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# Examining the role of self-regulated learning in adolescent physical activity behaviour

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Examining the Role of Self-Regulated Learning in Adolescent Physical Activity  
Behaviour

PITKETHLY Amanda Jane

A thesis submitted in partial fulfilment of the requirements  
for the degree of  
Doctor of Philosophy

Principal Supervisor: Prof. LAU Wing Chung, Patrick

HONG KONG BAPTIST UNIVERSITY

June 2015

## DECLARATION

I hereby declare that this thesis is entirely my own work which has been conducted after registration for the degree of Doctor of Philosophy at Hong Kong Baptist University, and has not been previously included in a thesis or a dissertation submitted as an award for a degree at this or any other University for a degree, diploma or other qualifications. I agree that the library may lend or copy this dissertation on request.

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## ABSTRACT

**Introduction** Physical activity (PA) engagement is highly beneficial for adolescents and although interventions are shown to be effective, participants often return to former PA levels once the intervention is removed. Adolescents may lack explicit training in psychological and behaviour change skills required to sustain PA behaviour changes, such as self-regulation. SR is a key process in psychological functioning and its failure can result in impulse control problems, such as a tendency not to engage in behaviours that require a delay of gratification such as physical activity.

**Purpose** Self-regulated learning (SRL) is an approach that focusses on how to make improvements through a systematic method of learning how to adapt to ever changing environments, i.e. through planning, self-monitoring, effort, self-efficacy, self-evaluation and reflection. Study 1 examined the effectiveness of studies examining SRL variables in a PA context. Study 2 translated and validated an English language SRL questionnaire to measure SRL in a Chinese adolescent population. Study 3 assessed the contribution of SRL variables to PA in both Chinese and Scottish adolescent samples. In preparation for study 5, study 4 qualitatively assessed Chinese students' motivation for and engagement in PA. Finally, study 5 taught SRL skills in a PA context with the aim of positively impacting on adolescent PA levels.

**Methods and Results** In study 1 a systematic review of the literature was conducted. The majority of reviewed studies demonstrated a positive effect of SRL variables on PA. The review highlighted a lack of research conducted using SRL theory. Study 2 translated and validated a Chinese version of an SRL questionnaire with 315 (and cross-validated with 480) Hong Kong Chinese adolescents. The short SRL-SRS-C was found to be a sufficiently reliable instrument to measure SRL in a Hong Kong Chinese adolescent population. In study 3, a cross-sectional study of 480 Hong Kong and 411 Scottish adolescents was conducted to assess the relationship SRL and physical activity. Results revealed that adolescents from Hong Kong and Scotland do not engage in sufficient PA to achieve the potential health benefits that PA can provide. Significantly more use of self-monitoring, self-evaluation and reflection was associated with significantly higher LTPA in Scottish adolescents. In both samples, SRL was weakly but significantly associated with higher PA, and self-efficacy and reflection played significant roles this SRL-PA relationship. Study 4 conducted two qualitative focus group interviews and found that most Chinese adolescents only engaged in PA during limited physical education classes. Most students were knowledgeable of the health benefits of PA, however, academic pressures and the effort required to overcome PA barriers was too great. Students propose that walking more and felt that novel ways to encourage PA, such as through WhatsApp, were worthwhile. Finally, study 4 used a quasi-experimental design with three groups (total  $n = 98$ ) Hong Kong Chinese secondary school students. Peers modelled SRL skills and the learning was prompted either face-to-face or through Whatsapp. Meaningful, but not significant, mean value increases in PA and SRL were found. SRL was weakly but positive and significantly associated with PA, and reflection emerged as the key SRL component in the SRL-PA relationship.

**Conclusions** SRL and PA are weak, but positive and significantly associated. Importantly, reflection has emerged as a significant predictor of adolescent PA. Adolescents with better SRL and reflective skills may be more aware of their strengths and weaknesses and able to translate this knowledge into future action. Considering that SRL skills are amenable to training, further experimental research should focus on teaching SRL strategies, particularly reflection, and assessing their impact on PA. SRL research in the adolescent PA area is promising but is at an early stage. Therefore, further research is recommended before strong conclusions can be made.

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## LIST OF SYMBOLS

$P$  Probability value

$F$  Fisher's F ratio

$n$  Number of participants

$M$  Mean value

$R$  The  $r$  value is the Correlation Coefficient

$B$  Beta coefficient value

$\Delta R^2$  The change in the squared coefficient value

$U$  Mann-Whitney-U test coefficient

$CI$  Confidence interval

Partial  $\eta^2$  Partial eta squared

## LIST OF ABBREVIATIONS

- LTPA Leisure-time physical activity
- PA Physical activity
- SCT Social cognitive theory
- SR Self-regulation
- SRL Self-regulate learning / self-regulation of learning
- WHO World Health Organisation
- HMR Hierarchical regression model
- V Pillai's trace test statistic

## CHAPTER 1 – INTRODUCTION

### Background

#### Inactivity and Ill Health

It is widely accepted that physical activity (PA) is necessary for optimal physical and mental health. Physical *inactivity*, however, has been identified as the fourth leading risk factor for global mortality causing an estimated 3.2 million deaths globally (World Health Organisation [WHO], 2013). The current global recommendations for 5 – 17 year olds are at least 60 minutes of moderate to vigorous intensity PA per day (WHO, 2010). However, PA levels of children and adolescents (5 – 17) are insufficient (van Sluijs, McMinn, Griffin, 2008; Kahn, Huang, Gillman et al., 2008; Hallal et al., 2012), with less than 50% of children and adolescents in developed countries meeting the global PA recommendations (WHO, 2010). Low levels of PA in Hong Kong (Hui, 2004) and mainland China (Tudor-Locke, Ainsworth, Adair, Du & Popkin, 2003; Parizkova, Chin, Chia & Yang, 2007; Ha, Abbott, Macdonald & Pang, 2009) are also a public health concern. Only 57.4% of 13 – 19 year old Hong Kong Chinese adolescents engage in 30 minutes of moderate to vigorous activity three or more days a week (Department of Health, Hong Kong SAR, 2010).

Results from a 10 year longitudinal study (Kjønniksen, Torsheim & Wold, 2008) show a significant decline in PA participation from 15 – 23 years of age. Unfortunately, low levels of PA are known to persist into adulthood (Telama., 2005; van Mechelen, Twisk, Post, Snel & Kemper, 2000) along with the persistence of physical, psychological and societal problems. Consequently, adolescence is a critical period in which involvement in PA is associated with its continuation into adulthood (Malina, 2001). Inactive adolescents are at high risk of developing into inactive adults. Therefore, it is imperative to promote the persistence of active lifestyles during this crucial stage (Reynolds et al., 2007).

Although it is true that adolescents' diet and exercise may still, to some extent, be determined by family eating patterns and other environmental factors, they spend a decreasing amount of time with their parents (Larson & Verma, 1999). Young people at this stage begin to have more control over their food choices in school canteens and in their choice of social activities with friends after school. Ultimately, they have more freedom and ability to decide whether or not to engage in PA. For these reasons it is pertinent to examine self-control and self-regulation concepts in relation to adolescents' health (Wills et al., 2007).

In terms of the particular aspect of PA, leisure-time physical activity (LTPA) is considered one of the most important dimensions of PA (Tudor-Locke, Ainsworth & Popkin, 2001) and accounts for 55% to 65% of PA time for children (Katzmarzyk & Malin, 1998). Sallis and Owen (1999) suggested the promotion of LTPA interventions to encourage the uptake of lifelong exercise. Increasingly researchers are recognising the importance of the out-of school PA context for children and adolescents (Sallis, Prochaska & Taylor, 2000; Hertz & Petosa, 2006; Matthews & Moran, 2011). The WHO guidelines suggest that increased PA behaviours can be achieved by games, sport and transportation, these can be planned or happen as part of a daily routine. The 60 minute recommendation can also be made more achievable through the accumulation of shorter bouts of exercise over the day.

### **Early PA Interventions**

Reviews of intervention studies that have focused on improving PA and / or dietary behaviours, have found positive and clinically meaningful results in terms of obesity prevention (Summerbell et al., 2005; Brown & Summerbell, 2009), and treatment of child and adolescent obesity (Oude Luttikhuis et al., 2009). However, the effects associated with these interventions are small (Baranowski & Jago, 2005; Brown & Summerbell, 2009; van Stralen et al., 2011). In addition, early school-based interventions that have focused on children and adolescent PA behaviours mostly had no impact on out-of-school PA (Luepker,

Perry & McKinlay, 1996; McKenzi, Nader & Strikmiller, 1996; Sallis, McKenzie & Alcaraz et al., 1997; Parcel, Simmons-Morton & O'Hara et al., 1989).

Furthermore, it seems that education alone is not enough to promote youth health (Bandura, 2004). A meta-analysis conducted by van Sluijs, McMinn and Griffin (2007) found no demonstrable effect among 17 adolescent education type interventions. Of the 24 adolescent trials in this review ( $n = 43027$ ), 13 studies achieved a statistically significant effect on PA. Six of these studies evaluated multicomponent (combination of education and environmental or policy based interventions), school-based interventions, three of which demonstrated statistical significance. Based on a meta-analysis of adolescent smoking prevention programmes, behavioural effect sizes were larger for programmes which targeted the crucial components of a self-mastery model. These components will have the effect of preventing or reducing detrimental health behaviours, such as social reinforcement (Bruvold, 1993). It is suggested that the most effective programmes to reduce or prevent detrimental health behaviours, are those that are intensive and comprehensive (Connel, Turner & Mason, 1985) in terms of being inclusive of the external effects of the family and community (Kelder, Perry & Klepp, 1992).

School-based, multicomponent interventions have been the most consistent and promising strategies. A recent meta-analyses of 69 after-school programmes designed to enhance social and emotional learning skills (self-control, self-efficacy, problem solving, conflict resolution, leadership skills, and responsible decision-making) in both children and adolescents (5 – 18; Durlak, Weissberg & Pachan, 2010), found that compared to the control participants, the treatment group demonstrated a number of positive outcomes such as, an increase in self-perception, social behaviours, and academic achievement outcomes. Bandura (2004) suggested that it is necessary to equip individuals with the relevant psychological skills and efficacy beliefs, to help them manage the daily multitude of emotional and social pressures, and to manage their environments and social relationships. In order to understand

the potential impact of interventions, it is important to determine which factors are associated with PA participation. Such factors or correlates could also be examined as mediators and moderators within a mediating variable framework as outlined by Baronowski, Anderson and Carmack (1998).

As such, research has turned its attention to the examination of psychological correlates of PA behaviour, particularly modifiable correlates which can be targeted through intervention (Biddle & Fuchs, 2009). Social-cognitive variables come under the heading 'psychological correlates of PA' (Matthews & Moran, 2011). From a social-cognitive perspective, a reciprocal relationship exists between the individual, the environment and behaviour, with behaviour being the result of the interaction of these three elements (Bandura, 1982). Social-cognitive variables such as self-efficacy and self-regulation are known to influence self-directed behaviour change in a variety of health behaviours, including PA (Bandura, 2004).

## **Theoretical Framework**

### **Self-regulation - perspectives and definitions**

*“All human behaviour is the result of an inherently organised internal guidance system, and the mechanism at the core of human behaviour is a system of self-regulation”* (Carver & Scheier, 1982).

In general, self-regulation involves processes that enable individuals to exert control over their thoughts, feelings and actions (Vohs & Baumeister, 2004) and adapt to their social and physical environments. For these reasons self-regulation is a key process in psychological functioning (Baumeister, Scmeichel & Vohs, 2003; Scmeichel & Baumeister, 2004). Self-regulation involves the initiation and maintenance of behavioural change, as well as the inhibition of unwanted desires and the capacity to deal appropriately with situational demands (Heatherton, 2011); it is at the heart of causal processes (Bandura, 1991). SR is a



complex, multi-level, time-dependent process which can be understood from a variety of psychological perspectives, for example, phenomenological, operant, information processing, volitional, Vygotskian and cognitive constructivist (Zimmerman & Schunk, 2001; Crews, Lochbaum & Karoly, 2001; Bandura, 2004). With a variety of perspectives has come a diversity of definitions, however, despite this diversity, a common ground exists among self-regulation theorists. *'Overall definitions tend to embody the basic ingredients of goal-setting, steering processes and strategies, feedback and self-evaluation'* (Pintrich & Ziedner & 2000, p.751). The broad question that all self-regulation theorists address is how individuals can direct consciously stated intentions or goals towards the satisfactory achievement of these intentions or goals (Crews et al., 2001). The ability of self-regulation theories to explain motivation in addition to learning makes this approach very useful to educators who deal with many poorly motivated learners. For example, in a PA context, knowing PA is healthy but avoiding it results in eventual health issues. How might researchers and practitioners help adolescents with little or no interest in exercise get to the point where they enjoy and value it?

Baumeister and colleagues (2003) suggest that self-regulatory failure is at the root of most personal and social problems. Although self-regulation alone is not the whole solution, if individuals were able to control impulses more effectively, many problems that society faces could be prevented. Many such societal problems present themselves in the difficult life-phase of adolescence and if left-unchecked can become major concerns. Poor self-regulation is known to contribute to underachievement at school, susceptibility to eating disorders (over or under eating), sexual problems (unwanted pregnancies, sexually transmitted diseases) and addictions (smoking, alcohol, drugs, gambling). Once self-regulatory failure is established, people are less likely or willing to persist in the face of failure, or make the right choices, set and reach goals, or sustain effort over a period of time. Self-regulation is required to override the impulse to seek immediate gratification and to

delay rewards. In the context of adolescent PA, many adolescents consider it to be uncomfortable and even painful, with undesirable consequences such as sweating (often cited by girls for not participating). Consequently, considerable effort and self-control is required to start and subsequently maintain an active lifestyle (Baumeister et al., 2003). Baumeister et al. (2003) explain self-regulatory failure as an issue of impulse control, part of the executive function of the human brain. Executive functions allow individuals to regulate their thoughts, emotions and behaviours, thus the ability to self-regulate or self-control. Executive functioning deficits have been proposed as underlying deficits in impulse control. There is evidence that weight-gain results, in part, from an inability to resist temptation and inhibit automatic responses to overeating and avoiding discomfort (i.e. physical activity) (Smith, Hay, Campbell & Troller, 2011).

### **Self-Regulation – A Social Cognitive Perspective**

According to the social cognitive view, to capture the complexity of human self-regulation an executive control system is said to include a) predictive anticipatory control of the expenditure of effort, b) affective and evaluative reactions to behaviour which are based on a value system, c) self-appraisal of personal efficacy for goal achievement, and d) self-reflective metacognitive activity which concerns the accuracy and efficiency of efficacy appraisals and also the acceptability of the level of the set standard (Bandura, 1991). Studies have demonstrated that having a clear theoretical basis predicted the efficacy of interventions (Dombroski, Sniehotta, Avenell, Johnston, MacLennan & Araújo-Soares, 2012; Taylor, Conner & Lawton, 2012). A sound theoretical foundation will help to specify constructs, relationships and the scientific explanations of the change process, and can systematically link behaviour change to constructs, offering an explanation of how, when and why any behaviour change occurs (Michie & Johnston, 2012).

With regard to health and exercise behaviours the social cognitive theory is most frequently cited (Crew et al., 2001) and capable of delivering meaningful interventions that

can cause lasting behaviour change. According to Bandura (1997, 2004), various other theories and models of health behaviour are predominantly concerned with *predicting* health behaviours. These include the Health Belief Model (Rosenstock, 1966; Janz & Becker, 1984), Theory of Reasoned Action (Fishbein & Ajzen, 1975), Theory of Planned Behaviour (Ajzen, 1985), and the Protection Motivation Theory (Rogers, 1975). In terms of health behaviour models, the social cognitive theory offers both *predictors* of health habits and *principles of how to inform, enable, guide and motivate* individuals to adopt health-promoting habits and minimise unhealthy habits (Crew et al., 2001).

In general, all self-regulated learning theories assume that learners can a) personally improve their ability through metacognitive and motivational strategies, b) proactively choose, structure, and create advantageous learning environments, and c) can play a crucial role in choosing the form and amount of instruction they may need. All SRL theories aim to describe and also explain, how a learner can learn and achieve despite the more traditionally assessed limitations of mental ability, social environment, or quality of schooling, and additionally, why they might fail despite the advantages of mental ability, social environment and quality of schooling (Zimmerman, 2001). However, Zimmerman's approach (1986) is capable of meeting the necessary theoretical demands for meaningful behaviour change research (Boekarts, 1997), and as well as being important for performance improvements may also be important for improving PA (Toering et al., 2012). Zimmerman's self-regulated learning theory is a social-cognitive perspective and is used as the basis of the current research. This comprehensive model suggests that SRL processes are represented by three phases: forethought, performance and self-reflective and there are a number of strategies that relate to each phase (see figure 2.2, page 27). A particular strength of this model is that it is possible to explicitly examine these underlying strategies. The following six variables extracted from Zimmerman's three phase model: planning and self-efficacy (forethought phase), self-monitoring and effort (performance phase) and self-evaluation and reflection

(self-reflective phase; please see page 28 for a detailed explanation of all six variables in relation to the social-cognitive, SRL model).

### **Statement of the Problem**

It is clear that PA is important and beneficial for adolescents and overall, interventions are shown to be effective, but once the intervention is removed, participants often return to their former PA levels. This may be due to the fact that adolescents have not been explicitly trained with the psychological and behaviour change skills required to sustain these behaviour changes. Adolescents do not anticipate and recognise health risk situations (Steptoe & Wardle, 2001; Johnson, Carey, Marsh, Levin & Scott-Sheldon, 2003). Further, although they have knowledge of the correct health behaviours and associated strategies, there is a gap between adolescents' knowledge of potential self-regulatory strategies and their ability to enact these strategies when they are required (Stok et al. 2012), and it is widely accepted that health-compromising behaviours such as physical inactivity and poor dietary habits are difficult to change. The importance of self-regulation in healthy psychological functioning has been highlighted and the potential for self-regulation of behaviour to help adolescents make healthier choices needs to be addressed.

It has been proposed that theory-based interventions may have more impact (Gould & Chung, 2004). SCT and self-regulation have been the most widely tested, but they are limited and often use self-regulation as an umbrella term, for example Winters et al., 2003. Additionally, novel interventions, such as using peer modelling and WhatsApp, may help to deliver such interventions more effectively and, importantly, may produce persistent PA effects for adolescents, but such studies have received limited attention in the literature. Thus, the following series of studies have been conducted to address these issues.

## **Purpose of the Research**

Generally, this thesis set out to examine the relationship between SRL and PA among adolescents. More specifically:

- To further the investigation of the association between adolescent SRL and PA (Umstatted et al., 2006; Mathew & Moran, 2011).
- To assess the generalisability of self-regulation among adolescents from Eastern and Western cultures.
- To develop the understanding of the nature of the psychological processes supporting the relationship between self-regulation and PA behaviours (Saelens, Gehrman & Sallis, 2000).
- Examine the SRL-PA relationship using a solid theory as a foundation.
- To investigate the use of a combination of self-regulatory mechanisms, rather than focussing on any single component.
- To stimulate knowledge as a result of this theoretically based series of studies that will enrich applied interventions and contribute to a solution for the problem of insufficient adolescent PA.

## **Significance of the Thesis**

It is well established that SRL (Zimmerman, 1986, 1989) has a role in the enhancement of development and learning in academic, sport and health settings. Self-regulatory variables (planning, self-monitoring, self-evaluation, reflection, effort and self-efficacy) are linked with directly observed proactive behaviours and communication about learning (i.e. optimised opportunities for learning included being aware of abilities and

inabilities, being more prepared and focused, taking more responsibility for their learning, and making fewer errors than their lower scoring counterparts; Toering et al., 2011). Such intentional self-regulatory strategies are crucial to PA promotion throughout life (Umstadt, Saunders, Wilcox, Valois & Dowda, 2006) and are linked to positive youth developmental outcomes in the development psychology domain (Gestsdottir & Lerner, 2008; Napolitano, Bowers, Gestsdottir & Chase, 2010).

A social-cognitive approach to examining the SRL-PA relationship will respect the importance of understanding the cognitions of adolescents within their social environments. More specifically, using Zimmerman's model in the current research makes it possible to examine the underlying strategies that adolescents use to negotiate their social worlds. Particularly, during adolescence which is a crucial stage where children become less dependent on family and are learning to live more independently. This is in small matters such as making their own choices about what to eat for lunch to how they spend their free time with friends. At this stage, it is vital that they be motivated to and develop good strategies for making healthy lifestyle choices.

Since children and young people do not naturally keep their goals in mind and evaluate progress, it is necessary to state goals explicitly and to teach individuals how to self-evaluate progress (Schunk, 2001). Goals and behaviour modification must be more than just intended they must be effectively implemented by motivated individuals (Golwitzer, 1999). Strategies are required for dealing effectively with getting started and persisting through pain, discomfort and boredom (Golwitzer, 1999; Salmon, Owen, Crawford, Bauman & Sallis, 2003). In the context of increasing PA levels in children, SR skills may be particularly important for modern children to learn and develop, in order to make proactive, healthier lifestyle choices as opposed to being reactive in an environment in which they are exposed to increased marketing of unhealthy food choices and attractive sedentary activities.

Pintrich (2000) suggested that a gap between theory and application is no longer valid, and that researchers should follow a user-inspired research model which involves two research goals being simultaneously pursued, one aimed at scientific understanding and the other at providing useful strategies to solve practical problems. The metacognitive, motivational and behavioural components of self-regulation (planning, self-monitoring, self-evaluation, reflection, effort and self-efficacy) are all 'trainable' skills that, after extended practice and feedback, promote self-directed behaviours. Therefore, examining the SRL-PA relationship among adolescents is considered a valuable and significant undertaking. In light of all the above reasons, the current research ideas were considered a worthy undertaking.

### **Research Questions**

Ultimately, the aim of the following series of studies is to contribute to the limited existing knowledge, and provide a greater understanding of how motivational, metacognitive and behavioural aspects of SRL are related to, and impact on, adolescent LTPA. The main questions are:

- 1) What do related studies in the field tell us about the effects of self-regulation or aspects of self-regulated behaviour on adolescents' PA?
- 2) Considering that the concept of SRL originated in the Western world, is SRL meaningful in a Chinese population?
- 3) Does this relationship differ from a similar Western adolescent population?
- 4) What is the contribution of each of the SRL components to PA?
- 5) In relation to SRL's trainability, what will be the effect on adolescent PA of training SRL skills?

## Definition of Terms

*Physical activity (PA)*: According to Caspersen et al. (1985), PA is defined as any bodily movement produced by skeletal muscles that require energy expenditure.

*Leisure-time physical activity (LTPA)*: Time spent in physical activities outside of the regular school day (i.e. 8 am to 3.30 pm Monday to Friday), for example, walking to or from school, team sports, dance or karate classes. LTPA does not include participation in activities during physical education classes.

*Self-regulation*: Involves processes that enable individuals to exert control over their thoughts feelings and actions (Vohs & Baumeister, 2004) and adapt to their social and physical environments “...refers to self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals” (Zimmerman, 2000b; p.14).

*Self-control*: According to Baumeister and Mick (2002), both self-regulation and self-control “refer to the self’s capacity to alter its own states and responses” (p. 670-671). These terms are often interchanged in the literature.

*Self-regulated Learning (SRL)*: “The extent to which individuals are metacognitively, motivationally and behaviourally proactive participants in their own learning and developmental processes” (Zimmerman 1986, p. 308).

*Physical activity behaviours*: According to Michie and Johnston (2012), in order for a behaviour to be modified, the intervention must be explicitly defined, therefore this study will focus on improving subjective LTPA behaviours, such as, brisk walking, taking the stairs, walking up and down moving escalators, cycling, swimming, playing active games with friends at the weekend (football, touch rugby, dance aerobics, jump-rope) (Godin Leisure-Time Questionnaire; Godin & Shephard, 1985).



*Physical inactivity*: Lack of activity or sedentary behaviours, which include sitting, reading, watching television, playing inactive video games, computer use, for the most part of waking hours.

### **Limitations**

All aspects of each phase of this research were limited to the practical application issues as defined by the authorities in each high school involved. Each granted permission within certain boundaries which related to participant numbers and the duration of time that was allocated to the researcher to spend with them. The cross-sectional findings are limited to Scottish and Hong Kong adolescents. The qualitative results are limited to a small number of opinions of Hong Kong Chinese adolescents. Because the age range of participants in the pilot intervention study, was specific and limited, they were Hong Kong Chinese, and were taught at in English-medium schools, generalising findings to other areas of China, other adolescent age ranges, and other Chinese adolescents without a good level of English language ability is limited.

This series of studies was limited to adolescents aged between 12 and 16 that were in high school education. In the cross-section and qualitative studies, the Hong Kong adolescents attended English-medium and Chinese schools. The Scottish sample was from one high school. In the intervention study, the study involves pupils from three first year high school classes from one English-medium high school. This pilot intervention study was also limited to three 90 minute training sessions and eight weeks of contact. In addition, all adolescents were apparently healthy without psychological or physical illness, or disability.

This series of studies is defined by the philosophical framework of the researcher, and by the methodology and variables that have been used to conduct each phase. The philosophical perspective that guides this research comes through the same guiding principle as the social cognitive theory i.e. an agentive perspective. This perspective suggests an

individual can exercise control over the nature and quality of their life. Personal agency operates within a broad network of sociocultural influences and as such, people are producers as well as products of social systems.

The selected methodologies restrict the findings to the questions raised and the statistical methods used to analyse the raw data. Self-regulation of learning, as opposed to other models of self-regulation, such as the cybernetic theory (Carver & Scheier, 1982), self-control strength theory (Baumeister & Heatherton, 1996), or stage model theories (Prochaska & Di Clemente, 1984), or coping self-regulation models (Levennthal, Meyer & Nerenz, 1980) delimit this series of studies. The same delimitation applies to the selected measured variables, as opposed to a variety of other self-regulation variables available, such as goal orientations, attention focussing, and causal attributions. Additionally, affect, an aspect of self-regulation, was not a focus in this series of studies. Thus these studies are restricted to the analysis of six selected components of SR, as they relate to LTPA. More specifically, this research examines students' self-reports of planning, self-monitoring, self-evaluating, and reflecting, as well as how self-efficacious they feel and how much effort they exert. Therefore, the focus is delimited to *how* these behaviours relate to PA, and not *why* they do so. In addition, the social aspect of the pilot intervention research is limited to those social aspects perceived by the participant to be important. For example, the social influence of the family is important but it was not measured in this study. All the variables have been extracted from Zimmerman's 3 phase model following a model adapted from Zimmermans' perspective for use with adolescent athletes (Toering et al., 2009; 2012).

