Feasibility of the ‘Girls Recreational Activity Support Program using Information Technology’ (GRASP-IT) pilot study: a randomised controlled trial to increase physical activity among older adolescent girls using a social networking website.

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This research project is submitted in partial fulfilment of the requirements for the degree of Master of Philosophy (Education).

February, 2012.
DECLARATION

I declare that this thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying subject to the provisions of the Copyright Act 1968.

Signed: ______________________________

Tracey Leona Kelty
DEDICATION

I would like to dedicate this publication to my whole family for putting up with the lack of space in our family room, my cranky mornings after long nights at the computer and your patience and time to make this journey possible.
ACKNOWLEDGEMENTS

I would like to acknowledge and show my appreciation for the assistance of the following people, who have made this research possible:

- To my supervisors, Professor Philip Morgan and Associate Professor David Lubans for constant patience, guidance and direction on this important journey.

- To my colleagues and friends in the Health and Physical Education building, thank you for your encouragement and support.

- A special thank you to Associate Professor Robin Callister and Doctor Ann McCormack for your unconditional guidance and encouragement.

- Thanks to Lee Mears, Amanda Tapley and Gabrielle Quick for your encouragement and support during data collection.

- Thanks to the school staff for your assistance and permission to allow this study to go ahead during your sport program.

- Finally a special thank you to the participants as the study would not have been possible without you.
This study evaluated the feasibility and preliminary efficacy of the Girls Recreational Activity Support Program using Internet Technology (GRASP-IT) intervention. The study involved a group randomised controlled trial for adolescent girls (mean age 15.7± 1.5 years) recruited from two secondary schools in New South Wales, Australia. The study included an intervention (n = 29) and control (n = 23) group. The 12-week school-based intervention combined six weekly face-to-face sessions, that provided participants with education and participation in physical activity and followed with six weeks utilising a social networking website (Facebook) with the aim to further educate and motivate the participants to increase their physical activity.

The study included baseline and 12-week follow-up measurements for physical activity (5 day pedometer step count), height and weight to indicate body mass index (BMI), estimated volume of maximal oxygen uptake (VO₂max) to indicate fitness (measured by the Queen’s College Step Test), as well as self-efficacy and peer support for physical activity (measured by questionnaires). A comprehensive process evaluation which included a questionnaire and focus groups interviews at the intervention school was also conducted.

The results of the study indicate that although, the intervention group significantly increased their physical activity (mean 1878 steps/day, p = 0.04) the difference
between groups was not significant \((p = 0.11, d = 0.8)\). Other results for secondary outcomes included BMI \((p = 0.12, d = -0.5)\), fitness \((p = 0.97, d = 0.1)\), self-efficacy \((p = 0.06, d = 0.8)\) and peer support \((p = 0.16, d = 0.6)\) all of these results changed over time, however, changes were not statistically significant between groups.

The process evaluation and adherence data revealed that, although participants engaged with and enjoyed the face-to-face component of the GRASP-IT intervention, engagement with the on-line component was low. According to the process evaluation the participants were satisfied with the GRASP-IT study however, it is conclusive that the study was not long enough to impact significantly on self-efficacy to significantly increase physical activity in this cohort.

The findings suggest the need for additional strategies to engage older adolescent girls to increase physical activity and improve their health and well-being. The school setting played an important role in providing opportunities for girls to be active and future studies need to consider school structures as well as other innovative interventions to engage adolescent girls to participate in physical activity. Interventions that utilise Facebook as a medium for increasing physical activity for adolescent girls require additional strategies to improve and, in particular, address the areas of engagement and compliance toward such online mediums for future success.
Preface

An article titled “Efficacy and Feasibility of the ‘Girls’ Recreational Activity Support Program using Information Technology’: a pilot randomised controlled trial’ has been submitted and accepted for publication to the online journal “Advances in Physical Education Vol.2, No.1 in February 2012”. Available through Scientific Research Publishing, USA [http://www.scirp.org/journal/ape/]. Co-authors are Philip J. Morgan and David R. Lubans.
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CHAPTER 1
INTRODUCTION

1.1 Overview of thesis

This thesis will report the development and evaluation of the Girls Recreational Activity Support Program using Internet Technology (GRASP-IT) intervention. Chapter one will introduce the field of work related to adolescent girls’ physical activity and highlight the rationale for conducting the GRASP-IT study. Chapter two will provide an overview of the literature relating to adolescent girls physical activity and health, including a review of physical activity interventions that have targeted older adolescent girls. Chapter two will also detail the rationale for this study. Chapter three details the methodology of the GRASP-IT randomised controlled trial and describes the study design and assessment protocols, including the details of the process evaluation completed by the intervention group at the conclusion of the study. Chapter four presents the results of the GRASP-IT study and Chapter five provides a discussion and interpretation of the results comparing the findings with the existing knowledge of the field. To conclude, Chapter 6 details the implications, recommendations and provides a closing statement for the GRASP-IT study.

1.2 Physical activity in context

This section will operationally define the term “physical activity” and place it in context for the purposes of clarity to enable readers to fully understand this study and its’ significance. The types of physical activity discussed in this thesis will include:
(1) **recreational or leisure physical activity** which involves participation in unstructured or non-organised activity for the purpose of enjoyment or health benefits;

(2) **Sport** which involves an organised game or activity that may be competitive or non-competitive, but will involve a set structure with rules and/or guidelines;

(3) **Incidental physical activity** which involves any movement that is carried out while acting on normal everyday tasks, for example, housework, gardening etc.

(4) **Active transport** which involves physical activity that is performed to travel from one place to another, for example, walking to school.

(5) **Employment physical activity** which involves a participant being active while carrying out the duties required by an employer, for example, steps taken while working at a fast-food outlet serving or cleaning.

Along with the types of activities that will be discussed in this thesis the intensity of physical activity is also an important consideration to clarify when researching adolescent girls’ physical activity behaviour. The intensity of physical activity is usually referred to as “how hard” a person is working and is classified into four general categories:

(1) Light (or low) physical activity (LPA),

(2) Moderate physical activity (MPA),

(3) Moderate to vigorous physical activity (MVPA),

(4) Vigorous or high level physical activity (VPA).
### 1.3 Definition of terms

**Body mass index (BMI)**  
A method of classifying whether a person is a normal weight, underweight, overweight or obese (Cole, Flegal, Nicholls, & Jackson, 2007). BMI is calculated by dividing the person’s weight by their height squared (kg/m²). Underweight is below 18.5, acceptable weight is from 18.5 to less than 25, overweight is 25 to 30 and obese is 30 and above.

**Determinant**  
Any factor that can increase the chances of ill health (risk factor) or good health (protective factor) in a population or individual.

**Self-efficacy**  
Is a person’s belief about his/her ability to perform and/or control behaviour in a certain way to succeed or achieve set goals and is featured in social cognitive theory (Bandura, 1989; Dishman, et al., 2005).

**Social network website**  
A web-based service that allows an individual to construct a public or semi-public profile within a bounded system that facilitates the user to view and/or interact with other participants on-line. The nature of the connections may vary from site to site (Boyd & Ellison, 2007).

**Sedentary behaviour**  
An activity that does not increase energy expenditure substantially above the resting level. For example, sitting, lying down or watching television (Pate, O'Neill, & Lobelo, 2008).
1.4 **Abbreviations**

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<td>AIHW</td>
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<tr>
<td>BMI</td>
<td>Body Mass Index</td>
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<tr>
<td>NSW DET</td>
<td>New South Wales Department of Education and Training</td>
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<td>GRASP-IT</td>
<td>Girls Recreational Activity Support Program using Internet Technology</td>
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<td>LEAP</td>
<td>Lifestyle Education for Activity</td>
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<tr>
<td>LPA</td>
<td>Light or low physical activity</td>
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<td>M-SPAN</td>
<td>Middle School Physical Activity and Nutrition</td>
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<td>MPA</td>
<td>Moderate physical activity</td>
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<tr>
<td>MVPA</td>
<td>Moderate-to-vigorous physical activity</td>
</tr>
<tr>
<td>PA</td>
<td>Physical activity</td>
</tr>
<tr>
<td>PE</td>
<td>Physical education</td>
</tr>
<tr>
<td>PDHPE</td>
<td>Personal Development, Health and Physical Education</td>
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<td>Project FAB</td>
<td>Project Fitness And Bone. A school-based intervention to promote physical activity and prevent osteoporosis among sedentary adolescent females.</td>
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<td>PSPP</td>
<td>Physical Self-perception Profile</td>
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<td>QCST</td>
<td>Queens College Step Test</td>
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<td>SCT</td>
<td>Social Cognitive Theory</td>
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<td>SES</td>
<td>Socio-economic status</td>
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<tr>
<td>SLAP</td>
<td>Self-led activity program</td>
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<td>SPAS</td>
<td>Social Physique Anxiety Scale</td>
</tr>
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<td>SPSS</td>
<td>Statistical Package for Social Sciences</td>
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<td>TAAG</td>
<td>Trial of Activity for Adolescent Girls</td>
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<td>TLAP</td>
<td>Teacher led activity program</td>
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<td>TTM</td>
<td>Transtheoretical Model</td>
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<tr>
<td>VO$_{2\text{max}}$</td>
<td>Volume of maximal oxygen uptake (ml/kg/min)</td>
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<td>VPA</td>
<td>Vigorous or high level physical activity</td>
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<td>WHO</td>
<td>World Health Organisation</td>
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Also see page 44 for specific abbreviations used in Table 5.
1.5 Background

Physical activity is positively associated with improved health and can prevent future lifestyle diseases such as coronary heart disease, type 2 diabetes and obesity (Australian Institute of Health and Welfare, 2010; World Health Organisation, 2004b). In a recent review, Janssen and LeBlanc (2010) concluded that participation in moderate-to-vigorous physical activity (MVPA) was associated with lower cholesterol, body fat, metabolic syndrome, depression, blood pressure and improved bone density.

Despite these established benefits, research has highlighted the steady decline in physical activity levels from childhood to adolescence, which is clearly more pronounced among girls (Jamner, Spruijt-Metz, Bassin, & Cooper, 2004; Nader, Bradley, Houts, Ritchie, & O'Brien, 2008; Pate, Dowda, O'Neill, & Ward, 2007). The National Children’s Nutrition and Physical Activity Survey was conducted in 2007 studied approximately 4,000 Australian children aged 2 to 16 years and reported that the majority of Australian girls in the 14-16 year age group were not meeting the recommended physical activity guidelines. As reported in the main findings, the girls were surveyed to investigate their MVPA over a 4 day period. This was reported using four methods:

1. The All Days Method - If they met the guidelines on each of the 4 days measured. Results revealed only 13% of girls aged 14-16 years met the MVPA guidelines.

---

1 Recommended at least 60 minutes of MVPA per day and this can be built up through the day with a variety of activities Source: (Australian Government Department of Health and Ageing, 2008)
2. The Most Days Method – If they met the guidelines on 3 or 4 of the 4 days measured. Results revealing only 33% of girls aged 14-16 years met the MVPA guidelines.

3. The 4-Day Average Method – An average was taken of the number of girls who met the guidelines across the 4 days measured. Results revealing only 59% of girls aged 14-16 years met the MVPA guidelines.

4. The Child x Method – Data on a randomly chosen child and a randomly chosen day was analysed. Results revealing only 51% of girls aged 14-16 years met the MVPA guidelines.

Similarly, only 26% of girls aged 14-16 years met the recommended number of steps per day\(^2\) (Australian Government Department of Health and Ageing, 2008).

The decline in physical activity for adolescent boys and girls is clearly illustrated by Nader et al. (2008) and illustrated in Figure 1. Nader et al. (2008) studied both girls (\(n = 515\)) and boys (\(n = 517\)) in a longitudinal study of children from 9 years of age through to 15 years of age and reported the mean MVPA in minutes per day over four to seven days using an objective measure of physical activity. The graph in Figure 1 clearly shows a decline in physical activity for both boys and girls. Notably, at age 9, girls participated in approximately 170 minutes of MVPA per day and progressively declined to below 30 minutes per day at age 15 years.

\(^2\) Recommended steps per day for pedometer-determined physical activity in children that apply to girls is 12,000 steps per day. Source: (Duncan, Schofield, & Duncan, 2007)
To address the decline in adolescent girls’ physical activity behaviour, evident in both national and global research, more effective physical activity promotion strategies are clearly warranted (van Sluijs, McMinn, & Griffin, 2007). The health behaviours of adolescents are important determinants of current and future health status and the current physical activity behaviour status of adolescent girls is cause for concern (World Health Organisation, 2004b).
1.5.1 Profile of the school setting

The school has been identified as an important setting for the promotion of physical activity in adolescent girls (Dishman, et al., 2004; Eliakim, et al., 1996; Schneider, et al., 2007; van Sluijs, et al., 2007). Youth spend approximately six hours a day at school and there are opportunities to improve the health and welfare of the school population during this time. Furthermore, when considering this time spent at school, it is important to note that the school setting may play a role in the decrease in physical activity for older adolescent girls. For example, reduced physical activity levels may occur as a result of the transition from junior secondary school (Grades 7 to 10) to senior secondary school (Grades 11-12). Senior secondary students in New South Wales, Australia, currently move from compulsory physical education lessons and sport in junior secondary school, to optional physical education and sport opportunities in senior secondary school (Board of Studies New South Wales, 2010) reducing the opportunities for many girls to be active at school. Furthermore, the number of senior students who sat the Higher School Certificate in NSW during 2010 was 71,310 students with 51% (36,368) being female candidates and the enrolment of girls into the Personal Development, Health and Physical Education (PDHPE) subject area in senior secondary school was 7,275 (out of a total candidature of 13659 for this subject area) and this represented 20% of the total candidature for girls in this subject (NSW BOS, 2010). These figures suggest a lack of interest and commitment by adolescent girls in the area of PDHPE as they move into senior studies and it is not clear of the impact this choice has on their physical activity behaviour while attending senior school.
1.5.2 Profile of a changing generation

The estimated resident population of Australia is 22.2 million (Australian Bureau of Statistics, 2010). Young people (aged 15-24 years) account for 14% of the population. According to the 2007-8 National Health Survey, 36% were overweight or obese and this has increased from 29% to 36% in the last decade (Australian Institute of Health and Welfare, 2010). Furthermore, the use of technology invariably promotes sedentary behaviours and the adolescent population of today are a ‘tech-savvy Generation Y cohort’ who have a need for instant gratification and have learnt to separate effort from reward (Sheahan, 2008).

McCrindle (2010) conducted a commissioned research project in 2002 and reported that Generation Y (those born between 1982 and 2000) have very different recreational pursuits to other generations with their top three rated activities as going to a party, listening to music and going to the movies (all sedentary or minimal physical activities). McCrindle (2010) also reported that Generation Y are most influenced by a core group of three to eight friends and a strong sense of loyalty to their peers is evident. The next most influential factors reported were music, television and home movies, demonstrating a preference for sedentary activities. This theme of sedentary behaviours is also evident nationally with the Australian Institute of Health and Welfare Biennial Health Survey (2003) revealing that 27% of young people (15-24 years) were sedentary two weeks before this health survey and females were slightly more sedentary than males (29% and 25% respectively).
1.6 **Significance**

Innovative strategies designed to combat the decline in physical activity observed during adolescence for girls are urgently needed. The internet has emerged as a promising strategy for promoting physical activity in youth populations (Norman, et al., 2007). Notably, the use of social network sites in the world is increasing with the most popular sites being Facebook and MySpace (Atif, Saqib, & Chen-Nee, 2008; Kazeniac, 2010; Minas, Michael, Athina, & Xiaowei, 2008; Thelwall, 2008) and these may be particularly appealing for adolescent girls. Given their popularity, on-line communication sites that utilise social networking are a potential innovative tool that may allow adolescent girls to engage with each other and provide social support for each other to be active. To the researchers’ knowledge, no previous intervention has targeted adolescent girls using a social network site in conjunction with a face-to-face program to promote physical activity.

1.7 **Purpose, justification and aims of the study**

The purpose of this thesis is to report the feasibility and preliminary outcomes of the GRASP-IT pilot study, a 12-week physical activity intervention for adolescent girls that utilised both face-to-face (school-based) and on-line (after school hours) components using a social networking site (Facebook). The choice to include face-to-face sessions in the first phase of this intervention was to promote enjoyable recreational physical activity opportunities in the local community and school setting to increase self-efficacy, promote social support and educate the participants about the benefits of physical activity. The face-to-face time was also used to introduce the participants to the on-line
social networking site at the end of phase one of the program. The choice to use Facebook as the social networking site for GRASP-IT during phase two was due to the capability of Facebook to facilitate a closed group setting, thus, avoiding contamination from outside participants. At the time of this study Facebook was the most viable option to utilise for the on-line component as no other social network site offered a closed group setting. The intervention participants were all enrolled in a state system secondary school and were expected to access the closed Facebook group outside of school hours, as social networking sites are blocked by New South Wales Department of Education and Training (NSW DET) schools during school hours and in the school setting.

To determine the efficacy of the GRASP-IT intervention, quantitative assessments were conducted at baseline and 12-week follow-up. At the completion of the intervention, quantitative and qualitative techniques were employed. Students provided written responses through questionnaires as well as verbal responses during focus group discussions. The use of a mixed-method for the process evaluation provided a more comprehensive insight into the girls’ thoughts and opinions to enable the researcher to seek comprehensive information to determine the feasibility, acceptability and girls’ satisfaction with the intervention.

Research questions to be addressed included:

1. Will the GRASP-IT intervention increase physical activity in a cohort of older adolescent girls?
2. Will the GRASP-IT intervention be feasible and acceptable to the girls?
3. Will the participants engage with each other to provide social support to be active using the social networking site (Facebook)?
4. Will the combination of face-to-face and on-line social support structures, provided in the GRASP-IT study, increase physical activity behaviour in adolescent girls?

5. Will the GRASP-IT intervention have an impact on BMI and/or fitness of the participants?

6. Will the GRASP-IT intervention promote self-efficacy and social support to increase physical activity?

7. Will the girls enjoy the program and be satisfied with the intervention quality and impact?

1.8 Chapter summary

Many adolescent girls are not participating in sufficient physical activity to gain the associated health benefits. Efforts to combat the declining levels of physical activity participation in adolescent girls are clearly warranted and this thesis will endeavour to design and evaluate a novel, evidence-based approach to increase adolescent girls’ physical activity.
CHAPTER 2
LITERATURE REVIEW

2.1 Introduction and overview

This literature review discusses the prevalence and trends of physical activity among adolescent girls, as well as the physiological and psychological benefits associated with physical activity. The demographic, biological, psychological, behavioural, social and physical environmental factors associated with adolescent girls’ physical activity are then described. The importance of health behaviour theories is then explored with a focus on Bandura’s Social Cognitive Theory (SCT) which provided the theoretical framework for the GRASP-IT intervention. Discussion of research into the assessment of physical activity is then outlined with a specific focus on anthropometric and psychometric variables. Specific interventions targeting adolescent girls in a school setting are then explored. To conclude, an investigation into the current use of technology for the promotion of physical activity focusing on targeted interventions for adolescent girls is provided.

2.2 Prevalence and trends of physical activity in adolescent girls

It is difficult to compare the prevalence of physical activity across different populations and generations due to differences in measures used and heterogeneity in study designs. While it is not clear whether the physical activity levels of youth have declined over the past 20 years, certain trends have emerged in the literature and will be discussed in this literature review:
i) Girls are less active than boys;

ii) Physical activity in adolescent girls and boys declines with age;

iii) Physical activity declines with age and is more pronounced in adolescent girls;

iv) Active transportation has declined over time.

