity, fitness and motor skills among adolescent girls have summarized them as methodologically poor, small in number, and inconclusive in providing evidence of an effect.\textsuperscript{1, 2, 3} As the prevalence of meeting physical activity recommendations among adolescent girls is low \textsuperscript{4, 5} and participation rates decline precipitously during adolescence,\textsuperscript{6} feasible and efficacious programs are needed to promote physical activity among adolescent girls.

Although motor skills are related to physical activity in adolescent girls,\textsuperscript{7} developing fundamental movement skills has not been tested as a strategy for promoting physical activity in this population group. Targeting fundamental movement skills may improve perceived competence in and enjoyment of physical activity \textsuperscript{8} as well as provide other health benefits.\textsuperscript{9} Moreover, developing skills is a major reason for girls to participate in physical activity \textsuperscript{10} and should be highly motivating.

Research has recommended tailoring interventions to promote physical activity, fitness and motor skills in young people.\textsuperscript{11} In other words, targeting those most in need and making activities specific to their needs. We hypothesise that targeting girls with low skill and fitness levels, and focusing on developing their enjoyment and perceived competence in a supportive environment might be an attractive way to promote physical activity and motor skills for them. If shown to be efficacious, it could provide an approach that could be integrated into multi-component interventions to promote physical activity among young people and tested among other groups.

The aim of this study was to assess the feasibility, acceptability, and potential efficacy of an innovative school-based physical activity and motor skill development program targeting adolescent girls with low skill and fitness levels. It was hypothesized that girls in the intervention group would have a smaller decline in physical activity and a greater increase in movement skill proficiency, compared with their control group peers.

Methods

The reporting of this study has been according to the CONSORT 2010 checklist \textsuperscript{12} and CONSORT statement: extension to cluster randomized trials.\textsuperscript{13} A 6-month, 2-arm parallel group, pilot randomised controlled trial (RCT) was conducted in a co-educational secondary school setting in Sydney, Australia. All girls (n=319) from Grades 7, 8 and 9 (first three years of secondary school), completed the 20-metre Shuttle Run Test \textsuperscript{14} in physical education classes and students who scored in the lowest 30\textsuperscript{th} percentile (classified as
not meeting the criterion reference standard for cardiorespiratory fitness \(^{15}\)) were deemed eligible and invited to participate. Girls and their parents who provided written consent were randomized, using a computer-based program number producing algorithm, to either the intervention or the control group after baseline assessments. Girls were informed of their allocation by the first author. The study was approved by the University of Wollongong Human Research Ethics Committee (HE05/206). Recruitment and follow-up occurred between 25\(^{th}\) February 2008 and 9\(^{th}\) September 2008. The flow of participants through the trial is shown in Figure 1.

The 6-month program comprised a weekly 90-minute School Sport session, incorporating fun and enjoyable activities designed to develop proficiency in five fundamental movement skills (sprint run, catch, overarm throw, two-handed strike and kick). One fundamental movement skill was the focus for each session and a variety of activities were included to develop and practice this skill within this time. This was delivered through modified sports and games, which were appropriate to participants’ age and gender. Peer helpers from Grades 10 and 11 assisted in these activities.

The second component was 3 x 15-minute behaviour modification lessons each week. These were held during morning homeroom (where student attendance is recorded and other administration tasks completed) and focused on teaching the behaviour skills required for regular participation in physical activity such as goal setting, time management skills, self-monitoring activities (including a pedometer challenge), decision-making skills, and motivation and planning for change. A further component of teaching these skills required girls to determine their level of participation in physical activity and thoughts towards physical activity participation and identify barriers to physical activity participation (and ways to overcome these) and identify places and people who support their participation in physical activity. The third component was a weekly 60-minute sport session held after school that included activities similar to those in the school sport sessions but with a greater degree of flexibility and participant choice. Activities included tennis, fitness circuits, boxing, aerobics, powerwalking, skipping and modified games.
A 3-month single-group feasibility trial was conducted in 2006 in the same school with 10 participants. It demonstrated that the program was feasible and acceptable and able to improve fundamental movement skill proficiency and physical activity participation.

Bandura’s Social Cognitive Theory (SCT) provided the theoretical framework for the Program. SCT posits that behaviour occurs through an interaction of personal, behavioural and environmental factors. To affirm the relationship between these factors, the Program provided opportunities in the theory lessons for participants to progressively change their behaviour through goal setting and self-monitoring. In the practical skill development lessons, positive behaviour was reinforced in a supportive environment through internal and external rewards. Practical sessions focused on fun and enjoyment to encourage participation in similar activity when in the home environment; and the critical self-reflection of situations to engage in physically active behaviour. Within SCT, the four key processes that influence the learning, adoption, and maintenance of new behaviours – attention, retention, production and motivation – were embedded in the theoretical and practical components of the interventions as follows: Attention. The Sport4Fun program offered activities that were unique and different to regular scheduled physical education and school sport activities. Retention. Participants were provided with opportunities to set goals, problem solve and monitor behaviour in relation to increased physical activity. Production. A supportive environment reinforcing positive behaviour through internal and external rewards from self, teacher and peers was provided throughout the program. Motivation. Participants were provided with extrinsic rewards such as school merit stamps and stationery items such as pens and highlighters. Intrinsic incentives came from the participation in challenges and the achievement of set goals.