### **Delimitations**

The assumptions include the fact that all adolescents participating did so willingly and were truthful in their responses at every stage. Participants in the pilot intervention study were taught via their peers how to engage with the eight week programme through their

logbooks, and given information and inspiration to engage in more PA. It is therefore assumed that all participants were willing to and thus complied with these requirements, as they had agreed to do. A further assumption is that the pilot intervention control group did not undergo any SRL training during the programme.

## Background of Self-Regulated Learning

### The social cognitive theory of self-regulation

The social cognitive theory, developed by Albert Bandura (1977), is a learning or knowledge acquisition theory founded on the idea that people learn by observation, and that the environment, behaviour and cognition are all influencing factors in a process of triadic, reciprocal determinism. Figure 1.1 below illustrates these interacting relationships.

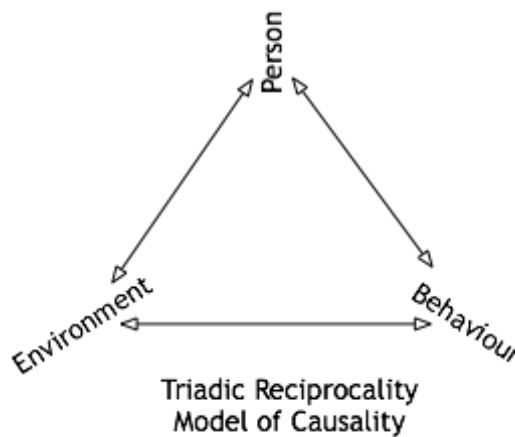


Figure 2.1. Bandura's Triadic reciprocal determinism.

Reciprocal interactions exist between behaviours, environmental variables, cognitions and other personal behaviours (Bandura, 1986). This is evident when one considers perceived self-efficacy, an individual's beliefs about their capabilities to perform specific behaviours at certain designated levels. These beliefs influence a variety of actions, such as choice of task, persistence, effort and achievement (Schunk, 1995). In turn, efficacy beliefs are modified, for example, as a student decides on a goal and chooses a task to work on, they will note their progress towards their set goal. Good progress will indicate that they are doing well, which will strengthen their self-efficacy for persisting towards the goal (Schunk, 2001).

Within the theory, the concept of agency assumes that individuals have self-beliefs that enable them to control their feelings, thoughts and actions as well as the capability of

making choices and acting on these choices (Bandura, 2001). Thus, agency both determines and is determined by the environment (Bandura, 2001). Social cognitive theory extends the idea of personal agency to collective agency, as people do not operate in a vacuum. There are three important aspects of social cognitive theory to support the promotion of psychosocial changes in health behaviours, and with respect to the present research are firstly, a sound theoretical model, which specifies the determinants of change and the mechanisms through which the effects are produced. Secondly, a translational and implementational model, that is able to innovatively operationalise the principles of the theory, focussing on a) specific content, b) the strategies that will produce the change, and c) how these strategies will be implemented. The third aspect is a diffusional model that focuses on functionally adaptive ways to ensure that the changes will be adopted more widely across varied societal settings, such as guidance and resources (Bandura, 2004).

According to the self-enhancement hypothesis, human nature tends towards the maximisation of positive feelings or effective mastery of challenging tasks (Deci & Ryan, 2002; Fox & Wilson, 2008). Perceived competence, expectations for success and personal agency can be enhanced by SRL (Bandura, 2001), which in turn may increase ability more effectively (Zimmerman, 2006). To help individuals truly change health behaviours, it is necessary to empower them by providing them with the self-management skills and accurate self-perceptions that they require to take control of their own health habits in challenging environments (Bandura, 2004). Ultimately, individuals need to self-regulate effectively. Importantly, self-regulation mediates the effects of most external influences and provides the basis for purposeful action (Bandura, 1986, 1991).

### **Self-regulated learning**

Learning is a change in behaviour brought about by intervening experiences (Schunk, 2001), and as such, *self-regulated learning* (Zimmerman, 1986) is a social cognitive approach which “...refers to self-generated thoughts, feelings, and actions that are planned

*and cyclically adapted to the attainment of personal goals” (Zimmerman, 2000b; p.14).*

Zimmerman’s model attempts to explain *how* individuals are able to make improvements through a *systematic method of learning how to adapt to ever changing environments* (Schunk, 2001).

SRL has attracted a great deal of interest among academic researchers and practicing educators due to the fact that learning the processes and skills involved in self-mastery of learning and development, is a worthy objective for students of all ages in all disciplines (Paris & Paris, 2001). It has been suggested that SRL may also be instrumental in enhancing levels of PA (Toering et al., 2012). Rooted in social-cognitive theory, SRL was developed through educational psychology research to answer the question of how learners can become masters of their own learning processes (Bandura, 1977, 1986; Zimmerman, 1989, 2000a). Therefore, from the social cognitive perspective, SRL is understood to be an interaction between personal, behavioural and environmental processes, such that cognitions are reciprocally determined by behavioural and environmental factors.

There are four basic assumptions that most SRL models have in common (Pintrich, 2004). First is the active, constructive assumption, which follows from a cognitive perspective where learners are seen as active participants in their learning process. Secondly, the potential for control is assumed, where the individual is potentially able to monitor, control and regulate their own cognition, motivation and behaviour, as well as some features of their environment. Thirdly, there is a goal, criterion or standard assumption, against which comparisons are made to be able to determine whether the learning process is effective or if changes are required. Fourthly, it is assumed that self-regulatory behaviours are mediators between personal and contextual characteristics and actual achievement or performance. With this assumption, it is not just the direct influence of culture, demographics, or personality on learning and achievement, or the contextual characteristics, but the individuals

own self-regulation of cognition, motivation and behaviour that mediate the relationships between the individual, the context and the outcome (Pintrich, 2004).

Therefore, better self-regulated learners demonstrate autonomy and control, using self-directed processes and self-beliefs to proactively acquire skills, such as planning and goal setting, as well as selecting and using appropriate strategies, such as monitoring, evaluating and reflecting, on effective or ineffective behaviours and outcomes rather than simply being reactive to the results of their own behaviours and to their environment (Zimmerman, 1990). For example, paying attention to instructions, processing information, rehearsing and relating new knowledge to previously learned knowledge, having the belief that one is capable of learning the task in question and creating productive environments to facilitate that learning (social and work related). It is important to note that metacognitive skills included in self-regulatory processes can be taught (Boekarts, 1997), which has been found to be the case for planning. In fact, teachers have been encouraged to teach metacognitive skills explicitly (Bransford, Brown & Cocking, 2000), due to the link between metacognitive activity and knowledge acquisition, post-training performance, and self-efficacy (Ford, Smith, Weissbein, Gully & Salas, 1998).

For the purpose of this thesis, self-regulation is expressed in accordance with Zimmerman's definition which is "*the extent to which individuals are metacognitively, motivationally and behaviourally proactive participants in their own learning and developmental processes*" (Zimmerman 1986, p. 308). The metacognitive component in the definition refers to the continuous cycle of planning, self-monitoring, evaluation, and reflection on the development process. The importance of metacognition in the process of learning dates back to Socrates questioning methods. Dewey (1933) suggested that we learn more from reflection than the actual experience, nonetheless in the last four decades, the term and research field of metacognition has emerged. Flavell (1976) defined metacognition as the knowledge about one's own cognitive processes or anything related to them. The

motivational component in SRL relates to the level of autonomy, self-efficacy and effort required during the performance development process. Finally, the behavioural component focuses on the ability of an individual to manage the social and physical environment to support personal development by interacting and communicating effectively within their social environment.

### **Self-regulation and superior performance**

The relationship between self-regulation and superior performance is rooted in academic achievement (Paris & Paris, 2001; Nota, Soresi & Zimmerman, 2004; Pintrich & De Groot, 1990; Zimmerman, Moylan, Hudesman, White & Flugman, 2011). Currently, this relationship is one of the most exciting areas of the contemporary sport and exercise sciences (Crews et al., 2001), and in the health and behaviour sciences (Bandura, 2005). In terms of health and well-being, self-regulation is also suggested to be a key factor in successful ageing. In later years, when life becomes less structured, people are likely to benefit from proactive, self-directed capabilities to set and pursue goals, but also to disengage from certain goals (Freund, Nikitin & Ritter, 2009).

Self-regulation has been found to be positively related to expert performance, superior skill level and improved behaviours in various domains, for example, sport (Kirschenbaum, Ordman, Tomarken & Holtzbauer, 1982; Anshel & Porter, 1996; Cleary & Zimmerman 2001; Kitsantas & Zimmerman, 2002; Toering, Elferink-Gemser, Jordet & Visscher, 2009; Jonker, Elferinck-Gemser & Visscher, 2010) and physical education (Ommundsen, 2003; Kolovelonis, Goudas & Dermitzaki, 2010; Kolovelonis, Goudas, Hassandra & Dermitzaki, 2012). Additionally, self-regulation is positively related to music performance (Nielsen, 2001), physical health and illness (Kitsantas & Zimmerman, 2000; Maes & Karoly, 2005), and weight management (Kitsantas, 2000; Teixeira, Mata, Williams, Gorin & Lemieux, 2012). Moreover, self-regulatory processing has been found to be more



predictive of successful performance than either technical knowledge or years of experience (Kitsantas & Zimmerman, 2002).

Jonker, Elferink-Gemser and Visscher (2009) used a 14 year longitudinal correlation design to determine that talented athletes were also academically high achievers and as such, they excelled in sports and academia due to their well-developed self-regulatory skills. Thus, better developed self-regulatory skills may result in students creating a more effective learning environment for themselves. This may ultimately result in an enhanced capacity for performance in elite athletes compared to their non-elite counterparts. Jonker et al. (2010) also found that elite youth soccer players were also high academic achievers, compared with typical students. The elite students in this study reported increased use of self-regulatory skills, in particular, self-monitoring, evaluation, reflection, and effort. As such, and echoing Jonker et al. (2009), relatively stronger self-regulatory skills reported by elites may be essential for performance at the highest levels of sport competition, as well as in academia.

### **The importance of reflection**

Reflection consistently emerges in the performance literature as the key component in self-regulated learning. Zimmerman (1986, 2000b) and Mezirow (1991) reasoned that as a result of frequent use of reflection, individuals are generally better able to understand themselves and what it takes to improve future performances based on their previous knowledge and experience. For example, Kitsantas and Zimmerman (2002) demonstrated that compared to non-experts and novices, expert volleyball players evaluated their performance more often and also attributed any failures to technique-oriented deficiencies more often. In doing so, they were able to self-correct their subsequent actions and were willing, more often than non-experts and novices, to adapt their behavior to change future actions. In the context of talent development, Jonker et al. (2010) reported that of six self-regulatory skills (planning, self-monitoring, self-evaluation, effort, self-efficacy and reflection, as measured by the Self-Regulated Learning-Self-Report Scale; SRL-SRS),

reflection discriminated the best among 12 to 16 year old youth international athletes (the best 1% in their age category) and nationals (the best 2.5% in their age category). In other words, junior internationals, irrespective of their sport, had higher scores on reflection (Jonker et al., 2010). In a follow-up study, Jonker et al. (2011) found that the use of reflection among 26 junior internationals and 26 junior nationals was associated with their attained senior competitive level 2.5 years later (during the age-related transition to a senior competitive level). These results show that regardless of junior competitive level, number of training hours, and years of sport experience, senior internationals reported using reflection more frequently 2.5 years earlier (before the transition) than their senior nationally competing peers. Moreover, athletes who progressed from junior national to senior international level had similar scores as their junior international peers who made a successful transition to senior international level. The junior internationals who did not progress but actually decreased in competitive level to senior national level, had similar reflection scores as their peers who did not make any advances in competitive level (they were nationals as juniors and remained nationals as seniors).

It seems therefore that there is some evidence to suggest that reflection, as an aspect of self-regulation, has predictive value for those who attained the highest competitive status in sport (Jonker et al., 2011). Research with athletes at such high levels is valuable in itself, especially considering that Jonker et al. (2011) were also able to track the athletes during their development, whilst having no knowledge about which of the athletes would become successful and which of them would not. In addition, Jonker et al. (2011) also found that athletes who were initially identified as less physically gifted (as defined by their junior national status), and managed to improve enough during their talent years consequently becoming senior internationals, reported using reflection comparatively more often than those who did not progress.

In a PA context, it may therefore be possible to identify those adolescents who are

high reflectors and ensure that they are placed in a suitable development track at school or in sports clubs. Nevertheless, reflective skills are ‘trainable’ and it is likely that those adolescents who do not naturally possess high levels of reflectiveness can learn to become more reflective, which would help them to improve their performance in any targeted domain (e.g. PA). As self-regulation has been identified as being important in PA and health contexts (Toering et al., 2012; Bandura, 2004; Teixeira et al., 2012) and reflection has been demonstrated to be of great importance in improved behaviours, it is considered necessary to explore this phenomenon among adolescents in a PA behaviour context.

### **Self-regulation Phase models**

It is important to specify the mechanisms that influence the self-regulation and performance or the behaviour change relationship (Crews et al., 2001; Matthews & Moran, 2011). Various models of SRL offer insight, such as Pintrich’s (2000, 2004) four phase model. In this model, phase one involves planning and goal setting, as well as the activation of various perceptions, knowledge of the context and the task, and also the self, in relation to the task. Phase two is concerned with a variety of metacognitive monitoring processes that represent different levels of awareness of the self in relation to the task and context. Phase three refers to efforts to control the different aspects of the self and the task or context. Phase four represents the variety of types of reactions and reflections on the self in relation to the task and context. All of these phases represent a general time-ordered sequence; however, it is important to note that there is not hierarchical or linear structure. As with most models of SRL, monitoring, control and reaction can occur dynamically and simultaneously as progress is made on the task. Goals and plans may be changed or updated according to the feedback from monitoring, control and reaction phases.

Similarly, Bandura’s (1986) social cognitive theory of self-regulation views self-regulation operating through a set of three psychological sub functions. Bandura and Simon (1977) posited that simply having the desire or the intention to produce any self-directed

change is not enough if individuals lack the ability to influence their own motivation and behaviours. These three sub-functions are self-monitoring, self-judgement and self-reactive.

More than simply “*a mechanical audit of one’s performance*” (Bandura, 1991; p. 250), self-monitoring provides important information required for setting appropriate goals and for the evaluation of the progress that is being made towards them. This affects personal competence and self-esteem, activating affective reactions (positive or negative) which, in turn, will influence self-perceptions when the behaviour occurs and is remembered at a later time. However, there are additional dynamic ways that paying close attention to thoughts and actions can contribute to desired, self-directed change. One way is through its self-diagnostic function where recurrent patterns in behaviour are observed and relevant environmental features are recognised. As a result of recognising these patterns, self-corrective measures can begin to take place (Bandura, 1991). These measures could be in the form of varying usual activities and noting the effects of the changes and experimenting with the methods and results. All this leads towards enhanced psychological functioning and well-being, as self-knowledge provides important information for self-regulatory control (Bandura, 1991).

Subsequently, through the awareness that paying close attention to performances develops, individuals are inclined to set progressive goals without encouragement from others. The self-evaluation that goal setting develops mobilises efforts towards the attainment of the particular goal. It should be noted that the knowledge acquired through self-monitoring can sometimes be disheartening if there is little or no progress towards the desired goal. A number of factors can affect the quality of self-monitoring, such as individual attributes, the specific behaviours, and the nature and type of self-monitoring, as well as the temporal proximity of self-monitoring. It is suggested that self-directed change is more likely to happen if the self-monitoring is of present, not distal effects, as the continuity of information in the present moment can enable self-influence to have an effect on strategy use and behaviour during goal attainment progress (Bandura, 1986). Furthermore, intermittent

self-monitoring may produce less effective self-regulation than regular attention to progress. Self-monitoring is less effective when there is any ambiguity about goal direction or progress (Bandura, 1991). Having the desire to change and the value that is placed on the behaviour will affect the evaluative reactions elicited by self-monitoring. Whether the individual is primarily focused on success or failure, will influence the outcome as self-monitoring successes will help to increase the required behaviour, but focussing on the failures will inhibit progress (Gottman & McFall, 1972). However, attending to failures can create success by suggesting areas for correction. It can be seen that self-monitoring alone can be very effective for behaviour that is relatively easy to change, but only transient effects on behaviours that are highly resistant to change. Perhaps it may be easier for people with a stronger sense of identity and who are strongly oriented towards a particular goal and therefore may be more self-regulated than those with have a lower commitment to personal standards or goal outcomes (Bandura, 1991). In physical activity research prompting self-monitoring has been identified as one of the most important behaviour change techniques which not only positively effects self-efficacy for physical activity, but also is associated with positive changes in physical activity (Olander, Fletcher, Williams, Aitkinson, Turner & French, 2013).

Following on from self-observations, table 1.1 shows that self-reactions emerge through judgmental processes. Certain factors affect how self-directed an individual will be, such as personal standards, reference points, the value they place on the behaviour, and the perception of how much of the behaviour change stems from their own abilities and efforts. The development of personal standards will come through three principle modes of influence (Bandura, 1986). Firstly, by how other people have reacted to their behaviour that may result in them judging themselves according to the standards reflected by other social sanctions. Secondly, judgements are made through direct teaching along with the evaluative reactions of others towards behaviour. Thirdly, people do not simply absorb standards from the social

influences around them, but they do so through reflective processing of multiple sources of both direct and vicarious influences. This results in a complicated self-construction of self-set standards by which to judge behaviour and progress towards goals.

Regulation of behaviour is easier when there is an objective indication of accuracy with which to compare. In certain situations there is less ambiguity due to standard norms, for example, with the ability to swim, but often, such as in academic situations, individuals will have to compare themselves to the rest of the group to make an appraisal of their progress (for example, a student with a score of 115 and wants to get into the top 10% of a group). Self-comparisons mean that past achievements affect how well an individual will appraise their achievements and the goals they will continue to set. Generally, people attempt to surpass their past achievement, as once a certain level is achieved it is no longer satisfying, so continued striving is required (Bandura, 1989). In addition, there is a collective comparison that operates in social systems organised around a collective principle. Here comparisons are still made with the self and others, although self-appraisal is based on the person's contribution to the group achievement and the standard adopted by the group. Finally, to self-regulate well individuals have to value the activity. They must also feel that they have achieved a certain goal as a result of their own efforts and abilities to take more pride in their achievements that will drive further progressive action. For example, self-reactions are critical when people feel a poor performance was their responsibility, but not where they believe they did not have the ability, or external circumstances outside their control (Weiner, 1986).

Self-reactive processes serve as the mechanism by which the judgements regulate present and future action (Bandura, 1991). Self-regulatory control is achieved by creating incentives for behaviour according to an internal standard. Generally, people pursue actions that produce positive self-reactions and avoid the opposite. Self-incentives may be tangible outcomes or self-reactive reactions and influence behaviour through their motivational

function (Bandura, 1991). Satisfaction (or dissatisfaction) with outcomes provide incentive to act in ways that increase the likelihood of successful goal attainment. Tangible incentives include breaks, free time, or other treats to mobilise resources to do things that may otherwise be procrastinated or avoided. Individuals who reward their goal attainments achieve more than those who perform the same tasks without self-incentives or are rewarded non-contingently (Bandura, 1986). In fact, self-incentives have been found to differentiate people who succeed in the regulation of motivation and behaviour to achieve what they want from those who are unsuccessful (Zimmerman, 1989).

Self-evaluation directs and motivates behaviour, and self-incentives are used to help in the behaviours that reflect on personal competence. By making self-satisfaction dependent on certain performances that match a personal index of merit, people can dedicate the effort required to achieve valuable goals (Bandura & Jourden, 1991).

Self-efficacy is another major mechanism of self-directed behaviour that exerts a strong effect on thought, affect, motivation and action, playing a central role in personal agency (Bandura, 1986, 1898). Self-efficacy beliefs exert this influence as they affect the choices people make, their aspirations, how much effort they will make, for how long they will persevere in the face of problems, whether their thoughts help or hinder, the amount of stress they experience, and their vulnerability to depression (Bandura, 1991). Self-efficacy beliefs depend on how the other sub functions of self-regulation operate. For example, self-efficacy affects cognitive and self-monitoring processing of all aspects of behaviours and outcomes and influences the perceptions of successes and failures. In this situation, highly efficacious people attribute their failures to insufficient effort as opposed to inefficacious people who will see their failures as stemming from low ability (Bandura, 1993). Self-efficacy also affects the goal-setting function of self-regulation, as the more capable people will set higher and more challenging goals to attempt and will persist in achieving them (Bandura, 1991; Locke & Latham, 1990). Furthermore, self-efficacy affects the evaluation of

activities as it is known that intrinsic interest is predicted by perceived self-efficacy than by actual ability (Bandura, 1993).

Table 2.1

*The structure of the system of self-regulation of motivation and action through internal standards and self-reactive influences.*

Self- Observation	Judgement Process	Self-Reaction
Performance Dimensions Quality Productivity Originality Sociability Morality Deviancy	Personal Standards Level Explicitness Proximity Generality	Evaluative Self-Reactions Positive Negative
Quality of Monitoring Informativeness Regularity Proximity Accuracy	Referential Performances Standard Norms Social Comparison Self-Comparison Collective Comparison Valuation of Activity Valued Neutral Devalued Performance Detriments Personal External	Tangible Self-Reactions Rewarding Punishing No Self-Reaction

### Zimmerman's three phase SRL model and the six self-regulatory components

The current research focuses on the comprehensive social-cognitive perspective model of SRL taken from Zimmerman's model (2000b), which suggests that SRL processes are represented by three phases (see figure 2.2). There are a number of strategies that relate to each phase and a particular strength of this model is that it is possible to examine these underlying strategies explicitly.



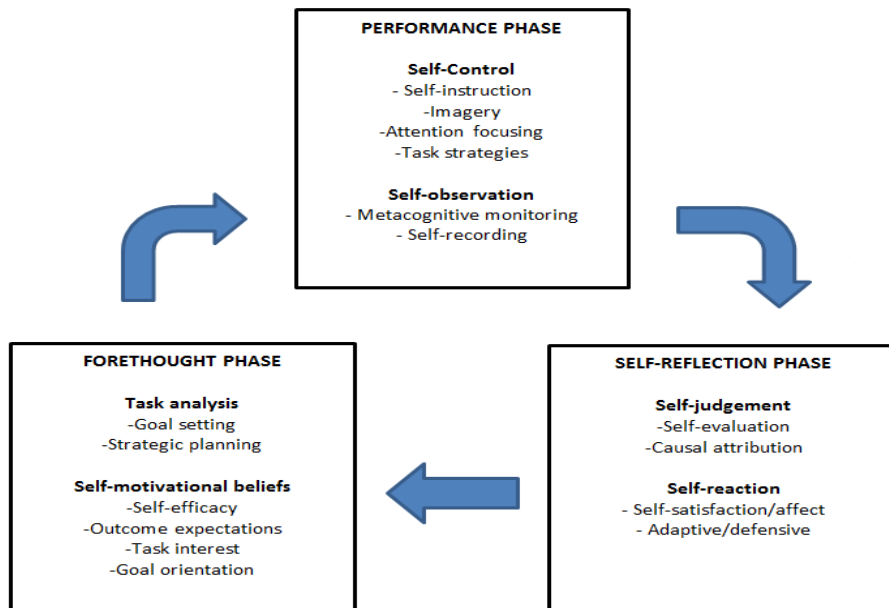


Figure 2.2. Phases and sub processes of self-regulation (Zimmerman, 2000).

As figure 2.2 shows, there are key processes during self-regulation from the social cognitive perspective. Particularly important in the forethought phase is strategic planning, (including goal setting) and social modelling. During the performance phase, particular attention needs to be paid to social comparisons, attributional feedback, strategy instruction and self-verbalisation. The self-reflective key processes are progress feedback and self-evaluation, self-monitoring and reward contingencies (Schunk, 2001).

*Self-efficacy* is a motivational component which refers to judgements of competency to perform a task, and is a key mechanism in social cognitive theory which has a profound effect on task choice, effort, sustained involvement and subsequent behavioural success (Schunk, 2003). Self-efficacy beliefs and self-regulatory processes are highly predictive of personal effectiveness (Feltz, 1992). For example, athletes who report higher self-efficacy beliefs are also more likely to set challenging goals and devise strategies that will help them accomplish these goals (Kane, Marks, Zaccaro & Blair, 1996). In recent behaviour modification literature, it is well documented that self-efficacy is crucial to enable the

positive effects of PA interventions among adolescents (Dishman, Motl, Saunders, Felton, Ward, Dowda & Pate, 2004; Lubans, Foster & Biddle, 2008). Self-efficacy beliefs are positively influenced by the use of positive self-talk and imagery (as with effort).

*Planning* and forethought activities can include setting specific targets or cognitive goals, stimulating prior knowledge and activating any metacognitive knowledge that the students may have about themselves (Pintrich, 2000). Humans are capable of intentionally changing their behaviour. Fishbein and Ajzen's theory of reasoned action and its more recent extension, the theory of planned behaviour (TPB; Ajzen, 1991), are motivational models where intention to perform a behaviour is the most important factor. However, it has been found that merely having the intention to change is insufficient (Sniehotta, 2009a). As Baumeister, Heatherton and Tice (1994) suggest beliefs are insufficient to overcome behavioural inertia due to the fact that they are only passive evaluations of behaviour.

The planning stage involves the consideration of how to approach a task in advance of action and includes specific strategies such as goal setting. Goal setting is thought to be a critical component of behaviour change and is often associated with self-regulatory skills, especially personal control from the social cognitive perspective (Bandura, 1986; Baranowski et al., 2002). In general, a personal improvement goal orientation in life is connected with adaptive self-regulatory strategies, such as commitment to change and the ability to persevere through difficult times, self-monitoring, self-rewards and self-instruction, planning and task-related strategies, as well as with the positive affect and high self-efficacy beliefs that determine adults and adolescent involvement in exercise (Papaioannou et al., 2009).

Goals are able to regulate behavioural performance through four mechanisms: 1) Goals direct attention and activity towards actions relevant to the achievement of a desired goal (Locke, Shaw, Saari & Latham, 1981). 2) Goals can mobilise personal and social resources that are required to achieve the goal. 3) When there are no time constraints, goals

affect persistence (i.e. directed effort over time) (Locke & Latham, 1994) and 4) guide self-regulatory skills (e.g. problem solving), avoiding distractions (Bandura & Simon, 1977; Gollwitzer, 1999; Locke et al., 1981). Goal characteristics also have an effect on the outcome, for example, specific, proximal (Bandura & Schunk, 1981), appropriate (Maibach & Cotton, 1995) goals framed in terms of positive outcomes (Higgins, 1997) are associated with successful goal achievement. Lan (1996) found that students' use of planning and task strategies (seeking information, rehearsal and memorisation, seeking help, reviewing before and after) was significantly correlated with final course grades. Ultimately, properly established goals and plans direct attention towards desired outcomes and motivates people to search for effective strategies (Roberts, 1992; Zimmerman & Kitsantas, 1996).