At a national level, many Australian youth are not accruing sufficient physical activity to benefit their health status (Australian Institute of Health and Welfare, 2010). The current Australian recommendations state that children aged 5 to 18 years should be accumulating at least 60 minutes, and up to several hours, of MVPA per day (Australian Government Department of Health and Ageing, 2008). Furthermore, this research shows that the majority of Australian girls in the 14-16 year age group are not meeting the recommended physical activity guidelines (Table 1). Recent population studies conducted in Australia include the 2007 Australian National Children’s Nutrition and Physical Activity Survey. This survey found that “girls met the guidelines less often than boys, and there was a drop-off with age, which is very marked in older girls” (p.27). Table 1 illustrates the national survey results showing self report measures of time for physical activity over one week and Table 2 shows measured (pedometer) steps taken per day for seven days illustrating the proportion of children who met the physical activity guidelines and highlights the decline that occurs with gender and age differences.
Table 1: Proportion (%) of children who met the physical activity guidelines using four different methods of interpreting the guidelines

<table>
<thead>
<tr>
<th>AGE (YEARS)</th>
<th>BOYS</th>
<th>GIRLS</th>
<th>ALL CHILDREN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9–13</td>
<td>14–16</td>
<td>9–16</td>
</tr>
<tr>
<td>All Days Method</td>
<td>46</td>
<td>25</td>
<td>38</td>
</tr>
<tr>
<td>Most Days Method</td>
<td>74</td>
<td>53</td>
<td>66</td>
</tr>
<tr>
<td>4 Day Average Method</td>
<td>94</td>
<td>77</td>
<td>87</td>
</tr>
<tr>
<td>Child x Day Method</td>
<td>80</td>
<td>64</td>
<td>74</td>
</tr>
</tbody>
</table>

1Population weights applied


Table 2: Mean number of steps taken per day by boys and girls aged 5-8, 9-13 and 14-16 years and the percentage reaching or exceeding recommended thresholds

<table>
<thead>
<tr>
<th>AGE (YEARS)</th>
<th>BOYS</th>
<th>GIRLS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5–8</td>
<td>9–13</td>
</tr>
<tr>
<td>Number of steps</td>
<td>13,815</td>
<td>13,361</td>
</tr>
<tr>
<td>% above threshold 1</td>
<td>55</td>
<td>46</td>
</tr>
<tr>
<td>% above threshold 2</td>
<td>32</td>
<td>24</td>
</tr>
</tbody>
</table>

1Population weights applied
2Threshold 1 = 13,000 steps for boys, and 11,000 steps for girls (Presidential Council on Fitness and Sport 2002)
3Threshold 2 = 15,000 steps for boys, and 12,000 steps for girls (Tudor-Locke et al. 2002)


The Australian recommendations are generally consistent with other nations, including The United States of America (USA) and the United Kingdom (UK). Similar to Australian guidelines, authorities from the USA and UK also recommend that children and adolescents participate in MVPA for a minimum of 60 minutes per day (Boreham & Riddoch, 2001; Butcher, Sallis, Mayer, & Woodruff, 2008; Daley, et al., 2008; Welfare, 2003). Local research into the physical activity levels of NSW youth was reported in the recent New South Wales Schools’ Physical Activity and Nutrition Survey (SPANS). The SPANS study involved approximately 8,000 children from 101 schools across Grades K, 2, 4, 6, 8 and 10. The survey reported that two thirds of the students in Year 6, 8 and 10
met the physical activity guidelines during summer and only half during winter. It is interesting to note that Year 10 girls in both summer and winter reported higher levels of physical activity (Figure 2 and 3) from 1997 to 2004 and then again to 2010 (Hardy, 2010). This data is not consistent with global trends, however, physical activity was assessed using self-report measures and may indicate higher results of data reported.

Figure 2: Prevalence of 60 minutes per day of MVPA during summer for school terms among girls in Year 10 in NSW (Hardy, 2010)

Figure 3: Prevalence of 60 minutes per day of MVPA during winter for school terms among girls in Year 10 in NSW (Hardy, 2010)
2.3 Benefits associated with physical activity

Participation in physical activity is paramount to the health of our population, as each year 1.9 million people die as a result of diseases that relate to physical inactivity (World Health Organisation, 2004b). The health benefits of physical activity are well documented and include both physiological and psychological factors. The Australian Government through the Department of Health and Ageing promote a campaign titled “Get Out and Get Active” that targets 12 to 18 year olds and lists the benefits of physical activity as:

- a great way to have fun with friends and make new ones;
- providing an opportunity for new skills and challenges;
- boosting confidence;
- improving fitness;
- making bones and muscles stronger;
- improving posture;
- helping to maintain a healthy weight;
- improving the health of your heart;
- can help you relax;
- reduces stress;
- helps to maintain healthy growth and development.

(Australian Government Department of Health and Ageing, 2005)

Research has shown that high cholesterol, depression, high blood pressure, bone density, obesity and metabolic syndrome are all positively associated with physical activity and that the more physical activity partaken the greater the benefit (Janssen & LeBlanc, 2010).
2.3.1 Physiological benefits of physical activity

Many studies have found that lack of physical activity can lead to Type II diabetes and cardiovascular disease, and that regular physical activity has a marked effect on health including an improved weight profile and improved bone health (Janssen & LeBlanc, 2010; Schneider, et al., 2007). A review conducted by a large panel of experts in the USA evaluated evidence about the influence of physical activity on several health and behavioural outcomes in youth aged 6 to 18 years of age (Strong, et al., 2005). They identified the following important physiological benefits of physical activity in youth:

Evidence-based data are strong for beneficial effects of physical activity on musculoskeletal health, several components of cardiovascular health, adiposity in overweight youth, and blood pressure in mildly hypertensive adolescents. Evidence is adequate to make informed judgments about the beneficial effects of physical activity on lipid and lipoprotein levels and adiposity in normal weight children and adolescents, blood pressure in normotensive youth and other cardiovascular variables (Strong et al 2005, p.736).

While the above review targets benefits of physical activity for youth, along with other previous reviews, much of the discussion is focused on the benefits that physical activity will bring to youth when they reach adulthood and do not tend to elaborate on immediate or short-term benefits for adolescents (Biddle, Gorley, & Stensel, 2004; Sallis, Prochaska & Taylor, 2000; Strong, et al., 2005).
2.3.2 Psychological benefits of physical activity

It is clear that regular participation in physical activity in youth can have a marked effect on mental well-being and the psychosocial benefits include improved body image, self-esteem, reduced depression and improved mental health (Biddle, et al., 2004; Biddle, Whitehead, O'Donovan, & Nevill, 2005; Huang, Norman, Zabinski, Calfas, & Patrick, 2007).

However, higher levels (or intensity) of physical activity are associated with increased self-esteem, self-concept and psychosocial well being by reducing stress, anxiety and depression (Azar, Ball, Salmon, & Cleland, 2008; Bauman, Sallis, Dzewaltowski, & Owen, 2002; Dishman, et al., 2006). Dishman et al. (2006) examined the relationship between physical activity and sport participation with depressive symptoms in a large sample of adolescent girls. They concluded that physical activity and sport participation may reduce depressive risk in this population.

The Strong et al. (2005) review identified the psychological benefits of physical activity. Physical activity was found to be positively associated with lower anxiety and reduced depression symptoms, although they did note that this association varies with the mode of activity. The influence of self-concept was reported to be mediated by the mode of the activity and Strong et al. (2005) stated that “beneficial effects associated with aerobics, aerobics combined with strength/flexibility activities, dance, perceptual motor, and cognitive behavioural modifications to augment physical activity” (p.734).
2.4 Factors associated with physical activity in adolescent girls

The correlates of youth physical activity have been widely studied. A major review by Biddle et al. categorised variables into five areas and reviewed potential correlates and their association (Table 3).

### Table 3 Variables shown to be associated with physical activity in adolescent girls

<table>
<thead>
<tr>
<th>Category of variable</th>
<th>Correlates</th>
<th>Association</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic and biological</td>
<td>Female (gender)</td>
<td>– S/M</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>– S/M</td>
</tr>
<tr>
<td></td>
<td>White ethnicity</td>
<td>+ S</td>
</tr>
<tr>
<td></td>
<td>Increase BMI</td>
<td>– S</td>
</tr>
<tr>
<td></td>
<td>Family income</td>
<td>+ M</td>
</tr>
<tr>
<td></td>
<td>Higher parental education</td>
<td>+ M</td>
</tr>
<tr>
<td>Psychological</td>
<td>Perceived competence</td>
<td>+ S</td>
</tr>
<tr>
<td></td>
<td>Self-efficacy</td>
<td>+ S/M</td>
</tr>
<tr>
<td></td>
<td>Enjoyment</td>
<td>+ S/M</td>
</tr>
<tr>
<td></td>
<td>Perceived body attractiveness</td>
<td>+ S/M</td>
</tr>
<tr>
<td></td>
<td>Physical self-worth</td>
<td>+ S/M</td>
</tr>
<tr>
<td></td>
<td>Appearance importance/concerns</td>
<td>+ S/M</td>
</tr>
<tr>
<td></td>
<td>Perceived barriers</td>
<td>- S/M</td>
</tr>
<tr>
<td></td>
<td>Lack of time barrier</td>
<td>- S</td>
</tr>
<tr>
<td>Behavioural</td>
<td>Smoking</td>
<td>- M</td>
</tr>
<tr>
<td></td>
<td>TV/video viewing</td>
<td>?</td>
</tr>
<tr>
<td></td>
<td>Participation in organised sports</td>
<td>+ M/L</td>
</tr>
<tr>
<td>Social and cultural</td>
<td>Peer involvement and support</td>
<td>?</td>
</tr>
<tr>
<td></td>
<td>Family and parental support</td>
<td>+ S/M</td>
</tr>
<tr>
<td></td>
<td>Mother’s physical activity</td>
<td>?</td>
</tr>
<tr>
<td></td>
<td>Father’s physical activity</td>
<td>+ S/M</td>
</tr>
<tr>
<td>Physical environmental</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** 0, zero association; +, positive association; –, negative association; ?, indeterminate; S, small; M, moderate; S/M, small-to-moderate; L, large. Variables indicated with * are considered “modifiable” correlates (see text for clarification). All studies are cited, including those showing no association. Source: .

The main findings of this review reported that modifiable correlates for adolescent girls clustered around “positive psychology”, involvement in organised sport and the family. Similarly, this section of the thesis has been divided into key categories identified in the literature:

- **2.4.1 Demographic factors**
- **2.4.2 Physiological and biological factors**
- **2.4.3 Psychological factors**
2.4.4 Behavioural factors

2.4.5 Social factors

2.4.6 Physical environmental factors

Each sub-section above will explore the literature surrounding a variety of factors associated with physical activity in adolescents. To introduce the literature and provide an overview, two major reviews are explored (Ferreira, I., van der Horst, K., Wendel-Vos, W., Kremers, S., van Lenthe, F., & Brug, J., 2007 and Sallis, J., et al., 2000).

It is worth mentioning that the Ferreira et al. (2007) review referred to a well known review conducted by Sallis et al. (2000) which builds upon their more recent review to update information about physical activity and youth. Additionally, it is worth noting that Ferreira et al. (2007) merged 51 of the original studies reviewed by Sallis et al. (2000) into their review.

The review by Sallis et al. (2000) identified 48 different factors that might influence an adolescent’s likelihood to be physically active. The main correlates were categorised into demographic, biological, psychological, behavioural, social, cultural, and physical environmental factors. Biddle and Wang (2003) also refer to this study and point out that of the 17 psychological constructs identified by Sallis et al. (2000) only three (achievement orientation, perceived competence and intention) were positively associated with physical activity and “depression” was negatively associated with physical activity.
The review conducted by Ferreira et al. (2007) focused on the environmental correlates of physical activity in youth and looked at studies completed during the past 25 years. This review utilised a semi-quantitative technique on children from 3 to 18 years using the Analysis Grid for Environments Linked to Obesity (ANGELO) conceptual framework. This framework focused on a micro (Eg. home, school, neighbourhood) and macro (Eg. town planning) settings to classify the following environmental determinants of physical activity:

- Physical
- Socio-cultural
- Economic
- Political

In this review, Ferreira et al. (2007) identified 150 studies of which 84 studies of adolescent physical activity were included. The majority of the studies reviewed used cross-sectional designs with adolescent or parental self-report of physical activity. It is worth noting that this review identified only nine studies that were female only (6.7% of the total review). The results of this review reported that the strongest correlates of physical activity in youth were:

- Fathers’ physical activity
- Time spent outdoors and school PA-related policies (in children)
- Support from significant others
- Mother’s education level
- Family income
- Non-vocational school attendance (in adolescents)
- Low crime incidence (in adolescents) was characteristic of the neighbourhood environment associated with higher physical activity.
Additionally it should be noted that a majority of the evidence for these correlates came from cross-sectional studies and therefore causation cannot be assumed.

2.4.1 Demographic factors

Biddle et al. (2005) identified six main demographic and biological correlates associated with physical activity in adolescent girls. These factors included small to moderate associations with physical activity in adolescent girls. The three positive associations were white ethnicity, higher family income and parents with higher education qualifications. Variables that were negatively associated with physical activity were: female gender, age, and BMI (Table 3).

2.4.2 Physiological and biological factors

Both physiological and biological factors are important to consider when studying adolescent girls. Many studies have demonstrated a considerable gender difference when investigating the trends and prevalence of physical activity in children and youth, with clear evidence that boys are generally more active than girls (Australian Government Department of Health and Ageing, 2008; Hardy, 2010; Nader, et al., 2008). Age is also a contributing factor to reduced physical activity participation in adolescent girls, as previously stated, physical activity declines with age (Australian Government Department of Health and Ageing, 2008; Hardy, 2010; Nader, et al., 2008).

Additionally, ethnicity has been found to be associated with physical activity in adolescent girls. Generally, caucasian adolescent girls are more active than non-
Genetic and biological traits of adolescent girls may also influence physical activity levels. Brodersen et al. (2007) conducted a five year longitudinal study of adolescent girls and boys (n = 5863) in the UK and explored developmental trends in physical activity in relation to sex, ethnicity and socioeconomic status. Students in this study were categorised as white, black or Asian and stratified by SES. The measurements included the number of days per week participating in VPA and the number of sedentary hours. Results revealed a marked reduction in physical activity between the ages of 15-16 years, boys were more active than girls, the physical activity decline was greater in girls. Interestingly, Asian students were less active than white students and black girls (not boys) were also less active than white students.

In the recent NSW SPANS study, Hardy (2010) reported that physical activity was consistently higher among students from high socio-economic status (SES) backgrounds compared with students from middle and low SES groups. Hardy (2010) also reported that when comparing girls from Middle-Eastern cultural backgrounds with students from English-speaking backgrounds, Middle-Eastern girls were significantly less active.

Figure 4 illustrates the revised transdisciplinary framework of Bryan et al. (2011) which provides an example of, and guide to genetic factors that influence both physiological response to exercise and the subjective experience of exercise. They discuss the genetic factors as genes that influence pain tolerance or cardiopulmonary systems and explain that they have a part to play in the physiological response to exercise. This response to exercise includes lactate concentration and temperatures regulation. Additionally, this affects the subjective experience of exercising being the psychological interpretation of
the physiological changes that take place during exercise, such as, perceived pain due to lactate increasing. Figure 4 clearly shows the connection of physiological response to the genetic factors, exercise experience, motivation and behaviour. These factors potentially affect the physical activity behaviour of adolescent girls and are worth consideration when designing physical activity interventions.

![Figure 4: An expanded and revised transdisciplinary model of exercise behaviour](image)

2.4.3 Psychological factors

Numerous psychological correlates of adolescent girls’ physical activity have been identified. Psychological aspects to consider for studies involving adolescent girls include the qualities that surround one’s “self”, for example, self-perception, self-concept, self-esteem, self-efficacy and motivation to participate in physical activity
Biddle et al. (2005) reviewed studies from 1999 to 2003 for correlates of participation in physical activity for adolescents and concluded that modifiable correlates for adolescent girls clustered around “positive psychology”. In this review the psychological correlates positively associated with physical activity in adolescent girls were enjoyment, perceived confidence, self-efficacy and physical self-perception:

“the most extensive and consistent evidence suggests that we should ensure that all physical activity environments for adolescent girls allow for choices and development of perceptions of competence and confidence, and that this is likely to lead to higher levels of enjoyment, better physical self-worth, and stronger persistence” (p.430).

Dishman et al. (2006) studied 1,250 girls in 12th grade to assess relations of physical activity and sport participation with depression symptoms. They carried out this study to test whether physical self-concept and self esteem would mediate cross-sectional relations of physical activity and sport participation with depressive symptoms. They discovered that both physical activity and sport participation had an indirect and positive relation to global physical self-concept and suggest that physical activity and sport participation might reduce depressive risk among adolescent girls.

An interesting study that investigated adolescent girls’ perceptions toward physical activity was conducted by Whitehead and Biddle (2008). In this study they investigated factors that may influence physical activity by conducting focus groups with adolescent girls to discuss their perceptions toward physical activity. Additionally, participants
also reported their physical activity level, so that differences in opinion according to the activity level were examined. Analysis of data by Whitehead and Biddle (2008) identified seven main themes surrounding the girls’ perceptions toward physical activity: perceptions of femininity; self-presentational concerns; changing priorities; lack of motivation versus appreciation of the benefits; the desired structure of physical activity; parental support; and enjoyment. This qualitative study highlighted the importance of social and psychological influences on physical activity for adolescent girls.

Another important psychological factor associated with physical activity in adolescent girls’ is perceived barriers to participation. Robbins, Pender and Kazanis (2004) point out that physical activity interventions are more likely to be effective if the barriers and factors that impact on physical activity participation are considered. Young et al. (2006) documented the process of informing interventions through formative research. They subsequently conducted formative research for the Trial of Activity for Adolescent Girls (TAAG) study by collecting oral and written reports, prioritizing, cross checking recommendations and objectives with the intervention strategies to inform future research of adolescent girls’ physical activity. In compiling this formative research Young and colleagues (2006) revealed that the major barriers for adolescent girls were “lack of skills and fear of injury”.

Kimm et al. (2006) surveyed 2,379 girls in the USA and discovered that “a lack of time” (60%) was a major barrier and “tiredness” and “lack of interest” as additional barriers to participation in physical activity. Dwyer (2006) conducted focus groups with 73 adolescent girls to gauge barriers of physical activity. She also noted that “lack of
time” was a major barrier to physical activity as well as “involvement in technology-related activities”; “influence of peers”, parents and teachers; concerns for safety; inaccessibility of facilities and the cost of using them; competition; and body-centred issues.

Biddle and Wang (2003) conducted a cross-sectional study that assessed 11-16 year old girls (n = 516) from the UK using a comprehensive profile of motivational and self-perception variables. This study used a cluster analysis to map cluster profiles and test whether clusters differed in physical self-worth, global self-esteem and physical activity. Results revealed a five cluster solution:

- 40% of the sample were moderately motivated;
- 30% lowly motivated in two clusters and
- 30% highly motivated in two clusters.

Of note is the differences between clusters on physical activity were quite small however, the results do show potential areas for interventions to enhance motivation of adolescent girls for physical activity.

Consideration toward the intensity of physical activity is a focus of some physical activity intervention research in adolescent girls and may link to psychological factors. Dunton and colleagues (2006) discussed the importance of physical activity programs that are designed to elevate self-perceptions and highlight the need to provide enough physical activity to also increase fitness levels. This is due to highly fit individuals rating themselves much more favourably than the less fit individuals and Dunton et al. (2006) also noted that physical self-concept is more closely related to physical fitness than physical activity.
2.4.4 *Behavioural factors*

The lifestyle behaviour of adolescent girls is clearly an area of interest to physical activity research. The Australian Government Department of Health and Ageing (2008) recommend 5 to 18 year old children accumulate at least 60 minutes of MVPA per day and to limit entertainment screen time to no more than two hours (excluding non-educational use) screen time per day.

However, the lack of physical activity evident in the adolescent girl cohort is evident and many youth are currently partaking in high levels of sedentary activities such as television viewing and computer use. Sedentary behaviour of our youth is cause for concern with 14-16 year old girls accumulating an average of 205 minutes of screen time per day (Australian Government Department of Health and Ageing, 2008).

The National Health Survey conducted in 2007-2008 reported that 72% of Australians aged 15 years and over were classified as sedentary or having low levels of physical activity and this increased with age. This survey reported 23% of 15-17 year old youth were sedentary. Furthermore, only 33% of children aged 9 to 16 years met the recommended screen time of no more than two hours of non-educational screen time each day (Australian Institute of Health and Welfare, 2010).