Participants in the control group attended regular homeroom classes and scheduled school sport each week for 90 minutes with their usual teachers. They did not attend an after-school physical activity session. School sport options for these participants consisted of a range of indoor and outdoor sports or dance.

Outcome measures were taken in the school setting by trained assessors, blinded to group allocation at baseline (March 2008) and 6-month follow-up (September 2008). Primary outcomes were time spent in total physical activity (accelerometer counts per minute, CPM) and overall fundamental movement skill proficiency.
Physical activity was assessed using an Actigraph accelerometer (Model 7164, Fort Walton Beach, FL, USA), worn over the right hip for seven consecutive days during the school term. Data were collected in 30-second epochs. The average number of minutes that the accelerometer was worn and the total physical activity were calculated. Activity counts per 30-sec were uploaded to determine the amount of time spent sedentary, and in light, moderate, and vigorous intensity activity during the monitoring period based on the classifications of Freedson et al.  

Weekdays and weekend days were analysed separately. For weekdays, participants needed to wear the accelerometer for at least nine hours per day on at least three days. For weekend days, the composite method was used to account for the greater amount of incomplete data. This involved averaging the participants’ weekend day data across the two days using the same process as described by Peralta et al.  

Five fundamental movement skills (catch, overhand throw, two-handed strike, kick and run) were video assessed using the “Get skilled, Get active” fundamental movement skill process-oriented checklists. An independent, trained assessor scored each component of each skill as present or absent. If the participants demonstrated the skill component consistently (80% of the time), they were recorded as possessing that skill component. The number of components of each skill correctly demonstrated was summed to give a score for each skill. An overall proficiency score was calculated by adding the number of components for all five skills. Detailed information on the validity and reliability of the skills can be found in the supplementary file (Attached Supplementary File FMS).  

Secondary outcomes were body mass index, waist circumference, perceived physical competence – assessed using Harter’s Perceived Competence Scale for Children, and enjoyment of physical activity – assessed using a validated instrument among children and adolescents. Height was assessed using a portable stadiometer (PE87, Mentone Education Centre, Victoria) and the stretch stature method. Weight was measured using portable body fat monitor (Tanita BF – 681, Tanita Corp., Tokyo, Japan), which was calibrated before testing. BMI was calculated from this using the formula wt(kg)/ht(m)^2. Waist circumference was measured at the level of the mid point between the lower costal border and the iliac crest using a non-extensible steel tape measure.
Process measures were included to assess the feasibility and acceptability of the intervention. These included participation attendance rates for each component of the intervention and the percentage of sessions delivered for each component of the intervention. Participant enjoyment for each activity in each practical session was assessed using a five-point Likert scale with semantic anchors ranging from “really disliked” to “really liked”.

Analysis was by intention-to-treat and intervention effects were assessed by comparing the follow-up values of the intervention and control groups using a one-way analysis of covariance (ANCOVA), with baseline values included as covariates. As a feasibility study, this RCT was not adequately powered to detect statistically significant differences between groups. With a sample of 10 participants in each group, using a two-sided alpha level of 0.05, the approximate power to detect standardized effect sizes (Cohen’s d) of ≥0.5 and ≥1.0 was 60% and 20%, respectively. Effect sizes were defined as small (0.2-0.5), medium (0.5-0.8) and large (>0.8).

Results
The mean age of participants was 13.2 (+ 0.9) years. The flow of participants through the study is shown in the Figure. Twenty students were recruited (10 in each group) with 19 retained at follow-up, (95% retention rate). All measurements were successfully collected at baseline and follow-up and met a priori aims for each outcome. All (100%) of the school sport sessions, 75% of the after-school sport sessions, and 98% of the behaviour modification lessons were implemented with attendance rates of 91%, 44%, and 79%, respectively. Enjoyment of the school sport sessions and after-school sport sessions was high, with mean scores of 4.0 and 4.7, respectively.

Table 1 shows the changes in primary and secondary outcomes from baseline to follow-up for the intervention and control groups. There were medium to large beneficial effects on all weekday physical activity outcomes and generally small effects on weekend day outcomes (although all of the latter were not in the hypothesized direction). The effects for weekday physical activity were statistically significant for total physical activity (counts per min; p=0.03), percentage of time spent in sedentary activity (p=0.02) and the percentage of time spent in light-intensity activity (p=0.02).
The Table also shows the changes in FMS, adiposity, perceived competence, and enjoyment of physical activity and the comparisons between groups. The differences resulted in small beneficial effects on FMS but no effect on adiposity. The results for perceived competence and enjoyment were inconsistent.