Goal setting is a common feature in youth dietary behaviour change interventions (for example, Baranowski et al., 2000) A review of dietary intervention studies revealed that use of the four step goal setting process was needed for positive results (Cullen, Baranowski & Smith, 2001). As a behaviour change procedure, effective planning and goal setting behaviour has recently been refined to consist of two phases, goal intentions and implementation intentions (Gollwitzer, 1999). These phases are separate but connected, goal intentions are a statement of what is intended ('My goal is to x') (Brandstätter, Lengfelder & Gollwitzer, 2001), whereas implementation intentions are a statement of how (e.g. when/where/in what way) the goal will be achieved ('If y happens, I will z') (Gollwitzer, 1999), often referred to as 'if-then' planning. The most important feature of implementation intentions is that an opportunity is provided, in advance rather than during the process, to decide how to meet one's goal. All potential situations can be examined for positive and negative outcomes and the situations most likely to result in goal attainment can be chosen. This creates stronger commitment to responding in the most appropriate way in pre-identified situations (Brandstatter et al., 2001; Gollwitzer, 1999). Instead of relying on conscious thought, environmental cues are highlighted and trigger goal-directed responses.

This has the benefit of automating behaviour, particularly in times of high cognitive load (Brandstatter et al., 2001), which in turn makes it more likely that the goal will be achieved (Bargh, Gollwitzer, Lee-Chai, Barndollar & Trotschel, 2001). Strong implementation intentions linking cues with planned responses can even be effective in overcoming habitual behaviour patterns (Gollwitzer, 1999). For implementation intentions to be effective, commitment to the two phases, goal intentions and implementation intentions, are crucial.

In a call to strengthen the gap between planning and actual behavioural outcome, the Sniehotta (2009) review recommended integrating planning processes within learning theory and self-regulation theory. Sniehotta (2009a) suggests that any theory that excludes effort and self-regulation behaviours (*in-situ*) will fall short of explaining successful volitional behaviour change.

*Effort* is a motivational component that has distinguished better performers from those not as good (Toering et al., 2009; Jonker et al., 2010) that will be enhanced through the cyclical self-regulatory processing. Effort is commonly accepted across existing conceptual models of self-regulation that goal directed movement across ever changing and challenging situations will not occur automatically or without conscious effort (Bandura, 1986). Controlling one's motivation and affect, sometimes referred to as volitional control (Boekarts, 1993; Corno, 1993), will have an effect on the amount of effort individuals are willing to exert on a goal, and some form of regulation of this is possible through incorporating awareness of goal orientation (reason for the task), self-efficacy (see below), and personal interest in the task. Learning suitable strategies, such as mental imagery and positive self-talk, can enhance an individual's choice of coping strategies that can help them to deal with fear or anxieties that may have an effect on the amount of effort available for the task. The amount of effort an individual is capable of exerting has been found to be an expendable resource (Baumeister & Heatherton, 1996). More specifically, after exerting

effort in self-regulatory control for a particular task, individuals are vulnerable to self-regulation failure at further attempts to control even unrelated behaviour.

*Self-monitoring* is needed to control and regulate behaviours towards certain goals and activities to adapt and change cognitions according to any discrepancy between a goal and the current progress towards that goal. Effective behaviour development will result from process and progress checking to relate actions to planned goals (Chen & Singer, 1992). In an early study (Sagotsky, Patterson & Lepper, 1978) it was found that for goal setting to be effective in improving performance behaviours, students required initial training in how to set challenging and attainable goals. In this study, fifth and sixth grade students conducted periodic monitoring of their work and recorded whether or not the work they were doing was appropriate, students in another group set daily performance goals, and students in a third group received self-monitoring and goal-setting training. The important finding in this study was that self-monitoring significantly increased student's time on task and on achievement, the goal setting condition alone had minimal effects (Schunk, 2001; p. 140).

In another early study, Lan (1996) examined three groups of statistics students, one received self-monitoring training, one referred to instructor-monitoring (keeping track of instructor's coverage) and a no-treatment control group. It was demonstrated that students who self-monitored had significantly higher course grades than the instructor training group. The self-monitoring group also reported greater use of planning, self-evaluation, environmental structuring, rehearsal and memorisation, reviewing as preparation, and reviewing past tests. More recently a review (Abraham, Michie, Whittington & McAteer, 2008) which looked at self-regulation for healthy eating strategies found that out of 26 SR strategies, self-monitoring was the most effective for the improvement of eating behaviour, and improved the efficacy of interventions if combined with other strategies. In related research with adults, adherence to self-monitoring is known to be significantly associated with weight loss. A review of the literature suggested that physical activity could be

increased by the habitual recording of minutes engaged in PA (Burke, Wang & Sevic, 2011).

*Self-evaluation* is a key metacognitive aspect of SRL necessary for learning, development and improved performance and other behaviours, through its ability to provide evidence that an individual is making progress (or not) towards their goals. The process of self-evaluating plans is crucial for developing strong self-efficacy, which in turn operates on behaviours through the mediating effects of planning, self-monitoring, self-evaluation and reflection (Bandura, 1989; Zimmerman, 2002). Progress feedback is essential. Self-evaluations or reactions to cognitive judgements, attributions and to progress, all affect self-efficacy and motivation for goal-directed behaviour (Schunk, 2003). Children can easily over or underestimate their own capabilities if goals are not explicit. It is therefore easy to misjudge progress and to subsequently develop incorrect strategies. Since children and young people do not naturally keep their goals in mind and evaluate progress, it is necessary to state goals explicitly and to teach individuals how to self-evaluate progress (Schunk, 2001). Lan (1996) found that student's use of self-evaluation was significantly correlated with final course grades. It is important that evaluation be realistic in terms of errors (attributions). For example, elite golfers attribute performance dips to controllable factors such as concentration, tenseness, poor imagination and feel (McAffrey & Orlick, 1989).

*Reflection* refers to adaptive or defensive inferences. Reflecting on progress helps the learner to comprehend knowledge and skills that have been acquired and to apply these to various situations (Peltier, Hay & Drago, 2006). Reflection is an individual's ability to apply previous experience to improve subsequent performance in an effective, goal-directed way (Mezirow, 1991; Peltier, Hay & Drago, 2006; Zimmerman, 2000b). From an educational perspective, reflection facilitates the problem solving process that results in effective learning (Dewey, 1933). According to Zimmerman's model (1986, 2000b), reflective learners (or developers in any context) who want to improve self-observed performance

against their current performance, previous performance or performance of other people (evaluation), will relate the reasons for success and failures to their self-observed performance (causal attributions), as during reflection they will either feel satisfied or dissatisfied with their standard or performance (self-satisfaction) and adapt their decisions and behaviour as required so that they can plan new or improved strategies for future improvement (adaptive inferences).

Mezirow (1991) considered reflection as an important characteristic of metacognitive reasoning affecting subsequent learning experiences. Reflective people, according to Mezirow (1991), are aware of their ability to reason and why they need to do it. These people are also conscious of prior learning experiences and are quite willing to challenge conventional meaning and patterns of behaviour in order to solve problems more effectively. Reflection enables an understanding of one's self and how one learns. Zimmerman (1986, 2000) placed reflection as the last phase in his SRL theory, where it is considered to be the metacognitive aspect that refers to the awareness of and knowledge about one's thinking and learning. Learners can reflect on the result or the standard or the goal, and learner differences here are related to self-reflective sub-processes such as self-evaluation, causal attributions, self-satisfaction and adaptive inferences (see figure 1.2). Zimmerman's early work was carried out in an educational setting. However, his theory has been also applied to sport (Cleary & Zimmerman, 2001; Kitsantas & Zimmerman, 2001). Several performance related adolescents studies have found reflection to be the key component in distinguishing elite from non-elite athletes (Toering et al., 2009), and between international and national level athletes across a range of team and individual sports (Jonker et al., 2010). The value of reflection thinking and performance improvement is also an established area of study in other domains, for example, human resource development (van Woerkom, 2004) and educational psychology (Phan, 2009). Reflection may facilitate the development of domain specific characteristics that are important to realise one's full potential, such as in sport (Jonker et al.,

2010). Since reflection is a key part of self-regulation, and is recommended to be important in a PA context (Toering et al., 2012), its application in the current research is considered valuable.

After having emphasised the importance of self-regulated learning to performance in various domains and proposing its potential for improving PA behaviours, and highlighting the six components to be investigated throughout this thesis, it is important to systematically investigate the literature to determine what has already been accomplished. As it has been explained, due to various definitions of self-regulation from various philosophical positions and from various psychological perspectives, the following section documents a systematic review of previous studies that have used elements from self-regulated learning in relation to adolescent physical activity.



## Systematic Review of Studies Assessing Self-Regulation for Improved PA

### Abstract

**Purpose** According to the PRISMA protocol, this study systematically reviewed the literature for intervention or cross-sectional studies examining the effect of SRL variables (planning (including goal setting), self-monitoring, effort, self-efficacy, self-evaluation and reflection) on physical activity outcomes.

**Methods** A systematic electronic database literature search was conducted according to specific inclusion criteria. For included studies, data were extracted and methodological quality assessed using standardised forms.

**Results** Eleven cross-sectional studies and fifteen experimental studies were included in the review. Six experimental studies were effective, a further eight were partly effective, and one was not effective in changing PA behaviour. All but one of the cross-sectional studies demonstrated significant associations of selected SR variables on PA levels.

**Conclusions** The majority of reviewed studies demonstrated a positive association or effect of aspects of SR on PA levels. Only two studies have used Zimmerman's practical SRL model, and as such further research using this practical model is warranted.

## Background of the Systematic Review

Regular engagement in physical activity is associated with a decreased risk of cardiovascular disease (Warburton et al. 2006) and improvements in psychological functioning in adolescents (Biddle & Asare, 2011). However, adolescents do not engage in sufficient health enhancing physical activity (Hallal, Andersen, Bull, Guthold, Haskell & Ekelund, 2012), with less than 50% of children and adolescents (5 – 17) in developed countries meeting the global PA recommendations (WHO, 2010). Effective solutions are required as low levels of PA persist into adulthood (Telama et al., 2005; van Mechelen, Twisk, Post, Snel & Kemper, 2000) along with the persistence of physical, psychological and societal problems.

The social cognitive theory (including related models such as the theory of planned behaviour, health action process, and so on) has demonstrated its usefulness in explaining PA, as it proposes that behaviours are influenced by social and psychological determinants (Bandura, 1982). Within social cognitive models, self-regulation processes are a major focus and are defined as “... *mental and behavioural processes by which people enact their self-conceptions, revise their behavior, or alter the environment so as to bring about outcomes in it in line with their self-perceptions and personal goals*” (Fiske & Taylor, 1991; p. 181).

In adult studies, it is known that self-regulatory strategies are crucial in enabling individuals to engage in and, importantly, maintain desired health behaviours (Umstadtdt et al., 2006). For example, in a cardiac rehabilitation study (Sniehotta, Scholz & Schwarzer, 2005) investigating prescribed PA as the health behaviour domain, it was found that self-regulatory strategies mediated the relationship between exercise intentions and PA two and four months later. Sniehotta and colleagues recommend that interventions aiming to enhance PA should focus on the improvement of action planning, self-efficacy and self-monitoring, awareness of standards and effort, as these were found to be crucial in bridging the intention-behaviour gap.

Bandura (2004) has maintained the necessity of equipping individuals with the relevant psychological skills and efficacy beliefs, which will help them to manage the daily multitude of emotional and social pressures. One particular self-regulation approach is self-regulated learning (SRL; Zimmerman, 1986; 1989) which has an established role in the enhancement of development and learning in academic, sport and health settings. This social-cognitive approach respects the importance of understanding the cognitions of adolescents within their social environments. The metacognitive, motivational and behavioural components of SRL (planning, self-monitoring, self-evaluation, reflection, effort and self-efficacy) are all ‘trainable’ skills that, after extended practice and feedback, promote self-directed behaviours. Zimmerman’s approach (1986) is capable of meeting the necessary theoretical demands for meaningful behaviour change research (Boekarts, 1997), and as well as being important for performance improvements, SRL may also be instrumental in enhancing levels of PA (Toering et al., 2012).

Many researchers have suggested that metacognitive skills, such as those in SRL (planning, self-monitoring, self-evaluation and reflection), should be taught explicitly in a specific context to have an impact on performance in any domain (Chen & Singer, 1992; Elliot-Faust & Pressley, 1986; Madsen et al., 1993; Bransford, Brown & Cocking, 2000; Ford, Smith, Weissbein, Gully & Salas, 1998). This may be particularly important for children and young people who do not intuitively keep their goals in mind or evaluate their progress, and can easily over or underestimate their own capabilities if goals are not explicit. Therefore, it is considered necessary to explicitly state goals and to teach individuals how to self-evaluate progress (Schunk, 2001). Such training may prevent the adolescent drop in PA motivation that occurs at crucial development stages (Brodersen et al., 2006; Biddle, Gorely & Stensel, 2004), such as following the move to high school (Stoeger & Ziegler, 2008), and contribute to the continuation of healthy behaviours into adulthood.

The purpose of the current study was to systematically review the impact of self-regulation strategies on levels of physical activity (subjective or objective measures). However, there are many self-regulation strategies that are grounded in different areas of psychology and the study of self-regulation is well known to be highly complex (Boekarts et al., 2005). There is also confusion in the literature which stems from the use of different constructs, models and theories by researchers studying the same issues (Boekarts, Pintrich & Zeidner, 2000). As such, the current study will focus specifically on six self-regulated learning variables adapted from Zimmerman's model (1986) in research with adolescents (Toering et al., 2012). More specifically, the current study will systematically review the literature for studies examining one or more of these six SRL variables: planning (including goal setting), self-monitoring, effort, self-efficacy, self-evaluation and reflection on PA levels. Intervention and cross-section studies were included in the review.

## Methods

The review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff, Altman, The PRISMA Group, 2009). Search terms included 'self-regulated learning', 'self-regulation', 'self-management', 'self-control', 'physical activity', 'exercise', 'adolescents', 'teenagers', 'youth'. as well as additional related self-regulation variables such as, self-efficacy, planning, self-monitoring, self-evaluation, reflection, effort). The search for synonyms was also included. Terms were used in the following order: a) self-regulated terms, b) physical activity terms, and c) adolescent terms. Studies were analysed according to the effect of self-regulation variables on physical activity levels. Searches were conducted using the following databases: Ebsco Host (including Academic Search Premier, ERIC, Medline and SPORTSDiscus), Proquest (including PsycINFO), and Web of Science.

**Inclusion criteria** a) published in the English language, full text, peer-reviewed articles from 1995 to the present year; b) based on an individual or integrated social-cognitive model (e.g. social cognitive theory (SCT), theory of planned behavior (TPB)), and / or a model or theory of goal setting, self-regulation or self-regulated learning; c) included at least one or more of six self-regulated learning variables (planning, self-monitoring, self-evaluation, reflection, effort, self-efficacy); d) cross-sectional and experimental studies focussing on the effect of meta-cognitive, motivational and behavioural variables (mentioned above) on PA levels; e) studies using self-efficacy theory (SET) and that measured or manipulated self-efficacy, must do so in combination with one of the other six SRL variables (mentioned above); f) conducted with healthy adolescents (12 to 18 years).

Exclusions included: book chapters, abstracts of conference proceedings and dissertations, participant mental or physical disability, obesity treatment studies, studies only examining physical fitness, articles relating to elite adolescent athletes and sport outcomes. Studies only applying the self-determination theory to levels of physical activity were excluded. Qualitative studies were also excluded.

**Methodological quality** Intervention studies: the quality of the data were assessed using a 10- item checklist developed for a previous PA intervention review (van Sluijs, McMinn, & Griffin, 2008; see table 2.2). Assessment of quality was rated as positive, negative or unknown. A methodological quality score was calculated by accumulating positive ratings for the ten items. Studies were rated 'high' or 'low'. A high score was considered six or more for randomised trials, and five or more for non-randomised trials (due to the checklist containing a specific item for randomisation).

For the cross-sectional and longitudinal studies, methodological quality was assessed with the 22-item STROBE checklist for cross-sectional studies (The PLOS Medicine Editors, 2014). For each included cross-sectional study a rating was of '++' (high quality), '+' (good quality), or '-' (poor quality), according to their methods of dealing with bias (i.e. sampling,

randomisation, or the use of adjustments for bias issues at the analysis stage e.g. hierarchical/multilevel/mixed model regression).

For all included studies, data were extracted by one researcher (AJP). The characteristics included: the countries the author contributions were from, size and source of the study population, study design, participant characteristics, theory and self-regulation variables used, PA level measures, and main effect of findings (see table 2.3).

Table 2.2  
Scale for Methodological Quality Assessment

Item	Description
1	Groups comparable at baseline on key characteristics (e.g., age, gender, weight, PA-relevant outcome measures) were statistically tested, and for All studies only positive when differences observed were controlled for in analyses
2	Randomization procedure clearly described and adequately carried out
3	Unit of analysis was individual (negative if unit of analysis was school level or school-level as randomization is not accounted for in individual-level analyses)
4	Validated measure of PA-related outcome used (positive if validation of measures was reported or referred to)
5	Dropout described and not more than 20 per cent for studies with follow-up of 6 months or shorter and 30 per cent for studies with follow-up of more than 6 months
6	Timing of measurements comparable between intervention and control groups
7	Blinding outcome assessment (positive if those responsible for assessing PA-related outcome were blinded to group allocation of individual participants)
8	Participants followed up for a minimum of 6 months
9	Intention to treat analysis used
10	Potential confounders accounted for in analyses

*Note:* PA = physical activity.

**Strength of the evidence** Following an existing evidence synthesis method (van Sluijs, McMinn, & Griffin, 2007), the effects of SR variables on PA were evaluated with a rating system. Five levels (strong, moderate, limited, inconclusive, and no effect) were defined based on study design, and methodological quality. Studies were separated into intervention and cross-sectional studies, and these two groups were stratified according to

the use of the six SRL variable of interest (planning (including goal setting), self-monitoring, self-evaluation, reflection, effort and self-efficacy). According to van Sluijs et al. (2007), if at least 66.6% of studies reported significant, positive results the overall results are considered to be consistent.

## Results

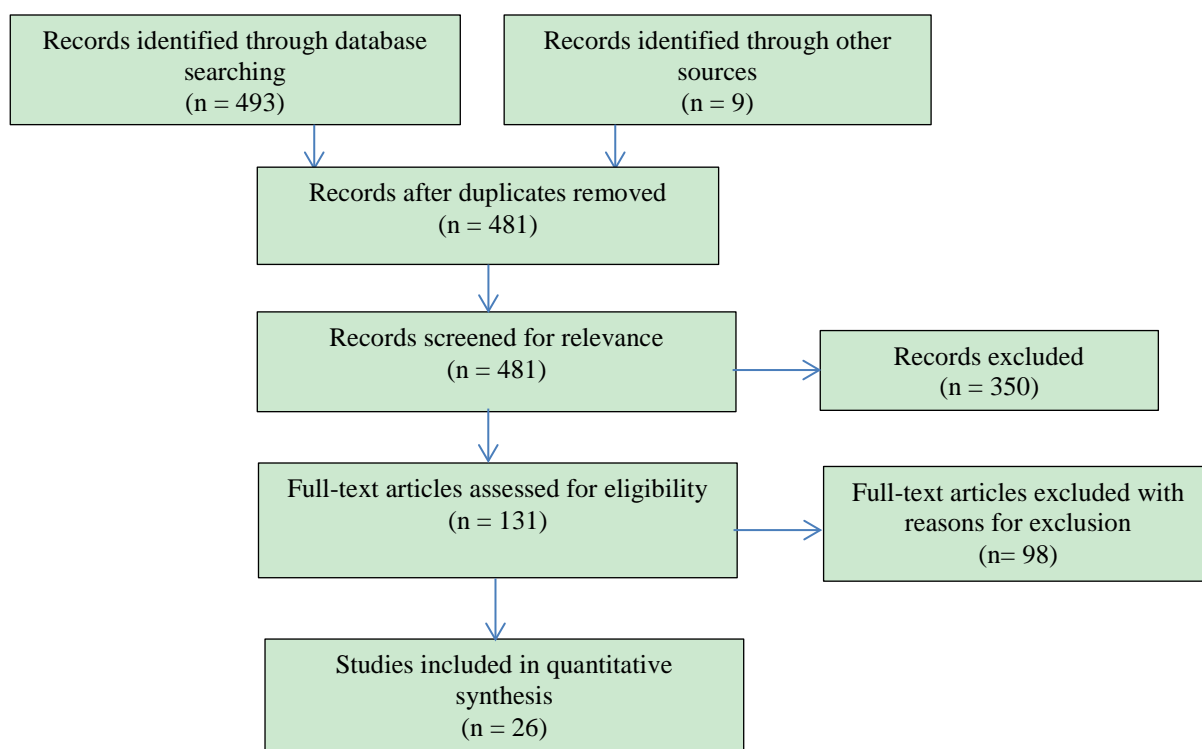


Figure 2.3 Flow diagram of the study selection process.

The flow of articles through the selection process is illustrated in figure 2.3. The search produced 502 potentially relevant papers (including papers that were found through reference lists of identified papers). Initial screening was based on the title, abstract, and removal of duplicates. After this, 131 papers were considered relevant and the full papers were retrieved and screened According to the inclusion/exclusion criteria. This resulted in the identification of 26 papers. The main reasons for excluding papers were that they were neither SR nor PA related, not conducted with healthy adolescents, or not conducted with

adolescents. Due to the heterogeneity of studies, a meta-analysis was not considered appropriate.

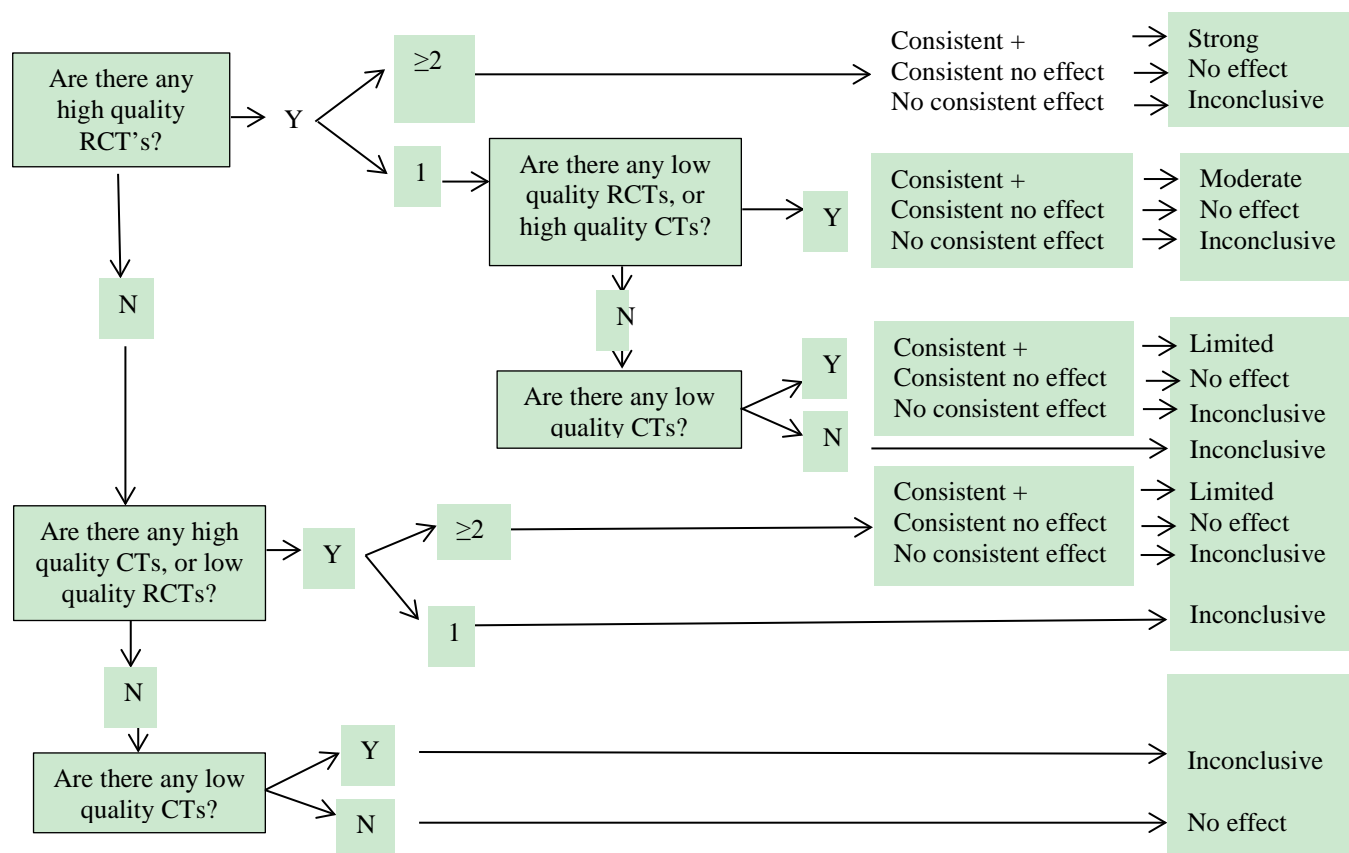


Figure 2.4. Flowchart of the decision making process based on study design and quality (adapted from van Sluijs et al., 2007; RCT = randomised controlled trial, CT= controlled trial, Y = yes, N= no.

### Summary of Included Studies

Studies were conducted with involvement from authors in 10 countries (USA 10; Scotland 3; Australia 8; the Netherlands 1; Poland 2; Ireland 1; Iran 3; Germany 2; China 2; Portugal 3). Eleven were cross-sectional studies, 15 were experimental studies. In total, there were 11948 participants, with sample sizes ranging from 85 to 1518. Seven studies included only female participants. All studies included adolescents recruited from schools. See table 2.3 for the summary of results.

**Interventions** Eleven intervention studies were designed to enhance PA, and four to impact on PA and dietary behaviours. Ten cross-sectional studies assessed PA only, two



assessed PA and diet. Follow-up analyses were conducted by 8 studies, ranging from one month to one year. Four of the cross-sectional studies used longitudinal designs.

Intervention PA measures included nine studies using only self-report measures, three both self-report and objectively measured PA, and two studies collected objective PA data only. Of the objective measures, five of the interventions used pedometers and one study used accelerometers. Of the cross-sectional studies, nine used only subjective PA measures and two studies used objective PA measures only, one of which was accelerometer and the other pedometer.