It is interesting to note that physical activity guidelines may be met by some girls yet the screen time recommendation may also be exceeded. Therefore, a balance of physical activity and sedentary behaviour is an area that needs to also be considered when studying adolescent girls’ physical activity behaviour.
2.4.5 Social factors

House, Umberson and Landis (1988), explained that social relationships affect health and well-being and they outline a structure of social support that is based on three terms of reference: social support, social integration and social networks, in which all three terms are referred to as a generic label of “social relationships”. Williams and Barclay (2004) explain that the use of the concept “social support” has many varied definitions and that none are definitive. However, they stress the importance of contextualising the use of social support when using this concept in research. Social scientists have a broad agreement that diversity of the adolescent population exists and this is a period of rapid development that may include experimentation or risk taking and research should consider the contextual influences that surrounding the social environment of this population (Steinberg & Morris, 2001).

In line with the above research the context of social support for the purpose of this thesis refers to social support as “social support to be active” and may involve support given by one person, or by a group of people, to another person to foster the participation and engagement of physical activity. This may include verbal support, guidance/advice or simply company to engage in physical activity. This support will also depend on the environment and demographics that exist to provide the opportunity to be physically active. Social support has been identified as a key correlate of the physical activity behaviour of adolescent girls.

The Trial of Activity for Adolescent Girls (TAAG) examined the relationship between adolescent girls’ physical activity and an activity-related social network variable
Voorhees et al. (2005) devised and validated a physical activity social network questionnaire based on preliminary focus group work with adolescent girls (Grade 6 and Grade 8). This study identified “friends” as an important source of social support for physical activity and adolescent girls who have more physically active friends reported higher activity levels for themselves.

The social influence of peers is an important consideration when studying adolescent girls’ physical activity. Coleman, Cox and Roker (2008) carried out a qualitative study in the UK among 75 girls (15 to 19 years of age) to explore the influences upon levels of physical activity participation. The study conducted in-depth interviews with the girls to explore the psychological and social influences. They concluded that friendship groups were the primary influence over all other factors.

Schofield and colleagues (2007) examined 318 adolescent girls (mean = 16 years) in a cross-sectional study of the relationship between girls and their nominated reciprocal friends’ physical activity level. Schofield et al. (2007) reported that friend’s physical activity levels explained between 27% and 32% of an objectively measured physical activity. The authors reported that reciprocity of friendship is a key factor influencing adolescent female friends’ physical activity.

### 2.4.6 Physical environmental factors

Environmental factors relating to the physical activity levels of adolescent girls have not been widely studied which is evident in Table 3. However, the school, home and neighbourhood environment could potentially influence physical activity participation.
for adolescent girls. A study by Butcher et al. (2008) was conducted by telephone targeting physical activity information from a large sample of adolescent girls aged 14 to 17 years (n = 6125) in the United States. The survey included information about the girls' physical activity during a typical week with a focus on compliance for at least 60 minutes of physical activity per day during the previous week. Results of this study revealed that the area of residence did not predict compliance.

Dunton, Jamner, & Cooper, (2003) conducted a study of 87 minimally active adolescent girls (14 to 17 years of age) to determine the relationship between adolescents’ perceptions of exercise resources in their environment and their actual physical activity. They found that minimally active adolescent girls were more likely to use facilities in their home as opposed to the general community facilities for physical activity.

2.5 Theories of health behaviour

Health behaviour theories provide a framework for the design and evaluation of effective interventions. While theory-based interventions appear to be more successful in changing behaviour than theoretical ones (Sharma, 2006), too many theories applied to an intervention may reduce its effectiveness and as Bandura (1998) points out:

“Following the timeless dictum that, the more the better, some researchers overload their studies with a host of factors that contribute only trivially to health habits because of redundancy. There is a marked difference between expanding the scope of an integrative theory and creating conglomerates from different theories with problems of redundancy and fractionation of predictors and theoretical disconnectedness” (p 624).
The most common theory of health behaviour used for the development of physical activity interventions is Bandura’s social-cognitive theory (SCT) (Biddle & Wang, 2003). SCT is based on the notion of reciprocal determinism, whereby behaviour both influences and is influenced by personal and environmental factors (Figure 5). Bandura and Schunk (1981) communicate the importance of these factors when studying health behaviour as they frame behaviour as either “internal” or “environmental” and the interaction of the three factors (behavioural, personal and environmental) promotes reciprocal determinism that may ultimately lead to greater self-efficacy (Bandura & Schunk, 1981).

<table>
<thead>
<tr>
<th>Table 4: Concepts of the Social Cognitive Theory</th>
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<tbody>
<tr>
<td><strong>Concept:</strong></td>
</tr>
<tr>
<td>Behavioural capability</td>
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<tr>
<td>Expectations</td>
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<tr>
<td>Expectancies</td>
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<tr>
<td>Self-control</td>
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<td>Reinforcement</td>
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<td>Environment</td>
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<td>Self-efficacy</td>
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<tr>
<td>Situation</td>
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<tr>
<td>Observational learning</td>
</tr>
<tr>
<td>Emotional coping responses</td>
</tr>
<tr>
<td>Reciprocal determinism</td>
</tr>
</tbody>
</table>

Source adapted from (Glanz, Rimer, & Lewis, 2002)
Bandura’s Social Cognitive Theory (SCT) is a well documented theory for structuring interventions that aim for positive behaviour change. Self-efficacy is the central determinant in SCT, as it operates on motivation and action both directly and through its impact on the other determinants. According to Bandura (1998), self-efficacy beliefs operating in conjunction with cognised goals, outcome expectations, perceived environmental impediments and facilitators in the regulation of human motivation, action and well-being.

**Figure 5: Bandura’s notion of reciprocal determinism**

The focus on social cognitive theory clearly contributes to the formation of a framework for interventions that is utilised to maximise the effectiveness of interventions however, this area of research seems to depend on the cohort studied. Bandura (1989) points out that in “social cognitive theory, people are neither driven by inner forces nor automatically shaped and controlled by the environment….they function as contributors to their own motivation, behaviour, and development within a network of reciprocally interacting influences” (p.6). The application of SCT to physical activity interventions involving adolescent girls is outlined in section 2.7.1.
2.6 Measurement of physical activity and fitness

The accurate assessment of physical activity and fitness is important for a number of reasons. First, to determine population physical activity and fitness levels and identify groups at-risk of inactivity. Second, to establish relationships between physical activity and potential health benefits and consequences. Third, to identify correlates and factors that may be targeted to change behaviour. Finally, valid and reliable measure of physical activity and fitness are needed to determine the effectiveness of interventions.

2.6.1 Physical Activity

Questionnaires are the most common form of physical activity assessment, but the validity and reliability of self-reported measures is problematic (Adamo, Prince, Tricco, Connor-Gorber, & Tremblay, 2009). Therefore, careful selection of valid and reliable methods of physical activity assessment need to be considered to enable accurate reporting of physical activity in adolescents and direct measures that are valid and reliable should be the preferred choice for physical activity research.

Pedometers are one instrument that has been validated and utilised in many studies to measure physical activity. The use of pedometers to measure steps has been well documented as a reliable method of assessment for physical activity and provides an objective assessment of physical activity levels (Felton, Tudor-Locke, & Burkett, 2006; Tudor-Locke & Bassett Jr, 2004). A recent review by Beets, Bornstein, Beighle, Cardinal, & Morgan (2010) found that 43 studies conducted in 13 counties with approximately 14,200 young people had used pedometers to measure physical activity.
The Yamax Digi-walker pedometers were the most commonly used pedometer and the median number of days recorded was four days. Beets, et al (2010) concluded that the use of pedometers is a feasible way to measure physical activity as they are widely available and inexpensive and provide an objective measure of physical activity and not influenced by memory or recall bias.

### 2.6.2 Physical fitness

Measurement of volume of oxygen uptake (VO$_2$ max) can be used to establish an individual’s cardio-respiratory fitness. There are many methods used to measure VO$_2$max, including treadmill, cycle ergo-meter, rowing and swimming tests, as well as more simple techniques such as timed running or step tests used for school-based field assessment (Zwiren, Freedson, Ward, Wilke, & Rippe, 1991). One popular step test to consider when assessing fitness is the Queens College Step Test (QCST). The literature surrounding the QCST supports the notion that it is easy to administer with minimal equipment and time and cost effective to use in a school setting for adolescent participants (Zwiren, et al., 1991). The QCST is a valid measure to estimate VO$_2$max ($r = -0.75$) and also has a well established test re-test reliability for recovery heart rate ($r = 0.92$) (McArdle, Katch, Pchar, Jacobson, & Ruck, 1972).

### 2.7 School-based physical activity interventions

Numerous school-based interventions have been designed and evaluated to increase physical activity in youth with varying success reported. The majority of physical activity interventions have targeted children and young adolescents and few have
targeted older adolescent girls (Clemmens & Hayman, 2004; van Sluijs, et al., 2007). In a review conducted by the author, seven studies were identified for older adolescent girls (14 years +). Of these studies, five had a significant impact on physical activity, while two did not result in behaviour change (Table 5). Further detail about the authors review is discussed in section 2.7.1.

### 2.7.1 Targeted physical activity interventions for adolescent girls only

A review of physical activity targeted interventions is presented in this thesis. The search for published articles was conducted using four databases (SPORTDiscus, PubMed, Science Direct and Scopus). The flow of studies through the review process is reported in Figure 6. The following terms were used in the search strategy: physical activity; adolescence; girls/females; school-based interventions. After initial searches the following inclusion criteria was applied to further refine the literature search: school based interventions (targeting secondary schools only); older adolescent girls (>14 years of age and <19 years of age) and included studies that were limited to those published in English and restricted to peer reviewed journal articles. Additionally this review of literature included interventions that targeted “female only” participants and must have included physical activity measures in the intervention.

Results of this review revealed very few physical activity interventions targeting adolescent girls aged ≥14 years and ≤19 years of age and discovered that no published studies utilised technology or computer use for information or social support in this cohort (Table 5).
Seven of the studies, included older adolescent girls’ physical activity cited a theoretical framework (Table 5). Two out of the seven studies used Bandura’s SCT (Murphy, Ni Dhuinn, Browne, & ÓRathaille, 2006; Neumark-Sztainer, Story, Hannan, & Rex, 2003). One study used Social Action Theory (Young et al., 2006) and four other studies targeted specific concepts from the SCT such as self-efficacy.

Although several intervention studies in this review targeted adolescent girls’ physical activity and had been somewhat successful, a limited number specifically targeted older adolescent girls (>14 years) to increase their physical activity (Table 5). All of the studies reviewed assessed physical activity using self-report measures and one study also used step counts (Schofield, Mummery & Schofield, 2005). The more successful interventions involved a multi-modal dimension to the study that included physical activity instruction/guidance sessions with support to increase physical activity. The study periods varied from 12-weeks to 9-months. Two studies being 12-weeks (Schofield, et al, 2005), one study for 4-months (Jamner, et al., 2004), one for 6-months (Murphy, et al., 2006) and two at 8-months (Neumark-Sztainer, Story, et al., 2003; Young, et al., 2006) and one 9-months (Schneider, et al., 2007). Furthermore, all seven studies reviewed were conducted during PE classes with one also combining community activities (Neumark-Sztainer, Story, et al., 2003) and another study setting homework (Bayne-Smith, et al., 2004). Only one study reported qualitative findings and conducted focus groups after follow-up assessments. (Murphy, et al., 2006).

Several other physical activity interventions that target younger adolescent girls were also reviewed by the author (mean age range 12 to 20 years of age) and many focused on BMI and measurement of fitness (estimate of VO₂ max) and not necessarily
increasing physical activity as the primary outcome (Barr-Anderson, et al., 2007; Clemmens & Hayman, 2004; Lindwall & Lindgren, 2005; Pate, et al., 2005; Stevens, et al., 2005).

1158 Potentially relevant articles identified by literature search:
- 635 Scopus
- 127 SPORTDiscus
- 233 Science Direct
- 163 PubMed

Excluded based on titles and review of the abstract:
- 47 Not school based
- 74 Review
- 40 Cross Sectional
- 27 Longitudinal
- 129 Young participants <14 years
- 21 Older participants >19 years
- 186 Medical condition or injury
- 116 Family or Community only
- 49 Included male participants
- 100 Included Dietary intervention
- 62 Drug intervention (smoking/alcohol)
- 286 Other

21 Full-text articles reviewed:
- 10 Scopus
- 3 SPORTDiscus
- 2 Science Direct
- 6 PubMed

15 Excluded after full-text review:
- 4 PA not measured
- 6 PA not a dependent variable
- 5 Other

9 Applicable articles included in review (7 studies)

Figure 6: Review flow chart for physical activity interventions in older adolescent girls
Table 5 Review of school based physical activity interventions for older adolescent females (14 years +)

<table>
<thead>
<tr>
<th>Author:</th>
<th>Participants:</th>
<th>Design and Measures:</th>
<th>Intervention Description:</th>
<th>Findings:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neumark-Sztainer, et al. (2003)</td>
<td>n= 201&lt;br&gt;Mean age 15.4 years&lt;br&gt;Grades 9 and 10.&lt;br&gt;Intervention (n =89)&lt;br&gt;Control (n = 112)&lt;br&gt;USA&lt;br&gt;Girls classified as over-weight or at risk of over-weight.</td>
<td>Design: True experimental.&lt;br&gt;Measures:&lt;br&gt;Behaviour, personal factors and socio-environmental factors were assessed using questionnaire, process evaluation and interviews at school. BMI. Self-report PA and sedentary behaviour. Parent survey.</td>
<td>An 8 month multi-component school-based program. Participants were randomly allocated into groups across six schools.&lt;br&gt;Intervention group participated in a 5 days/week 16 week program instead of PE class as well as some community activities.&lt;br&gt;The control group received a nutrition and PA theory handout at baseline and regular PE lesson. Post test at 3 months and 8 months. SCT drawn upon for behaviour change.</td>
<td>Results show no difference in BMI for both groups 20% of control group girls and 31% of intervention group girls progressed in their stage of PA but the majority of outcome variables at post-intervention and follow-up were not statistically significant.</td>
</tr>
<tr>
<td>Bayne-Smith (2004)</td>
<td>n = 442&lt;br&gt;Mean age 16 years&lt;br&gt;Control (n = 132)&lt;br&gt;Intervention (n = 310)&lt;br&gt;USA</td>
<td>Design: Experimental&lt;br&gt;Measures:&lt;br&gt;BMI, BP and total serum cholesterol. VO2 max (Queens College step test). Questionnaire for self report PA and food frequency,</td>
<td>A 12 week PE based program consisting of 30 minute classes 5 days/week. Classes included a 5-10 min information session with homework assignments followed by 20-25 mins of vigorous PA.</td>
<td>Physical activity had a beneficial effect on health knowledge, health behaviour, and onset risk factors for coronary artery disease. However, there were no significant differences in non-school related physical activity.</td>
</tr>
<tr>
<td>Author:</td>
<td>Participants:</td>
<td>Design and Measures:</td>
<td>Intervention Description:</td>
<td>Findings:</td>
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</table>
| Jamner et al. (2004) | n = 47  
Mean age 14.9 years  
Grades 10 or 11  
Control (n = 22)  
Intervention (n = 25)  
USA  
Sedentary adolescent girls. | **Design:** Experimental  
**Measures:**  
Peak oxygen uptake using cycle ergometer = CVF.  
DEXA = Body Composition.  
Height & Weight = BMI.  
2DPAR = PA converted to METS.  
SUPAS = Unstructured aspects of lifestyle PA assessment.  
Psychosocial assessment of self-efficacy, barriers, social support and enjoyment. | An allocated intervention group at one school attended a special PE class 5 days a week for 60 mins approximately 40 mins of PA and one day a week devoted to education and the control group at another school.  
Clinical and behavioural assessments were conducted at baseline and follow-up at 4 months. | The intervention had a favoured significant effect on fitness (cardiovascular fitness \( p = .017 \)), PA recall revealed in a significant effect to improve lifestyle activity \( (p = .005) \), light \( (p = .023) \), moderate \( (p = .007) \) and total activity \( (p = .043) \).  
No effect for the intervention occurred on psychosocial variables targeted by the intervention. |
| Schofield, Mummery, & Schofield (2005) | n = 85  
Mean age 15.8 years  
Control Group  
Pedometer Group  
Minutes Group  
AUSTRALIA | **Design:** Experimental  
**Measures:**  
4 day blinded step count.  
3DPAR  
BMI  
Baseline, 6 week and 12 week assessments took place. | The intervention consisted of a control group, a pedometer group and a minutes group.  
Intervention consisted of a self-monitoring and education program for 12 weeks and the pedometer group set daily step targets while the minutes group set daily time-based goals for PA. | At post-intervention only the pedometer group increased their total activity significantly \( (p = 0.03) \), both the pedometer and the minutes group increased their step count over 12 weeks \( (p = 0.01) \), the pedometer group had the greater increase \( (p = 0.04) \) in step count at mid-intervention (6 weeks) BMI did not significantly change for any group. |
| Author: Murphy, Ni Dhuinn, Browne, & ÓRathaille (2006) | Participants: n = 90  
Mean age 16.3 years  
SLAP (n = 30)  
TLAP (n = 30)  
Control (n= 28)  
Ireland  
Sedentary adolescent girls | Design and Measures:  
*Design*: Experimental  
*Measures*:  
Height and weight = BMI.  
LMFT = VO2 max.  
BUA, SOS and OCSI ultrasound completed = Bone measurements.  
FFQ = calcium intake assessment.  
Questionnaire = PA frequency and intensity at baseline + use of daily activity diary to record PA and rated using Borg RPE Scales.  
Focus groups one month after completion | Intervention Description:  
A six month osteogenic (bone study) PA program. Self-led activity program (SLAP) were asked to participate in three to four activity sessions/week of 20-90 mins duration, teacher led activity program (TLAP) completed two activity sessions for 60 mins duration at school and the control group did their usual physical activity.  
SCT drawn upon for behaviour change. | Findings:  
Both intervention groups significantly increased participation in PA during the six month intervention resulting in the TLPA group engaging in an average of 4.5 hours/week of PA (and increasing fitness significantly \( p = .03 \)) and SLPA group 3.4 hours/week of PA and increasing fitness significantly \( p = .02 \).  
The SLPA group also continued to exercise after the intervention program.  
There were no significant changes in anthropometry for intervention groups, control group weight increased significantly \( p = .001 \). |
| Author: Young et al. (2006) | Participants: n = 221  
Grade 9 age level.  
Predominantly African American girls (83%)  
USA | Design and Measures:  
*Design*: Randomised control trial  
*Measures*:  
7 day PA recall.  
CVF = submaximal 3-stage step test.  
Questionnaire assessed sedentary behaviour.  
BMI, BP and waist circumference  
Utilised Social Action Theory. | Intervention Description:  
An 8-month physical activity intervention consisting of a standard PE class (control) that spent 30.5% of time in MVPA or an intervention PE class that spent 46.9% of time in MVPA. | Findings:  
There was no significant between-treatment group differences total physical activity for mean daily, moderate, or hard to very hard energy expenditure. The rate of TV viewing (3+ hours/day) for the intervention group declined (22.3% to 17%) and control group remained at 26.7%. \( p = .03 \).  
Both groups improved CVF \( p = .001 \). |
Abbreviations used in Table 5

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description/title</th>
<th>Abbreviation</th>
<th>Description/title</th>
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<tbody>
<tr>
<td>BMI</td>
<td>Body Mass Index</td>
<td>PSPP</td>
<td>30 item self reported questionnaire for physical self-perceptions</td>
</tr>
<tr>
<td>Borg RPE scale</td>
<td>Borg rating of perceived exertion scale</td>
<td>PSDQ</td>
<td>Physical self description questionnaire</td>
</tr>
<tr>
<td>BUA</td>
<td>Broadband ultrasound attenuation</td>
<td>SOS</td>
<td>speed of sound</td>
</tr>
<tr>
<td>CVF</td>
<td>Cardiovascular fitness</td>
<td>SPA</td>
<td>Social physique Anxiety scale</td>
</tr>
<tr>
<td>DEXA</td>
<td>Dual x-ray absorptiometer</td>
<td>SUPAS</td>
<td>Stanford Usual Physical Activity Scale</td>
</tr>
<tr>
<td>FFQ</td>
<td>Food frequency questionnaire</td>
<td>VO₂ max</td>
<td>Maximal oxygen uptake</td>
</tr>
<tr>
<td>LMFT</td>
<td>Loughborough Multistage Fitness Test</td>
<td>3DPAR</td>
<td>3 day physical activity recall</td>
</tr>
<tr>
<td>METS</td>
<td>Metabolic expenditure units</td>
<td>2DPAR</td>
<td>2 day physical activity recall</td>
</tr>
<tr>
<td>OCSI</td>
<td>Calcis stiffness index</td>
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</table>

Author: Schneider et al. (2007)
Participants: n = 120
Design and Measures: Design: Controlled trial.
Measures: 3DPAR = PA converted to METS CVF (Cycle ergometer) BMI Body fat (DEXA) Physical self-concept (PSDQ) HR monitoring (intervention only for one class period every other week to monitor average HR during PE class)

Author: Schneider, Dunton, & Cooper (2008)
Participants: Mean age 15.2 years Grade 10 or 11.
Design and Measures: Control ( n = 59) Intervention (n = 61)
USA
Sedentary adolescent females

Author: Dunton, Schneider & Cooper (2007)
Participants: n = 120
Mean age 15.2 years Grade 10 or 11.