Discussion

The results show that compared with adolescent girls randomized to their usual school sport program and homeroom class, girls randomized to the Sport4Fun Program showed medium to large beneficial effects on their weekday physical activity and motor skill proficiency. Although not adequately powered as a pilot study, the differences in total physical activity, and the proportions of time spent in sedentary and light intensity activity were large enough to be statistically significant at follow-up. Although retention of participants and collection of measurements at baseline and follow-up exceeded hypothesized rates, one aspect where the hypothesised number was not met was recruitment (20/30 students). This may have been due to the nature of the school environment and students being required to participate in activities different to the scheduled activities their peers were attending. Future studies could possibly address this through making the program available for all students rather than exclusively for a specific sub-group.

Hypothesised rates for implementation and attendance were met for the school sport sessions and were only slightly below the hypothesised rates for the behaviour modification lessons and after-school sport sessions. However, these results for implementation and attendance were similar to another school-based pilot RCT involving adolescent boys. Mean enjoyment rates for both the school sport sessions and after-school sport activities were high (>3 out of 5), providing evidence of positive student support for the program.

The results for the primary outcome of time spent in physical activity were encouraging. The significant intervention effect found for weekday total physical activity and the proportion of time spent in light-intensity and sedentary activity may be attributed to the physical activity challenges held throughout the intervention, as well as the focus of the physical activity sessions. Students participated in various challenges, with the primary aim of increasing physical activity. Individual and group progress was monitored and incentives offered to encourage and motivate students to achieve goals. School sport sessions and after-school sport
activities focused on fun activities that developed skills, predominantly through games. Behaviour modification lessons encouraged students to set goals and monitor their progress, with incentives rewarded for levels of achievement. These factors may have encouraged increases in light physical activity, replacing time spent in sedentary activities.

However, these positive changes were not seen in the weekend day physical activity data. This may be due to the practical sessions being held during or after school on weekdays. Although the Behaviour modification sessions encouraged girls to set goals across the entire week, most girls goals targeted the after school period on weekdays. This is understandable given the afternoon (between 3:30pm and 5:30pm) is a critical window where adolescent girls have the opportunity to replace sedentary activities with more physically active options. It seems that the girls self-selected more light-intensity activities (such as recreational walking and social tennis) which may explain why MVPA did not increase as much as LPA. Another limitation of the weekend physical activity data is the imputation method used. This is weaker than what was used for the weekday activity as it makes certain assumptions. This therefore means limited conclusions can be drawn from the weekend physical activity data. The difference of \( \approx 78 \) counts per min is meaningful, as it has been shown among girls of similar age that a higher physical activity level (100 counts per min) at age 12 is associated with a lower fat mass (4%) at age 14.\(^{28}\) Future interventions should attempt to more specifically target weekend days, which is another period where adolescent girls may have opportunities to displace sedentary activities with more active ones, resulting in greater increases in physical activity.

We also found greater increases in motor skills in girls in the Sport4Fun program when compared with their control group peers. This is the first known intervention that has targeted motor skills as an intervention strategy to promote physical activity among adolescents and shows that even among adolescent girls, motor skill proficiency can be improved and that this can contribute to greater increases in weekday physical activity. It is recommended, based on these outcomes, that a larger, adequately powered trial be implemented testing the intervention strategy of targeting motor skills to promote physical activity among this age group.

Compared with the intervention group, the increase in enjoyment of physical activity and perceived physical competence was larger in the control group. Other studies have reported
similar findings for enjoyment of physical activity. Neumark-Sztainer and colleagues (2003) assessed enjoyment of physical activity with results indicating the change from post to follow-up was greater in the control group. Furthermore, the Girls on the Move Program found no significant differences in enjoyment of physical activity between intervention and control groups. Possible explanations for this finding in the current study include the instruments not being sensitive enough to determine changes and many students in the intervention group already having high levels of enjoyment of physical activity at baseline. The perceived competence questions included in the instrument may need to be structured more specifically to the secondary school environment to detect these changes. Another explanation may be that as a result of participating in the program, students in the intervention group may have become more aware of their limitations in skills when these were targeted in the intervention, hence impacting their perceptions of their athletic competence.

As a pilot study, the main limitation was the small sample size. Even though the purpose of the pilot RCT was to report on trends in outcomes, the sample size was not large enough to detect statistically significant differences and therefore recommendations for a future study would be a larger sample size to allow this. A further limitation was no follow-up beyond post-intervention, making it difficult to determine whether the Behaviour modifications continued for the intervention participants once the program had finished.

This study showed that it is possible to recruit girls with low fitness to participate in an intervention within their school. The program was designed to be easy for other staff in other schools to implement as it does not require, apart from the after-school session, additional time to be found in the school day and uses existing infrastructure and resources.

Conclusion
This pilot RCT provides valuable information concerning the feasibility, acceptability and potential efficacy for secondary school-based interventions. The results for time spent in physical activity and fundamental movement skill proficiency are particularly promising and are recommended to be tested further in an adequately powered efficacy trial.

Practical Implications
- It is possible to target adolescent girls with low-fitness to participate in an intervention within their school environment.
• A multicomponent approach using the homeroom, school sport and after-school period is a feasible and acceptable approach for high school interventions.
• Large effect sizes for physical activity are possible to obtain among adolescent girls through focusing on improving fundamental movement skills.

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