The duration of interventions ranged from four weeks to 24 months. The number and content of sessions within which SRL skills were taught varied considerably. Prins et al. (2012) included three lessons, plus homework, over one year with six month follow-up. Lubans et al. (2012) conducted three interactive sessions by researchers with teacher led sport sessions over four weeks and continued over four terms (two years) with a 12- month follow-up. Contento et al. (2010) conducted 24 lessons over eight to ten weeks with no follow-up. Schwarzer et al. (2010) conducted two, one -hour sessions over 4 weeks- no follow-up. Shimon and Petlikoff (2009), in addition to self-monitoring data, conducted one 10-minute goal-setting strategy session. The intervention period was four weeks with no follow-up. Araújo-Soares et al. (2009) conducted 12 weekly sessions with 9 month follow-up. Shilts et al. (2009) included a one-hour session, twice a week, for 5 weeks with no follow-up. Lubans et al. (2009) conducted one session a week for 10 weeks with 6 months follow up. Lubans and Morgan (2008) included one session a week for eight weeks, over one year with no follow-up. Hertz and Petosa (2008) included one session per week for eight weeks with no follow-up. Taymoori and Lubans (2008) conducted four educational sessions plus 4 counselling sessions and follow-up phone calls over six months with 6 months follow-up. Taymoori et al. (2008) included four educational sessions over 18 weeks with a six month follow-up. Hertz and Petosa (2006) conducted one session a week for eight weeks

with no follow-up. Schofield et al. (2005) included one session per week for six weeks with no follow-up. Dishman et al. (2004) conducted units in health education, biology, family and consumer science, or physical education classes over 2 years with a one year follow-up.

**Theories used in intervention studies** The social cognitive theory was the most popular theory to cite as the foundation of the research (Lubans et al., 2012; Lubans et al., 2009; Lubans & Morgan, 2008; Hartz & Petosa, 2008; Hartz & Petosa, 2006; Dishman et al., 2004). Contento et al., (2010) used social cognitive theory along with control theory of self-regulation theory (e.g. Carver & Scheier, 1982; and Muraven, Baumeister & Tice, 1999). Araújo-Soares et al. (2009) used the social cognitive theory along with self-regulation theory. Another study (Shilts et al., 2009) used social cognitive theory along with goal setting theory by Locke and Latham, (1990). One study (Prins et al., 2012) used the control theory of self-regulation by Carver & Scheier (1982); and another (Shimon & Petlikoff, 2009) used Zimmerman's self-regulation theory (1986) along with Karoly's (1993) systems view of self-regulation. Two used the health promotion model as well as elements from the transtheoretical model (Taymoori et al., 2008; Taymoori & Lubans, 2008). One study used the health action process model (Schwarzer et al., 2010). One study did not mention a particular theory but used social cognitive variables (Schofield et al. 2005).

**Use of the six SR variables in intervention studies** Twelve studies used goal setting, eight used self-monitoring; five used planning; two used evaluation and two used reflection. Nine studies used self-efficacy in combination with: goal setting (one); planning (one); planning and self-monitoring (one); and planning and goal setting (two). Four studies used a combination of self-efficacy and goal setting within their studies (Dishman et al., 2004; Shiltz et al., 2009; Contento et al., 2010; Schwarzer et al., 2010). Araújo-Soares et al. (2009) used a similar combination of self-efficacy and planning, and Taymoori et al. (2008) and Taymoori & Lubans (2008) used a combination of self-efficacy, planning and goal setting. Two studies used a combination of self-monitoring, goal setting and self-efficacy

(Lubans et al., 2011; Lubans et al., 2009). Two studies used a combination of self-monitoring and goal setting (Schofield et al., 2005; Lubans et al., 2011), while a combination of self-monitoring, goal setting and evaluation was used by Prins et al. (2012) and Shimon et al. (2009). Two studies included

For methodological quality, all 14 intervention studies were rated 'high' according to the predetermined rating (see table 2.2). Scores ranged from 5 to 10. Despite, the high quality, blinding of outcome assessment was not reported in 12 studies; eleven studies failed to report intention-to-treat analysis; eleven did not include a follow-up period of at least 6 months; and participant dropout was not described in 5 studies.

**Intervention effects of SR variables on PA: Significant findings** Shimon and Petlikoff (2009) compared three groups, a self-regulation group, a group given open pedometers (free to view step counts), and a group that had sealed pedometers (no step count viewing option). The authors found significant differences for the self-regulation and open groups compared to the control group. Overall, the self-regulation group increased their daily step counts 12% above their baseline levels, whereas those in the open and control groups increased 7% and 1%, respectively. In particular, those students who were taught basic self-regulation strategies or who were able to check their daily pedometer counts (self-monitoring) increased daily step counts over baseline values. Hartz and Petosa (2008) designed the Planning to be Active (PBA) programme in which the construct of self-regulation was targeted with instruction on goal setting, strategic planning, self-monitoring, and self-reflection. The PBA programme results demonstrated that the intervention group had significantly more days of moderate intensity exercise than the comparison group at post-test. In addition, results showed increased self-regulation and social situation scores, which both mediated the intervention effectiveness in increasing moderate intensity exercise.

Schofield et al. (2005) designed two intervention groups. The difference between them was that the pedometer group set daily step count goals and the minute group set daily

time-based goals for physical activity. At post intervention, only the pedometer group had significantly increased their total step count compared to the control group which suggests the importance of the self-monitoring aspect of the intervention. Dishman et al. (2005) designed a multicomponent intervention which emphasised the enhancement of self-efficacy and development of behavioural skills through their school curricular physical education classes. The intervention had significant effects on PA as well as on self-efficacy and goal setting, and the effect of the intervention on physical activity was partially mediated by self-efficacy. In a study by Taymoori et al. (2008) both intervention groups participated in four group educational sessions, four individual counselling sessions, and received follow-up phone calls to support behaviour change. Attempts were made to increase self-efficacy through goal setting, positive feedback, verbal persuasion, and physical activity planning. Interventions were tailored for individuals in the preparation stage of the transtheoretical model (TTM). Results revealed that both their interventions were successful in increasing PA through changes in the theoretical constructs.

**Partially significant findings** Lubans et al. (2009) designed a multicomponent, extracurricular school sport intervention which included social support from parents with e-mail feedback. Pedometers for self-monitoring were provided to encourage physical activity self-management strategies. The intervention specifically targeted social support and self-efficacy for physical activity. The authors found that all participants in the intervention group increased their step counts. However, findings were only significant for boys. Contento et al. (2010) used a novel combination of science inquiry methods and behavioural theory to provide effective strategies. The authors suggest that the use of a guided goal-setting process is likely to have enhanced students' cognitive self-regulation skills, and this was reflected in improved competence scores. However, although students who received the intervention intentionally walked and took the stairs more often and walked rather than take public transport, the findings were only significant for boys.

Araújo-Soares et al. (2009) targeted variables from social cognitive theory, self-regulation theory and planning as evidenced mediators of PA change through a school-based intervention, using an intervention and a control group with a pre, post, follow-up design, and found no significant differences at post-test. However, at nine months follow-up the intervention group reported significantly more self-reported moderate to vigorous intensity PA. The authors suggest that this inexpensive classroom-based intervention delivering a moderate increase in PA to a large number of adolescents might produce substantial health promotion effects. Taymoori and Lubans (2008) designed two interventions, one based on Pender's Health Promotion model, and one based on an integration of the health promotion model and selected constructs from the transtheoretical model significantly improved PA across the 24-week intervention, whereas the control group did not. This improvement continued at follow-up with both intervention groups reporting significantly more PA than the control group.

Lubans and Morgan (2008) designed a programme for secondary school students to promote lifestyle (e.g. walking/cycling to school) and lifetime physical activity. Goal setting and physical activity monitoring were the primary behaviour modification strategies focussed on in the intervention. Results revealed significantly more steps being accumulated by adolescents who were inactive at baseline but not for adolescents classified as active.

Hortz and Petosa (2006) found that as a result of a planning and behavioural skills intervention, there was a significant increase in moderate but not vigorous intensity physical activity.

**Non-significant findings** Lubans et al. (2012) found that girls in the intervention group did not increase their physical activity, but the authors noted that significant differences in screen time were observed during intervention period. These large reductions in self-reported screen have important health implications, as young people spend up to four hours a day in screen-based recreation and up to 10 hours a day sedentary, both of which are

associated with a range of negative health consequences. Shiltz et al. (2009) found that when they analysed the data from the whole sample, there were no statistically significant differences between conditions for dietary self-efficacy and physical activity behaviours ( $p = .86$ ,  $p = .51$ , respectively). However, a sub-sample was created based on Locke's (1991) recommendations (i.e. use treatment participants who made goal effort and control participants who did not spontaneously set goals) and treatment participants in the sub-group demonstrated significantly higher PA than the sub-sample control group. The authors suggest that the guided goal setting procedure is effective for enhancing PA behaviours but that it may be more useful for those 'teachable' students who would benefit from guidance during the process. Schwarzer et al. (2010) delivered two, one-hour interventions (resource communication and planning) to Chinese adolescents at different stages (pre-intenders, intenders, and actors) of readiness for change according to the health action process model. They found that pre-intenders and intenders both benefited from the resource communication treatment. However, it had been hypothesised that intenders may already be sufficiently motivated and planning would be beneficial for them. The authors suggest that the planning treatment was therefore unnecessary because resource communication alone was sufficient to improve behaviour. Although another reason for this could be that planning may not have been correctly implemented and that the training was only conducted for one hour. Furthermore, as the intervention had been successful in adults, perhaps the problem is that adolescents are not as action-outcome oriented compared to adults.

The YouRAction interventions (Prins et al., 2012) had no impact and even some negative impact on adolescent moderate to vigorous PA (MVPA). This was the only computer-based programme in the current review. The authors cited sub-optimal exposure to the intervention and the fact that a control group also underwent a generic PA programme as the major problems. In addition to the fact that it was dependant on repeated exposure through a computer based programme, it was plagued with computer server and log-in

problems. However, the study followed intervention mapping protocol which facilitates that the intervention is strongly rooted in behaviour change theory. The authors suggest that it may be too early to say that the content of the tailored interventions is ineffective, but that this approach has indicated effectiveness in adult studies and should be pursued with consideration of the limitations.

### **Cross-section Studies**

**Theories used in cross-section studies** Five studies used social cognitive theory (Lubans et al., 2011; Taymoori et al., 2010; Luszczynska et al. 2010; Petosa et al., 2005; Winters et al., 2003). One (Matthews & Moran, 2001) used Zimmerman's theory of self-regulation and two (Araújo-Soares et al., 2009; Dombrowski, & Luszczynska, 2009) used the theory of planned behaviour. Dishman et al. (2005) cited the use of self-efficacy theory and Carver and Scheier's (1982) control theory of self-regulation was used in Wills et al. (2007). One study (Lubans & Morgan, 2009) made no specific mention of a theory but used social cognitive variables (self-efficacy, self-management strategies e.g. goal setting, monitoring).

**Use of the six SR variables in cross-section studies** Planning was included in seven studies, goal setting was included in six studies, self-monitoring in six, and self-efficacy in five. With regards to the six SRL variables of interest in the current study, one study used self-efficacy, goal setting, self-monitoring and planning (Winters et al., 2003). Two studies used self-efficacy and planning (Araújo-Soares et al., 2009; Luszczynska et al., 2010). Lubans et al. (2011) used self-efficacy, goal setting and self-monitoring. Two studies used goal setting and self-monitoring (Petosa et al., 2005; Lubans & Morgan, 2009). Wills et al. (2007) used planning and self-monitoring. Dishman et al. (2005) used goal setting, planning and self-monitoring. Two studies adopted planning alone (Dombrowski & Luszczynska, 2009; Taymoori et al., 2010), and one study (Matthews & Moran, 2011) used only goal setting. Two studies (Hortz & Petosa, 2006; 2008) used goal setting, planning, self-monitoring, and self-reflection.

**Impact of SR variables on PA** Ten out of eleven cross-section and longitudinal studies demonstrated positive associations between selected SR variables and PA. Matthews and Moran (2011) used three SRL (goal setting, imagery, and causal attributions) variables from Zimmerman's model and found they all significantly contributed and accounted for 10.7% of the variance in adolescent PA.

Wills et al. (2007) used a self-control model (including planning and monitoring) to test self-regulation's effect on PA and diet. Their results demonstrated that the self-control constructs significantly accounted for 5 – 15% of the variance in the health behaviour outcomes after controlling for demographics. The authors suggest that this contribution is meaningful from a prevention perspective, especially considering the multiple contributions to these behaviours, as well as the fact that self-control characteristics are adaptable.

Petosa et al. (2005) examined the effect of eight social cognitive theory variables on adolescent PA, i.e. self-regulation, social situation, self-efficacy for skill, self-efficacy for barriers, negative outcome expectations, social outcome expectations, physical appearance outcome expectations, and general health outcome expectations. All of the variables explained 31% of the variance in the frequency of moderate and vigorous PA days. Within this model self-regulation explained 26.4 % of the variance.

Winters et al. (2003) measured outcome expectations, self-regulation, social situation and strength of self-efficacy and the prediction of these on leisure-time moderate and vigorous PA. The regression model for moderate PA, which included each of the four SCT variables, significantly accounted for 11% quantity of variance. For vigorous exercise, the model also contained all four variables and explained 29% of the variance; self-regulation alone explained 8% of the variance in this model.

**Longitudinal studies** Luszczynska et al. (2010) examined intentions at baseline and planning, self-efficacy and PA four weeks later in a Chinese sample. The authors also examined PA, intentions, planning, self-efficacy and a follow-up of the same measures 10



weeks later in a Polish sample. Overall, the results demonstrated that planning mediated the relationship between intentions and PA, and self-efficacy moderated the planning-PA relationship. The authors suggest that planning might only be useful if adolescents have high levels of self-efficacy.

Another longitudinal study (Araújo-Soares et al., 2009) examined two types of planning on PA, at three time points. Over a period of five months the authors found a consistent pattern, firstly, behaviour intentions are predictive of behaviour change suggesting that intentions are a necessary prerequisite to change adolescent PA. Self-efficacy did not contribute to the prediction of PA. The planning aspects did not display significant main effects but were significant longitudinally, with coping planning (approaching significance) possibly being a predictor of long term changes. However, over time the interaction between coping and action planning consistently added to the prediction of PA, more so than the established predictors of PA (self-efficacy, intention and past behaviour). The authors suggest that this consistent pattern would be very small or undetectable in correlation studies. Therefore, action planning may relate to PA increases if adolescents also have high levels of coping planning.

Dombrowski et al. (2009) used a longitudinal design and assessed physical activity, intention, planning, and lack of awareness (an aspect of automatic self-regulation). The authors found that physical activity is predicted by adolescents' use of conscious self-regulatory processes. Intention did not predict behaviour. The authors also found that past performance did not guarantee that behaviour would be under the control of automatic self-regulation and so conscious self-regulation, particularly planning, may be much more important later in life (e.g. early adulthood). Importantly, results of the cross-lagged panel analysis demonstrated that adolescents' physical activity is particularly influenced by the use of self-regulatory strategy of action planning.

Dishman et al. (2005) also used a longitudinal design with 6<sup>th</sup> and 8<sup>th</sup> grade girls examining self-management strategies (including goal setting, planning, monitoring), self-efficacy, barriers, outcome expectations, enjoyment and PA. The association between self-efficacy and physical activity was mediated by self-management strategies which authors suggest are a possible mechanism by which self-efficacy might influence self-initiated physical activity. This study also found no direct association between self-efficacy and the older group of girls. The association was instead indirect, mediated by self-management strategies. This suggests that interventions should recognise the necessity of self-management strategies as girls move through adolescence.

**Studies with Large models** Lubans and Morgan (2011) examined a large number of PA correlates in Australian adolescents. The correlate included peer support, exercise self-efficacy, outcome expectancy, perceived barriers, watching television, computer use, duration playing electronic games as well as the use of physical activity self-management strategies (including goal setting and self-monitoring). Within this large model in the final step, 4% of the PA variance was explained by the self-management strategies and barriers to physical activity, with gender and self-management strategies as the significant predictors of steps per day.

Lubans et al. (2011) used structural equation modelling assessing a combination of psychological, behavioural, social (including self-efficacy, goal setting, self-monitoring) and environmental correlates of PA. However, although they found a good model fit, the amount of variance in PA was only 5%. Pathways to PA from self-efficacy, school environment and physical self-worth were significant.

**No effect on PA** Only one (Taymoori et al., 2010) out of eleven studies found no evidence of a direct effect of the selected SR variables on PA. This study investigated the impact of a variety of social cognitive aspects in explaining Iranian female adolescent PA behaviour. It incorporated social support (three types: mothers, fathers and friends), self-

efficacy, outcome expectations, self-regulatory planning and PA. This model explained 52% of the variance in PA. Significant direct effects on PA were from self-efficacy and outcome expectations, and significant indirect effects on PA through self-efficacy were social support from mothers, fathers and friends. Self-regulation planning did not exhibit a direct effect on PA after controlling for self-efficacy.

### **Strength of intervention evidence**

**Intervention methodological quality** Fifteen studies were intervention studies, including ten cluster randomised trials (CT; Schwarzer et al., 2010; Araújo-Soares et al., 2009; Lubans & Morgan, 2008; Lubans et al., 2009; Shimon et al., 2009; Contento et al., 2010; Lubans, et al., 2012; Prins et al., 2012; Schofield et al., 2005; Dishman et al., 2004). Only three of these CT studies (Schwarzer et al., 2010; Schofield et al., 2005; Shimon et al., 2009) demonstrated significant effects on PA. In two CT studies (Lubans et al., 2009; Contento et al., 2010), only the boys demonstrated significant effects on PA, and in another (Lubans & Morgan, 2008) only adolescents that were classified as low active at baseline demonstrated significant effects. As only 50% of the CT intervention studies demonstrated significant effects, therefore these findings are inconsistent. Among three individual-randomised control trials RCT; Shilts et al., 2009; Taymoori, et al., 2008; Taymoori & Lubans, 2008), Shilts found that only a subsample of participants demonstrated significant effect on PA, while the other two studies both demonstrated a significant effect. Taken together, these studies are considered moderate. Two quasi-experimental, non-randomised trials (Hortz & Petosa, 2006; Hortz & Petosa, 2008) were both successful, although Hortz and Petosa (2006) were successful in increasing moderate, but not vigorous, intensity PA. Thus, taken together, intervention studies using a non-randomised design are limited in their effect of SR on PA.

**Strength of the evidence for SRL variable effect** Four studies used a combination of self-efficacy and goal setting within their studies (Dishman et al., 2004; Shiltz et al., 2009;

Contento et al., 2010; Schwarzer et al., 2010). Of these studies, Shilts et al. found no significant impact on PA and Contento et al. found only a significant impact for boys. The strength of the evidence of using a combination of self-efficacy and goal setting is moderate. Araújo-Soares et al. (2009) used a similar combination of self-efficacy and planning, and found no significant effect on PA.

Taymoori et al. (2008) and Taymoori & Lubans (2008) used a combination of self-efficacy, planning and goal setting. This combination was found to be effective in both studies. The strength of this evidence is strong. Two studies used a combination of self-efficacy, self-monitoring and goal setting (Lubans et al., 2008; Lubans et al., 2009). Both of these studies found only significant effects on PA for part of their samples i.e. boys only (Lubans et al., 2009) and low-active at baseline (Lubans et al., 2008). The strength of this evidence is inconclusive. Two studies used a combination of self-monitoring, goal setting (Schofield et al., 2005; Lubans et al., 2012), but only Schofield et al., were effective for PA outcomes. The strength of this evidence is moderate. A similar combination of self-monitoring, goal setting and evaluation was used by Prins et al. (2012) and Shimon et al. (2009). Only Shimon et al. (2009) found significant effects on PA. The strength of this evidence is inconclusive. Two studies used a combination of self-efficacy, goal setting, planning, self-monitoring, and reflection (Hortz & Petosa, 2006; 2008) which had direct effects on PA. The strength of this evidence is inconclusive.

In sum, the strength of this evidence is largely inconclusive (six studies), with moderate effects from four studies and strong effects from two studies. Only one study found no effect of the selected SR variables' contribution to PA.

### **Strength of evidence for the cross sectional and longitudinal studies**

**Methodological quality** Overall, for the methodological quality, five studies were rated '++', five '+' with respect to considerations of randomised sample selection, gender

imbalances, and methods used to deal with any reported bias e.g. correcting for bias in regression.

Two cross-sectional studies were longitudinal with random sampling (Dombrowski et al., 2009; Araújo-Soares et al., 2009), and both studies demonstrated a significant association with PA. Two studies were longitudinal with convenience samples (Dishman et al., 2005; Luszczynska et al., 2010), and both demonstrated a significant association with PA. These types of study demonstrate strong evidence. Five studies were cross sectional with convenience sampling (Matthews & Moran, 2011; Lubans & Morgan, 2009; Wills et al., 2007; Petosa et al., 2005; Winter et al., 2003), and all demonstrated significant associations between SR variables and PA. Finally, two studies were cross-sectional with randomised sampling (Lubans et al., 2011; Taymoori et al., 2010), one demonstrated a positive association and the other did not (Taymoori et al., 2010), therefore this type of study did not demonstrate strong evidence.

**Strength of the SRL variable evidence** One study used self-efficacy, goal setting, self-monitoring and planning (Winters et al., 2003), and demonstrated that these variables significantly contributed to PA. Lubans et al. (2011) used self-efficacy, goal setting and self-monitoring, and these variables significantly contributed to the PA. Two studies used self-efficacy and planning (Araújo-Soares et al., 2009; Luszczynska et al., 2010), both of which demonstrated significant effects on PA. Two studies used goal setting and self-monitoring (Petosa et al., 2005; Lubans & Morgan, 2009), both demonstrated significant effects on PA. Wills et al., (2007) used planning and self-monitoring, and Dishman et al. (2005) used planning and self-monitoring with the addition of goal setting, both of which found significant associations with PA. Two studies only used planning. Dombrowski and Luszczynska, (2009) found planning to be the most important predictor of PA, whereas Taymoori et al. (2010) found that planning did not have a direct effect on girls' PA. Finally, one study (Matthews & Moran, 2011) used only goal setting, which was a significant a

significant predictor of PA. Only one study among the cross-sectional studies found no effect on PA, therefore, overall these studies demonstrate a consistent effect.

Table 2.3

*Systematic review summary results.*

Authors	Participants characteristics	Study design and duration	Theory and self-regulation variables tested	PA Level measures	Main effect of findings on PA
1 Prins, R. G., Brug, J., van Empelen, P., & Oenema, A. (2012). The Netherlands	1213 adolescents aged 12–13 years from 54 classes in 12 schools. Healthy male and female children	Experimental design 3 lessons + homework - over one year - 6 month follow-up- 3 armed trial CLUSTER RANDOMISED Internet intervention	Self-regulation theory. Self-monitoring, goal setting, evaluation	PACE+ sixty-minute and Activity Questionnaire for Adolescents & Adults accelerometer (Actigraph GT3X)	This study could not demonstrate that the YouRAction and YouRAction+e interventions were effective in promoting MVPA
2 Lubans, D. R. Morgan, P.J., Okely, A. D., Dewar, D., Collins, C. E., Batterham, M., Callister, R., & Plotnikoff, R. C. (2012) Australia	357 adolescent girls from twelve secondary schools aged 12 to 14 years.	Experimental 3 interactive sessions by researchers + teachers sport sessions over 4 weeks – over 4 terms (2 years) + 12-month follow-up- 2 GROUP RANDOMIZED	Social cognitive theory. Goal setting and self-monitoring	Actigraph accelerometers (MTI models 7164,GT1M, and GT3X	No group by time effects for physical activity
3 Contento, I. R., Koch, P. A., Lee, H., Sauberli, W., & Calabrese-Barton, A. (2010). USA	1136 Middle School pupils 11-13 years from 10 schools Healthy male and female children	Experimental design 24 lessons over eight to ten weeks- no follow-up- 2 groups CLUSTER RANDOMISED	Social cognitive theory. Goal setting and self-efficacy	Eat-Walk survey measures frequency of walking	Non-significant but meaningful practical changes in girls, boys significantly increased intentional walking

Authors	Participants characteristics	Study design and duration	Theory and self-regulation variables tested	PA Level measures	Main effect of findings on PA
4 Schwarzer, R. Cao, D, S., & Lippke, S. (2010) Germany & China	534 Chinese participants mean age of 13.8 years (SD = 1.4) 46% boys	quasi-experimental 2 1 hour sessions over 4 weeks- no follow-up-3 groups- CLUSTER RANDOMISED BY CLASS	Health Action Process. Goal setting, self-efficacy	International Physical Activity Questionnaire (IPAQ)	Those who are not motivated to exercise benefit from resource-based messages, whereas those who have behavioural intentions benefit from planning
5 Shimon, J., & Petlichkoff, L. M. (2009). USA	113 junior high school pupils healthy male and female children	Experimental In addition to self-monitoring data, a 10-minute session on goal-setting strategies- over 4 weeks - no follow-up- 3 groups CLUSTER RANDOM BY CLASS	Zimmerman Social-cognitive perspective & Karoly's Self-regulation theory. Self-monitoring, goal setting, evaluation	Yamax SW-200 Pedometer measure only	Follow-up analyses indicated participants in the self-regulation group took 2071 to 4141 more steps/d than the control.
6 Araújo-Soares, V., McIntyre, T., MacLennan, G., & Sniehotta, F. F. (2009). (Scotland & Portugal)	291 healthy male and female children. Ten 6th grade (64.9%) and six 7th grade (35.1%) classes aged 10 – 16 from 8 Portuguese schools	Experimental 12 weekly sessions – 9 month follow-up CLUSTER-RANDOMISED	Social cognitive theory & self-regulation theory. Self-efficacy and planning	Moderate to vigorous PA (IPAQ)	Non-significant at post but significant tat follow-up. The combination of high levels of action planning and coping planning is associated with increases in PA
7 Shilts, M. K., Horowitz, M., & Townsend, M. S. (2009). USA	94 urban 8 <sup>th</sup> grade (13/14) school pupils 55% healthy male and female children	Experimental 1-hour sessions, 2x a week, for 5 weeks -2 groups- no-follow-up INDIVIDUAL RANDOMISED	Social cognitive theory and goal setting theory. Goal setting, self-efficacy	PA behaviours as part of the Youth Risk Behaviour Survey	No significant differences were found for the whole sample, but significant in a subsample in PA behaviour



Authors	Participants characteristics	Study design and duration	Theory and self-regulation variables tested	PA Level measures	Main effect of findings on PA
8 Lubans, D. R., Morgan, P. J., Callister, R., & Collins, C. E. (2009). Australia	124 healthy male and female children Six schools participants mean age 14.1 years	Experimental One session a week for 10 weeks – 6 month follow up -2 groups CLUSTER RANDOMISED control trial	Social Cognitive Theory. Self-monitoring, goal setting, self-efficacy	Yamax SW700 pedometers	Participants in the intervention group increased their step counts, but only significant for boys
9 Lubans, D., & Morgan, P. (2008) Australia	116 adolescents healthy male and female mean age 14.2	Experimental 1 session a week for 8 weeks over 1 year – 2 groups – no follow-up GROUP RANDOMISED	Social Cognitive Theory. Self-efficacy, self-monitoring and goal setting	Yamax SW701 pedometer, Adolescent Physical Activity Questionnaire (APAQ)	Significant only for adolescents in the intervention group classified as low-active at baseline
10 Hartz, B., & Petosa, R. L. (2008) USA	143 healthy male and female in the intervention group and 97 subjects in the comparison groups from 2 rural high schools	quasi-experimental one session per week for 8 weeks- no follow-up 2 non-equivalent comparison group research design - NOT RANDOMISED	Social Cognitive Theory. Planning, self-monitoring, self-reflection	previous day physical activity recall (PDPAR)	Self-regulation and social situation mediated moderate-intensity exercise at posttest.
11 Taymoori, P., & Lubans, D. R. (2008) Iran & Australia	161 females from 3 Iranian schools	experimental design 4 educational sessions + 4 counselling sessions _ follow phone calls – 6 months 6 month follow-up. 3grps INDIVIDUALLY RANDOMISED	Health Promotion Model & elements from Transtheoretical Model. Self-efficacy, planning, goal setting	modified version of the Child/Adolescent Activity Log	Both interventions were successful in increasing PA. Self-efficacy and commitment to planning were mediators in the HP intervention.