Intervention Description: A 9 month intervention concentrated on increasing PA and fitness to improve psychosocial factors including physical self-concept. Intervention group enrolled in a special PE class and met 5 days/week for 60 mins/day (40 mins activity) while the control were given no instruction for PA.

Findings: This intervention had significant impact on vigorous activity ($p = 0.001$) and cardiovascular fitness ($p = 0.008$).

The conclusion for the three articles related to this study outlined the following points:
* the study did not have a significant influence on self-concept dimensions overall.
* Although there was an increase in global physical self-concept among those intervention participants who increased cardiovascular fitness.
2.7.2 Targeted physical activity interventions for adolescent boys and girls

Interventions that target adolescent boys and girls to increase physical activity are explored in this section. The focus in section 2.7.1 was on older adolescent female only studies and additionally the author will discuss prominent younger adolescent (12> years and <14 years) female only studies as well as studies including both female and male (co-educational) participants to enable comparison of physical activity interventions.

The structure of the school curriculum and relevant school policy are considerations and potential mediums for change in school-based physical activity interventions. Sallis et al. (2003) implemented the Middle School Physical Activity and Nutrition (M-SPAN) intervention which was evaluated over a 2 year period in 24 middle schools. Sallis et al. (2003) reported that there was a significant intervention effect for physical activity for the total group ($p < 0.009$) and boys ($p < 0.001$), but not girls ($p < 0.40$). They concluded that school environmental and policy interventions have potential to improve physical activity behaviour as increases in MVPA were greater for boys and that additional strategies may be needed for girls.

One study that targeted younger adolescent girls by utilising the school curriculum was the Lifestyle Education for Activity (LEAP). Dishman and colleagues (2004) designed this intervention to be guided by Bandura’s SCT to bring about positive behaviour change and promote self-efficacy toward physical activity in the school setting. The intervention was evaluated over a two year period with 24 high schools, randomised into 12 control groups ($n = 1038$) and 12 experimental groups ($n = 1049$) in 8th Grade at
baseline and 9th grade at follow-up. The intervention aimed to change the instructional programs and school environment to increase physical activity and fitness in adolescent girls. An example of strategies utilised by the LEAP study included staff development training, implementation of gender-separated PE classes (75%), health education, demonstrations and community support (including newsletters and meetings). While the LEAP study reported statistically significant group differences, it only had small effects on self-efficacy, goal setting and physical activity outcomes (Dishman, et al., 2004).

Another large scale intervention targeting physical activity in adolescent girls was the Trial of Activity in Adolescent Girls (TAAG) study. Stevens and colleagues (2005) conducted this intervention in an attempt to reduce the age-related decline in MVPA in middle school girls. The TAAG study was a group randomised trial (n = 36 schools) in the USA involving two cross-sectional samples of 6th Grade girls and then two years later 8th Grade girls. The intervention focused on altering the environment to introduce change using school-based, community linked intervention techniques to improve physical activity participation. Results revealed that the intervention group moderately increased physical activity (approximately 1.6 minutes more MVPA than the control group).

2.8 Interventions that utilise technology to increase physical activity

The potential of technology-based interventions to improve health behaviours has been noted in the literature. Norman et al. (2007) conducted a review of ehealth interventions that targeted physical activity, healthy eating or both. The inclusion criteria for the interventions reviewed was that some type of electronic technology was the main
intervention or an adjunct component. The review identified 13 physical activity interventions between 2000 and 2005 for both adults and children with a majority of these studies targeting the over 40 years of age range and only two school based studies target primary aged children. Results revealed that eHealth interventions were superior to comparison groups for 21 of the 41 (51%) studies but only three physical activity studies were reported. Norman et al. (2007) concluded that eHealth interventions reviewed indicated that the effectiveness of the interventions had mixed findings and that future interventions be refined and more rigorously evaluated to determine their potential to facilitate health behaviour change.

A study by Steele, Mummery and Dwyer ((2007) was conducted to investigate the impact of a randomised trial targeting adults over 18 years of age (mean age 39.1 years) that focused on four modes of delivery (face-to-face, Internet-mediated, combined Internet and face-to-face and Internet-only). Evaluation surveys were completed (n=159) and focus group discussions were conducted to gauge satisfaction (n= 23). The authors concluded that face-to-face participants were more satisfied than the internet groups and website usability scores were high for both Internet groups although difficulties associated with time and motivation were raised. This research is useful in development of future on-line physical activity interventions.

In a more recent review by Neville, O’Hara and Milat (2009) examining computer-tailored interventions in adults reviewing sixteen interventions of which ten studies found significant positive effects of the computer-tailored interventions. However, the authors noted that evidence of the effectiveness for computer-tailored
physical activity interventions is inconclusive and it is uncertain whether reported effects are generalized and sustained due to inconsistent results of the studies reviewed.

Upon researching the limited literature surrounding internet-based interventions that target physical activity it seems that the participants targeted are predominantly adults with internet access and very limited studies have been conducted targeting children and adolescents, especially in a school-based setting (Neville, et al., 2009; Norman, et al., 2007).

Notably, the use of social network sites in the world is increasing with the most popular sites being Facebook and MySpace (Atif, et al., 2008; Kazeniac, 2010; Thelwall, 2008), and these may be particularly appealing for adolescent girls. Given their popularity, online communication sites that utilise social networking are a potential tool that could allow adolescent girls to engage with each other to provide support to be active. However, few interventions have targeted older adolescent girls using the internet as a source of social support (Norman, et al., 2007). Furthermore, to the authors’ knowledge, no previous study has used a social network site to promote physical activity in adolescent girls (van Sluijs, et al., 2007).

2.9 Chapter Summary

First, physical activity levels decrease during adolescent years as evidenced in well-conducted longitudinal studies (Jamner, et al., 2004; Nader, et al., 2008). Secondly, girls are less active than boys, which conclusively appear in a large number of studies reviewed (Biddle, et al., 2005; Nader, et al., 2008; van Sluijs, et al., 2007). Finally, there
has been a marked decrease in the number of students walking or riding their bikes to school (Biddle, et al., 2004; Booth, et al., 2006; Hardy, 2010)

Many Australian youth and others from industrialized nations are not accruing sufficient physical activity (Nader, et al., 2008; van Sluijs, et al., 2007). Innovative strategies designed to combat the decline in physical activity observed during adolescence are needed. Details of the authors review in Figure 6 and Table 5 suggest that older adolescent girls are not being targeted by innovative interventions that utilise technology. The internet has emerged as a promising strategy for promoting physical activity in youth populations; however, this type of intervention is in its infancy and requires more rigorous evaluation in the future.
CHAPTER 3

METHODOLOGY

3.1 Chapter overview

This chapter provides a description of the methodology of the GRASP-IT study. The research design, sample and setting selection, specific treatment conditions, measures, analytical plan and evaluation framework are detailed.

3.2 Recruitment and participants

A convenience sample of five schools from New South Wales (NSW) Australia was approached to take part in the pilot study. Schools were approached based on similar drawing areas for each school and were of similar low/medium socio-economic status. Schools were excluded based on a convenient sport day. Two schools consented to participate and were randomly allocated to intervention or control conditions. The study was open to all girls enrolled in Grade 10 during 2009. Study participants were 52 adolescent girls (mean age 15.7± 1.5 years). The protocol for this study was approved by the NSW State Education Research Approval Process (SERAP) and the University of Newcastle Human Research Ethics Committee (HREC) and each participant gave informed consent to participate in the study (Appendix C, D and E). The flow of participants through the study process is reported in Figure 7 and each school Principal also gave informed consent to conduct the study in their school (Appendix A and B).
3.3 Treatment conditions

The GRASP-IT intervention involved two distinct phases. Phase one involved a 6-week school-based physical activity program delivered during school sport followed by Phase two, a 6-week web-based component using Facebook outside of school hours to promote and encourage physical activity. The on-line component was completed in the girls’ own time as use of the social network site was not permitted during school hours. Girls at the control school continued their existing school sport program.

3.3.1 Preliminary group discussion

After baseline assessments the researcher conducted an informal discussion with the intervention group to gauge their views about the types of physical activities that they would like to participate in throughout the program. This discussion was informal and provided the researcher with information to tailor the program to the interests, wants and needs of the participants. The following points were noted:

- No hard running
- Use good music
- Go to the gym
- Lots of sit-ups
- Beach swimming
- Enjoyable activities, e.g. cheerleading
Additionally, the intervention group were asked to write down the names and artists of songs that they like that have a good 4/4 beat that could potentially be sought to use during the GRASP-IT intervention.

### 3.3.2 Phase 1 – School-based physical activity program

This was a 6-week face-to-face program that included a 30 minute information session delivered by the researcher, who is also a qualified physical education teacher, followed by approximately 60 minutes of physical activity during school sport. The intervention was developed in reference to Bandura’s Social Cognitive Theory (Bandura 1986) and was designed to target social support, outcome expectations, goal setting and self-efficacy as key mediators of physical activity behaviour change (Lubans, Foster, & Biddle, 2008). The information sessions detailed strategies to be active alone and with friends as well as teaching girls about the exercise intensity necessary for improving fitness (Table 6). The practical physical activity sessions were designed to enhance exercise self-efficacy and provided girls with an opportunity to participate in fun, easily accessible, recreational physical activity that utilised community and school facilities in a group setting. The intervention focused on recreational activity with no pressure to participate or compete against other girls. There were no “boot camp” style workouts and the sessions were designed to provide girls with activity of moderate-to-vigorous intensity that could easily be replicated by the girls in their spare time.

The rate of attendance for Phase 1 was monitored using a roll each week. Additionally, pedometers were used to measure the average number of steps for the group for each session and encourage self-efficacy and goal setting. During the final week of the face-
to-face session’s guidance and encouragement for Facebook use was delivered by the researcher. A detailed instruction sheet explaining how to register and use Facebook (Appendix R) was distributed prior to the on-line component. Additionally, this information sheet (Appendix R) was also sent to all students via their email.

Table 6: Phase 1 - Intervention description and components

<table>
<thead>
<tr>
<th>Week</th>
<th>Specific focus for the information session</th>
<th>Activity (time/minutes)</th>
<th>Targeted construct</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to GRASP-IT. Target heart rate and use of pedometers for fitness.</td>
<td>Information and discussion (30mins). Beach walk (50mins).</td>
<td>Self-efficacy Outcome expectancy</td>
</tr>
<tr>
<td>2</td>
<td>Goal setting to increase physical activity. Use of music and pom-pom</td>
<td>Information and discussion (30mins). Pom-Pom aerobic class and floor work in recreation room (35mins).</td>
<td>Behavioural Strategies Self-efficacy</td>
</tr>
<tr>
<td>3</td>
<td>Music speed/choice for an effective workout. Counting beats in music for effective intensity and duration.</td>
<td>Information and discussion (30mins). Walk to local gym (800m). Step class at local gym (45mins).</td>
<td>Self-efficacy</td>
</tr>
<tr>
<td>4</td>
<td>Alternative activities for health and fitness.</td>
<td>Information and discussion (30mins) Walk to local gym (800m). Pilates and oxygen fitness class (50mins)</td>
<td>Self-efficacy Social support.</td>
</tr>
<tr>
<td>5</td>
<td>Combining aerobic exercise with strength and conditioning.</td>
<td>Information and discussion (30mins) Walk to local gym (800m). Aerobic class incorporating gymstick workout (40mins)</td>
<td>Self-efficacy</td>
</tr>
<tr>
<td>6</td>
<td>Guide to on-line component. Importance of continuous and regular physical activity.</td>
<td>Theory handout on Facebook registration. Guide to joining and use (30 mins) Bush walk (50mins)</td>
<td>Self-efficacy Social support Outcome expectancy</td>
</tr>
</tbody>
</table>
3.3.3 Phase 2 – Online support component

This phase of the GRASP-IT intervention was the on-line support component and targeted social support as an important mediator of behaviour change. This part of the program consisted of the creation of a closed group in the social networking site Facebook was utilised by the participants in two ways. First, the site was used as an information provision to increase physical activity and second as a strategy for providing social support for physical activity.

The girls from the GRASP-IT intervention school were invited by the researcher, directly and via email, to join a closed group on Facebook (Appendix R). The girls were asked to complete some simple physical activity tasks each week and encouraged to participate in an on-line discussion about their physical activity experiences. The tasks were designed to motivate, engage and be achievable for all participants. The activities were set to be fun, of low/medium intensity and the duration set at a minimum of 20 minutes (full details of the schedule and activities is set out in Table 7). The on-line task requests were placed on Facebook asking the girls to complete the weekly activities and then write on the “wall” (an area that may facilitate discussion) in the Facebook site to discuss their strategies to increase physical activity with friends. Engagement was analysed by monitoring the number of participants who registered for the site and monitoring the interaction on the “wall” throughout the program.
### Table 7: Phase 2 - Intervention description and components

<table>
<thead>
<tr>
<th>Week</th>
<th>Specific focus for the week</th>
<th>Activity and information placed on Facebook</th>
</tr>
</thead>
</table>
| 7    | Introduction to GRASP-IT on-line.  
Goal setting update.  
Tips for increasing physical activity. | • Instructed to suggest activities you can do with friends to keep active - Write on Wall.  
• Discussion about how it feels during and after a physical activity session – Write on Wall.  
• Link: 10,000 Steps link and Better Health Initiative site see “Tips for being active” and recommendations for age. |
| 8    | Perception of current and future health status?  
Nutrition and physical activity. | • Provided internet links to follow and discover health status and nutritional tips.  
• Promote discussion about nutrition and physical activity.  
• Challenge to eat foods that are not processed for one day – Write on the wall. |
| 9    | Music as a motivator to be active.  
Activities to do alone or with friends. | • Task set - choose songs of 130 – 140 beats per minute to use for stepping at home with a music device, aim to step at your target heart rate or use to walk every day. |
| 10   | Self-esteem and self-efficacy | • Link to an article about increasing self-esteem, feelings of self-worth and motivation.  
• Asked to comment on activities done with friends and/or family.  
• Emailed a weekly workout log and encouraged to stick to a program. |
| 11   | Alternative activities – Outdoor recreational pursuits. | • Progress update – Write on wall.  
• Encouragement to increase physical activity.  
• Link to girls’ outdoor education site for ideas to be active. |
| 12   | Completion of the program  
Encouragement to continue to increase physical activity behaviour and develop healthy habits. | • Encouraged to continue to exercise in many different ways and to engage in physical activity every day.  
• Link to government health sites for current and future use. |

**Note:** Pom Pom’s were made during baseline assessment in groups. Gymstick are elastic resistance training devices. The “wall” is an area in Facebook used for a brief comment that is clearly seen. Discussion section is a larger area to write a more extensive description/explanation.
3.4 Measures

All assessments were conducted at the study schools by the researcher using the same instruments and equipment at baseline and 12-week follow-up assessments. Assessment organisation at baseline and follow-up are in Appendix J.

3.4.1 Primary outcome

The primary outcome was physical activity (steps/day) and was objectively measured using pedometers. All participants wore a Yamax © digi-walker SW-700 pedometer for five days (four weekdays and one weekend day) and recorded their steps on a register (Appendix P) at night before sleep. It is worth noting that previous research indicates four to five days of step count measurement results in a reliability coefficient of 0.77 (Rowe, Mahar, Raedeke, & Lore, 2004). Details of the assessment protocol are in Appendix M and Q. To assist with compliance during assessment the researcher sent the girls a mobile phone text message to remind them to place the pedometer on each morning and a message each night to record their daily steps in their log books.

3.4.2 Secondary outcomes

A number of secondary outcomes were also measured including body mass index (see section 3.4.2.1), fitness (see section 3.4.2.2) and self-efficacy and social support (see section 3.4.2.3).
3.4.2.1 Body mass index

Weight was assessed using calibrated digital scales (measuring kilograms) and details of the procedure is in Appendix L and Q. Height was assessed using a standard calibrated stadiometer height sliding scale (measuring centimetres) and details of the procedure is in Appendix K and Q. These measurements enabled BMI scores to be calculated (kg/m²) and age specific cut-off points from the International Obesity Task Force and World Health Organisation were used to determine whether the girls were in the healthy weight, overweight or obese weight range (Cole, et al., 2007).

The International Obesity Task Force have provided cut-off points to improve accuracy and guide the classification of weight in children and adolescents, these cut-off points are outlined at section 3.5 in this thesis (Cole, et al., 2007; World Health Organisation, 2004a).

3.4.2.2 Fitness

The Queens College Step Test (QCST) was used to provide an estimate of maximal oxygen uptake (VO₂ max). To complete this test the girls stepped up and down for three minutes continuously using a 41cm bench; wearing a Polar © heart rate monitor at a cadence of 88 beats per minute set by a metronome. After three minutes, the girls’ heart rate was taken three times for 15 seconds at the time intervals of 5 seconds, 10 seconds and 20 seconds after completion of the 3 minutes stepping (Lubans, Morgan, Collins, Boreham & Callister 2009; Zwiren, et al., 1991) The average of the three scores was calculated to estimate the maximal oxygen uptake [VO₂ max (ml/kg/min) = 65.81 –
0.1847 x heart rate (beats/min)] (McArdle, et al., 1972). Details of these procedures are provided in Appendix N, O and Q. A sub-maximal test of cardio-respiratory fitness was chosen because the participants were low-active adolescent girls and a maximal measure may have resulted in lower rates of consent.

3.4.2.3 Self-efficacy and social support

Validated questionnaires were administered to measure self-efficacy scales (Motl, et al., 2000) and peer social support scales (Prochaska, Rodgers & Sallis, 2002) as these were identified as potential mediators of behaviour (Lubans et al., 2008b; Whitehead, Biddle, O’Donovan & Nevill, 2006). Details are provided in 3.4.3 and Appendix G.

3.4.3 Questionnaire

A questionnaire was administered at both schools at baseline and follow-up and all assessments were completed in exam-like conditions and confidentiality was assured (Appendix F). Part 1 of the questionnaire consisted of general demographic information (i.e. age, grade, nationality). Part 2 and 3 included validated measures for self-efficacy and peer support for physical activity (Motl, et al., 2000; Prochaska, Rodgers, & Sallis, 2002) scales (Appendix G).

The self efficacy scale designed by Motl et al. (2000). In this section of the questionnaire participants read a set of statements and related their confidence to be active and using a five level Likert scale. This scale ranges from Strongly Disagree to
Strongly Agree and participants may choose one response to indicate their opinion. For example:

*I can be physically active during my free time on most days; or*

*I can ask my best friend to be physically active with me during my free time on most days.*

Refer to Part 2 in Appendix G for the full set of items in the questionnaire.

Part 3 of the questionnaire consisted of peer support scale questions that included a set statement based on social support and using a five level numbered Likert scale, ranging from 0 to 4 (0 = never, 1 = once, 2 = sometimes, 3 = almost daily or 4 = daily) participants choose one response to indicate their opinion. For example:

*Do you encourage your friends to do physical activities or play sports?*

*Do friends tell you that you are doing well in physical activities or sports?*

Refer to Part 3 of Appendix G for the full set of items in the questionnaire.

### 3.5 Process Evaluation

At the completion of the intervention, a mixed-methods process evaluation was completed to reveal insights into the recruitment, retention, adherence and program satisfaction of GRASP-IT. The process evaluation consisting of a questionnaire and a self-selected (based on friendship and time availability) focus group discussion (2 groups n = 12) for 30 minutes to reveal insights into their experiences and perceptions of GRASP-IT.
3.5.1 Questionnaire

The process evaluation was developed using the conceptual framework outlined by Crutzen, R., De Nooijer, J., Brouwer, W., Oenema, A., Brug, J., & De Vries, N. K. (2009) see Appendix H. The items in the questionnaire were framed around the three aspects of exposure:

(1) access to the intervention website;

(2) staying long enough to use and process the information (noting that it is difficult to determine how long is enough); and

(3) revisiting the intervention website.

(Crutzen, et al., 2009)

The questionnaire also included open-ended questions regarding satisfaction/enjoyment and suggestions for program improvement. The qualitative data for analysis of the process evaluation and focus groups were sorted into themed responses for the 12 process evaluation items as well as the 12 focus group questions and all were coded (see section 4.6) according to common responses and themes (Appendix H and I). After coding, statistical principles were applied to report the responses and themes qualitatively using SPSS16. Question 1, 3, 4 and 5 require answers using a five point Likert scale and this is numerically coded from 1 to 5 (1 being strongly disagree to 5 strongly agree). Question 2 and 6 require an answer to two alternatives (yes or no) and this was numerically coded as 1 for “yes” and 2 for “no”. Percentages of responses were also calculated for this data and are reported in Table 11.
3.5.2 Focus Groups

Focus groups discussions were conducted after the questionnaire and aimed to extend
the responses and gauge more information about the thoughts and opinions of the
participants about the GRASP-IT study. The participants were asked to discuss aspects
of the GRASP-IT study with the researcher. The questions included:

(1) Why did you volunteer for this program?
(2) Do you like PE at school? Why or why not?
(3) Do you like Sport at school? Why or why not?
(4) Do you prefer small group or large group physical activity participation?
(5) Did you like the Facebook component of this program? Why or why not?
(6) Did you complete the activities from the on-line tasks? Which ones? Why some
or not others?
(7) What do you think about adults giving information and tasks to you through
internet sites to increase your physical activity?
(8) If any, what on-line social networking site would you prefer to use for
communication about physical activity?
(9) Do you think Facebook could be used in a better way to promote physical
activity? If so, how?
(10) What did you like about the GRASPIT program?
(11) What did you dislike about the GRASPIT program?
(12) Do you have any other comments or questions about the program?

The responses to the focus groups questions are reported in the results section of this
thesis at 4.6 on page 69 and Table 12 on page 72.
3.6 Statistical analysis

Comparisons of the intervention and control groups were completed using the Statistical Package for Social Sciences (SPSS) version 16 software and statistical significance was set at \( p < 0.05 \). Data were assessed for normality and satisfied the criteria. Analysis of covariance (ANCOVA) was used to evaluate the impact of the GRASP-IT intervention for both the primary and secondary outcomes. In the analysis the relationship between conditions (intervention and control) and time (baseline and follow-up) was examined.

For each outcome, the follow-up score was the dependent variable, treatment condition was the fixed factor and the baseline score was the covariate. This analysis allowed for existing differences between groups at baseline to be controlled for in the analysis.

Due to the relatively small sample size, effect sizes were measured to indicate the magnitude of the experimental treatment. Cohen’s \( d \) (1988) was used to determine effect sizes and was calculated using the mean difference (3 months minus baseline) between groups and the pooled standard deviation of change for the whole group. The effect sizes reported in the GRASP-IT intervention are interpreted as follows: small effect \( (d = 0.20) \); medium effect \( (d = 0.50) \); large effect \( (d = 0.80) \) (Cohen, 1988).

3.7 Chapter summary

The information in this chapter details the recruitment processes used and details the study participants recruited for the GRASP-IT intervention. The flow diagram (Figure 7) illustrates the organisation undertaken by the researcher to collect baseline and 12-
week follow-up data for the intervention. Additionally, a full description of the intervention is detailed in a logical sequence that informs the processes undertaken in Phase I and Phase II of the study. All instruments used by the researcher for GRASP-IT were previously validated and procedures accurately adhered to during assessments. This chapter also included details of the process evaluation to examine the feasibility of the GRASP-IT intervention.
CHAPTER 4
RESULTS

4.1 Chapter overview

This chapter describes the results of the GRASP-IT intervention. Participants’ demographics are presented in section 4.2 to highlight the specific characteristics of the intervention and control group at the commencement of the study, along with the baseline values for the control and intervention groups. The flow of participants through the intervention process is reported in Figure 7 (see page 64) and only girls who completed all assessments at baseline and all assessments at follow-up were included in the analysis for primary outcome. This chapter will inform the quantitative data for the GRASP-IT intervention and are reported at baseline and 12-week follow-up. Furthermore, the questionnaire, process evaluation and focus groups present evidence for the GRASP-IT intervention feasibility.

4.2 Baseline characteristics

Baseline results are displayed in Table 8. All 52 girls recruited for the study were born in Australia and one was of Aboriginal descent. The average age of the girls was $15.7 \pm 1.5$ years and all were enrolled in Grade 10. Physical activity (mean steps/day) for the intervention group was 2639 steps less than the control group at baseline and the BMI result for the intervention group was similar to the control group being. Additionally, the BMI $z$ scores were all low and are displayed in Table 8. Although the control group
Step counts were slightly higher ($mean = 11,690$) than the intervention group ($mean = 10,370$) both groups were below the recommended step count/day for adolescent girls ($mean = 12,000$) (Duncan, et al., 2007).  

### Table 8: Baseline values by group for outcomes

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Control (n = 14)</th>
<th>Intervention (n = 21)</th>
<th>Whole (n = 35)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Age</td>
<td>15.6</td>
<td>0.5</td>
<td>15.7</td>
</tr>
<tr>
<td>Weight</td>
<td>59.8</td>
<td>8.8</td>
<td>61.9</td>
</tr>
<tr>
<td>Height</td>
<td>1.62</td>
<td>0.5</td>
<td>1.65</td>
</tr>
<tr>
<td>BMI</td>
<td>22.8</td>
<td>3.7</td>
<td>22.7</td>
</tr>
<tr>
<td>BMI $z$ scores</td>
<td>-0.004</td>
<td>-0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>VO$_2$ max</td>
<td>35.4</td>
<td>2.0</td>
<td>35.2</td>
</tr>
<tr>
<td>Mean steps/day $^a$</td>
<td>11690</td>
<td>4696</td>
<td>9051</td>
</tr>
<tr>
<td>Self-efficacy $^b$</td>
<td>3.7</td>
<td>0.7</td>
<td>3.4</td>
</tr>
<tr>
<td>Peer support $^b$</td>
<td>2.3</td>
<td>0.9</td>
<td>1.9</td>
</tr>
</tbody>
</table>

$^a$ = Students wore pedometers for 4 weekdays and 1 weekend day  
$^b$ = Questionnaire scales range from 0 to 4.
March 2009
5 schools invited

March 2009
2 schools randomized

May 2009
Recruited participants
Assessed for eligibility and consent obtained
N = 52

May 2009
Intervention (n = 29)

May 2009
Control (n = 23)

March 2009
3 schools ineligible due to sport day/time restrictions

March 2009
3 schools invited

June to August 2009
12 week Intervention
Phase 1 – Information session and school program - 6 weeks (n = 26)
Phase 2 – Facebook component – 6 weeks (n = 8)

August 2009
Intervention (n = 14)
Lost to follow up (n = 12)
Reason: Pedometer log not returned

Analysed for primary outcome
Intervention (n = 10)

August 2009
Control (n = 10)
Lost to follow up (n = 4)
Reason: Pedometer log not returned

Analysed for primary outcome
Control (n = 8)

June to August 2009
12 week school sport program (n = 14)

Baseline

Intervention

3 Month Follow-Up

Figure 7: Participant flow diagram analysed for the primary outcome
4.3 Effect of intervention on primary outcome

Although the intervention effect for GRASP-IT was not significant ($p = 0.11$), an increase in physical activity from baseline to follow-up for the intervention group was found. Alternatively, physical activity for the control group regressed from baseline to follow-up and this represented a large effect size ($d = 0.8$) shown in Figure 8 and Table 9.

![Figure 8: Mean steps/day from baseline to follow-up](image)

4.4 Effect of intervention on secondary outcomes

A non-significant reduction in BMI was observed among participants in the intervention group, with no change in BMI among those in the control group. At baseline, 73% of participants were in the healthy weight for age range and this increased to 92% at follow up. In addition, those in the overweight category decreased from 19% to 4% and those
in the obese category decreased from 8% to 4% respectively. The estimated VO$_2$max of girls in both intervention and control groups increased slightly, but with no significant difference between groups (Table 9). Self-efficacy marginally increased ($p = 0.06$, $d = 0.8$) between groups and improved slightly for the intervention group with no improvement in peer support evident ($P > 0.05$; $d = 0.6$). These results are displayed in Table 9.

<table>
<thead>
<tr>
<th>Table 9: GRASP-IT intervention effects at post-intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcomes</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>BMI (kg/m$^2$)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>BMI $z$ score</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>VO$_2$max (ml/kg/min)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Steps per day a</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Self-efficacy b</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Peer support b</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

The means and standard deviation (SD) are reported for all participants; BMI = Body Mass Index; Effect sizes ($d$) were calculated by subtracting baseline from post-test values then dividing by the pooled standard deviation of change. Note: ANCOVA was used to compare the means between treatment and control conditions $d = $ Cohen’s $d$ ($d = M_1 - M_2 / \mu_{pooled}$). $a = 4$ weekday and 1 weekend day; $b = $ Questionnaire scales range from 0 to 4.
4.5 Retention and adherence

Recruitment at both schools was generally successful, with 29 and 23 students recruited at the intervention and control schools, respectively. Retention and adherence to the assessment components of the program was low and the drop-off rate of girls to log and/or return their pedometers decreased over the study period (Figure 7). The attendance at the face-to-face component (Table 10) was high (mean 80%) however, the number of girls who registered and participated in the on-line component of the intervention was low (33% registered).

<table>
<thead>
<tr>
<th>Week</th>
<th>Physical Activity</th>
<th>Mean (SD) pedometer steps</th>
<th>Attendance n = 26 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Beach walk (Approximately 40 minutes)</td>
<td>3176 (140)</td>
<td>21 (80)</td>
</tr>
<tr>
<td>2</td>
<td>Pom Pom aerobics class (Approximately 25 minutes)</td>
<td>1766 (191)</td>
<td>26 (100)</td>
</tr>
<tr>
<td>3</td>
<td>Step aerobics class (Approximately 45 minutes)</td>
<td>2954 (227)</td>
<td>18 (69)</td>
</tr>
<tr>
<td>4</td>
<td>Pilates and oxygen fitness class (Approximately 45 minutes)</td>
<td>No pedometers</td>
<td>20 (76)</td>
</tr>
<tr>
<td>5</td>
<td>Aerobic class with gym stick (Approximately 40 minutes)</td>
<td>3047 (315)</td>
<td>23 (88)</td>
</tr>
<tr>
<td>6</td>
<td>Bush walk (Approximately 40 minutes)</td>
<td>3184 (237)</td>
<td>20 (76)</td>
</tr>
</tbody>
</table>
All of the participants who attended the face-to-face sessions wore pedometers to measure steps for each activity (with the exception of week 4 due to pedometers not being available). The number of steps performed for each person was recorded at the end of the session to determine an average step count for each activity each week. The mean group step count for each week varied according to the type and length of time taken to participate in the activity (Table 10). The average step count for the participants over the 5 weeks measured was 2825 steps and average time participated in the activity was 38 minutes. Week 1, 2, 3, 4, and 6 were all aerobic physical activities while week 5 combined aerobic with strength and conditioning exercises. Additionally, week 3, 4 and 5 included extra walking that was not measured due to the girls travel time to commute to and from the local community gym (this amounted to an additional 800 metres of walking at a leisurely pace each way).

4.6 Process evaluation and focus groups

To further evaluate the feasibility of the GRASP-IT study, a process evaluation questionnaire and focus groups discussion were conducted at the intervention school. Full results of the process evaluation are reported in Table 11.
Table 11: Process evaluation for the GRASP-IT study

<table>
<thead>
<tr>
<th>Construct (Items)</th>
<th>Example Item</th>
<th>Mean (SD)</th>
</tr>
</thead>
</table>
| Website appeal and navigational design (7 items – Q1a to 1g) | “I found the Facebook site visually appealing”
“I was easy to navigate from one point to another in the site” | 3.06 (0.2) |
| Expectations and use of website features (8 items Q2a to 2h) | “Did the website meet your expectations”
“Was the website personally useful to you?” | 2.23 (0.6) |
| Instigation of physical activity planning (3 items Q3a to 3c) | “I am now aware of how much physical activity is beneficial to girls my age”
“I now keep a record of my physical activity” | 3.40 (0.7) |
| Satisfaction (5 items Q4a to 4e) | “My involvement in the GRASP-IT program was enjoyable”
“I am satisfied with the GRASP-IT program” | 3.60 (0.3) |
| Social support structures (4 items – Q5a to 5d) | “The GRASP-IT program provided me with enough support to help me increase my physical activity”
“I now enjoy physical activity with my friends more often” | 3.57 (0.5) |
| Action taken to increase physical activity (6 items – Q6a to 6d) | My involvement in the GRASP-IT program encouraged me to be more active with my friends”
“My involvement in the GRASP-IT program encouraged me to discuss my physical activity strategies with others” | 1.32 (0.2) |
| Current use and type of social network site/s (1 item – Q7) | Facebook
MySpace
None | 0
91%
9% |
| Frequency of use with the site of their choice (1 item – Q8) | More than once a day
Once a day
Once every two days
Once a week
Not at all | 50%
23%
9%
9%
9% |
| Preferred atmosphere to engage in physical activity (1 item Q9) | Alone
With one friend
Small group of friends
Large group of friends
Group of unknown people | 9%
14%
55%
18%
4% |
| Preferred program choice for increasing physical activity (1 item Q4e) | Prefer an internet based program
Prefer a program that meets face-to-face
Undecided | 13%
78%
9% |

See Appendix H (GRASP-IT Process Evaluation) for details of all items.
The process evaluation questionnaire (n = 24) revealed that girls were generally satisfied with the GRASP-IT study. Sixty-three per cent of girls agreed (27% strongly agree) that the GRASP-IT study provided support to help them increase their physical activity. However, they indicated that they preferred a face-to-face program rather than an internet-led program. Of note was their preferred atmosphere for physical activity being with a small group of friends. A positive result was reported for social support with a high mean score (3.57 out of 5) for items indicating “social support strategies” thus, indicating that the intervention helped to increase their physical activity and enjoyment to be active with their friends. It was encouraging to note that the girls generally believed that the intervention motivated them to take “action taken to increase their physical activity”. This result indicates the GRASP-IT program did encourage the girls to be more physically active with friends and encouraged them to discuss their physical activity strategies with their friends (Table 11 and Appendix H).

Furthermore, the process evaluation as well as the focus groups discussion revealed that girls would prefer to interact with friends on-line using Myspace (50% of girls used Myspace more than once a day) rather than Facebook, suggesting that this was a contributing factor to the low level of compliance for the on-line component. Due to the low level of compliance to the on-line component it was not viable to assess whether or not the website appeal and navigation design was effective and whether or not the website met the girls’ expectations. Those that did use the website as intended (n = 3) were satisfied with its appeal.
During the focus group sessions the girls’ indicated that they were not interested in the on-line activities and therefore, would not have stayed on the site long enough to benefit from its use.

The three main themes extracted from the focus group responses included:

(1) The girls’ lack of interest to register and engage with each other using the Facebook site. Quotes regarding the on-line component stated “Facebook is for old people” and “Facebook is for the older generation”.

(2) The girls’ indicated a preference for MySpace over Facebook to interact on-line stating “MySpace is for the younger generation” and “we all know how to use MySpace and we enjoy it more”.

(3) The third theme was a preference for the program to be extended with several girls stating “I think it should be longer”.

The responses received for each focus group varied and examples of the responses are detailed in Table 12.
<table>
<thead>
<tr>
<th>Focus group question</th>
<th>General theme extracted from the response</th>
<th>Example of quotes for this question</th>
</tr>
</thead>
</table>
| **Question 1:** Why did you volunteer for this program?      | A general response to this question was given by the girls that included their interest to improve their fitness and be with their friends for sport | “we thought it would be a fun sport”  
“cause I didn’t want to do ......(named another sport) ... with (named a teacher)..... as ....(he/she) is not fun”. many girls agreed with the above statement.  
“You (meaning the researcher) seemed nice and we thought it would be fun”. |
| **Question 2:** Do you like PE at school? Why or Why not?      | The girls generally indicated that they do like PE at school.                                            | “yeah it is okay”.  
“sometimes it is boring”.                                                                 |
| **Question 3:** Do you like Sport at school? Why or Why not?   | The girls generally indicated that they do like sport at school.                                        | “yeah sport is pretty good, but we should have more girl only sports like this one”. Most girls agreed with this statement.  
“I hate sport with the boys”.                                                                 |
| **Question 4:** Do you prefer small group or large group physical activity participation? | After a short discussion with each other the consensus was that they generally like small group activities.              | “I like doing exercise with my group”.  
“I like exercising on my own and in a group”.                                                                 |
<table>
<thead>
<tr>
<th>Focus group question</th>
<th>General theme extracted from the response</th>
<th>Example of quotes for this question</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Question 5:</strong> Did you like the Facebook component of this program? Why or why not?</td>
<td>At this point of the discussion all girls agreed that they did not like Facebook and that they preferred MySpace over Facebook.</td>
<td>“Facebook is for old people”. “Yeah Facebook is for my mum”. “I just use MySpace”. “Facebook is ....... (swear word)”</td>
</tr>
<tr>
<td><strong>Question 6:</strong> Did you complete the activities from the on-line tasks? Which ones? Why some or not others?</td>
<td>Only three girls indicated that they completed the activities from the on-line tasks and did not elaborate on the completion of the tasks.</td>
<td>“I could not be bothered doing all that stuff”. “I just did the fun stuff, like look at the photos”.</td>
</tr>
<tr>
<td><strong>Question 7:</strong> What do you think about adults giving information and tasks to you through internet sites to increase your physical activity?</td>
<td>Girls seemed to be of the opinion that it is fine to give the tasks out but they cannot be expected to do them alone.</td>
<td>“I don’t care about that but we probably will not do em”. “I just want the teachers to tell us what to do and do it too”.</td>
</tr>
<tr>
<td><strong>Question 8:</strong> If any, what on-line social networking site would you prefer to use for communication about physical activity?</td>
<td>All of the girls agreed that MySpace is the preferred social networking site for their age.</td>
<td>“just MySpace”. “not the Facebook one”.</td>
</tr>
<tr>
<td>Focus group question</td>
<td>General theme extracted from the response</td>
<td>Example of quotes for this question</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td><strong>Question 9:</strong> Do you think Facebook could be used in a better way to promote physical activity? If so, how?</td>
<td>This question did not arouse a lot of discussion they all responded “no” and with no suggestions for Facebook, only to do it on MySpace</td>
<td>None to report.</td>
</tr>
<tr>
<td><strong>Question 10:</strong> What did you like about the GRASPIT program?</td>
<td>All of the girls indicated that they liked the program and that they liked the researcher.</td>
<td>“it was really fun going to different places each week”. “I liked the gym stuff”. “you are really nice and you should do this all the time, can we do this next term too”.</td>
</tr>
<tr>
<td><strong>Question 11:</strong> What did you dislike about the GRASPIT program?</td>
<td>A majority of the girls indicated that they did not like the questionnaires as they do not like answering questions about themselves.</td>
<td>I hated all those long questions”. “I hated the hard walking with those belt things” (meaning pedometers).</td>
</tr>
<tr>
<td><strong>Question 12:</strong> Do you have any other comments or questions about the program?</td>
<td>A majority of girls did not have many additional comments about the program and they indicated that they thought it was “fun” and can requests for the program to continue were stated at this question.</td>
<td>“no, it is really good”. “we want it to go next term too”. “can you come back and do this again next term”.</td>
</tr>
</tbody>
</table>
4.7 Chapter Summary

Results of the GRASP-IT study revealed that although the intervention group significantly increased their physical activity (mean 1878 steps/day) the difference between groups was not significant. Additionally, the participants of the GRASP-IT study intervention saw minor trends for improvements in BMI, slightly increased their fitness level and improved self-efficacy and peer support. However, these changes were not statistically significant between groups over time.