Authors	Participants characteristics	Study design and duration	Theory and self-regulation variables tested	PA Level measures	Main effect of findings on PA
12 Taymoori, P., Niknami, S., Berry, T., Lubans, D., Ghofranipour, F., & Kazemnejad, A. (2008) Iran, Australia	161 females from 3 Iranian schools	experimental design 4 educational sessions Over 18 weeks - 6 month follow-up- 3 groups – INDIVIDUALLY RANDOMISED	Health Promotion Model Transtheoretical Model. Goal-setting, planning, self-efficacy	modified version of the Child/Adolescent Activity Log	PA intervention based on Pender's HP model combined with selected aspects of the TTM on potential determinants to increase PA were effective
13 Hortz, B., & Petosa, R. (2006).USA	240 students male and female from two rural high schools	quasi-experimental One session a week for 8 weeks – no follow-up - 2 groups nonequivalent comparison group NOT RANDOMISED	Social Cognitive Theory. Self-efficacy, goal setting, planning, self-monitoring, and self-reflection.	Previous Day PA Recall (PDPAR)	There was a significant increase in moderate physical exercise (but not vigorous PA) as a result of the planning and behavioural skill intervention
14 Schofield, L., Mummery, W. K., & Schofield, G. (2005). Australia	85 adolescent girls healthy but low-active	quasi-experimental 1 x per week for 6 weeks- 3 groups - no follow-up CLUSTER RANDOMISED	None mentioned. Self-monitoring and goal setting	SW700 Yamax Digiwalker pedometers, self-report: 3DPAR	The use of pedometers and daily step count targets with low-active adolescent girls may result in enhanced physical activity when compared with traditional time-based PA prescriptions
15 Dishman, R. K., Motl, R. W., Saunders, R., Felton, G., Ward, D. S., Dowda, M., & Pate, R. R. (2004). USA	2087 healthy high school girls from 24 schools 2 groups	Experimental Units were implemented in health education, biology, family and consumer science, or physical education,over 2 years -1 year follow-up -2 groups SCHOOL RANDOMISED	Social Cognitive Theory. Self-efficacy and goal setting	PAQ for older children.Self-management measures	The intervention had direct effects and physical activity self-efficacy partially mediated the effect of intervention on physical activity

Authors	Participants characteristics	Study design	Theory and self-regulation variables tested	PA Level measures	Main effect of findings on PA
16 Matthews, J., & Moran, A. (2011). Ireland	233 healthy high school pupils male and female children	Cross section CONVENIENCE SAMPLE	Zimmerman's Self-regulation Theory. Goal setting	PA – Godin Leisure-time exercise questionnaire	There is a significant positive relationship between adolescent leisure-time physical activity and certain theoretically derived SRL strategies (incl. goal-setting) accounted for 10.7% of the variance
17 Lubans, D.R., Okely, A.D., Morgan, P.J., Cotton, W., Puglisi, L. & Miller, J. (2011)Australia	1518 girls (aged 13.6 % 0.02 years) from 24 secondary schools	Cross section RANDOMISED	Social cognitive theory. Self-efficacy, goal setting, self-monitoring	Actigraph accelerometers (MTI model 7164 and GT1M)	Behavioural strategies emerged as potential mechanisms of behaviour change in youth interventions. This large model was a good fit but explained only 5% of the variance in PA.
18 Taymoori, P., Rhodes, R. E., & Berry, T. R. (2010). Iran	558 healthy female Iranian adolescents from 133 schools mean age =14.43 years (SD = 1.60; range: 12–17).	Cross-sectional CLUSTER RANDOMISED	Social cognitive Theory. Self-regulation planning	PA - Child/Adolescent Activity Log (CAAL)	Self-regulation planning did not exhibit a direct effect on PA after controlling for self-efficacy.
19 Luszczynska, A., Cao, D. S., Mallach, N., Pietron, K., Mazurkiewicz, M., & Schwarzer, R. (2010). Poland, USA, China, Germany	534 Chinese adolescents; 620 Polish adolescents healthy male and female	Descriptive longitudinal CONVENIENCE SAMPLE	Social cognitive theory. Self-efficacy and planning	Self-ratings concerning the frequency and duration of leisure-time exercise. The average number of times in an average week (during the past month)	Planning mediated intentions and behaviour; self-efficacy moderated planning behaviour relationship, remained valid after accounting baseline PA

Authors	Participants characteristics	Study design	Theory and self-regulation variables tested	PA level measures	Main effect of findings on PA
20 Araújo-Soares, V., McIntyre, T., & Sniehotta, F. F. (2009) (Scotland; Portugal)	157 adolescents (mean age: 12) male and female	Longitudinal cross section RANDOMISED	Theory of planned behaviour. Planning, self-efficacy	International Physical Activity Questionnaires	Past behaviour accounted for a significant 25–51% of the variance in PA. A combination of high levels of action planning and coping planning is associated with increases in PA
21 Lubans, D. R., & Morgan, P. J. (2009). Australia	119 14 – 15 male and healthy female adolescents	Cross sectional CONVENIENCE SAMPLE	None mentioned. Self-efficacy, (self-management strategies e.g. goal setting, monitoring)	PA - <i>Yamax</i> SW701 pedometer	All variables explained 16% of the variance in mean steps/day. 4% of the variance was explained by self-management strategies and perceived barriers Gender and self-management strategies were significant predictors.
22 Dombrowski, S., & Luszczynska, A. (2009) Scotland, Poland	155 adolescents aged 13 to 17 years 3 schools healthy male and female	Cross-lagged panel design SCHOOLS RANDOMLY SELECTED	Theory of Planned Behaviour. Planning	International Physical Activity Questionnaire	Among the self-regulatory processes, planning was found to be the most important predictor of adolescents' PA; past behaviour remained the strongest predictor of future behaviour.
23 Wills, T. A., Isasi, C. R., Mendoza, D., & Ainette, M. G. (2007). USA	539 9th grade pupils healthy male and female	Cross-sectional CONVENIENCE SAMPLING	Carver & Scheier Self-control. planning and monitoring	PA (Youth Risk Behaviour Survey)	Good self-control was related to more fruit and vegetable intake, more participation in sports, and less sedentary behaviour

Authors	Participants characteristics	Study design	Theory and self-regulation variables tested	PA level measures	Main effect of findings on PA
24 Dishman, R. K., Motl, R. W., Sallis, J. F., Dunn, A. L., Birnbaum, A. S., Welk, G. J., ... & Jobe, J. B. (2005). USA	3096th grade and 2968th grade girls healthy male and female children	Longitudinal cross section CONVENIENCE SAMPLE	Self-efficacy theory. Self-efficacy, (self-management strategies e.g. goal setting, planning, monitoring)	PA. self-report measures of PA over the previous 7 days, how often very active	Self-management strategies mediated the association of self-efficacy with physical activity.
25 Petosa, R. L., Hartz, B. V., Cardina, C. E., & Suminski, R. R. (2005) USA	183 9 <sup>th</sup> grade and 166 12 <sup>th</sup> grade students 330 total healthy male and female	Cross-sectional CONVENIENCE SAMPLE	Social Cognitive Theory. Self-regulation (e.g. goal setting, self-monitoring)	PA previous day recall (PDPAR) PA beliefs	All variables accounted for 31% of the variance in PA. Self-regulation accounted for 26.4% of the variance in moderate and vigorous PA
26 Winters, E. R., Petosa, R. L., & Charlton, T. E. (2003). USA	248 high school healthy students male and female	Cross-sectional CONVENIENCE SAMPLING	Social Cognitive Theory. Self-efficacy, goal setting, self-monitoring, planning	PA – Godin Leisure-time exercise Q,	Self-regulation accounted for 8% of unique variance in vigorous PA and 6% of the variance in moderate PA

## Discussion

The current study systematically reviewed the impact of self-regulation strategies on physical activity levels. More specifically, one or more of six self-regulated learning (SRL) variables of planning (including goal setting), self-monitoring, effort, self-efficacy, self-evaluation and reflection had a positive impact on levels of PA. Intervention cross-section and longitudinal studies were included in the review.

In terms of experimental studies, the positive impact of self-regulation variables were found in all but one study in this review (Prins et al., 2012). Despite the good quality of the study, the YouRAction interventions did not have the effect of improving adolescent moderate to vigorous intensity PA (MVPA). This was the only computer-based intervention study in this review and issues concerning the delivery of three sessions as well as adolescent engagement are reported as the reasons for the negative findings. The authors suggest that it may be too early to suggest the content of the tailored interventions are ineffective, but that this approach should be pursued with consideration of the limitations.

Lubans et al. (2009) and Contento et al. (2010) only found significant effects on PA for the boys in their samples. Furthermore, Lubans and Morgan (2008) found that their programme was only significant for adolescents who were inactive at baseline, but not for individuals classified as active. In a similar vein, Shilts et al. (2009) only found significant changes in a sub-group of their sample when accounting for goal effort. All four studies conducted weekly sessions over at least five weeks. Perhaps for more effective results specific SR skills should be targeted at specific groups (eg. active/non-active, gender etc.) for the best PA outcomes.

Schofield et al. (2005) focused on adolescent girls only. They taught one session a week for six weeks, and found a significant increase in steps in two of the groups. Schwarzer et al. (2012) focused on adolescents at different stages (preintenders, intenders, and actors) of readiness for change according to the health action process model. Preintenders and

intenders both benefited from the resource communication treatment. It had been hypothesised that intenders may already be sufficiently motivated and planning would be beneficial for them. This was an effective but short intervention with a total of only two sessions conducted.

One reason for the effective studies (Schofield et al., 2005; Dishman et al., 2004; Taymoori et al., 2008; Taymoori & Morgan, 2008; Araújo-Soares et al., 2009; Shimon & Petlikoff, 2009) may be due to the fact that participants were all randomised either by group or individually. All these studies conducted at least four weekly sessions, except for Shimon and Petlikoff (2009) who conducted one minimal 10-minute session.

Two effective studies that were not randomised (Hortz & Petosa, 2006, 2008) were the only studies to include reflection as a variable. Reflection is an individual's ability to apply previous experience to improve subsequent performance in an effective, goal-directed way (Mezirow, 1991; Peltier, Hay & Drago, 2006; Zimmerman, 2000b). This may be an important variable to include. However, although Hortz and Petosa (2006) found a significant increase in moderate physical exercise, this was not the case for vigorous intensity physical activity. Hortz and Petosa (2008) went on to design the Planning to be Active (PBA) programme which targeted moderate intensity activity only, with significant results. Thus, targeted focus on the participants' characteristics and the inclusion of reflection, may be effective in non-randomised trials. Both Hortz and Petosa (2006) and Hortz and Petosa (2008) conducted eight weekly sessions but the quasi nature of the studies mean that the findings are inconclusive.

With regard to the cross-section studies, the majority demonstrated a positive association or effect of aspects of self-regulation training. Only one out of 11 studies found no positive or direct effect of self-regulation planning on PA (Taymoori et al. 2010). The authors speculated that this could be a culture effect related to the fact that the population was specifically Iranian girls. The cross-section studies include a wide variety of SRL

measures and selection of SRL variables. The PA level measures, leisure-time PA, MVPA, moderate intensity exercise (MIE), and these were predominantly measured by questionnaire. Only two studies used objective PA measures.

In terms of theoretical models, SRL (Zimmerman, 1986) is a self-regulation approach which attempts to explain *how* individuals are able to make improvements through a systematic method of learning how to adapt to ever changing environments (Schunk, 2001). During adolescence, learning is a crucial part of life and learning the processes and skills involved in self-mastery of learning and development, has been said to be a worthy objective for students of all ages and in all disciplines (Paris & Paris, 2001). This particular model of self-regulation has been successfully applied in academic contexts (Paris & Paris, 2001; Nota, Soresi & Zimmerman, 2004; Pintrich & De Groot, 1990; Zimmerman, Moylan, Hudesman, White & Flugman, 2011). However, in the current review, the only two studies to cite Zimmerman's model were Matthews and Moran (2011) and Shimon and Petlikoff (2009). One other paper by Shilts et al. (2009) included Zimmerman in their reference list. Considering its applied approach, it is recommended that Zimmerman's model be used by researchers in the future to develop adolescent proactive capacities for physical activity.

### **Limitations**

Only one intervention study demonstrated strong evidence based on design and quality and only eight out of the fifteen intervention studies conducted a follow-up assessment, which limits the potential to determine patterns of self-regulation over time. This is important to note because both Shimon and Petlichkoff (2009) and Araújo-Soares et al. (2009) only found significant effects at follow-up, not at post-testing. In a similar vein, only four out of eleven cross-sectional studies used longitudinal designs (Dishman et al., 2005; Araújo-Soares et al., 2009; Dombrowski et al., 2009; Luszczynska et al., 2010). Small and non-significant statistical variance can still result in big practical differences (Rosenthal,



1990), therefore, follow-up designs in both experimental and cross-sectional designs are important. A further limitation is that only eight out of the 26 studies used objective PA measures, as self-report PA data may be inaccurate and does not capture the daily patterning and intensity fluctuations as well as certain objective PA measures, such as accelerometry. Limitations of the current review include selection bias of English only articles published from 1995 onwards. It was also limited to searches that could provide full text articles. There is also the possibility that there are studies that are pertinent to this review that have not been retrieved.

In conclusion, SRL training programmes are effective in improving various academic performance outcomes (Dignath, Buettner & Langfeldt, 2008). As such, SRL is considered a worthy theory to associate with adolescents' physical activity behaviours (Toering et al., 2010) due to its focus on the specific and trainable strategies to change behaviours. Further research is required focusing specifically on self-regulated learning. This review has examined a heterogeneous set of intervention and exploratory studies and found potential for the use of various combinations of SRL variables to enhance PA levels. However, the variation among intervention studies in terms of combinations of variables, number of training sessions, intervention duration and so on make it difficult to determine what kind of approach works most effectively.

The following chapter documents the translation and validation of the self-regulation of learning self-report scale (SRL-SRS). From the systematic review, it is evident that there is a lack of specific SRL (Zimmerman's model) and PA research available in an adolescent population, which has also been noted by several authors (Wills et al., 2007; Matthews & Moran, 2011). In addition, there is currently no Chinese measure of general SRL tendencies in adolescents. Considering that the concept of SRL has been developed from a Western perspective, it is pertinent to this enquiry to first determine whether the concept of SRL is applicable to a Chinese adolescent population.

**Reliability and Validity of the Short Hong Kong Chinese Self-Regulation of Learning  
Self-Report Scale (SRL-SRS-C)**

**Abstract**

**Purpose** This study translated and shortened the original English, six-factor, Self-Regulated Learning Self-Report Scale (SRL-SRS). This version was subsequently assessed for its reliability and validity, for use in a Hong Kong Chinese adolescent population.

**Methods** The SRL-SRS was translated into Chinese following the back-translation procedure. Exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and test–retest reliability analysis, were conducted on a sample of Hong Kong Chinese adolescents ( $n = 314$ ; mean age = 13.2 years,  $SD = .99$ ; male = 155). Cross-validation was conducted on a second sample of adolescents ( $n = 477$ ; mean age = 14.92 years;  $SD = 1.77$ ; male = 283).

**Results** EFA results support the original six-factor model. Subsequent CFA results supported the short version with sufficient goodness-of-fit statistics (CFI = 0.93; TLI = 0.92; RMSEA; 95% CI = 0.0047 [0.041, 0.053]; SRMR = 0.044). Further support was also found in across-validated sample (CFI = 0.915; TLI = 0.906; RMSEA = 0.052; SRMR = 0.043). Cronbach's  $\alpha$  ranged from .72 to .89 for all subscales (sample 1); ICC values ranged from .69 to .80, for all subscales.

**Conclusions** The short SRL-SRS-C is a sufficiently reliable and valid instrument to measure self-regulation of learning in a Chinese adolescent population. In addition, the SRL-SRS-C has demonstrated sufficient content, construct validity, and test–retest reliability.

## Background

Self-regulation is a key process in psychological functioning, enabling people to adapt to ever-changing social and physical environments (Schmeichel & Baumeister, 2004). This adaptation occurs through processes that help individuals control their thoughts, feelings, and behaviours (Vohs & Baumeister, 2004a). From a social cognitive perspective, self-regulation of learning (SRL) refers to those self-regulated processes that give learners the opportunity to transform mental abilities into performance skills (Zimmerman, 2008). Zimmerman's definition of SRL is "*the extent to which individuals are metacognitively, motivationally and behaviorally proactive participants in their own learning and developmental processes*" (Zimmerman, 1986, p. 308).

Cyclical self-regulatory processes (including planning, self-monitoring, and self-evaluation) have the potential to contribute to positive feelings of competence and self-esteem by enhancing ability (e.g. Zimmerman, 2006; Toering et al., 2009; Jonker et al., 2010). For example, self-regulated individuals recognise an absence in skills and initiate actions to acquire the relevant skills to support their progress (Chen & Singer, 1992). Additionally, learning emerges as a result of reflection on the process of goal attainment. This new knowledge is then transformed into new strategies for future task performance (Ertmer & Newby, 1996). Importantly, individuals must believe they are capable of both coping with and achieving task requirements (self-efficacy) to sustain motivation (Bandura, 1997). These self-efficacy beliefs will determine (a) the types of goals that individuals set for themselves, (b) how much effort and persistence they are prepared to invest, and (c) their resilience in the face of failed attempts (Bandura, 1997). Thus, self-regulated individuals act rather than react, showing initiative, perseverance, and adaptability, which all stem from motivational beliefs and favourable metacognitive strategies (Zimmerman, 2006, 2008).

It is not surprising to find that individuals with a tendency to take a more proactive approach to personal learning and development can also apply this to other areas. For

example, talented athletes have been found to be high self-regulators and high academic achievers (Jonker, Elferink-Gemser, & Visscher, 2009). Learning and SRL are both important for performance improvements, including engagement in physical activity (PA) (Toering, Elferink-Gemser, Jonker, van Heuvelen, & Visscher, 2012). Indeed, Rosenbaum, Carlson, and Gilmore (2001) suggest that it is difficult to find meaningful differences between those factors affecting the acquisition of intellectual skills and those that affect the acquisition of perceptual motor skills. As such, self-regulation is positively related to performance and skill level in various domains, such as sport (e.g. Cleary & Zimmerman 2001; Toering et al., 2009), physical education (PE) (e.g. Kolovelonis, Goudas, Hassandra, & Dermitzaki, 2012), music performance (e.g. Nielsen, 2001), and academic achievement (e.g. Zimmerman, Moylan, Hudesman, White, & Flugman, 2011).

SRL could also play an important role in increasing PA levels (Matthews & Moran, 2011; Toering et al., 2012; Winters, Petosa, & Charlton, 2003). In this context, individuals must be motivated to improve, and to continue to improve, despite a considerable variety of internal (boredom, discomfort, and amotivation) and external (lack of equipment, facilities, and weather) barriers, all of which must be overcome to achieve beneficial health improvements (e.g. Salmon, Owen, Crawford, Bauman, & Sallis, 2003). In China, there is a growing need to counteract the growing rate of obesity related physical inactivity (Ha, Abbott, Macdonald, & Pang, 2009; Tudor-Locke, Ainsworth, Adair, Du, & Popkin, 2003). There is also a growing necessity for China to develop strategies to improve adolescent PA levels, for psychological reasons. For example, Salili, Lai, and Leung (2004) found Hong Kong students more anxious than Canadian students. Although, it is widely accepted that physically active adolescents are less likely to suffer from mental health issues, such as anxiety (Biddle & Asare, 2011).

## **Cultural Considerations**

Student learning and motivation are influenced by cultural beliefs (Holloway et al., 1990), values (Stevenson et al., 1990), and practices (Salili, 1995; Salili, Chiu, & Lai, 2001). Much of the education psychology literature around the world is based on research conducted in Western countries, particularly America (e.g. Lonner, 1990). This also applies to cultural differences in learning and academic achievement across ethnicity (e.g. Steinberg, Dornbusch, & Brown, 1992). However, it is important to consider the social context in the country of origin (Rao, Moely, & Sachs, 2000; Stanley & Okazaki, 1990), as it is understood that important cultural differences can be obscured by research using English language questionnaires with people from different cultures who may share English as a common language (Harzing, 2005). “Cultural accommodation” occurs when respondents subconsciously adjust their responses to reflect the cultural values associated with the language the questionnaire is presented in (Harzing, 2005).

Currently, the measurement of an individual’s general tendency for SRL is only possible with a valid English and Dutch measure (SRL-SRS). While English proficiency is good among many Hong Kong Chinese adolescents, in its current form, the SRL-SRS may not accurately capture SRL among this non-Western culture. For example, cultural differences have been demonstrated by variations in the factor structures of Western body image questionnaires that have been translated for use in non-Western cultures (Swami, 2009; Swami & Chamorro-Premuzic, 2008).

There is a growing Asian interest in SRL education research (e.g. Law, Chan, & Sachs, 2008; Rao et al., 2000; Sha, Looi, Chen, & Zhang, 2012; Tang & Neber, 2008). However, most of these studies have used the education-specific Motivated Strategies for Learning Questionnaire-Chinese Version (MSLQ-CV; Rao et al., 2000; Rotgans & Schmidt, 2008). Therefore, a valid a tool to measure learners’ general tendency for SRL, across multiple learning domains (e.g. academic achievement, sport, and music; Toering et al.,

2012), would not only benefit education researchers, but also enable much needed research in the Chinese adolescent PA domain.

### **Assessment of SRL**

The original, English SRL-SRS (Toering et al., 2012) comprises 46 items. Reliability and validity for the original scale were established by two confirmatory factor analyses (CFAs) with 601 and 600 adolescents (aged 11–17 years), respectively. The final six-factor adjusted CFA model demonstrated a good fit ( $\chi^2 = 3193.70$ ,  $df = 970$ , CFI = .95, root square mean error of approximation (RMSEA) = .061, RMSEA (90%CI) = [.059, .064]), and factor loadings were all statistically significant. The original SRL-SRS demonstrated Cronbach's  $\alpha$  coefficients as follows: planning = .81, self-monitoring = .73, evaluation = .82, reflection = .78, effort = .85 and self-efficacy = .81. Relative and absolute test–retest reliability was satisfactory. All Intra- class Correlation Coefficients (ICCs) varied between .69 and .84, indicating relative temporal stability.

In addition to translating and validating the SRL-SRS, the current study aimed to develop a shorter version. Reynolds and Richmond (1978, p. 272) noted in child anxiety research, “*An omnipresent concern ... is the efficiency of the measuring instrument. Keep it as brief as possible to do the job needed*”. Shorter questionnaires have higher response rates (Edwards et al., 2002). Respondents of longer questionnaires often omit questions and give inconsistent responses, resulting from frustration due to the length of the questionnaire (Stanton, Sinar, Balzer, & Smith, 2002). This frustration may result in transient measurement errors (e.g. Schmidt, Le, & Ilies, 2003). Furthermore, younger populations may be less likely to respond with their full attention to long questionnaires. Indeed, questionnaires containing around 50 items are considered too long for adolescents (e.g. Myers, MacPherson, McCarthy, & Brown, 2003). Additionally, young adolescents are mostly accessible in school settings which are notoriously pressed for time, particularly in Hong Kong (Salili et al., 2004).

However, shortened questionnaires must be developed through reliable factor analysis

techniques and provide sufficient criterion-related validity (Donnellan, Oswald, Baird, & Lucas, 2006; Tsaousis & Kerpelis, 2004; Stanton et al., 2002).

### **Factor Structure and Item Selection**

It has been found that factor structures in translated questionnaires have been less applicable in some Asian cultural contexts (Swami, 2009). Therefore, the current study first assessed if the factor structure held in the translated version before confirming this with CFA. This analysis was conducted to understand whether the Chinese version of the SRL-SRS would be applicable in a Chinese youth population. Swami (2009) applied this methodology with the original Sociocultural Attitudes towards Appearance Questionnaire (SATAQ-3). Similarly, Jackson and Chen (2010) translated the (SATAQ-3) into Chinese for use with adolescent boys. The authors argued that establishing the utility of the measure in new cultural contexts would be achieved more effectively by using exploratory factor analysis (EFA), with subsequent CFA testing. Additionally, EFA factor loadings (Donnellan et al., 2006; Stanton et al., 2002), corrected item-total correlations, and judgmental item qualities (clarity of expression, relevance to the target population, semantic redundancy and face validity) were examined for item selection (Stanton et al., 2002). These steps were taken to avoid narrow measurement of the construct (Cattell, 1973), decrease in validity (Kline, 1986), or any potential inability to transfer the instrument across cultures (Boyle, 1991).

Thus, the aim of this study was to examine the factor structure of the translated SRL-SRS and develop and validate a short, Chinese version to serve as a concise, time-efficient measure of dispositional SRL. This would enable the study of SRL and its association with performance in a variety of domains (e.g. PA, sport, and academic achievement) in an adolescent Hong Kong Chinese population.