The process evaluation indicated that the girls were generally satisfied with the GRASP-IT intervention. However, the participants would have liked the program to be longer. Additionally, the girls’ preferred to participate in physical activity in small groups over other options, such as large groups and individual sessions. Furthermore, the participants at the intervention school preferred the face-to-face contact with the researcher leading an activity, rather than the researcher providing information and prompts using the on-line social network site in their own time.

The process evaluation also revealed a number of important insights into the value of the on-line component of the intervention. First, Facebook was not utilised by a majority of the study participants as most of the girls preferred MySpace over Facebook. Second, the number of participants who did register with Facebook, and use the closed group as intended, was very low and therefore does not provide enough statistical power to discuss the success or otherwise of the on-line activities nor does it allow an accurate measure of engagement.
CHAPTER 5
DISCUSSION

5.1 Introduction

The GRASP-IT study aimed to evaluate the feasibility and preliminary efficacy of a novel 12-week physical activity intervention for older adolescent girls. This chapter will discuss the significance of the study and the implications of combining face-to-face strategies with the use of social network site Facebook. The interpretation of GRASP-IT will be compared to previous research in the field as well as divulge the implications that may occur as a result of this study.

5.2 Summary of major findings

To the researchers’ knowledge, this is the first study to evaluate a program that used an on-line social networking component to increase physical activity in adolescent girls. The results of the GRASP-IT study indicates that although, the intervention group significantly increased their physical activity, the difference between groups was not significant. Similarly, the secondary outcomes of BMI, fitness, self-efficacy and peer support all changed over time but also resulted in changes that were not statistically significant between groups.

The process evaluation and adherence data revealed that although participants engaged with and enjoyed the face-to-face component of the GRASP-IT intervention, engagement with the on-line component was low. According to the process evaluation,
the participants were satisfied with the GRASP-IT study. It was encouraging to note that the intervention effect size on the primary outcome (physical activity) was large (\(d = 0.8\)). However, due to the small sample size the intervention effects were not statistically significant.

5.3 Significance

No previous intervention has exclusively targeted older adolescent girls’ physical activity using a social networking site. While many previous studies have successfully increased physical activity in adolescent girls they have differed in their design and delivery and few integrate an internet component. One study, Project FAB (targeted fitness, activity and bone density) did use the internet for participants to record physical activity but not to support or motivate girls to increase physical activity (Schneider, et al., 2007). Another study that utilised the internet was a study by Haerens et al. (2007) that evaluated the acceptability and feasibility of a computer tailored physical activity education program for adolescents in 7th grade (\(n = 281\)) at 10 schools in Belgium. This program combined environmental strategies with computer-tailored feedback to increase MVPA. Physical activity was assessed using self-report measures and Haerens and colleagues reported that the intervention was significantly effective (\(p = 0.05\)) for increasing school–related physical activity levels but not for increasing total physical activity or leisure time physical activity.

The GRASP-IT study is the first study internationally that has attempted to use Facebook to engage adolescent girls in physical activity. A recent systematic review of electronic interventions to prevent and treat overweight and obesity in youth concluded
that gaps exist in studies using technology to prevent obesity. The review noted that evidence-based research that includes well-designed long-term trials of high quality that incorporate innovative electronic media such as Facebook may be a potential avenue for physical activity interventions (Nguyen, Kornman, & Baur, 2010). However, my findings suggest further strategies are required to engage girls using social networking to increase physical activity and additional formative research may be required prior to the design and implementation of studies of this nature.

5.4 Satisfaction with GRASP-IT

The GRASP-IT study included a comprehensive process evaluation that provided a number of insights to evaluate the feasibility of the intervention. In general, the girls were satisfied with GRASP-IT intervention and were more likely to self-monitor their physical activity after participating in the program. They believed the GRASP-IT intervention provided them with enough support to be active, but interestingly, they believed that this level of support did not necessarily lead to physical activity behaviour change. It is unclear why this result is contradictory, however, experience in physical activity and sport in the early years of the girls’ lives could be a potential area to focus on in future studies. Pate and colleagues (2007) point out “early-in-life participation in sports and other forms of vigorous physical activity are important to the maintenance of physical activity during adolescence in girls”.

Another study worth comparison to the GRASP-IT process evaluation is the New Moves study. This study was a multi-component school-based intervention carried out by Neumark-Sztainer and colleagues which also included a comprehensive process
evaluation to gauge participants’ satisfaction and evaluate the feasibility of the program. The New Moves study targeted older adolescent girls (mean age 15.4 years) and studied 89 girls in the intervention and 112 girls in the control group but in contrast to GRASP-IT used three schools and conducted the intervention during PE classes instead of sport. They studied the impact on physical activity, eating patterns, self-perceptions and BMI and at the conclusion, along with the process evaluation, conducted participant interviews, staff interviews and parent surveys. Neumark-Sztainer et al. (2003) concluded that the outcome variables were not statistically significant between groups, however, the girls were satisfied with the program (91% overall satisfaction) and commented that they liked the variety of activities offered and believed that the program was helpful in increasing their level of physical activity.

5.5 Challenges and limitations of the GRASP-IT intervention

The researcher had many challenges in the implementation and evaluation of the GRASP-IT intervention. The first challenge was to encourage the girls to sign up and return consent forms prior to the baseline assessment. Several visits to the school and a motivational question and answer session delivered during school assembly seemed successful at initial recruitment. However, great difficulty resulted during the follow-up of consent and attendance for the initial stages of recruitment and assessment; this is displayed by the flow of recruitment in Figure 7. The next challenge was to follow-up the girls who did not attend the baseline assessments, as scheduled, and arrange an alternative time within a week.
After baseline assessments, the girls were keen to be involved in the activities each week, but clearly some girls struggled with the physical activity sessions that involved a moderate-to-high level of intensity. This resulted in some girls frequently stopping or complaining if they were tired or the exercise was perceived to be difficult. Thus, intensity of the physical activity workout sessions was set at a moderate level. While the opportunity for increasing the intensity throughout the face-to-face physical activity sessions was available, a minority of girls engaged with this option. This limited the capacity for many of the girls to experience increased physical activity and higher intensity level for some sessions.

Another major limitation, and one that affected the statistical power of the results, is the fact that many girls did not return their pedometer logs and/or failed to record their step counts at baseline and/or follow-up assessment. This lack of compliance was beyond the researcher’s control and despite many attempts by the researcher (via text messages and school visits), as well as support by school staff, to retrieve this data did not achieve the desired result which greatly affected the measure of data analysed for primary outcome at the conclusion of the study (displayed in Figure 7). It seems that assessment compliance is an ongoing concern in physical activity research as other studies have also experienced difficulty with data collection (Neumark-Sztainer, Wall, Story, & Perry, 2003; Schofield, et al., 2005).

Another factor that may have potentially hindered the retention and adherence of the program is the logistics of use for the participants after school hours. Several factors that limited the effectiveness of the instructional use of the social networking site, Facebook, occurred. First, in the majority of Australian schools (all NSW DET schools
and some Independent Schools) social networking sites are currently blocked by educational authorities and students cannot access them during the school day using school computers. Second, other than an overview at the initial information session, guidance and encouragement for Facebook use did not commence until the end of the face-to-face component. Even though a detailed instruction sheet explaining how to register and use Facebook (Appendix R) was distributed and explained at the conclusion of the face-to-face sessions prior to the on-line component registration was low. Additionally, information via student email was also sent to all girls but the lack of face-to-face instruction at a computer, with guidance and assistance to register, during this time was non-existent for the on-line component of the study. This lack of access to a computer in the school setting may have affected the registration of the on-line component. Furthermore, results revealed that the girls’ preferred mode of delivery for increasing physical activity was one that meets face-to-face (78 %) over an internet based (13 %) program. To improve this situation in the future it may be worth while setting some online tasks to occur within the same period of the face-to-face component. This may then increase the registration and engagement of the participants with the online intervention and iron out any problems.

5.6 Chapter summary

This chapter discussed the major findings of the GRASP-IT intervention and explored the significance of this program in context of existing research. This chapter also discussed the encouraging program satisfaction level and the disappointingly low level of engagement with the on-line component of the intervention. The GRASP-IT intervention provided a novel approach to increasing adolescent girls’ physical activity
and the researcher outlines how the study had some challenges and limitations that have the potential to be improved upon if addressed in future research. The discussion that takes place in this chapter may inform future research to greatly improve the design and conduct of physical activity trials with adolescent girls.
CHAPTER 6
CONCLUSION

6.1  Overview

The GRASP-IT study provided insights into the physical activity behaviour of older adolescent girls and may provide a platform for future research. As stated in chapter one, the purpose of this thesis is to report the feasibility and preliminary outcomes of the GRASP-IT pilot study. The primary aim of the GRASP-IT intervention was to increase physical activity in a sample of adolescent girls.

It is well known that increasing physical activity can greatly benefit the health of young people and research informs us that a steep decline in physical activity is typically observed among adolescent girls (Nader, et al., 2008). In light of the above information, interventions to engage older adolescent girls are clearly warranted. The GRASP-IT intervention targeted older adolescent girls and attempted to create a positive atmosphere to foster social support, increase self-efficacy and in-turn increase physical activity.

6.2  Implications and recommendations for further research

This is the first study that has attempted to engage older adolescent girls to increase their physical activity behaviour using the social networking site Facebook. This section will outline several areas to consider when designing and implementing physical activity interventions for adolescent girls using face-to-face and on-line components.
6.2.1 Recruitment at the school level

The GRASP-IT intervention recruitment at both schools was initially successful; however, strategies to address compliance for the collection of physical activity data is an issue to be further addressed in future studies. Although similar concerns with recruitment and compliance exist in other studies conducted with adolescent girls (Neumark-Sztainer, et al., 2003; Schofield, et al., 2007), the issue of compliance may be better addressed with a committed school coordinator who is given extra time to assist and seek daily feedback from the participants and trouble shoot to assist the program success. The suggestion of extra work for a teacher is a huge request by a researcher. Teachers in schools are already time poor and the burden of assisting an academic to research can be looked upon as an extra duty and viewed as a hindrance or interruption to their daily routine. To combat this perception a time incentive for the teachers may be discussed or negotiated and could potentially meet with better outcomes for both recruitment and adherence to a future study.

6.2.2 Duration of intervention studies

Future programs targeting older adolescent girls should consider an increase in the length of time and number of face-to-face sessions. This increase in time may maximise outcomes, given the GRASP-IT intervention groups preference for this medium, and the following evidence reported in two significant published literature reviews (Kahn, Ramsey, & Brownson, 2002; van Sluijs, et al., 2007) Both of these reviews support the strategy to increase the length of time for future interventions.
Van Sluijs and colleagues (2007) reviewed the effectiveness of interventions to promote physical activity in children and adolescents and identified 24 studies that aimed to increase physical activity in adolescents. Of note, 20 studies evaluated school-based interventions, including 12 studies that targeted adolescent girls. The studies reviewed ranged in duration from 4 weeks to 2 years duration. Furthermore, only two studies showed statistically significant effects and one of these was a female only study. This study involved a 12 month multi-component intervention with school, community and family based activities (Pate, et al., 2005). Consistent with the abovementioned research is an earlier review by Kahn et al. (2002), who also confirmed that physical activity related interventions reviewed noted the limitation of a short follow-up and that a small number of studies that exceeded 12-month follow-ups. Both of these reviews recommended longer physical activity interventions with post-intervention follow-up 6-12 months after the intervention to determine long-term effectiveness.

The length of physical activity interventions is also a key influencing factor to increase physical activity and to promote self-efficacy. In accordance to the above reviews a longer duration for the GRASP-IT study with a more comprehensive face-to-face component may have been required to further increase self-efficacy. The process evaluation and focus group session of GRASP-IT revealed that participants would have desired a longer program. Of note, Project FAB research supports this view and described in the findings that a program that is longer than two semesters, or 6 months or more, is more likely to successfully impact on physical activity, as physical activity increased in the later months of their intervention (Neumark-Sztainer, Story, Hannan, Tharp & Rex, 2003; Schneider, et al., 2007).
6.2.3 Internet use in the school setting

The internet is clearly an emerging medium with great potential for engaging the youth of today with a high use of technology on their agenda for social, educational and entertainment pursuits. Engagement with the GRASP-IT on-line component may have been greater if the face-to-face component used more time to encourage, inform, clarify and motivate girls to use the website in conjunction with the preferred face-to-face activities on a weekly basis rather than the GRASP-IT program structure that delivered the face-to-face and on-line components separately. Future studies should consider integrating both the face-to-face and on-line components to encourage compliance, monitor use and trouble shoot to maximise the intervention dose and potentially impact on physical activity behaviour.

Intervention designs should consider this type of technology and develop innovative ways to engage older adolescent girls. The availability of computer access with internet is increasing and advancing technology in schools will give many adolescent girls access to internet support, both during school hours and out of school hours and this in turn will potentially benefit their health through the use of programs such as GRASP-IT.
6.2.4 Selection of the social network type

The results of the GRASP-IT study revealed that the preferred social networking site of choice is MySpace and at the time of conducting this study this site did not have the capability of a closed group area. Thus, the researcher’s choice to use the Facebook site was due to the availability of the ‘closed group’ area. The closed area enabled invitation only entry and therefore avoided contamination of results. A recommendation based on this research is to investigate other more popular sites that may be more desirable for the gender and age of the adolescent cohort studied. This could involve a survey of preferred sites to enable higher recruitment, adherence, engagement and compliance while supporting each other to be physically active using on-line or other technology applications.

6.2.5 Social support structures that embed the use of internet

A more comprehensive intervention may be necessary to reduce the decline in physical activity typically observed among adolescent girls. Bandura (1998) points out that changing the practices of social systems that have widespread detrimental effects on health rather than solely changing the habits of individuals would create a more collective efficacy with an aim to accomplish social change in relation to health promotion. The use of the social network site Facebook has the potential to create this “collective efficacy” and future work in this area has the potential to reach a large audience on-line. Although the intervention group were more active post-program, they exhibited low levels of compliance and motivation to significantly change their physical activity behaviour. Despite the GRASP-IT intervention girls’ preference for
participating in physical activity with a small group of friends, rather than alone or in a large group, additional strategies may be required to encourage girls to provide social support for physical activity to each other.

6.2.6 Other potential areas for investigation

To improve and extend this study further, investigation of self-concept, self-perception and self-evaluation of body image could further inform insights into adolescent girls’ feelings and thoughts about physical activity and may also inform the types of activities they would value in such a program. In addition, individual responsibility for health behaviours could also be further investigated and has potential to improve the outcomes of adolescent girls’ physical activity, health and well-being. Adolescent girls seek independence at this stage in their life and their readiness to take on responsibility for their health and well-being will be paramount to their future health status. Programs like GRASP-IT could support adolescent girls to support each other to be active and seek social support through this dynamic time in their life. It may also be of benefit to explore physical activity levels after the face-to-face sessions, as well as after the online component and additionally three to six months after conclusion of the intervention. This would allow a more thorough evaluation of each phase as well as of their levels of self-efficacy after intervention contact.
6.3 Closing statement

Although the GRASP-IT study was a small scale study, the primary outcome of increasing physical activity among the intervention group was achieved. However, the results revealed that there was no significant difference between groups. The relatively small sample size and lack of statistical power may explain our null findings.

The GRASP-IT participants were motivated to attend the face-to-face component of the intervention but did not engage with the on-line component. The GRASP-IT study results highlight the ongoing concern that there is no “one size fits all” approach for this cohort when it comes to providing opportunities for increasing physical activity. Therefore, research that engages with new technology mediums in innovative ways may benefit the health and well-being of older adolescent girls. However, interpretations of these results reinforce the need for additional strategies to engage older adolescent girls to increase physical activity. The school setting plays an important role in providing opportunities for girls to be active and future studies need to consider school-based opportunities as well as other innovative interventions to engage adolescent girls. Interventions that utilise Facebook as a medium for increasing physical activity for adolescent girls require additional strategies to improve and in particular address the areas of engagement and compliance toward such programs for future success.
REFERENCES


APPENDICES
Appendix A  Principal Information Sheet

Tracey Kelty
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PRINCIPAL INFORMATION SHEET

Research project: Girls Recreational Activity Support Program using Information Technology (GRASP-IT): A pilot randomized controlled trial utilising on-line support to promote physical activity for adolescent girls’.

Dear Principal,

Your school is invited to participate in the research project identified above which is being conducted by Tracey Kelty, Philip Morgan and David Lubans from the University of Newcastle.

Why is this research being done?

Physical inactivity is a global public health concern. Research suggests that the greatest decline in physical activity occurs during adolescence, this decline is more pronounced in adolescent girls and increases with age (Biddle, et al., 2005; Booth, et al., 2006; Kimm, et al., 2006; Nader, et al., 2008). This is a study to investigate the physiological, psychological and sociological factors associated with adolescent girls’ physical activity behaviour.

What is involved in this study?

Students will participate in one of two programs, a control group or intervention group program. Schools will be randomly allocated to a program. To evaluate the effects of the programs, participants will be asked to complete a number of assessments at baseline and post-test for both control and intervention school participants. The following fitness assessments will be conducted: height and weight, body mass composition, cardio-respiratory fitness, current physical activity level. Students will also complete a questionnaire exploring adolescents’ thoughts and feelings about physical activity. The intervention school will participate in a six week physical activity program and a six week on-line program during sport time.

Who can participate in this research?

Two DET schools in the Hunter Region will be invited to participate in this study. Eligible participants will be secondary school students at the study school in years 10 and 11. Participants will be ineligible if they have a medical condition or physical injury preventing testing or training. I will aim to recruit approximately 30 participants for the study from your school.
What choice do you have?
Participation in this research is entirely your choice and only schools where principals have given their explicit consent will be included in the study. If you do agree to your school’s participation, you may withdraw from the study at any time without giving a reason. A decision not to participate or discontinuation of involvement in the study will not jeopardise your relationship with the University of Newcastle. Similarly, students in your school will be included in the study only after a consent form has been signed by the students and their parents/guardians. If they initially agree to participate, they can choose to withdraw from the study at any time without giving a reason.

What are the risks of participating?
The intervention will be delivered by Tracey Kelty with the assistance of trained research assistants during the assessment phase of the study. Based on previous studies, participants will have no greater chance of injury by participating in these programs in comparison to other sports and physical activities.

How will the information collected be used?
The data collected from this study will be used for partial fulfillment of research higher degree qualifications, journal publications, conference presentations and to inform future practice for the design of valuable initiatives to increase physical activity behaviours for this cohort with a view to the improvement of school curriculum in the future.

How will privacy be protected?
Any personal information provided by parents/guardians and students will be confidential to the researchers. The results of the study will be published in general terms and will not allow the identification of individuals or schools. Once the data has been collected and entered into an electronic data file and verified, the questionnaires will be destroyed. The electronic data files will be retained for at least 5 years but no person will be identifiable in the data files or published reports.

What do you need to do to participate?
If you are willing for your school to participate in this study, could you please complete the accompanying Consent Form and return it to the researcher in the reply paid envelope provided. Upon receipt of your consent, I would like to organise a time to visit the school and provide students with information about the study. If you would like to organise a different route for the dissemination of the Information Sheet and Consent Form to students, please let me know. All students will be required to return a Consent Form signed by them and their parents/guardians before the study commences.

Further information
Following the completion of the study, the school will be sent a dissemination report describing the findings of the study. It is suggested that the findings are disseminated to students and their parents/guardians via a school newsletter or similar method.

If you would like further information please do not hesitate to contact me. Thank you for considering this invitation.

Chief Investigators:
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Assoc. Prof. Philip Morgan
Dr David Lubans
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David.Lubans@newcastle.edu.au

This project has been approved by the University’s Human Ethics Committee, Approval No.H2009-003. Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email Human-Ethics@newcastle.edu.au.
Appendix B    Principal consent form

Research project: Girls Recreational Activity Support Program using Information Technology (GRASP-IT): A pilot randomised controlled trial utilising on-line support to promote physical activity for adolescent girls.

Research Higher Degree Student: Tracey Kelty
Project Supervisors’: Associate Professor Philip Morgan and Dr David Lubans

I have been given information about the project identified above. I understand that if I consent to my school’s involvement in this project, my students will participate in one of two programs, a control group or intervention group program. Schools will be randomly allocated to a program. To evaluate the effects of the programs, participants will be asked to complete a number of assessments at baseline and post-test for both control and intervention school participants. The following fitness assessments will be conducted: height and weight, cardio-respiratory fitness by participating in a simple step test, current physical activity level by wearing a pedometer. Students will also complete a questionnaire exploring adolescents’ thoughts and feelings about physical activity. The intervention school will participate in a six week physical activity program during sport time, a six week on-line program and a small group of students will participate in focus groups at the conclusion of the program to evaluate and inform future research in this cohort.

I have had an opportunity to ask Tracey Kelty questions about the research and negotiate the type of feedback that will be given to the students prior to the commencement of the research. I understand that my school’s participation in this research is voluntary and that my school and my students are free to withdraw from the research project at any time. My refusal to participate or withdrawal of consent will not affect my relationship with the University of Newcastle.

By signing below I am indicating my consent for my school to participate in this research project conducted by Tracey Kelty, as it has been described to me in the Information Statement, a copy of which I have retained.

This project has been approved by the University’s Human Ethics Committee, Approval No.H2009-0003. Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email Human-Ethics@newcastle.edu.au.

Name of school: ______________________________
Principal’s name: ___________________________________________________
Signature: __________________________________________ Date: _____________

Please return this completed consent form in the prepaid envelope enclosed. Your cooperation is greatly appreciated.

Chief Investigators:
Tracey Kelty    Assoc. Prof. Philip Morgan    Dr David Lubans
Faculty of Education & Arts    Faculty of Education and Arts    Faculty of Education and Arts
School of Education    School of Education    School of Education
Phone: (02) 4921 6227    Phone (02) 49217265    Phone (02) 49212049
Tracey.Kelty@newcastle.edu.au    Philip.Morgan@newcastle.edu.au    David.Lubans@newcastle.edu.au

This project has been approved by the University’s Human Ethics Committee, Approval No.__________________. Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email Human-Ethics@newcastle.edu.au.
Appendix C  Parent/Student Information Sheet

Research Project - Girls Recreational Activity Support Program using Information Technology (GRASP-IT): A pilot randomised controlled trial utilising on-line support to promote physical activity for adolescent girls.

Dear Student and parent/guardian,

This letter is to inform both parent/guardian and student of the above program. This is also an invite to you (the student) to participate in a study being conducted by Tracey Kelty, a Research Higher Degree student, from the University of Newcastle. Associate Professor Philip Morgan is the Principal Supervisor and Dr David Lubans is the Co-supervisor who will both oversee the research.

Why is this research being done?

Physical inactivity is a global public health concern. Research suggests that the greatest decline in physical activity occurs during adolescence, this decline is more pronounced in adolescent girls and increases with age. This is a study to investigate factors associated with adolescent girls’ physical activity behaviour and improve the physical activity levels, fitness and health of adolescent girls.

What is involved in this study?

Students will participate in one of two programs, a control group or intervention group program. Schools will be randomly allocated to a program. To evaluate the effects of the programs, participants will be asked to complete a number of assessments at baseline and post-test for both control and intervention school participants. The following fitness assessments will be conducted: height and weight, aerobic fitness by participating in a simple step test and current physical activity level measured by wearing a pedometer. Students will also complete a questionnaire exploring adolescents’ thoughts and feelings about physical activity. The intervention school will participate in a six week physical activity program during sport time that involves a fun and active form of physical activity each week. For example, beach activities, aerobic dance and bush walking. Students will then participate in a six week on-line program that will involve a small amount of time participating in a group support communication program with a variety of tasks that educate, motivate and challenge the mind and body to get active. To conclude a small group (n = 20) of girls will participate in focus groups to evaluate and inform future research of this cohort. The control school staff will be offered all developed program resources to enable implementation of the program in the future.

Who can participate in this research?

Two DET schools in the Hunter Region will be invited to participate in this study. Eligible participants will be secondary school students at the study school in years 10 or 11. Participants will be ineligible if they have a medical condition or physical injury preventing testing or training.

What choice do you have?

Participation in this research is entirely your choice and only schools where principals have given their explicit consent will be included in the study. If you do agree to participate, you may withdraw from the study at any time without giving a reason. A decision not to participate or discontinuation of involvement in the study will not jeopardise your relationship with the School or University of Newcastle. Similarly, you will only be included in the study after a consent form has been signed by you and your parent/guardian. If you initially agree to participate, you can choose to withdraw from the study at any time without giving a reason.
What are the risks of participating?

Based on previous studies, participants will have no greater chance of injury by participating in these programs in comparison to other sports and physical activities. Safety will be a high priority throughout this program.

How will the information collected be used?

The data collected from this study will be used for partial fulfilment of research higher degree qualifications, journal publications, conference presentations and to inform future practice for the design of valuable initiatives to increase physical activity behaviours for this cohort with a view to improvement of school curriculum in the future.

How will privacy be protected?

Any personal information provided by parents/guardians and students will be confidential to the researchers. The results of the study will be published in general terms and will not allow the identification of individuals or schools. Once the data has been collected and entered into an electronic data file and verified, the questionnaires will be destroyed. The electronic data files will be retained for at least 5 years but no person will be identifiable in the data files or published reports.

What do you need to do to participate?

If you are willing to participate in this study, and have parent/guardian approval could you please complete the accompanying Consent Forms and return both forms to your PD/H/PE Head Teacher as soon as possible. You will not be permitted to participate without returning the consent forms. You will also need a pair of sports shoes and preferably your school sports uniform.

Further information

Following the completion of the study, the school will be sent a dissemination report describing the findings of the study. It is suggested that the findings will be given to students and their parents/guardians via a school newsletter or similar method.

If you would like further information please do not hesitate to contact me. Thank you for considering this invitation. I look forward to meeting you in the near future.

Chief Investigators:

Student researcher: Tracey Kelty
Faculty of Education & Arts
School of Education
Phone: (02) 4921 6227
Tracey.Kelty@newcastle.edu.au

Principal Supervisor: Assoc. Prof. Philip Morgan
Faculty of Education and Arts
School of Education
Phone (02) 49217265
Philip.Morgan@newcastle.edu.au

Co-Supervisor: Dr David Lubans
Faculty of Education and Arts
School of Education
Phone (02) 49212049
David.Lubans@newcastle.edu.au

This project has been approved by the University’s Human Ethics Committee, Approval No.H-2009-0003. Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email Human-Ethics@newcastle.edu.au.
Appendix D  Parent consent form

Research Project - Girls Recreational Activity Support Program using Information Technology (GRASP-IT): A pilot randomised controlled trial utilising on-line support to promote physical activity for adolescent girls.

Research Higher Degree Student: Tracey Kelty
Project Supervisors’: Associate Professor Philip Morgan and Dr David Lubans

I have been given information about the project identified above. I understand that if I consent to my child’s involvement in this project, they will participate in one of two programs, a control group or intervention group program. Schools will be randomly allocated to a program. To evaluate the effects of the programs, participants will be asked to complete a number of assessments at baseline and post-test for both control and intervention school participants. The following fitness assessments will be conducted: height and weight, cardio-respiratory fitness by participating in a simple step test, current physical activity level by wearing a pedometer. Students will also complete a questionnaire exploring adolescents’ thoughts and feelings about physical activity. The intervention school will participate in a six week physical activity program during sport time, a six week on-line program and a small group of students will participate in focus groups at the conclusion of the program to evaluate and inform future research in this cohort.

I have had an opportunity to ask Tracey Kelty questions about the research. I understand that my child’s participation in this research is voluntary and they are free to withdraw from the research project at any time. Their refusal to participate or withdrawal of consent will not affect their relationship with the University of Newcastle. Withdrawal from this task will not result in any disciplinary action against your child, nor will it affect their academic grades, given that this is a purely voluntary research task.

By signing below I am indicating consent for my child to participate in this research project conducted by Tracey Kelty, as it has been described to us in the Information Statement, a copy of which I have retained.

This project has been approved by the University’s Human Ethics Committee, Approval No.H-2009-0003. Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email Human-Ethics@newcastle.edu.au.

Student name: __________________________________________

Parent/guardian name: ________________________________________

Signature: _________________________ Date: ______________________

Additional Information:
I ____________________________ give or do not give permission for the researcher to contact my daughter
(Full name of parent) (choose one)
at a later date to allow the choice to participate in future research if she desires.

________________________________  Date: _____ / _____ /09
(Signature)

Please sign the completed consent letter and allow your daughter to return, with her consent letter, to school and place in the allocated box in the PD/H/PE Staff room.
Appendix E  Student consent form

Research Project - Girls Recreational Activity Support Program using Information Technology (GRASP-IT): A pilot randomised controlled trial utilising on-line support to promote physical activity for adolescent girls.

Research Higher Degree Student: Tracey Kelty  
Project Supervisors’: Associate Professor Philip Morgan and Dr David Lubans

I have been given information about the project identified above. I understand that if I consent to my child’s involvement in this project, they will participate in one of two programs, a control group or intervention group program. Schools will be randomly allocated to a program. To evaluate the effects of the programs, participants will be asked to complete a number of assessments at baseline and post-test for both control and intervention school participants. The following fitness assessments will be conducted: height and weight, cardio-respiratory fitness by participating in a simple step test, current physical activity level by wearing a pedometer. Students will also complete a questionnaire exploring adolescents’ thoughts and feelings about physical activity. The intervention school will participate in a six week physical activity program during sport time, a six week on-line program and a small group of students will participate in focus groups at the conclusion of the program to evaluate and inform future research in this cohort.

I have had an opportunity to ask Tracey Kelty questions about the research. I understand that my participation in this research is voluntary and I am free to withdraw from the research project at any time. My refusal to participate or withdrawal of consent will not affect my relationship with the University of Newcastle. Withdrawal from this task will not result in any disciplinary action against me, nor will it affect my academic grades, given that this is a purely voluntary research task.

By signing below I am consenting to participate in this research project conducted by Tracey Kelty, as it has been described to me in the Information Statement, a copy of which I have retained.

This project has been approved by the University’s Human Ethics Committee, Approval No.H-2009-0003. Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email Human-Ethics@newcastle.edu.au.

Student name: ___________________________________________
Signature: _____________________________ Date: ______________________

Additional Information:
I ____________________________ give or do not give permission for the researcher to contact me (Full name) at a later date to allow the choice to participate in future research if I desire. (choose one)
(Signature) Date: _____/_____/09 Address: ________________________ Post

Please sign the completed consent letter and return to the allocated box in the PD/H/PE Staff room as soon as possible.
Appendix F  Pre and Post Questionnaire cover sheet

Subject ID code:

GRASP-IT REGISTER INFORMATION:

Thank you for taking the time to participate in this program.

Please complete the information below for the researcher to create a register of participants. This register will be used to code your identity and ensure research of individual results to be confidential. This personal information will be kept confidential and secure by the researcher, who will allocate a personal code that will link all of your results. If you have any questions regarding this process contact Tracey Kelty.

Full Name: __________________________________ Year: __________

Address: __________________________________

__________________________________ Post Code: _______

Email Address: _________________________________________________

PLEASE COMPLETE AND LEAVE THIS FORM ATTACHED TO YOUR QUESTIONNAIRE AND PLACE IT IN THE BOX SUPPLIED NEAR THE DOOR. Thank you.

Tracey Kelty
Phone: + 61 (0)2 4921 6227
Fax: +61 (0)2 4921 7407
Email: Tracey.Kelty@newcastle.edu.au
Appendix G  Pre and Post Questionnaire

GRASP-IT Questionnaire

Girls Recreational Activity Support Program using Information Technology (GRASP-IT) Study

This study relies on your participation to share information about your life and experiences to provide knowledge that will contribute to adolescent girls’ health in the future. Participation is completely voluntary, and you are free to withdraw from the study at anytime.

Please take a few minutes to answer this questionnaire. There are no right or wrong answers for any of the following questions as everyone will differ. Information in this questionnaire will be confidential and all privacy is assured, you will not be identified in any information used for this research.

Please choose one response for each question by ticking one box to indicate your answer.

PART 1 – GENERAL INFORMATION

1. What is your age this year?

   15 □
   16 □
   17 □
   18 □

2. What year are you in at school?

   Year 10 □
   Year 11 □

3. In which country were you born?

   □ Australia                  □ Other (please specify) _________________________

4. Are you of Aboriginal or Torres Strait Islander origin?

   □ No                      □ Yes, Aboriginal         □ Yes, Torres Strait Islander
### PART 2: Confidence to be active.

**Circle one response to the following questions:**

<table>
<thead>
<tr>
<th>Questions.</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Unsure</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I can be physically active during my free time on most days.</td>
<td>SD</td>
<td>D</td>
<td>U</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>2. I can ask my parent or other adult to do physically active things with me.</td>
<td>SD</td>
<td>D</td>
<td>U</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>3. I can be physically active during my free time on most days even if I could watch TV or play video games instead.</td>
<td>SD</td>
<td>D</td>
<td>U</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>4. I can be physically active during my free time on most days even if it is hot or cold outside.</td>
<td>SD</td>
<td>D</td>
<td>U</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>5. I can ask my best friend to be physically active with me during my free time on most days.</td>
<td>SD</td>
<td>D</td>
<td>U</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>6. I can be physically active during my free time on most days even if I have to stay at home.</td>
<td>SD</td>
<td>D</td>
<td>U</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>7. I have the coordination I need to be physically active during my free time on most days.</td>
<td>SD</td>
<td>D</td>
<td>U</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>8. I can be physically active during my free time on most days no matter how busy I am.</td>
<td>SD</td>
<td>D</td>
<td>U</td>
<td>A</td>
<td>SA</td>
</tr>
</tbody>
</table>
PART 3 - SOCIAL SUPPORT

(Circle one number for each statement)

DURING A TYPICAL WEEK, how often:

<table>
<thead>
<tr>
<th>Statements:</th>
<th>0 Never</th>
<th>1 Once</th>
<th>2 Sometimes</th>
<th>3 Almost Daily</th>
<th>4 Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do you encourage your friends to do physical activities or play sports?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. Do your friends encourage you to do physical activities or play sports?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. Do your friends do physical activities or play sports with you?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. Do friends tell you that you are doing well in physical activities or sports?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

THE END OF THE QUESTIONNAIRE

Thank you for your time your responses are valued contributions to this research.

Tracey Kelty
The University of Newcastle.
Appendix H  Process evaluation questionnaire

PROCESS EVALUATION

Name: _____________________________________

To protect your privacy this cover sheet will be removed and destroyed once you have been allocated a study number.

Associate Professor Philip Morgan
Faculty of Education & Arts
School of Education
Phone: (02) 4921 7265
Philip.Morgan@newcastle.edu.au

Dr David Lubans
Faculty of Education & Arts
School of Education
Phone: (02) 4921 2049
David.Lubans@newcastle.edu.au

Tracey Kelty
Faculty of Education & Arts
School of Education
Phone: (02) 49216227
Tracey.Kelty@newcastle.edu.au
**Evaluation of the GRASP-IT program**

Thank you for taking part in the GRASP-IT study. We would like to know what you thought of the program and would be grateful if you could complete the following questions. Your responses will help us to improve the program for the future.

Please say how much you agree or disagree with the following statements and questions by circling the most appropriate response:

Please be honest in your reply. All responses will be confidential.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

1) **Website (Facebook GRASP-IT group) design:**

   a) The Facebook GRASP-IT group site was easy to understand.  
   b) The Facebook GRASP-IT group site provided me with useful information.  
   c) I found navigating around the Facebook website difficult.  
   d) I found the Facebook site visually appealing.  
   e) It was easy to navigate from one point to another in the website.  
   f) The content of the website was relevant to my age.  
   g) The website was well set up to be visually appealing to me.

2) **Use of website features in the Facebook GRASP-IT group:**

   a) Did you complete the set tasks from the GRASP-IT group website?  
   b) If yes, did you enjoy these tasks?  
   c) Did you participate in any online discussions (GRASP-IT or email)?  
   d) Did you participate in writing on the Wall in GRASP-IT group?  
   e) Will you revisit this website to use it further?  
   f) Was this website personally useful to you?  
   g) Did you use the web links in the GRASP-IT group?  
   h) Did the aim of this website meet your expectations?

3) **Current physical activity planning**

   a) I now keep a record of my physical activity.  
   b) I am now aware of how much physical activity is beneficial to girls my age.  
   c) I now set myself physical activity goals.
4) Opinion of the GRASP-IT program

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) I am satisfied with the GRASP-IT program.</td>
<td>SD D N A SA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) The GRASP-IT program was long enough.</td>
<td>SD D N A SA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) The GRASP-IT program helped dispel myths about physical activity.</td>
<td>SD D N A SA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) My involvement in the GRASP-IT program was enjoyable.</td>
<td>SD D N A SA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) I would prefer being in a program that meets on the internet than one that meets in person.</td>
<td>SD D N A SA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5) Social support

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) The GRASP-IT program provided me with enough support to help me increase my physical activity.</td>
<td>SD D N A SA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) The quality of the internet support in GRASP-IT was good.</td>
<td>SD D N A SA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) The quantity of internet support in GRASP-IT was good.</td>
<td>SD D N A SA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) I now enjoy physical activity with my friends more often.</td>
<td>SD D N A SA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6) My involvement in the GRASP-IT program has encouraged me to:

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) use a pedometer.</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>b) join a gym, fitness centre or health club.</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>c) join a sports team or club.</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>d) to be more active with my friends.</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>e) discuss my physical activity strategies with others.</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>d) to be more active with my family.</td>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>

Please tick one box for each question and provide details as follows:

(7) Which one of the following computer generated mediums do you access for communication with friends?

- (a) Facebook  □
- (b) My Space  □
- (c) Twitter  □
- (d) None  □
- (e) Other  □ Please specify type ____________________________
(8) How often do you use this communication medium to speak with friends?
   (a) More than once a day □
   (b) Once a day □
   (c) Once every two days □
   (d) Once a week □
   (e) Not at all □

(9) I prefer to do physical activity:
   (a) alone □
   (b) with one friend □
   (c) with a small group of friends □
   (d) with a large group of friends □
   (e) with a large group of people I do not know □

(10) Which aspects of the GRASP-IT program did you most enjoy? (Describe)

(11) How can the GRASP-IT program be improved? (Please explain)

(12) Do you have any additional comments about the GRASP-IT program that you think might be useful for the researcher?

Thank you for your time to complete this survey.
Your cooperation is greatly appreciated.
Appendix I  Focus group questions

(1) Why did you volunteer for this program?
(2) Do you like PE at school? Why or Why not?
(3) Do you like Sport at school? Why or Why not?
(4) Do you prefer small group or large group physical activity participation?
(5) Did you like the Facebook component of this program? Why or why not?
(6) Did you complete the activities from the on-line tasks? Which ones? Why some or not others?
(7) What do you think about adults giving information and tasks to you through internet sites to increase your physical activity?
(8) If any, what on-line social networking site would you prefer to use for communication about physical activity?
(9) Do you think Facebook could be used in a better way to promote physical activity? If so, how?
(10) What did you like about the GRASPIT program?
(11) What did you dislike about the GRASPIT program?
(12) Do you have any other comments or questions about the program?