## Methods

### Participants

EFA, CFA (Step 1), and test-retest reliability analyses were conducted with 314 Hong Kong Chinese adolescents aged 12–17 years (mean age = 13.2,  $SD = .99$ ; male = 155) recruited from one English-medium (lessons taught predominantly in English), government-aided secondary school in Hong Kong. The sample size was decided *a priori* to meet standards appropriate to factor analysis (i.e. at least 300, Field, 2009). Cross-validation analysis (Step 2) was conducted with an additional sample of 477 Hong Kong Chinese adolescents aged 11–19 years (mean age 14.92;  $SD = 1.77$ ; male = 283) from three English-medium, government-aided secondary schools in Hong Kong.

Recruitment was conducted through existing networks of PE teachers. The principals of each school were approached in writing, and upon receipt of their written consent, parents were contacted and informed of the study. All parents provided written consent, and participants assented prior to questionnaire completion.

### Procedure

Ethical approval was obtained from Hong Kong Baptist University. Participants completed the questionnaires in classroom settings with class teachers present. Teachers were fully informed about the study and were prepared for any potential issues surrounding questionnaire completion. Sample 1 participants took 20 minutes to complete the questionnaires and 20 minutes for the test-retest data collection. Sample 2 participants took 10 minutes to complete the questionnaires.

The SRL-SRS was translated into Chinese following the back-translation procedure (Guillemin, Bombardier & Beaton, 1993). Three professional, bilingual individuals (physical education, sport psychology, and behaviour modification) individually translated the items from English into Chinese. Translations were assessed for congruency through a committee approach between the three translators and the two authors. Initial linguistic modifications



were made. For example, it was considered that the translated word “task” may not be easily understood by Chinese adolescents and this was changed to “work”. Thereafter, the amended Chinese version was translated back into English by a bilingual professor (the second author) and further minor linguistic adjustments were discussed and amended with the original translators.

### **Data Analyses**

**Step1- EFA** EFA was conducted in SPSS (IBM Corp., 2012; version 21.0). Principal component analysis, with varimax rotation, was carried out as it was considered that the six factors (planning, self-monitoring, self-evaluation, self-efficacy, effort, and reflection) were independent (e.g. Toering, Jordet, & Ripegut, 2013). To determine the number of factors, analysis of a scree plot and eigenvalues  $> 1.00$  were used as criteria (e.g. Stevens, 2002).

**Item selection** In order to produce a shorter questionnaire, EFA was used to select appropriate items. Factor loadings below 0.40 would be removed from the analysis (e.g. Martens & Webber, 2002; Toering et al., 2012). Items that loaded strongly onto one factor with relatively low loadings on other factors were considered for inclusion, as well as the examination of corrected item-total correlations, and semantic judgments (Stanton et al., 2002).

**Step 2-CFA (sample 1)** Initial data entry and data checking were conducted in SPSS. EFA was conducted in SPSS, and both sample CFAs were conducted in R software (R Core Team, 2013). To confirm whether the short version model fitted the observed data, correlation matrices were analysed, and CFA was conducted with maximum likelihood estimation. The metric of each latent variable was determined by fixing the variances to 1.0. All factors were allowed to correlate freely, and standardised values were calculated. Unexplained variances were estimated (theta-delta diagonal). After adjustments had been made to the first sample, the new model was cross-validated with the second sample ( $n = 477$ ).

In line with Toering et al. (2012), this study used multiple criteria. Model fit was assessed with  $\chi^2$ , CFI (Bentler, 1990), Tucker–Lewis index (TLI); Bentler & Bonett, 1980) criterion  $> .90$  (Byrne, 1998; Hu & Bentler, 1999), RMSEA (Steiger, 1990) criterion  $< .05$  (Jöreskog, 1993), and SRMR criterion  $< .08$  (Byrne, 1998; Hu & Bentler, 1999). Factor loadings were tested using a significance level of  $.05$ , and all loadings were required to be at least  $.40$  (e.g. Martens & Webber, 2002). The modification indices were also examined, where the  $\chi^2$  statistic indicated model fit. The internal consistency of the scale was determined by calculating Cronbach’s coefficient criterion value of  $> .70$  (Nunnally, 1978). Corrected item-total (criterion  $.30$ – $.70$ ; Ferketich, 1991), inter-item (criterion between  $.30$  and  $.90$ ; Field, 2009, p. 657), and inter-scale correlations (criterion not exceeding  $.80$ ; Carron, Widmeyer, & Brawley, 1985) were also examined.

**Step 3- cross-validation CFA (sample 2)** Cross-validation procedures and related criteria adopted were the same as those described for Step 2 CFA.

**Step 4- test-retest reliability (sample 1)** The questionnaire completion was repeated as in sample 1. The two-week time interval was considered most feasible for teachers’ schedules, and considered long enough to ensure that adolescents could not remember the questionnaire in any great detail (e.g. Goldfield et al., 2011).

Relative test-retest reliability is the extent to which participants, in a repeated measures sample, maintain their rank. This was assessed by conducting one-way random consistency analyses of variance to calculate average measure ICCs of repeated measures. Confidence intervals for all ICCs (95%) were calculated, and ICC values are required to be at least  $.70$  (Litwin, 1995). Absolute test-retest reliability, conducted on sample 1, indicates how the scores vary for participants in a sample regardless of rank (Atkinson & Nevill, 1998). This was calculated by measuring the mean difference between both time points and conducting a one-sample t-test ( $p = .05$ ) to determine if the difference between measurements was significant.

## Results

### EFA Factor Structure and Item Selection

**Step 1 - EFA (sample 1)** A series of EFAs were conducted to determine whether the factor structure of the Chinese version of the SRL-SRS was similar to that of the original English version (Jackson & Chen, 2010; Swami, 2009), and to select items for the short Chinese version (Donnellan et al., 2006). Values for the Kaiser–Meyer–Olkin statistic and Bartlett’s test of sphericity indicated an interpretable factor solution (KMO = .94; Bartlett’s test,  $p < .001$ ).

Results of the first EFA showed that eight factors explained most of the variance (see Table 3.1). The original six-factor structure was clearly evident in the translated version, for example, original items 1, 5, 9, 13, 17, 25, 28, from planning, clustered together in one separate factor. Additionally, all items belonging to the original self-evaluation and reflection subscales emerged in exactly the same structure as the original version. Items that loaded onto any factor lower than .40 were removed (one item: ‘I double-check to make sure I did it right’). A subsequent EFA revealed that one of the two additional factors comprised only one item (self-monitoring). As this single factor item was disconnected from the rest of the questionnaire, and after checking the item-total correlation and the “if-item deleted” option, it was removed. The other additional factor comprised a combination of items from three of the original SRL-SRS factors.

Further EFA again produced an 8-factor structure (see table 3.1), within which items from the original SRL-SRS 6 factor version clustered together. One of the two additional factors comprised a combination of items from three of the original scale’s factors (planning, effort, and self-efficacy). The other additional factor only contained two double-loaded items (see table 3.1). The items in the other additional factor were checked for meaning and scale consistency was examined. For example, if planning items 21 “I figure out my goals and what I need to do to accomplish them” and 34 “I ask myself questions about what a problem

requires me to do to solve it, before I do it” were deleted, the planning scale ( $\alpha = .86$ ) would still have a reliability of .86. Table 3.1 shows all 32 items (in bold), their factor loadings, and explained variance of selected items in each factor.

Table 3.1

*EFA Factor Loadings (sample 1) for Translated SRL-SRS Items (32 selected items in bold)*

Original Items (ordered according to subscale)	Factor 1: (Self-evaluation) (R <sup>2</sup> = 27.9%)	Factor 2: (Planning) (R <sup>2</sup> = 12.3%)	Factor 3:	Factor 4: (Reflection) (R <sup>2</sup> = 14.5%)	Factor 5: (Self-efficacy) (R <sup>2</sup> = 5.2%)	Factor 6: (Effort) (R <sup>2</sup> = 7.7%)	Factor 7: (Self-monitoring) (R <sup>2</sup> = 3.5%)	Factor 8:
1		<b>.563</b>						
5		<b>.485</b>						
9		<b>.512</b>						
13		<b>.484</b>						
17		<b>.472</b>		.413				
21				.522				.418
25		<b>.481</b>						
28		<b>.512</b>						
34				.533				
2		.432					<b>.594</b>	
6							<b>.616</b>	
10							<b>.669</b>	
14								.468
18		.465						
22								
3		.475					<b>.511</b>	
7							<b>.721</b>	
11							<b>.595</b>	
15							<b>.487</b>	
23							<b>.463</b>	
26				.461			.413	
30								

Table 3.1 continued

Original Items (ordered according to subscale)	Factor 1: (Self-evaluation) (R <sup>2</sup> = 27.9%)	Factor 2: (Planning) (R <sup>2</sup> = 12.3%)	Factor 3:	Factor 4: (Reflection) (R <sup>2</sup> = 14.5%)	Factor 5: (Self-efficacy) (R <sup>2</sup> = 5.2%)	Factor 6: (Effort) (R <sup>2</sup> = 7.7%)	Factor 7: (Self-monitoring) (R <sup>2</sup> = 3.5%)	Factor 8:
32			.604					
4					<b>.619</b>			
8		.714						
12		.554						
16			.496		<b>.420</b>			
20								
24					<b>.678</b>			
27			.426					
29					<b>.537</b>			
31		.532						
33		.404	.510					
35	<b>.549</b>							.493
36	<b>.698</b>							
37	<b>.722</b>							
38	<b>.637</b>							
39	<b>.642</b>							
40	<b>.692</b>							
41	<b>.628</b>							
42	<b>.704</b>							
43				<b>.735</b>				
44				<b>.766</b>				
45				<b>.793</b>				
46				<b>.723</b>				
47				<b>.697</b>				

Note. Factor loadings below .40 were excluded from the analyses.

## Confirmatory Factor Analysis

**Missing data** The amount of missing data was 5.1% in sample 1 and 2.1% in sample 2. These data were replaced using missing values with maximum likelihood estimation, which takes all subscales into consideration when replacing missing values (Acock, 2005). Normal distributions were not violated.

**Step 2 – CFA (sample 1).** CFA was conducted on the selected 32 items. Goodness of fit indices for CFA sample 1 are:  $\chi^2 = 4660.370$ ;  $df = 496$ ; CFI = 0.93; TLI = 0.92; RMSEA = 0.047; RMSEA (95% CI) = 0.041 - 0.053; SRMR = 0.044. See Table 3.2 for the standardised factor loadings for CFA sample 1, which were all positive and significant ( $p < .05$ ). Cronbach'  $\alpha$  coefficients for sample 1, were all above the criterion of .70 and ranged from .72 to .89 (planning = .86, self-monitoring = .72, effort = .83, self-efficacy = .77, self-evaluation = .89, reflection = .79).

Corrected item-total correlations within each scale were all positive: planning .52 to .66; self-monitoring .48 to .52; effort .60 to .65; self-efficacy .51 to .60; self-evaluation .62 to .75; reflection .59 to .65. The ranges of inter-item correlations, for each subscale, are as follows: planning .29 to .56; self-monitoring .39 to .45; effort .43 to .53; self-efficacy .35 to .49; self-evaluation .37 to .65; reflection .41 to .56. Inter-scale correlations (for both samples) are presented in table 3.3.

Table 3.2

*Factor Loadings and Explained Variance (R<sup>2</sup>) of Items after First CFA for Sample 1*

Item	Planning	Self-monitoring	Effort	Self-efficacy	Self-evaluation	Reflection	R <sup>2</sup>
1	<i>I determine how to solve a problem before I begin</i>	0.578					0.33
2	<i>I carefully plan my course of action to solve a problem</i>	0.658					0.43
3	<i>I think through in my mind the steps of a plan I have to follow</i>	0.622					0.39
4	<i>I ask myself questions about what a problem requires me to do to solve it, before I do it.</i>	0.652					0.43
5	<i>I imagine the parts of a problem I still have to complete</i>	0.652					0.43
6	<i>I clearly plan my course of action to solve a problem</i>	0.698					0.49
7	<i>I develop a plan for the solution of a problem</i>	0.722					0.52
8	<i>I check how well I am doing when I solve a task</i>		0.667				0.44
9	<i>I check my work while doing it.</i>		0.652				0.43
10	<i>I check my accuracy as I progress through a task</i>		0.641				0.41
11	<i>I keep working even on difficult tasks</i>		0.722				0.52
12	<i>I put forth my best effort when performing tasks</i>		0.650				0.42
13	<i>I concentrate fully when I do a task.</i>		0.670				0.45
14	<i>I don't give up even if the task is hard</i>		0.735				0.54
15	<i>I work as hard as possible on all tasks</i>		0.714				0.51
16	<i>If I persist on a task, I will eventually succeed</i>			0.599			0.36
17	<i>If I am in a bind, I can usually think of something to do</i>			0.654			0.43



Table 3.2 Continued.

Item	Planning	Self-monitoring	Effort	Self-efficacy	Self-evaluation	Reflection	R <sup>2</sup>
18				0.661			0.44
19				0.732			0.54
20					0.685		0.47
21					0.696		0.48
22					0.720		0.52
23					0.680		0.46
24					0.760		0.58
25					0.794		0.63
26					0.669		0.45
27					0.802		0.64
28						0.651	0.42
29						0.741	0.55
39						0.695	0.48
31						0.672	0.45
32						0.528	0.23

**Step 3 - cross-validation CFA (sample 2)** The goodness of fit indices for CFA cross-validation sample were: ( $\chi^2 = 7202.115$ ;  $df = 449$ ; CFI = 0.92; TLI = 0.91; RMSEA = 0.052; RMSEA (95% CI) = 0.048 - 0.056; SRMR = 0.043). Standardised factor loadings were all positive and significant ( $p < .05$ ), and ranged from .61 to .81. Cronbach'  $\alpha$  coefficients, for all six subscales, was higher than the required .70. and ranged from .72 to .89 (planning = .84, self-monitoring = .68, effort = .80, self-efficacy = .75, self-evaluation = .89, reflection = .84).

Corrected inter-item correlations within each scale were as follows: planning .59 to .65; self-monitoring .51 to .59; effort .59 to .70; self-efficacy .55 to .60; self-evaluation .60 to .75; reflection .55 to .64. The range of inter-item correlations, for each subscale: planning .34 to .55; self-monitoring .40 to .49; effort .44 to .61; self-efficacy .39 to .52; self-evaluation .40 to .64; reflection .30 to .54. Table 3.3 presents inter-scale correlations (for both samples) which were all positive.

Table 3.3

*Inter-scale Correlation Matrix for CFA Sample 1 and CFA Sample 2*

	Planning Sample1/ Sample2	Self-monitoring Sample1/ Sample2	Effort Sample1/ Sample2	Self-Efficacy Sample1/ Sample2	Self-Evaluation Sample1/ Sample2	Reflection Sample1/ Sample2
Planning	1					
Self-Monitoring	.618** / .703**	1				
Effort	.694** / .591**	.548** / .516**	1			
Self-Efficacy	.671** / .689**	.518** / .528**	.664** / .601**	1		
Self-Evaluation	.687** / .671**	.573** / .615**	.622** / .520**	.550** / .528**	1	
Reflection	.366** / .331**	.207** / .299**	.372** / .368**	.285** / .293**	.363** / .403**	1

Note. \*\* Correlations are significant at the .01 level (2-tailed).

**Step 4 -Test-retest reliability (sample 1)** Relative test-retest analysis (see table 3.4) demonstrated that ICCs varied from .69 to .8. This indicates that all subscales achieved sufficient temporal stability, apart from self-monitoring (.69) and self-efficacy (.69), which were slightly below the .70 criterion. Absolute test-retest reliability analysis revealed that mean differences for subscales were non-significant except for effort ( $p < .05$ ) and reflection ( $p < .05$ ). This means that sufficient absolute temporal stability was demonstrated for all subscales, except for effort and reflection, although mean differences were small (.01 and .08).

Table 3.4

*ICC and Absolute Test-retest Statistics for the Short SRL-SRS-C for Sample 1*

	ICC Sample 1	95% CI for ICC Sample 1	Mean T1 (SD)	Mean T2 (SD)	Mean difference M10T1 – M10T2	Significance of One-sampled T-test (.05) M1	SE of T1- T2 M3	95% CI for T1 – T2 M1
Planning	.82	.77 - .86	2.44(.52)	2.43(.52)	.01	.74	.02	-.04 - .05
Self-Monitoring	.69	.74 - .83	2.32(.55)	2.34(.58)	-.05	.12	.03	-.11 - .01
Effort	.79	.68 - .8	2.51(.55)	2.58(.55)	.07	.01	.03	.02 - .12
Self-efficacy	.69	.61 - .75	2.48(.55)	2.47(.54)	-.01	.81	.03	-.07 - .05
Self-evaluation	.8	.75 - .84	3.27(.67)	3.23(.64)	.03	.39	.03	-.03 - .09
Reflection	.73	.66 - .78	3.63(.62)	3.55(.57)	.08	.01	.03	.02 - .14

## Discussion

This study translated the English SRL-SRS questionnaire into Chinese. To address any potential cross-cultural issues of English to Asian language questionnaires (e.g. Jackson & Chen, 2010), EFA was conducted to assess the factor structure of the Chinese version. Internal consistency measures and judgmental item quality assessments were made to select items for the shorter version. As a result, the original SRL-SRS six-factor structure was kept by selecting items that had acceptable factor loadings, and clustered together just as they appear in the original SRL- SRS. In total, fourteen items were removed and subsequent CFAs confirmed that the selected 32 items produced an acceptably reliable instrument with which to measure a general tendency for self-regulated learning among Hong Kong Chinese adolescents. Furthermore, relative and absolute test–retest reliability analyses revealed that the short SRL-SRS-C was sufficiently stable over time.

However, this does suggest that the full 46-item translated version is not as structurally sound as the original version. This is due to two additional factors that emerged in the Chinese version. Despite these two additional factors, and in accordance with Zimmerman’s theory (1986, 2006), closer inspection did not raise any concerns that new and distinct subscales of SRL had emerged. The self-evaluation and reflection factors had emerged in exactly the same structure as in the original version, suggesting that these items were effectively translated and well understood. However, five of the items that were not selected for the short version emerged in the planning subscale of the new measure (1 self-monitoring, 1 effort, and 4 self-efficacy), along with another five items in factor 3 (2 planning, 1 effort, and 2 self-efficacy items). It appears that, for Chinese adolescents, the motivational components (effort and self-efficacy) correlate higher with planning than was the case in the Western sample. This may be due to cultural differences in motivational components. For example, despite similar strategy use between Australian and Japanese students (Purdie, Hattie, and Douglas, 1996), the Japanese notion of persistence and effort in

relation to studying is for the benefit of the group, whereas, generally for Westerners, effort is for personal gain. Furthermore, Rotgans and Schmidt (2008) found that although students from culturally different backgrounds (Chinese, Malay, and Indian) did not differ significantly in their use of self-regulated learning strategies, differences in latent mean values suggested minor cultural variations in motivational beliefs.

It is also possible that translation problems occurred despite the systematic back-translation method used. According to Phillips (1960), achieving conceptual equivalence is a common but unsolvable problem as every word carries a set of assumptions, values and feelings unique to each individual and his or her culture. Despite these issues, sufficient items clustered together under the six factors and were subsequently confirmed with CFAs, in two separate samples.

All items in the short SRL-SRS-C represent important aspects of self-regulatory processes, which contribute to the achievement of personal potential (Toering et al., 2012). According to Zimmerman (1986, p. 308), the metacognitive component refers to the continuous cycle of planning, self-monitoring, and self-reflection related to the development process. The importance of metacognition, in the learning process, dates back to Socrates' questioning methods, and Dewey (1933) suggested that we learn more from reflection than the experience itself. The motivational component in SRL relates to the level of autonomy, self-efficacy, and effort, which are required during learning or development of any kind (Bandura, 1997). Therefore, the confirmation of the SRL-SRS-C points to the existence of self-directed processes and self-beliefs among Chinese adolescents.

Toering et al. (2011) assessed behavioural correlates of SRL and discovered that self-regulated adolescents (elite youth soccer players) optimised opportunities for learning, were more focused and prepared for training, took more responsibility and initiative, and were aware of their abilities and inabilities. Considering this amongst adolescents in any learning domain, good self-regulators will pay attention to instructions and process

information effectively. They will assess their strengths and deficiencies in skills or strategies, and create opportunities and productive environments to facilitate learning. Additionally, regardless of domain, good self-regulators will relate new knowledge to existing knowledge and act accordingly, while maintaining the belief that they are capable of learning, developing, and achieving their learning goals.

Content validity of the short SRL-SRS-C is supported as it is based on Zimmerman's theory, which also supports the original SRL-SRS (Toering et al., 2012). Four out of six subscales of the original SRL-SRS were adapted from English questionnaires that were also developed in line with this theory (e.g. Hong & O'Neil, 2001). Furthermore, as in Toering et al. (2012), the CFA results are acceptable, and the content validity is further strengthened by demonstrating stability across two samples. Construct validity of the short SRL-SRS-C was supported because the theory-based model fitted the data acceptably in two samples, as in Toering et al. (2012). All subscales were significantly correlated, demonstrating their associations with the overall SRL construct (Zimmerman, 1989, 2006). Although the planning subscale demonstrated higher correlations with self-monitoring, effort, self-efficacy, and self-evaluation, none of the inter-scale correlations exceeded .80 (Carron et al., 1985). Planning was also highly correlated with self-monitoring and evaluation, in the original SRL-SRS, because these subscales represent the three associated phases of SRL (Cleary & Zimmerman, 2001; Zimmerman, 2006, 2008). In the same way, the Chinese SRL-SRS results support the construct validity of the model. Additionally, the SRL-SRS-C was sufficiently stable over time with only self-monitoring and self-efficacy being just below the criterion, although there is no consensus for what constitutes a good ICC (Weir, 2005).

The cross-sectional nature of this study limits the findings. Additionally, the short SRL-SRS-C is only applicable to an adolescent population; therefore, extending these findings into younger or older populations would require further research. The SRL-SRS-C can also only be applied in a Hong Kong Chinese population due to the different cultural



context in other parts of China. Additionally, this validation study has not evaluated the selected items with external criteria, such as other related questionnaires which may limit its external validity.

Toering et al. (2011) pointed out that the behavioural correlates of SRL may be different in academic situations compared to sport or physical activity. Considering this, behavioural correlates of SRL may also turn out to be different in Chinese populations compared to Western samples, as the differences in the full Chinese version of the SRL-SRS may indicate. As such, future research should consider developing local, domain-specific instruments (such as the soccer-specific instrument, Toering et al., 2013), to measure behavioural correlates of SRL. It may then be possible to ascertain whether SRL can predict certain behaviours. It may also be important to create a locally developed SRL questionnaire rather than reliance on translated Western questionnaires (Swami, 2009). Additionally, it is important to note that researchers have recommended that self-regulation should be explicitly taught (e.g. Chen & Singer, 1992). As such, future research should consider experimental research with SRL skill training to assess the impact on various behaviours, for example, increasing PA levels.

In conclusion, the short SRL-SRS-C is a sufficiently reliable instrument to measure SRL in an adolescent Hong Kong Chinese population. The short SRL-SRS-C has demonstrated sufficient content and construct validity and stability over time. Recommended use of short SRL-SRS-C should include experimental research to assess the impact of training SRL skills to improve performance and health behaviours.

The following chapter examines the association between SRL and LTPA in two culturally different populations. Considering that existing evidence regarding the association of SRL and LTPA comes from Western samples (e.g. Matthews & Moran, 2011), a comparison between an Eastern (Hong Kong) and a Western (Scotland) sample can provide a broader view of how SRL may be related to adolescent LTPA. In addition, the similarities

and differences in behaviours between the two samples can be examined. As self-regulation is well documented to have strong associations with superior performance in other domains, a deeper understanding of how self-regulated learning is associated with adolescent physical activity can inform the development of effective interventions to enhance adolescent PA.

**Investigating the Association of Self-Regulation of Learning with Adolescent Leisure-Time Physical Activity**

**Abstract**

**Purpose** This study examines the role of self-regulated learning (SRL) in adolescents PA among Hong Kong Chinese and Scottish adolescents.

**Methods** Using a cross-sectional design, 480 Hong Kong Chinese (aged 11 – 19; mean age = 14.93 years, SD = 1.77, male = 61.3%) and 411 Scottish, aged 12 – 16 years (mean = 13.84; male = 47.9%) healthy adolescents participated in this study. PA and SRL were assessed with the Chinese and the English versions of a self-regulated learning scale.

**Results** Moderate-plus-vigorous intensity LTPA was significantly higher among Scottish compared to Hong Kong adolescents. A weak but significant relationship was found between total SRL scores and moderate-plus-vigorous LTPA for both the Hong Kong and the Scottish samples. In both samples, all SRL variables significantly explained a small amount of variance in PA, with reflection being a significant predictor.

**Conclusions** Higher self-regulating adolescents may be more likely to engage in higher levels of LTPA. SRL has a significant impact on LTPA, and of all the SRL variables, reflection plays a key role in both Hong Kong and Scottish students.

## Background

Globally, four out of five adolescents do not achieve recommended levels of physical activity (PA) (Hallal et al., 2012). Regular participation in PA is associated with a decreased risk of cardiovascular disease (Warburton et al. 2006), obesity and improvements in psychological functioning in adolescents (Biddle & Asare, 2011). As activity levels track from adolescence to adulthood (Malina, 2001; Telama et al., 2005) young people are at risk of developing into inactive adults along with the persistence of physical, psychological and social problems. Thus, improving physical activity levels is a public health priority. Physical activity levels are declining not only in wealthy countries, such as the United States (US) and the United Kingdom (UK), but also in low to middle-income countries, such as China. This decline in PA is considered an important contributor to the global obesity epidemic, as well as many non-communicable diseases (Ha, Abbott, Macdonald, & Pang, 2009; Lee et al., 2012).

Hong Kong's children are among the most inactive children in the world (Guldan, Cheung & Chui, 1998; Adab & Macfarlane, 1998). In 2012, only 12.8% of adolescent boys and 4.2% of adolescent girls met the recommended levels of PA (Leisure and Cultural Services Department (LCSD), 2012). Additionally, the prevalence of obesity in Hong Kong for secondary school students, rose from 13.6% in 1997/1998 to 18.7 in the 2010/2011 school year (Department of Health, Hong Kong SAR, 2012). Within Europe, the UK is the third most inactive country and the eighth most inactive in the world (Hallal et al., 2012). Of the four nations that comprise the UK, Scotland and Northern Ireland have the highest prevalence of obesity, Scotland (68.3%), Northern Ireland (69%), England (67%) and Wales (63%) (Gilman, 2015). According to Scottish Government statistics, even though, 75% of 11 – 12 year olds and 59% of 13 – 15 year olds reported meeting the daily PA recommendations, 31.6% of children were overweight or obese and 15.7% children were obese or morbidly obese in 2011 (Gray & Leyland, 2011). Both Hong Kong and Scotland's

PA recommendations for 5-18 year olds are in line with the World Health Organisation (WHO, 2013; at least 60 minutes of moderate intensity PA daily, vigorous intensity activities, and activities to strengthen muscles three times per week), and both governments have set targets to improve activity levels. However, on an individual level, considerable effort and self-regulation (SR) is required to start and subsequently maintain an active lifestyle (Baumeister, Scmeichel & Vohs, 2003).