To conclude:

Allow any questions from the participants.
Thank participants for their time and effort to attend the focus group session.
Appendix J  Assessment organisation at baseline and follow up.

Assessment Organisation for the venue (2 rooms/areas):

* Arrive at the school 40 minutes early to set up.
* Sign in at the office.
* Seek information for the rooms.
* Set up Room 1 for questionnaire and step test.
* Set up Room 2 for height and weight measurement and pedometer registration.

1. INTRODUCTION – Tracey Kelty (TK) introduce Research Assistant (RA)  (5 minutes)

   Seat girls in room 1 at desks and talk to them about completing each of the assessments. Outline the following assessments and what is required:

   i. Questionnaire and registration  
      (To be done first all at the same time in one room)
   ii. Height (individual)  TK and RA to do.
   iii. Weight (individual)  TK and RA to do.
   iv. Register and collect pedometer and information booklet  
      (Teacher or assistant to do)
   v. Queens College Step Test. (In groups of 6 – 3 step and 3 buddy/record)

2. COMPLETION OF QUESTIONNAIRE  (20 minutes)

   All girls in room 1 with desks set up to complete the questionnaire and registration on the cover of the questionnaire.

   - Hand out questionnaire and pen, if required, to each girl.
   - Hand out the 4 recording slips  
     (4 colours - all girls to place name on the slips ready to hand to TK or RA to record results)

   Registration of name and research number is on cover of questionnaire.

   Height registration sheet = Pink
   Weight registration sheet = Yellow
   Step Test registration sheet = Purple
   Pedometer registration sheet = Green

   Assessment for each test will be done by the researcher and/or research assistant. This is then recorded on the corresponding slip (see above for colours) and placed in the sealed box after each assessment, a roll is also marked with a tick when the assessment is completed for each girl to keep track of the assessments completed.

   - Girls all complete the questionnaire and hand in when finished.
   - When they finish the questionnaire they all proceed to Height and Weight measurement.
   - After the above tests the step test and pedometer collection will occur.
3. ASSESSMENT OF HEIGHT AND WEIGHT *(30 minutes)*

TK and RA will measure the height and weight in the following process:
- Girls line up and wait well away from the equipment.
- Girls remove their shoes and wait their turn at either the height or weight equipment points.
- One girl at a time is measured for height and weight. The process will be for each girl to hand their slip to TK or RA and they will record and place this in the recording box. We then tick off their name on the roll beside the box to indicate that they have completed the assessments.
- After these assessments are complete girls move to area for the step test.

**Room 1:**
(TK and RA to oversee height and weight assessment and recording)

\[ X = \text{Student.} \]

---

![Diagram showing the process of height and weight assessment]
4. ASSESSMENT OF STEP TEST AND Pedometer REGISTRATION  
(95 minutes) 
A demonstration by the TK is done to all participants and then in 10 groups of 3 girls will proceed to an allocated room (12 girls to room 2–step test and 18 girls to room 1) as follows:

PART 1:

STEP TEST PROCEDURE – In 6 groups of 2 girls (12 girls):

**STEP 1** - 4 girls here - 2 girls put on the wet heart rate monitors and receivers with 2 buddies assisting (RA to supervise and test equipment).

**STEP 2** - 2 girls already with heart rate monitors/receivers on complete the step test for three minutes and then straight away step two/three steps back into their allocated hoop and wait with arm straight out in front ready to record heart rate with buddy assisting and Researcher overseeing.

**STEP 3** - 2 buddies will have the steppers own record slip ready and with a pen stand at the hoop and record the heart rate at 5, 10 and 20 seconds immediately after the test signalled by the researcher. TK and RA check the procedure and results are correct and collect the record slip and place in allocated box.

**Room/Area 2**

**STATION 3 STEP TEST**

**EQUIPMENT REQUIRED:**

- 41cm High Bench.  
- Stop Watch x 2 (1 spare)  
- Polar Heart Rate Monitors x 6.  
- Receivers x 6.  
- 2 small desks and 4 pens.  
- Metronome x 1  
- Spare batteries for all equipment.  
- Recording sheets.  
- 8 Witches hats.  
- Bucket of water/sponge.
EQUIPMENT SET UP AND PROCEDURE FLOW DIAGRAM:

Step 1 - Prepare with buddy (put on monitor/receiver) then test it before assessment. Move from the preparation area to the bench when called.

Step 2 - Perform the assessment facing the wall at the bench (buddy waits with recording sheet behind them at the hoop shown by a ○)
Step 3 - After assessment walk to step into the allocated hoop and record heart rate.

**STEP 1**     **STEP 3**     **STEP 2**
Preparation   Record Results   Bench
Area          Stand in hoop    Step Test here

S1           B1 ○  S1 →
S2           B2 ○  S2 →  wall

S1 = Subject No. 1 etc.
B1 = Buddy to No. 1 etc

PART 2: Station 4 – Pedometer

Room 1 – Desks set up and teacher to hand out pedometers. Register and collect their pedometer and information sheet.

Girls collect their pedometer from the teacher.
- Record the pedometer number and register this number on the green slip.
- Mark name off on the roll after collection.
- Collect the information/log record sheet, write name on the cover and read this straight away.
- Test the pedometer and ask any questions.

Instruct the girls to wait patiently to be called in for the next set of girls to do the step test.

ADDITIONAL INFORMATION:

Time allocated will be from 1pm to 3.30pm over a one or two week period.

Depending on how smoothly the process runs.

Minimal waiting time is envisaged however, some waiting will occur between assessments.
Appendix K - Procedure for height measurement

GRASP-IT CHECKLIST
HEIGHT MEASUREMENT

<table>
<thead>
<tr>
<th>DETAILS</th>
<th>PRE-TEST</th>
<th>POST-TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set up stadiometer on even ground/floor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject has removed shoes and any jumper or hat. Ensure hair is flat on</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the top of the head. Eg. No buns in the way.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Place feet parallel to stand on the platform facing away from the bar.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject is to look straight ahead, with shoulders back and back straight.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Researcher records the height in cm on the subjects record slip.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject steps off platform at the researchers signal.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Researcher places subjects record slip into the sealed box</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject then ticks off name on the roll after assessment is complete</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix L - Procedure for weight measurement

GRASP-IT CHECKLIST

WEIGHT MEASUREMENT

<table>
<thead>
<tr>
<th>DETAILS</th>
<th>Pre-Test</th>
<th>Post-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set up scales on even ground/floor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject has removed shoes and any jumper or hat.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Place feet parallel to stand on the scales</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject is to look straight ahead</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Researcher records the weight in kg on the subject’s record slip.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject steps off scales at the researchers signal.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Researcher places subjects record slip into the sealed box</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject then ticks off name on the roll after assessment is complete.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix M  Procedure for pedometer administration

GRASP-IT PEDOMETER CHECK LIST

<table>
<thead>
<tr>
<th>DETAILS</th>
<th>PRE-TEST</th>
<th>POST-TEST</th>
</tr>
</thead>
</table>
| Researcher explains the use of pedometers for the study.  

*Pedometers are worn to count your steps. (show a pedometer)  
Please wear it for 4 consecutive weekdays and one weekend day.  
Commence your step counts from tomorrow morning.  
Press the reset button in the morning before you put the pedometer on for the day. (show how)*  

*Please carry on as normal as I need to have a typical step count for this 5 day period.  
Do not place it in the water (pool, shower, bath etc)  
If you swim or cycle please note this in your log sheet.  
Do not do extra activity that you would not normally do.  
Record your steps at the end of each day before you go to sleep.  
Remember to put it on each morning when you get out of bed.  
Make sure it is reset to zero for the day.*  

| Researcher is to seek name and mark name off using the register sheet.  |  |  |
| Researcher is to give the subject a pedometer and information/log sheet.  |  |  |
| Researcher records the number allocated to the pedometer and records this on the information slip.  |  |  |
| Subject is to record name and mobile phone number on the registration sheet.  |  |  |
| Subjects are to test the pedometer.  |  |  |
| If the pedometer is in working condition the subject will then record their name and number on the pedometer record log sheet.  |  |  |
| Subject may now read the information and ask questions.  |  |  |
**Appendix N  Procedure for administration of estimate of Vo2 max assessment**

**GRASP-IT CHECKLIST**

**QUEENS COLLEGE STEP TEST SET UP**

<table>
<thead>
<tr>
<th>DETAILS</th>
<th>PRE-TEST</th>
<th>POST-TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Researcher explains the purpose of the assessment and demonstrates the procedure as follows:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EXPLAIN PROCEDURE FOR SUBJECT AND A BUDDY**

1. Hand your record slip to your buddy.
2. Your buddy then places this record slip on the desk with a pen ready to record.
3. You then clasp the heart rate monitor so that you can step into it and slide it up to your waist. Then wet the inside with the sponge and gently slide it up under your shirt to be around your chest just below the bra.
4. Place the receiver (watch) onto your wrist.
5. Press the button to turn it on.
6. Hold it level with the heart rate monitor until it beeps once and then take the receiver (watch) away. (This connects the signal)
7. Keep the receiver (watch) away from your chest during the test
8. See the researcher if it is not working.
9. You should see a small heart and hear a small beep from the receiver (watch).
10. You will see your heart rate on the receiver (watch).
11. Your buddy now stands behind the table ready for you to finish.

Researcher now demonstrates the test.
Place feet on the step in time with the metronome. (Up, up, down, down)

At the 3 minute signal take two steps back and stand in your allocated area (hoop).

The researcher will say 5 seconds. (You must tell your buddy your heart rate at this time) Eg. 164.
Your buddy then records the result on your record slip with the researcher checking.

The researcher will then say 10 seconds and you record again
Then 20 seconds. A score for the three heart rates must be recorded.

Researcher then instructs all girls to change over to help their buddy get ready for the test.

The next group waiting will proceed to the test while the others prepare by placing the monitor and receiver on and testing it so that they are ready to go without delay.

If a monitor stops the subject can rest until full recovery and then participate again. This should only occur once if required.
Appendix O  Additional information to administer the estimate of Vo2 max assessment.

Queen’s College Step Test Guidelines

EQUIPMENT REQUIRED:

- 41.3cm High Bench.
- 2 desks
- Stop Watch X 3
- Polar Heart Rate Monitors x 4
- Receivers x 4
- Metronome x 1
- Container of water and sponge
- Spare batteries for all equipment
- Recording sheets
- Pens

S1= Subject 1 and S2 = subject 2

EQUIPMENT SET UP:

- Step Bench
- S1 Buddy
- Recording stand in hoop
- S2 Buddy

NOTE:
Each subject should have at least one metre between each other at the bench when stepping and move back into the allocated hoop when the stepping is completed. Their buddy then records the HR when the researcher requests.

PRE TEST PREPARATION:

1. Set up the bench and test to see it is not slipping.
2. Place the heart rate monitor and receiver on the bench ready to fit (buddy to assist with fitting.
3. Have the recording sheets and pen ready to record results.

Before starting the QCST outline the procedures and allow practice as follows:

1. Advise the subject they will be stepping for 3 minutes only and then must stand still to have their heart rate recorded at 5, 10, and 20 seconds after the test. The test will commence after the words “ready” then “go”.
2. Subject is to attach the “wet” POLAR® heart rate monitor (model number FS1) to the chest and place the receiver on the wrist. Press the button on the receiver and then hold to the monitor until it beeps once. This should then display the heart rate. Stand one metre from the subject.
3. Check that this equipment is working. (advise the subject not to place the receiver near the chest again during the test).
4. Set the metronome at 88 beats per minute and keep it on for the test.
5. Demonstrate a step up and down to the single beat of the metronome. Left up/right up and then left down/right down. (4 beats)
6. Allow the subject to do this for two cycles (8 beats)
7. Allow a one minute rest before commencing the test.

COMMENCE THE TEST:

1. Make sure the metronome is still on.
2. Give the signal “ready” and “go” on “go” start the stop watch.
3. Time the test for 3 minutes exactly.
4. Give warning to stop “ready” and “stop”
5. Subject is to stand for 5 seconds and take heart rate and record.
6. Then repeat at 10 seconds and record.
7. Then repeat at 20 seconds and record.
8. Subject then removes the equipment and places it on the bench. Allow the subject to walk slowly around the room to recover.
FURTHER INFORMATION

I can be contacted at Tracey.Kelty@newcastle.edu.au if you need further information or need to contact me before I return.

I will be returning to your school to collect the pedometers in one week from today.

Please make sure you have returned your pedometer to your PD/H/PE staff room after the week, as arranged, and make sure you sign the form to register it as returned.

The pedometers are the property of the University of Newcastle and need to be handled with care.

Thank you for participating in this important study.

Tracey Kelty
GRASP-IT Coordinator.

PEDOMETER INFORMATION

Name: __________________________

Pedometer Registration Number: __________

Date of return: __________

Please read these instructions carefully now and test your pedometer before leaving today.

Ask any questions to help with your understanding.
PEDOMETER
INSTRUCTIONS

GENERAL INSTRUCTIONS:

This pedometer will measure your steps per day and you will need to wear it for 5 consecutive days, 4 weekdays and 1 weekend day.

(1) Make sure the pedometer is set on zero before clipping on.
(press yellow reset button).

(2) The first thing to do in the morning as you get out of bed is to put the pedometer on each day, and transfer it to the clothes.

(3) Clip the pedometer to your skirt/shorts/trouser band and align it with the right or left knee and make sure it is sitting straight.

(Picture of hip and pedometer is placed here)

(4) Wear it all day until you go to sleep at night.

(5) Before you go to sleep record your steps for the day in the table on the next page.

(6) It is not to be worn in the water or shower, so record your water activities in the comment box over the page if you do any water activities. Record the time and type of activity in the comment box.

(7) If you removed it or forgot to wear it for more than 1 hour please indicate in the table on page 3.

(8) If you did an activity like cycling or other activity that does not involve stepping please also detail comments about this in your log on page 3.

RECORD LOG:

This log is for you to record your steps for the 5 days. Please note, you are not asked to do any extra activity for this task. The task is to indicate how active you are for a typical week.

Pedometer Registration Number: _______ (see front cover)

<table>
<thead>
<tr>
<th>DATE AND DAY</th>
<th>STEPS TAKEN</th>
<th>QUESTIONS &amp; COMMENT</th>
</tr>
</thead>
</table>
| Weekday Day 1 | Record total number of steps per day here | (1) A typical day?  
(2) Did you perform any exercise?  
(3) Comment on reason removed and/or extra activity, Eg. Swim, cycle etc. |
| Weekday Day 2 | Refer to the questions in row 1 above to answer the following points:  
(1) YES or NO  
(2) YES (how long) ___ or NO.  
(3) Reason/Comment: |
| Weekday Day 3 | Refer to the questions in row 1 above to answer the following points:  
(1) YES or NO  
(2) YES (how long) ___ or NO.  
(3) Reason/Comment: |
| Weekday Day 4 | Refer to the questions in row 1 above to answer the following points:  
(1) YES or NO  
(2) YES (how long) ___ or NO.  
(3) Reason/Comment: |
| Weekend Day | Refer to the questions in row 1 above to answer the following points:  
(1) YES or NO  
(2) YES (how long) ___ or NO.  
(3) Reason/Comment: |

Page 2
Appendix Q  GRASP-IT recording sheet for baseline and follow up assessments

Note: All of the recording slips below were photo copied in a different colour for each assessment and cut out to enable confidential submission of results to be placed in a sealed box:

- Height registration sheet = Pink
- Weight registration sheet = Yellow
- Step Test registration sheet = Purple
- Pedometer registration sheet = Green

<table>
<thead>
<tr>
<th>GRASP-IT RECORD SHEET FOR Height Measurement</th>
<th>GRASP-IT RECORD SHEET FOR Weight Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Name: ____________________________</td>
<td>Full Name: ____________________________</td>
</tr>
<tr>
<td>Measurement: __________ cm</td>
<td>Measurement: __________ kg</td>
</tr>
<tr>
<td>(Place in the box marked Height Measurement)</td>
<td>(Place in the box marked Weight Measurement)</td>
</tr>
<tr>
<td>Thank you.</td>
<td>Thank you.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GRASP-IT RECORD SHEET FOR Step Test Measurement</th>
<th>GRASP-IT RECORD SHEET FOR Pedometer Register</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Name: ____________________________</td>
<td>Full Name: ____________________________</td>
</tr>
<tr>
<td>Score (1) at 5 seconds ______ beats per minute</td>
<td>Pedometer Number: ________________________</td>
</tr>
<tr>
<td>Score (2) at 10 seconds ______ beats per minute</td>
<td></td>
</tr>
<tr>
<td>Score (3) at 20 seconds ______ beats per minute</td>
<td></td>
</tr>
<tr>
<td>(Place in the box marked Step Test Scores)</td>
<td>(Place in the box marked Pedometer Register)</td>
</tr>
<tr>
<td>Thank you.</td>
<td>Thank you.</td>
</tr>
</tbody>
</table>
Appendix R – Facebook instructions to register

GRASPIT ON-LINE COMPONENT

This part of the study is the use of the Internet to support each other to be physically active. It will have links to information sites to improve your physical activity and health. You are free to do as little or as much on the site as you like. You will be given an invitation to join a closed group on the Facebook site.

There is no fee for Facebook, it is a free site. It is a social networking site that can be accessed from your home computer. It is not able to be accessed from school.

I have created a closed (invitation only) Facebook group it is titled GRASPIT PILOT STUDY.

Soon you will get an email from me to invite you to be a member of this group. When you accept this invitation you can then join Facebook by following the instructions below.

Enjoy interacting on this site as little (once a week minimum) or as much as you like.

If you have never used Facebook before please login to Facebook using the following method:

- Go to http://www.facebook.com/login.php
- Select the Green sign up box on the left of your screen.
- Place in the information as required. You will need to put the following information in the fields on the screen:
  - Full Name: (Place your first name and Surname in here)
  - Your Email address: (Place your email address in here)
  - New Password: (Make up your own password – keep this confidential)
  - I am: Select Sex (This is a drop down menu and you need to select female)
  - Birthday: Month: Eg. Jan  for January  Day: Eg. 21
  - Year: Eg. 1993 (the year you were born)

Then press the sign up green button.
You can then build up your profile if you wish (you do not have to put your photo on) or just skip this section if you are not interested. This section is your site and at the end of the program you can take yourself off or continue to use the site if you wish.

**TASK: EACH WEEK LOG IN AND USE THE SITE:**

After you have received my email for the invitation and accepted you will then be able to use the group site in Facebook. If you do not get an email please contact me by email at Tracey.Kelty@newcastle.edu.au and I will then send you an invitation.

**USING THE GRASPIN T PILOT STUDY SITE:**

- Login to Facebook and you will get your home page profile screen.
- Go to the top right SEARCH box and type in GRASPIN T PILOT STUDY to find the group
  OR go to the bottom of the screen to the shadow of two people side by side to search for the group.
- Be aware that there are other groups in the world wide site called GRASPIN T so be careful to choose the GRASPIN T PILOT STUDY as this is our site.

**NOTE:** You will not be able to access any of this until you have accepted the invitation by email.

**HOW TO USE:**
You can go to several areas in this site:

- There is a **Discussion Board** section to read and discuss each others comments. Each week I will place a task in there for you to get tips on increasing your physical activity and improving your health.
- There is a **Wall** you can write comments on the wall if you wish. I have placed a comment on here for you to write about when you first use the site.
- There is a **Links** section to other websites that you can use. I will set this up for you to go to a site of interest each week. The links will build up and I will keep them all on there for the whole program.
- You can load a **Photo** of you and/or your friends being active if you wish, but make sure you have their permission to do so first. I will load some pictures on there for you to view as well. Note: These pictures must not be inappropriate and must be your property. They can not be seen by others in Facebook as this is a closed group.

**ENDING THE PROGRAM:**

The Facebook closed group will be deleted from the site at the end of the year.
I will be back to the school during Term 3 to complete the program and see how you are progressing. Thank you for being part of this important study. I greatly appreciate your effort to turn up each week and cooperate with the assessment and physical activity program. The on-line Facebook part is the next part of the study and I would value you being a part of this section of the study. If you have any concerns or questions about the study please email me at Tracey.Kelty@newcastle.edu.au