Self-regulated Learning (SRL) is defined as “*The extent to which individuals are metacognitively, motivationally and behaviourally proactive participants in their own learning and developmental processes*” (Zimmerman 1986, p. 308). Bandura (2004) suggested that it is necessary to equip individuals with the relevant psychological skills and efficacy beliefs, to help them manage the daily multitude of emotional and social pressures, and to manage their environments and social relationships. SRL (Zimmerman, 1986) has an established role in the enhancement of development and learning in academic achievement (Zimmerman, Moylan, Hudesman, White & Flugman, 2011), sport (Kitsantas & Zimmerman, 2002; Toering, Elferink-Gemser, Jordet & Visscher, 2009) and health settings (Kitsantas, 2000; Maes & Karoly, 2005). It is not surprising to find that individuals with a tendency to take a more proactive approach to personal learning and development can also apply this to other areas. For example, talented athletes have been found to be high self-regulators and high academic achievers (Jonker, Elferink-Gemser, & Visscher, 2009).

Thus, metacognitive SRL skills such as planning, self-monitoring, self-evaluation, reflection as well motivational aspects of self-efficacy and effort are important, not only for performance improvements, but also for improved engagement in PA (Toering, et al., 2012). By helping to explain motivation in addition to learning, the SRL theory is very useful for educators who deal with poorly motivated students. In short, Zimmerman’s (1986) self-regulated learning model attempts to explain *how* individuals are able to make improvements through a systematic method of learning how to adapt to ever changing environments

(Schunk, 2001). Such an approach is capable of meeting the necessary theoretical demands for meaningful behaviour change research (Boekarts, 1997) and may be instrumental in enhancing levels of PA (Toering et al., 2012).

### **SRL and Culture**

Research into SRL within academic settings has demonstrated cultural differences between Eastern and Western populations (Chen, Lee & Stevenson, 1995; Purdie, Hattie & Douglas, 1996; Stevenson & Lee, 1996; Ho, 2004). In this field, Western scholars tend to describe Asian learners as being reactive rather than proactive in their approaches to learning, and more dependent on instruction rather than initiating their own learning (Turingan & Yang, 2009). Purdie, Hattie & Douglas, 1996 found that Australian students had a narrower school-based view of learning, and the Japanese students understood learning from a much broader perspective. Despite the differences in perspective, analysis of the strategy use between the Japanese and Australian students was found to be similar. Pilay, Purdie and Boulton-Lewis (2000) also provided evidence against the commonly cited notion of passive Asian students (Kember, 2000). Pilay et al. (2000) assessed cross-cultural variations in Australian and Malay students using two well validated questionnaires in conceptions of learning (Purdie, Hattie & Douglas, 1996); and motivated strategies for learning (Pintrich et al., 1991). This research identified a new factor termed 'learning as duty', which resulted in the only significant difference between the groups. The authors explained this finding through the collectivist nature of Malaysian society and the Asian phenomenon of 'loss of face'. This 'loss of face' might translate into 'duty to learn' and an obligation for the students to behave in a way expected by their families and communities. This finding supports the idea that Asian students, despite the collectivist culture notion, demonstrated 'self' responsibility and 'self' regulate their learning to benefit the collective ideal.

## **SRL and PA**

With regards to SRL and adolescent PA, evidence suggests that interventions that manipulate aspects of self-regulation with the aim of improving PA are beneficial. For example, positive associations between SRL and PA have been found (Winters et al., 2003; Mathews & Moran, 2011). With regards to experimental evidence, Lubans and Morgan (2008) designed a programme for secondary school students to promote lifestyle (e.g. walking/cycling to school) and lifetime physical activity. Goal setting and physical activity monitoring were the primary behaviour modification strategies focussed on and the results revealed significantly more steps being accumulated by adolescents who were inactive at baseline. Araújo-Soares et al. (2009) targeted variables from social cognitive theory, self-regulation theory and planning theory as evidenced mediators of PA change through a school-based intervention. Although no significant differences were found at post-test, at nine months the follow-up, the intervention group reported significantly more self-reported moderate to vigorous intensity PA. This suggests the long-term potential of impacting on PA behaviours through variables such as those under the SRL umbrella.

Despite promising empirical support for the role of SR on PA among adolescents, research in this area is limited. For example, it is unclear which self-regulatory strategies are most effective in facilitating PA behaviours, particularly among adolescents (Mathews & Moran, 2011). This cross-sectional study sought to investigate the SRL-PA relationships in Hong Kong Chinese and Scottish adolescents. The research aimed to answer the following questions: 1) How do levels of leisure-time PA (LTPA) and SRL component scores compare between Hong Kong and Scottish adolescents? 2) Are self-regulatory components from a theoretically driven model associated with LTPA in Hong Kong Chinese and Scottish adolescents? 3) Do any differences exist in the contribution of SRL variables between moderate and vigorous intensity LTPA between Hong Kong Chinese and Scottish Adolescents?

## Methods

### Design and Participants

This study used a cross-sectional design, with purposive sampling of healthy adolescents with no physical or psychological contraindications to exercise from two countries. Four hundred and eighty adolescents (age range 11 – 19; mean age = 14.9 years, SD = 1.8, male = 294) recruited from three secondary schools in Hong Kong participated in this study. Recruitment was achieved by contacting physical education (PE) teachers via existing networks. Four hundred and eleven Scottish adolescents, aged 12 – 16 years (mean = 13.8; SD = 1.4; male = 197), from a culturally representative secondary school in Scotland, agreed to take part in this study. The Scottish school enrolls students from a wide catchment area covering four large towns on the west coast of Scotland, with children from all walks of Scottish (unemployed to professional parents). Recruitment was achieved by contacting PE teachers through existing networks.

### Measures

**SRL** was assessed in the Hong Kong sample with the self-regulated learning self-report scale -Chinese version (SRL-SRS-C; Pitkethly & Lau, 2015; Cronbach'  $\alpha$  coefficients, for all 6 subscales ranged from .72 to .89; ICC's range from .69 to .82 for all 6 subscales), which assesses dispositional SR as a metacognitive and motivational construct (Toering et al., 2012). Self-reported SRL was measured in the Scottish sample with the self-regulation of learning scale (SLR-SRS) for English speaking populations (Toering et al., 2012;  $\alpha$  = .73 to .85 for all 6 subscales; ICC's range from 0.70 to 0.84 for all 6 subscales).

For both the Chinese and English SRL measures a total SRL score can be generated from all six components (planning, self-monitoring, effort, self-efficacy, self-evaluation, reflection). Higher scores indicate a higher tendency for SRL. Component scores can be calculated separately for each of the six components and are interpreted in the same way as the total score. For example, higher planning scores indicate better planning capabilities. An



example of an item from the planning scale is '*I carefully plan my course of action to solve a problem*'.

**Self-Reported LTPA** In this study leisure-time PA (LTPA) was examined as it is considered one of the most important dimensions of PA (Tudor-Locke, Ainsworth & Popkin, 2001) and accounts for 55% to 65% of PA time for children (Katzmarzyk & Malin, 1998). This could positively impact on the uptake of lifelong exercise Sallis & Owen (1999). The Godin Leisure-Time Exercise Questionnaire (GLTEQ) was used to measure subjective leisure-time PA (Godin & Shephard, 1985) in both samples. This measure has been validated in a number of studies with adolescents (Hortz & Petosa, 2008; Matthews & Moran, 2011). The Godin questionnaire has demonstrated a test-retest reliability of .81 (Sallis, Buono, Roby, Micale, & Nelson 1993).

### **Procedure**

Ethical approval was obtained and after the PE teachers had declared their interest to take part in the study, the principals of each school were approached in writing. Upon receipt of written consent from the principals, all parents were contacted and informed of the study. All parents provided written informed consent and participants assented prior to questionnaire completion. Questionnaires were administered during school hours as determined by class teachers. Researchers and research assistants were available at data collection times to clarify any issues.

### **Analyses**

SPSS 21.0 (IBM Corp., 2012; version 21.0) was used for all data analyses. Little's chi-square (MCAR = 1155.731,  $df = 915$ ,  $p = 0.000$ ) indicated that SRL and LTPA data were missing at random and dealt with by listwise exclusion. As the recommended daily guidelines (WHO, 2013) for adolescent PA are 60 minutes of moderate to vigorous PA, the GLTEQ data analysis focused on moderate and vigorous scores and excluded the light

activity scores (Matthews & Moran, 2011). All data were assessed for outliers and normality to ensure the data were fit for statistical analyses.

Pearson product correlations were conducted to analyse the relationship between gender and LTPA, and among SRL variables and LTPA. Independent t-tests were conducted in both samples to examine LTPA, SRL and gender mean differences. Measurement invariance was conducted to confirm the equality of factor structures across the Hong Kong and Scottish groups using AMOS (within SPSS 21.0; IBM Corp., 2012; version 21.0). According to cross-cultural literature, in order to meaningfully compare differences between cultures, measurement invariance should be conducted. In addition to measure adaptation and validation (SRL-SRS; Toering et al., 2012; and SRL-SRS-C; Pitkethly & Lau, 2015), a further three levels of invariance (configural invariance, metric invariance and scalar invariance) require to be fulfilled (e.g. Horn & McArdle, 1992; Byrne, 2004). Within a multi-group CFA (MGCFA; Milfont & Fischer, 2010), configural invariance was tested by cross-validating the factor structure across groups. A covariance matrix was analysed and a maximum likelihood method of estimation was used. In this model one factor loading was set to be equal in each group. The metric invariance model set all factors loading to be equal across groups. The scalar invariance model (model 3) set all factor loadings, item intercepts and residual variances equal across groups. A structural invariance model (model 4) set all factor loadings, item intercept, residual variances and factor variances equal across groups. Additionally, a model with equal variances was examined (e.g. Brown, 2006).

Several fit indices were used to determine measurement invariance across groups. Model fit was assessed with  $\chi^2$ ; comparative fit index (CFI; Bentler, 1990); Tucker-Lewis index (TLI); Bentler & Bonett, 1980) criterion  $> .90$  (Hu & Bentler, 1999), and the root square mean error of approximation (RMSEA; Steiger, 1990), MacCallum, Browne and Sugawara (1996) have suggested that 0.01, 0.05, and 0.08 to indicate excellent, good, and mediocre fit, respectively. The RMSEA 95% confidence intervals are also presented.

Additionally, the change in CFI ( $\Delta$ CFI) was assessed and values of above .01 indicate decreasing fit (Cheung & Rensvold, 2002). Subsequently, after confirming the measurement invariance across both samples of students, independent t-tests were conducted to test differences between SRL components.

Assumptions of HMR were tested for and found to be acceptable in both samples including, normality, and independence of residuals, linear relationships, homoscedasticity, and collinearity statistics. The range of ages in both samples was taken into consideration by including age in the first block of the HMR analyses along with gender. Thereafter, the six SRL variables were entered into HMR analyses according to social cognitive theory (SCT). Self-reported LTPA (separate analysis for moderate, vigorous or moderate to vigorous LTPA) was the dependent variable; gender and age, followed by self-efficacy, and subsequently the remaining SRL variables were entered as predictors in steps, according to their hierarchy in Zimmerman's model (see Zimmerman, 2000).

## **Results**

Means, standard deviations and Pearson correlations for moderate, vigorous and both moderate and vigorous intensity LTPA and self-regulation variables in the Hong Kong and Scottish samples (see table 1).

Table 4.1

Mean, standard deviations and Pearson correlations for moderate, vigorous and both moderate and vigorous intensity LTPA and self-regulation variables in the Hong Kong ( $n = 475$ ) and Scottish samples ( $n = 393$ )

Hong Kong									
	N	Mean	SD	Planning	Self-monitoring	Effort	Self-efficacy	Self-evaluation	Reflection
Moderate LTPA	475	10.93	10.88	.16**	.13**	.14**	.15**	.14**	.16**
Vigorous LTPA	475	20.22	16.45	.12**	.05	.15**	.18**	.16**	.14**
Total LTPA	475	31.14	22.26	.17**	.10*	.18**	.21**	.19**	.18**
Scotland									
Moderate LTPA	393	17.54	12.36	.02	.02	.05	.091	.069	.128*
Vigorous LTPA	393	31.04	20.04	.14**	.08	.19**	.23**	.08	.19**
Total LTPA	393	48.58	26.01	.12*	.08	.17**	.22**	.09	.21**

Note. \*  $p < .05$ . \*\*  $p < .01$ ; SD, Standard deviation;  $N =$  number of participants

### LTPA Differences between Hong Kong and Scotland

There was a statistically significant difference in moderate intensity LTPA between the Hong Kong ( $M = 10.93$ ;  $SD = 10.88$ ) and Scottish adolescents, ( $M = 17.54$ ;  $SD = 12.36$ ; mean difference =  $-6.9$ ; 95% CI  $[-8.51, -5.39]$ ;  $t(780) = -8.73$ ;  $p = .0005$ ). A statistically significant difference was also found for vigorous intensity in the Scottish ( $M = 31.04$ ;  $SD = 20.04$ ) adolescents compared to Hong Kong ( $M = 20.22$ ;  $SD = 16.45$ , mean difference =  $-11.3$ ; 95% CI  $[-13.83, -8.81]$ ;  $t(746) = -8.85$ ;  $p = .0005$ ). Moderate to vigorous intensity LTPA was also significantly higher among Scottish adolescents ( $M = 48.58$ ;  $SD = 26.01$ ; mean difference =  $-18.3$ ; 95% CI  $[-21.52, -14.98]$ ,  $t(773) = -10.96$ ;  $p = .0005$ ) compared to Hong Kong ( $M = 31.14$ ;  $SD = 22.26$ ).

**Frequency of LTPA** Eleven per cent of Hong Kong adolescents reported engaging in moderate every day of the week and 4% in vigorous intensity LTPA. While 23.4% of Scottish adolescents reported engaging in moderate and 17% in vigorous intensity LTPA on seven days a week. Table 4.2 below presents the frequency of self-reported moderate and vigorous intensity LTPA for Hong Kong and Scottish adolescents.

Table 4.2

*Moderate and vigorous intensity LTPA reported for days of the week*

Number of days	HK adolescents ( <i>n</i> = 475)		Vigorous LTPA		Scottish adolescents ( <i>n</i> = 393)		Vigorous LTPA	
	Moderate LTPA				Moderate LTPA			
	n (valid%) (cum%)		n (valid%) (cum%)		n (valid%) (cum%)		n (valid%) (cum%)	
0	111	(23.4) (23.4)	78	(16.4) (16.4)	47	(12) (12.0)	49	(12.5) (12.5)
1	125	(26.3) (49.7)	117	(24.6) (41.1)	58	(14.8) (26.7)	35	(8.9) (21.4)
2	90	(18.90) (68.6)	99	(20.8) (61.9)	60	(15.3) (42.0)	70	(17.8) (39.2)
3	46	(9.7) (78.3)	86	(18.1) (80.0)	57	(14.5) (56.5)	63	(16.0) (55.2)
4	28	(5.9) (84.2)	35	(7.4) (87.4)	31	(7.9) (64.4)	46	(11.7) (66.9)
5	18	(3.8) (88.0)	26	(5.5) (92.8)	30	(7.6) (72.0)	48	(12.2) (79.1)
6	6	(1.3) (89.3)	14	(2.9) (95.8)	18	(4.6) (76.6)	16	(4.1) (83.2)
7	51	(10.7) (100.0)	20	(4.2) (100.0)	92	(23.4) (100.0)	66	(16.8) (100.0)

Note: *n* = number of participants; valid% = valid percentage of participants; cum% = cumulative percentage of participants; HK = Hong Kong; SC = Scotland

**SRL and LTPA**

A weak but significant relationship was found between total SRL scores and moderate to vigorous LTPA for both Hong Kong (*n* = 475;  $r = .17$ ,  $p = .0001$ ) and Scottish adolescents (*n* = 391;  $r = .17$ ,  $p = .001$ ). Pearson correlations between SRL variables and self-reported LTPA for both samples are presented in table 3.

Table 4.3

*Means and standard deviations for self-regulatory components and total SRL score*

	Planning	Self-monitoring	Effort	Self-efficacy	Self-evaluation	Reflection	Total SRL score
Scotland	2.51 (.50)	2.61(.56)	2.77 (.55)	2.67 (.50)	3.51 (.73)	3.80(.59)	132.93 (21.41)
Hong Kong	2.52 (.52)	2.45 (.60)	2.71 (.55)	2.60 (.56)	3.32 (.64)	3.65 (.63)	86.93 (12.49)
Significance level (2-tailed)	.931	.000**	.116	.056	.000**	.001**	.000**

Note. \*\* $p < .01$

## Measurement Invariance of SRL

Initially, a configural model fitted the data adequately, followed by a metric model, constraining corresponding factor loadings to be equal across the Hong Kong and the Scottish group, which fitted the data adequately and showed that the  $\Delta$ CFI value between the configural and the metric model was less than the criterion of .01 ( $\Delta$ CFI = .001; Cheung & Rensvold, 2002). Scalar invariance was then tested which imposed constraints on the item corresponding item intercepts but this model did not meet the  $\Delta$ CFI criterion. However, based on the AMOS output, the cross-group equality constraint for self-evaluation and self-monitoring contributed most to the lack of fit. As a result, a partial scalar model (see table 4) freely estimated these parameters in both groups and provided evidence of partial scalar invariance ( $\Delta$ CFI = .006). The following model tested partial error invariance, which imposed additional cross-group equality constraints on all corresponding error variances apart from those for self-evaluation and self-monitoring. This model was accepted using the  $\Delta$ CFI criterion ( $\Delta$ CFI = .004). Overall, evidence of partial measurement invariance analysis was provided which indicate that the factorial structure, the slopes and intercepts, and variances of the SRL construct are similar between the Hong Kong Chinese and the Scottish samples. Table 4 presents the measurement invariance results.

Table 4.4  
*Fit indices for the measurement invariance analysis (n = 899)*

Model	CMIN/DF	TLI	CFI	$\Delta$ CFI	RMSEA	RMSEA (95% CI)
Configural invariance across groups	8.264	.88	.95		.09	[.08, .10]
Metric invariance across groups	6.957	.90	.95	.001	.08	[.07, .09]
Partial Scalar invariance across groups	6.957	.90	.94	.006	.08	[.07, .09]
Partial Error invariance across groups	6.492	.91	.94	.004	.08	[.07, .09]

*Note:* CMIN/DF = chi-square divided by its degrees of freedom; TLI = Tucker Lewis Index; CFI = comparative fit index;  $\Delta$ CFI = change in CFI; RMSEA = root mean square error of approximation; 95%CI =95% confidence interval.

## **SRL Component Differences between Hong Kong and Scotland**

Total mean SRL score was significantly higher for Scottish adolescents ( $M = 132.93$ ;  $SD = 21.41$ ; 95% CI [-47.84,-43.09],  $t(619) = -37.65$ ,  $p = .0005$ ) compared to Hong Kong adolescents ( $M = 86.93$ ;  $SD = 12.49$ ).

For Scottish adolescents, self-monitoring ( $M = 2.61$ ;  $SD = .56$ ; 95% CI [-.23,-.07];  $t(888) = -3.849$ ;  $p = .0005$ ), self-evaluation ( $M = 3.51$ ;  $SD = .73$ ; 95% CI [-.28,-.09];  $t(796.034) = -4.070$ ;  $p = .0005$ ) and reflection ( $M = 3.80$ ;  $SD = .59$ ; 95% CI [-.23,-.06];  $t(858.247) = -3.506$ ;  $p = .0005$ ) were significantly higher compared to Hong Kong adolescents. Planning ( $p = .931$ ), effort ( $p = .116$ ) and self-efficacy ( $p = .056$ ) were not significantly different between Hong Kong and Scottish adolescents.

## **Hierarchical Multiple Regression (HMR)**

**Hong Kong.** Only the model containing age, gender and self-efficacy significantly predicted moderate intensity LTPA ( $\Delta R^2 = .020$ ,  $F(1,466) = 3.996$ ,  $p = .002$ ). None of the other SRL variables significantly contributed to the prediction of moderate intensity LTPA. For vigorous intensity LTPA, controlling for age and gender, the final model containing all self-regulatory variables was significant  $\Delta R^2 = .018$ ,  $F(2,461) = 6.620$ ,  $p = .009$ ; adjusted  $R^2 = .035$ . The SRL variables explained 4.7% ( $R^2_{\text{model 5}} - R^2_{\text{model 1}} = .047$ ) i.e. all SRL predictors minus gender and age ( $R^2 = .047$ ) of the variance of vigorous intensity LTPA. Of the SRL variables, self-evaluation ( $p = .03$ ) significantly predicted LTPA. For combined moderate to vigorous intensity LTPA, 5.9% ( $R^2 = .059$ ) of the variance was explained by the model containing all SRL variables ( $\Delta R^2 = .021$ ,  $F(2,461) = 6.320$ ,  $p = .005$ ; adjusted  $R^2 = .048$ , with reflection ( $p = .027$ ) being the only significant predictor.

**Scotland** Only the model containing age, gender and self-efficacy predicted ( $\Delta R^2 = .010$ ,  $F(1,381) = 1.328$ ,  $p = .048$ ; adjusted  $R^2 = .003$ ) moderate intensity LTPA. For vigorous intensity LTPA, the final model containing all SRL variables ( $R^2_{\text{model 5}} - R^2_{\text{model 1}} = .062$ ) predicted 6.2% of the variance in vigorous intensity LTPA ( $\Delta R^2 = .016$ ,

$F(2,376) = 11.422, p = .027$ ; adjusted  $R^2 = .178$ ). In this model self-efficacy ( $p = .008$ ) and reflection ( $p = .008$ ) were significant SRL predictors. All SRL variables ( $R^2_{\text{model 5}} - R^2_{\text{model 1}} = .068$ ) significantly explained 6.8% of the variance in moderate to vigorous intensity LTPA ( $\Delta R^2 = .020, F(2,376) = 8.427, p = .013$ ; adjusted  $R^2 = .134$ ), with self-efficacy ( $p = .003$ ) and reflection ( $p = .003$ ) as the significant predictors.



Table 4.5

HMR for Hong Kong ( $n = 473$ ) and Scottish ( $n = 389$ ) adolescent moderate and vigorous intensity LTPA

Model	Hong Kong					Scotland						
	B	SE	Beta	$t$	$R^2$	$\Delta R^2$	B	SE	Beta	$t$	$R^2$	$\Delta R^2$
1					.040	.04**					.08	.08**
Constant	60.32	9.03		6.68			118.78	12.74		9.32**		
Gender	-7.91	2.06	-.174	-3.84**			-8.21	2.56	-.16	-3.20**		
Age	-1.22	.57	-.097	-2.15**			-4.17	.90	-.23	-4.63**		
2					.07	.03**					.13	.05**
Constant	37.20	10.56		3.52			88.83	14.11		6.29**		
Gender	-6.95	2.04	-.153	-3.40**			-7.31	2.51	-.14	-2.91**		
Age	-1.05	.56	-.083	-1.86			-4.20	.88	-.23	-4.78**		
Self-efficacy	7.33	1.81	.183	4.06**			10.85	2.41	.22	4.49**		
3					.07	.00					.13	.00
Constant	35.77	10.77		3.32			90.58	14.25		6.36**		
Gender	-6.92	2.04	-.152	-3.39**			-7.11	2.52	-.14	-2.82**		
Age	-1.06	.56	-.084	-1.8			-4.22	.88	-.23	-4.79**		
Self-efficacy	6.17	2.47	.154	2.50**			12.96	3.41	.26	3.80**		
Planning	1.83	2.66	.042	.69			-2.95	3.36	-.06	-.88		
4					.08	.00					.13	.00
Constant	32.32	11.00		2.94			90.04	14.56		6.19**		
Gender	-6.87	2.05	-.151	-3.35**			-7.14	2.53	-.14	-2.82**		
Age	-1.04	.57	-.083	-1.82			-4.21	.89	-.23	-4.71**		
Self-efficacy	4.92	2.61	.123	1.88			12.57	3.98	.25	3.16**		
Planning	1.11	3.23	.026	.34			-3.23	4.02	-.07	-.80		
Effort	3.69	2.37	.091	1.56			.61	3.45	.01	.18		
Self-monitoring	-.78	2.39	-.021	-.37			.16	3.23	.00	.05		
5					.09	.02**					.15	.02**
Constant	19.18	11.66		1.65			70.93	15.81		4.49		
Gender	-7.18	2.03	-.158	-3.53**			-7.34	2.51	-.14	-2.92**		
Age	-1.00	.56	-.080	-1.78			-4.01	.89	-.22	-4.51**		
Self-efficacy	4.45	2.59	.111	1.71			11.98	3.97	.24	3.02**		
Planning	-1.24	3.36	-.029	-.37			-3.23	4.05	-.07	-.80		
Effort	2.16	2.39	.053	.90			-.42	3.47	-.01	-.12		
Self-monitoring	-2.32	2.45	-.062	-.95			.39	3.31	.01	.12		
Self-evaluation	4.21	2.24	.119	1.88			-1.65	2.34	-.05	-.70		
Reflection	3.87	1.73	.109	2.24**			6.93	2.33	.16	2.98**		

Note: B, unstandardised coefficients; SE, standard error; Beta, standardised coefficients; \*\* $p < .01$

## Discussion

The current study found that Scottish students engaged in significantly more LTPA than Hong Kong students, which was associated with higher self-monitoring, self-evaluation and reflection scores. This study has also demonstrated a similar pattern between SRL and LTPA in both Western and Eastern adolescent samples with reflection playing a key role in combined moderate to vigorous intensity LTPA in both samples.

### **How do levels of PA and SRL component scores compare between Hong Kong and Scottish adolescents?**

Despite the fact that the Scottish adolescents engaged in significantly more LTPA than Hong Kong adolescents, neither adolescent sample engaged in the recommended amount of PA. These results highlight the urgency for PA promotion strategies for Hong Kong adolescents in particular. In addition to the fact that Scottish adolescents engaged in more LTPA than Chinese adolescents, they also used more self-monitoring, self-evaluation, and reflection. Self-monitoring has been identified as one of the most important behaviour change techniques to have a positive effect on PA (Olander et al., 2013). The Scottish adolescents in the current study may have benefited from the fact that self-monitoring provides important information for setting appropriate goals and for the evaluation of progress towards those goals and affects personal competence and self-esteem.

The Scottish adolescents' higher self-evaluation scores represent a higher ability to assess behaviours for accuracy and error towards the execution of a set plan (Toering et al., 2009). Educational psychology research has demonstrated that providing frequent self-evaluation opportunities strengthen self-efficacy and raise achievement outcomes for children and college students (Schunk & Swartz, 1993, 1993b; Schunk & Ertmer, 1999). The strengthening of self-efficacy, in turn, operates on behaviours through the mediating effects

of planning, self-monitoring, self-evaluation and reflection (Bandura, 1989; Zimmerman, 2002).

The Scottish adolescents appear to also have higher reflective abilities. The importance of reflection in learning, stressed by Ertmer and Newby (1996), enables thoughts to be translated into action. In this way a learner, or a developer, is able to comprehend newly acquired knowledge and skills, and apply these to a variety of situations (Peltier, Hay & Drago, 2006). It has long been understood that we learn more from reflection than actual experiences (Dewey, 1933). This ability is crucial considering the dynamic interactions between personal, environmental and behavioural factors which adolescents face in daily life. Although limited research is available to compare the current study's links between reflection and adolescents PA, elite level sport performance among adolescents shows reflection to be the most important factor related to superior performance, and distinguishes the best performers (Cleary & Zimmerman, 2001; Toering et al., 2009; Jonker et al., 2012).

### **Are self-regulatory components from a theoretically driven model associated with LTPA in Hong Kong Chinese and Scottish adolescents?**

With regards to the contribution of SRL to adolescent PA, the current study has added weight to current knowledge by assessing six SRL variables from Zimmerman's model, and revealing that these variables weakly but significantly predicted 6.1% of the variance in Hong Kong adolescents and 7.5% of the variance Scottish adolescents for combined moderate and vigorous intensity LTPA. The current findings are comparable to Winters et al. (2003) who found that self-regulation accounted for 8% of variance in vigorous LTPA and 6% of the variance in moderate LTPA. Mathews and Moran (2011), found that three SRL variables explained 10.7% in combined moderate and vigorous intensity LTPA.

Although current findings only demonstrate a small amount of significant explained variance, the amount is comparable with other studies and is considered important. It is

widely acknowledged in social-cognitive theory and PA related literature, that most of the PA variance remains unexplained and that further research is needed (Plotnikoff, Costigan, Karunamuni & Lubans, 2013). According to Rosenthal (1990) small amounts of variance can result in big practical differences. Indeed, Epstein (1979) suggested that low predictive power is expected when attempting to predict a single behaviour from a single personality trait, however, when aggregating behaviour across occasions, the predictability of behaviour from personality traits increases. The fact that individual human behaviour has low reliability is a well understood phenomenon in psychometrics (e.g. Spearman-Brown prophecy formula).

In terms of the cultural differences, the current results show that the contribution of SRL variables to LTPA is similar in both cultures as all SRL variables explained a similar amount of variance in LTPA (5.9% for the Hong Kong and 6.8% for the Scottish adolescents; see table 4). In addition, reflection played the most important in the SRL-LTPA relationship role in both samples. This may indicate that, despite the collectivist and individualist differences between the two cultures (Triandis, 1995) and the commonly cited notion of passive Asian students (Turingan & Yang, 2009), it appears for this study that, whether self-regulated learning strategies are used for the individual or for the collective benefit, SRL variables contribute similarly towards LTPA in both cultures as they do in academic SRL research (Purdie et al., 1996; Pilay et al. 2000).

A cross-sectional study with Hong Kong adolescents conducted by Ho (2004) concluded that although SRL was related to academic achievement, mean SRL scores indicated much less frequent use of strategies compared to students from other countries on the same measure. Ho (2004) suggested that perhaps other cultural factors may have a powerful influence on achievement for Hong Kong students, such as parental expectations (Chen, Lee & Stevenson, 1995) and cultural values in education (Ho, 1994). In a similar vein, the current study found that SRL is related to LTPA in Hong Kong adolescents, although the

Hong Kong adolescents indicated much less use of self-monitoring, self-evaluation and reflection, which was associated with lower LTPA levels. Thus, other cultural factors may be at play, for example, Yu, Chan, Cheng, Sung and Hau (2006) point out academic success is widely regarded as the only indicator of success in Chinese culture, and too much PA is generally discouraged as it is believed to drain energy and affect concentration.

Although the current study may not explain a large amount of the variation in LTPA from SRL, it is a lack of SR that contributes to problem behaviours such as overeating and inactivity. Tangney, Baumeister, and Boone (2004) identified that individuals with better scores in self-control had better grades, better relationships, higher self-esteem, healthier emotional lives and fewer impulse control problems, including over-eating. Therefore, the important evidence provided by the current study of the link between SRL and PA suggests that further SRL-PA research is warranted.

### **Do any differences exist in the contribution of SRL variables between moderate and vigorous intensity LTPA between Hong Kong Chinese and Scottish Adolescents?**

In terms of SRL variables, the current study found that only self-efficacy predicted moderate intensity LTPA for both Hong Kong and Scottish adolescents. Thus, it seems self-efficacy beliefs alone, without any other SRL variables, may be sufficient for adolescents to engage in moderate intensity LTPA. Self-efficacy is clearly important in the adoption of physical activity (Bandura, 1989), and it is a putative mediator of successful interventions to increase PA. Winters et al. (2003) also demonstrated behavioural differences between self-reported moderate and vigorous intensity LTPA. The authors found that SR significantly accounted for 6% of the variance in moderate intensity LTPA. The differences found were due to varied contributions of selected SCT variables to either moderate or vigorous intensity LTPA.

However, beliefs alone may be insufficient to overcome behavioural inertia due to the fact that beliefs are only passive evaluations of behaviour (Baumeister, Heatherton & Tice, 1994). The current study shows that a combination of all the six measured SRL variables appear to contribute to higher intensity (vigorous) LTPA in both the Hong Kong and the Scottish adolescents. In the Hong Kong sample, all six SRL variables explained 4.7% of the variance in vigorous LTPA, and 6.2% in the Scottish sample. A similar level (8%) of unique explained variance in vigorous LTPA was found by Winters et al. (2003).

The significant predictors for vigorous LTPA in the Hong Kong and the Scottish models varied. Self-evaluation predicted vigorous intensity LTPA in the Hong Kong sample, and both self-efficacy and reflection did so in the Scottish sample. These findings not only confirm important role of self-efficacy in engaging at any intensity of LTPA, but also highlights the importance of Zimmerman's self-reflective phase in LTPA, which includes self-evaluation and reflection. The linear relationship between physical activity and health status is well documented (e.g. Warburton, 2006), so for improved cardiovascular fitness, in healthy adolescents, high intensity and high volume activity is strongly encouraged (>80 minutes per day; e.g. Eliakim Makowski, Brasel & Cooper, 2000). The value of self-efficacy beliefs for encouraging moderate intensity physical activity levels is important to consider, especially for unfit or inactive adolescents, until they are able to engage in gradually higher intensity, vigorous activities (Gutin, Yin, Humphries & Barbeau, 2005). However, to encourage higher intensity vigorous activity it may be important to focus on the combination of and the cyclical nature of SRL variables with particular attention to the reflective phase.

### **Limitations**

Limitations of the current study include the cross-sectional design which prohibit causal inferences. Typical criticisms of PA self-report data include that results are highly dependent on social desirability, respondent's cognition, the day of the week as well as the

time of day. In addition, recalling intensity of PA is a limitation of self-report questionnaire (Smith et al., 2013).

### **Future Research**

Explicitly training SRL skills, by specifically focussing on teaching adolescents *what* and *how* to plan and monitor, *what* to evaluate and reflect on and *how* to do so in a specific context is important. Future research should devise interventions that teach SRL in a way that prompts real-life ecological behaviour in adolescents. This may have the potential to prevent the adolescent drop in PA motivation that occurs at crucial development stages (Brodersen et al., 2006; Biddle, Gorely & Stensel, 2004) and contribute to improved continuing healthy behaviours into adulthood.

### **Conclusions**

Both Scottish and Hong Kong Chinese adolescents engaged in insufficient levels of PA. All SRL variables may be important for LTPA in both cultures, with reflection the most important factor in this relationship. Young people with higher levels of SRL skills may be more likely to engage in higher levels of PA.

The following chapter documents two qualitative focus groups which were conducted to gather information specifically about PA from Hong Kong adolescents. There is limited qualitative information about the benefits and barriers to PA among Hong Kong adolescents which could help to inform the literature about the meaning that adolescents attach to their PA experience. It was deemed crucial to take into consideration adolescent PA views as Hong Kong adolescents live in a culture that disregards PA in favour of academic pursuits. This is particularly important as adolescence is a stage in life associated with the greatest decrease in PA levels and likely to persist into adulthood. Therefore, it was considered crucial to engage with young Hong Kong people to understand how they perceive PA, how it fits into their lives, and what factors may influence them to engage in more PA. This information

would assist in the development of an intervention to improve engagement and persistence in PA.



## CHAPTER 5 – QUALITATIVE INVESTIGATION

### Abstract

**Purpose** Hong Kong's children have been said to be some of the most inactive children in the world with 12.8% of boys and only 4.2% of girls being classified as physically active. This investigation gathered Hong Kong adolescent PA perspectives to inform the design of an intervention study to teach SRL skills to enhance physical activity.

**Methods** Two focus groups were conducted with a total of 26 participants. A framework analysis approach was used to analyse the data that emerged eight pre-determined questions.

**Results** Participants reported engaging in a variety of activities outside of school no more than twice a week. The most common physical activity suggested by the participants as a feasible activity was walking. Most adolescents understood the health benefits but discussed many barriers, particularly a lack of time, and being too tired. Low initial exercise loading and walking were suggested methods of overcoming barriers. Finally, using Whatsapp was considered useful for encouraging PA.

**Conclusions** Despite the limitations due to one overly large focus group, students demonstrated their knowledge of the health benefits of engaging in physical activity, and most were particularly interested in the aesthetic aspects of being fitter. However, the majority of adolescents only engaged in PA during PE lessons. The academic demands on the students were high, and considering the pressure they were constantly under the required effort to overcome barriers to engage in more PA seemed too much. Focussing on the value in engaging in PA, building self-efficacy, and encouraging more walking that can fit in with adolescents' busy schedules may be effective. Novel ways to encourage PA behaviours, such as through WhatsApp peer groups could also potentially encourage Hong Kong adolescents PA.

## Background

Hong Kong's children have been said to be some of the most inactive children in the world (Guldan, Cheung & Chui, 1998; Adab & Macfarlane, 1998; Macfarlane, 1999). More recent statistics show that this situation has not vastly improved. The 2012 Hong Kong government report (Hong Kong Leisure and Cultural Services Department (HKLCS), 2012) analysed data from questionnaires and fitness tests of 8,178 participants aged three to 69. The report claims to be the first scientific-based survey to investigate Hong Kong people's fitness levels and PA participation patterns using random sampling. Adolescents in the study were classified as 13 to 19 years old ( $n = 2,517$ ), and the data for the 2012 report, which is collected every five years, was collected in 2010/2011. Within the adolescent category, boys were found to be more active than girls with 12.8% of boys and only 4.2% of girls being classified as physically active. The 'active' classification in the HKLCS report was based on the '2008 Physical Activity Guidelines for Americans' with 'active' adolescents defined as those who have an accumulation of at least 60 minutes of moderate or above intensity physical activity daily, including vigorous intensity physical activities on three days a week. Furthermore, the prevalence of overweight and obesity for secondary school students rose from 13.6% in 1997/1998 to 17.7% in the 2008/2009 school year (Department of Health, Hong Kong SAR, 2010). The risk for the population in Hong Kong is very real. Lam et al. (2004) reported that the attributable risk from inactivity in the Hong Kong population already exceeds that of smoking. Therefore, it is important to discern reasons for this level of inactivity.

Part of the reason for the low levels of physical activity among Hong Kong Chinese adolescents may be the unique high-density residential environment and lack of urban space (He, Cerin, Huang & Wong, 2014) and that Chinese families consider physical activity dispensable and trivial (Adab & Macfarlane, 1998). Researchers have long suggested that the

low level of physical activity in Hong Kong children is connected to the pressure on adolescents to succeed academically (Adab & Macfarlane, 1998; Macfarlane, 1999; Cockram, 2000). Parental value orientations are associated with the way parents place academic success above physical activity participation and these value orientations are rooted in Confucian educational philosophy. According to Wu (1999), Yates and Lee (1996), and Yu (1996), academic excellence and examination results have always been the primary concern for Chinese parents, so much so that any other activities, including physical activity, that could compromise their studies or have the potential to negatively affect exam results are not allowed and generally discouraged. In fact, Yu, Chan, Cheng, Sung and Hau (2006) point out academic success is widely regarded as the only indicator of success in Chinese culture, and too much PA is discouraged as it is believed to drain energy and affect concentration. Tudor-Locke, Ainsworth, Adair and Popkin, (2003) conducted a study across areas of China other than Hong Kong, and found that participation in moderate and / or vigorous PA outside of school is almost nonexistent. They also highlighted the broader Chinese picture of the pressure that Chinese youths are under to achieve scholastically.

More recently, the 2012 HKLCS report has underlined the problem of increasing study pressure faced by adolescents and suggests that it accounts for the decline in their level of physical activity. Consequently, the HKLCS report has emphasised the fact that academic research has demonstrated that children and adolescents who engage in appropriate levels of physical activity tend to perform better at school (Yu et al., 2006; Liao et al., 2013). Evidence such as this has encouraged the HK government to publicise the benefits of physical activity in an effort to enhance academic performance and to motivate students to engage in more physical activity.

## Adolescents Views on PA

The main reason to conduct the current qualitative study was to gather information about PA from adolescents' perspectives to inform the design of an intervention study. The intervention study will teach adolescents SRL skills to enhance leisure-time PA, i.e. self-initiated and self-regulate PA. Firstly, it was important to determine which PA activities would be appropriate to encourage within the intervention.

The HKLCS report conveyed adolescents' perceived benefits to exercising, which were 'raising ability in sports', 'health strengthening/prevention or cure of sickness', 'releasing pressure and emotion' and 'keeping fit'. The barriers highlighted by adolescents were 'not interested', 'lazy' and 'lack of spare time'. However, in the HKLCS report, adolescents' perspectives were collected by questionnaire using set questions rated on a scale. There is limited qualitative research assessing Hong Kong adolescents' PA perspectives. One such qualitative study by Ha, Macdonald and Pang (2010) found that older secondary school students (12 and above) think, or are told, that academic achievement is the most important thing to focus on and that physical activities are not a priority. There is little survey research assessing adolescents attitudes to PA, with the exception of a study which investigated perceived benefits and barriers to physical activity, physical activity participation and physical fitness in Hong Kong female adolescents (Cheng, Cheng, Mak, Wong, Wong & Yeung, 2003).

A qualitative approach studies people in their natural settings and begins by accepting that there are a range of different ways of making sense of the world. The aim is to understand the meanings that the study participants attribute to things by attempting to comprehend their view of the world (Denzin & Lincoln, 1994). As such, researchers who conduct active research work with the research community, such as adolescents, to identify the problem, in this study inactivity, as the community sees it, and to work with the

community to develop solutions. These solutions produce practical knowledge that is useful to people as they go about their daily lives (Reason & Bradbury, 2001).

The current study made use of a focus group approach. Focus groups are defined as ‘a group discussions organised to explore a set of issues’ (Kitzinger, 1994) and they have the advantage of potentially revealing information that might be difficult to obtain by individual interviews (Kingry, Tiedjem & Friedman, 1990). This type of interview can bring the researcher closer to the research topic through direct contact with the target group (Clarke, 1999). Qualitative focus groups can examine how and what individuals think, additionally, why they might think in certain ways, and gain a deeper understanding of their priorities in particular situations (Kitzinger, 1996). During a focus group, individuals have the ability to refute or confirm information from other participants, as well as probe deeper into areas, this process in itself is an empowering and health promoting experience (Lane, McKenna, Ryan & Fleming, 2001).

Thus, undertaking focus groups with adolescents is suggested to be beneficial in raising awareness for those adolescents taking part. Additionally, one of the main considerations for conducting the current focus groups was to gather additional information that could be used to encourage and prompt behaviour change. In physical activity research, prompting self-monitoring has been identified as one of the most important behaviour change techniques which not only positively affects self-efficacy for physical activity, but is also associated with positive changes in physical activity (Olander, Fletcher, Williams, Aitkinson, Turner & French, 2013). Therefore, two further questions about mobile phones, to prompt behaviour change, and role models, to enhance self-efficacy, were asked.

### **Role Models and Modelling**

Would social models be useful to enhance adolescents’ motivation to engage in more PA? According to social cognitive perspective on behaviour change is social modelling,

much cognitive skill learning is achieved through a combination of both inactive and vicarious learning, for example, students observe teachers' demonstrations and practice with feedback. Bandura's social learning theory posits that people learn from one another via observation, imitation, and modelling (Bandura, 1962). The model can be real, or symbolic, including fictional characters (e.g. television, media or movie stars) who display desired behaviours. Their spoken words and unspoken gestures are observed and act as cues that are modelled by the observers (Schunk, 1987). Modelling also has the benefit of allowing the observers to strengthen or weaken behavioural inhibitions. The observation of competent models serves both informational and motivational functions (Schunk, 2001), and observing the consequences of modelled actions, appropriate outcome expectations and beliefs related to the outcome of actions is possible (Schunk, 2001). The type and quality of learning that follows will be related to the specific content and type of model that has imparted the information, and the learner's particular cognitive and behavioural processes. These processes include, motivation (the decision to, or refrain from, reproducing an observed behaviour), attention (impacted by perceptual and cognitive abilities, level of arousal and past performance), retention (impacted by cognitive abilities and rehearsal, and the complexity of the event), and reproduction (ability of the learner to organise responses according to the modelled behaviour, impacted by physical and cognitive capabilities and previous performance; Bandura, 1977).

### **Mobile Phones to Prompt Behaviour Change**

Would mobile phones be useful to prompt adolescent PA behaviour change? It is agreed by most researchers that healthier lifestyle decisions (diet, exercise, stress management, dental care, maintaining social relationships) positively impact on quality of life, and so many researchers have been considering how mobile technology can motivate long-term decision making, which could prevent or at least delay the onset of such chronic

disease that are associated with unhealthy decision making. As such, the ubiquitous nature of the mobile phone has been receiving much attention. While some researchers believe computer, web and phone communications to be crucial in assisting developmental problems, others view it as insufficient (Kaplan, 2006). However, there is preliminary support for the use of mobile phones to promote physical activity behaviour change in young people using text or Short Messaging Services (SMS) (Newton, Wiltshire & Elley, 2009; Sirriyeh, Lawton & Ward, 2010; Woolford, Clark, Strecher & Resnicow, 2010). A review by Lau, Lau, Wong, and Ransdell (2011) found that the nine studies included in the review provided support for the use of SMS among children and adolescents in improving PA for children and adolescents.

In summary, at the time of conducting the focus groups, plans were being discussed with the PE teacher of a Hong Kong secondary school who had agreed to participate in an intervention study, the aim of which was to teach self-regulated learning skills in a PA context (see Chapter 6). Therefore, due to the unique cultural disregard for PA in favour of academic pursuits, the main aim of the current focus group study was to qualitatively gather information regarding Hong Kong adolescent PA perceptions and to determine appropriate methods of prompting motivation and behaviour change.

## **Methods**

### **Design**

Purposive sampling was used. Two semi-structured focus group interviews with two adolescent groups, in two separate Hong Kong secondary schools, were conducted. Each interview lasted 40 minutes and was recorded, with permission from all participants, for the purpose of transcription.

## Participants

**School 1** Eighteen participants participated in this focus group. The age of the male and female participants from this school ranged from 16 – 19 years. This school is a Chinese language, government funded school.

**School 2** Eight students took part in this focus group. The age of the male and female participants from this school ranged from 14 – 17 years. This school is an English language medium, government funded school.

The sample size in the majority of qualitative studies follows the concept of saturation (e.g. Glaser & Strauss, 1967), which is when the collection of new data does not bring any new information to the issue under investigation (Mason, 2010). In the current study, due to practical reasons, it was not possible to decide on a number of groups as there was limited commitment available from schools. Requests were made of head teachers that were not responded to. In addition, teachers that were already involved were asked for access to other groups of students but these requests were declined. As explained in the introduction, Hong Kong schools do not prioritise PA as they are under a lot of pressure to achieve academically. Finally, this research was granted two time slots to conduct focus groups.



## Interview questions and question rationale

Table 5.1.

### *Focus interview questions.*

- 
1. Do you do extra exercise outside of school hours, after school and at the weekend? If you do – WHY do you do it?
  2. What can you really do? What is possible?
  3. WHY should we DO PA?
  4. What stops you doing PA? What are the costs to you? What is bad about PA?
  5. What would be really good about being really fit and healthy?
  6. So, if things are going to stop you doing exercise, what can you do to make sure that you will do it?
  7. Would mobile phone messages be useful to encourage you to be more active outside of school hours? What about SMS? Or a WhatsApp group?
  8. Who inspires you? Role models, celebrities, sportsmen and women etc
- 

Eight main questions were asked (see table 5.1) and the issues raised as a result of these questions were openly discussed. An explanation of the recommended government guidelines of 60 minutes per day was given, along with the information that the 60 minutes can be an *accumulated* 60 minutes. Students were encouraged to think about how to divide the 60 minutes into chunks and to consider ideas of what they could do and how to do it.

*Question 1* intended to gather information and raise discussions about what adolescents were currently doing, or not doing, in terms of general physical activity.

*Question 2* examined students' perceptions of what PA was possible for them to do, particularly, PA that was *feasible* for them on a daily basis. For example, this was asked as a prompt: '*You may have homework, or things to do with your family, so when and where could you really do more LTPA?*'

*Question 3* aimed to discover what students think about the value of PA. Probes were used such as, ‘*What is the point? What are the benefits to you? What is good about it?*’

*Question 4* attempted to discover what turned adolescents off about PA, and the barriers that existed for them.

*Question 5* aimed to have the students discuss the positive aspects of being fit and healthy.

*Question 6* aimed to find out how students could overcome barriers and to discover adolescents’ unique ideas on the subject. Using some of the adolescents’ examples of barriers, they were prompted as follows: ‘*So you have planned to do this ... but you find that you can’t be bothered, you are tired, and would rather ... what can you do to make sure you will do it?*’ Additionally, they were asked about contingency planning (if *x* happens then I can do *y*), and finally, how teachers, parents or friends could help them become more active.

*Question 7* addressed mobile technology. With mobile phone use being prolific among young people, this question aimed to find out whether this technology could help to deliver appropriate PA behaviour prompts within an intervention to enhance PA? In particular, would the adolescents accept some form of mobile intervention?

*Question 8* aimed to discover whether there were obvious role models which could be utilised to promote motivation and self-efficacy within an intervention to enhance PA. This discussion also aimed to encourage adolescents to discuss what they consider to be appropriate and valuable behaviours worthy of pursuing for their own health.

## **Procedure**

Ethical approval was granted by Hong Kong Baptist University. Students from two of the schools in study three were invited to participate in the focus groups. PE teachers and school principals were approached to request permission for their pupils to take part. Prior to the study, signed consent forms were obtained from parents and schools. Arrangements were

made with school principals and parents accordingly to conduct the focus groups, and dates with each school were set. On the arranged dates, all assenting participants gathered together with the PE teacher and the researcher.

Each group was informed via their PE teachers in advance of the aims and objectives of the interviews. Due to school policies, and language barriers (the researcher did not speak Chinese and although most students spoke English, not all of them spoke or understood English fluently), it was necessary to have a teacher present during the interviews. Furthermore, due to scheduling issues, the head teachers could only spare the assistance of the PE teachers. The researcher conducted the interviews, with each PE teacher acting as a moderator. This moderator role is important as it creates a non-threatening, warm, accepting, objective and encouraging environment (Reiskin, 1992). However, the necessity of objectivity from the moderator was discussed with the PE teacher prior to the interviews to minimise potential bias. Casual communication with the students prior to the interviews indicated that the PE teachers were well-liked and respected by the students and they felt that they could talk openly in front of them. Prior to both interviews, participants were informed that the interviews would be recorded. There were no objections. To begin with, the students were made welcome, the aims were reiterated and their anonymity assured. As an icebreaker, all participants were asked to say their names and subsequently, the researcher began with the set of eight questions (see table 5.1). Both focus groups were conducted in the same way as previously described.

### **Analysis**

A framework approach was used to assist with the analysis of both focus group interviews. Framework analysis suits research that has specific aims, *a priori* issues, a limited time frame, and a pre-designed sample (Ritchie & Spencer, 1994). Qualitative research is said to require skill and experience (Dingwall et al., 1998), therefore, for the novice researcher,

the framework approach can assist in developing those skills inherent in robust qualitative data analysis (Smith & Firth, 2001).

Ritchie and Spencer's (1994) framework analysis is suited to analysing cross-sectional descriptive data enabling the capture of different aspects of the phenomena under investigation (Ritchie & Lewis, 2003). Five key stages of analysis include familiarisation, identifying a thematic framework, indexing, charting and mapping, and interpretation of the key objectives (Ritchie & Spencer, 1994). Once the transcripts had been written, they were searched for themes, patterns and similar words. Specific comments were extracted according to the questions asked. The researcher listened to the recordings again to confirm the patterns and themes that had been discovered.

Framework analysis provides systematic and transparent stages to the analysis process and these add to the trustworthiness of the research (Malterud, 2001). As such the questions and answers from the groups were organised in a data sheet, so that it was possible to see the responses to each question clearly in table format. In a framework approach, the way in which the data and results are prepared, means that the data are accessible, easily viewed, judged and applied by people other than academic researchers (Ritchie & Spencer, 1994), such as teachers and other researchers.

## Results

### What Activities do Adolescent do, and Why?

Participants reported engaging in: basketball, volleyball, swimming, running, cycling, badminton, Tai Chi, fencing, tennis, and going to the gym. These activities were conducted no more than twice a week. The duration of engagement ranged from half an hour to an hour.

When asked why they did these activities, responses included: '*healthy*', '*I like sport*', '*keep fit*', '*happy*', Other reasons included, '*I enjoy it. I love play badminton since from*

*primary school*, *'I think it's quite an interesting sport (Tai Chi) and I really do like it'*, *'improve my fitness'*, *'I think it is (cycling) quite healthy and I just think it's convenient... as transportation'*, *'spend more time with my family...and friends'*, *'exercise for relax'*, *'its good for me to relax and also its good for my health'*, *'for relaxing for fun and because it is a time for me and my family to enjoy sport and also it's a time for me to bond with my friends'*.

Those who said they did not do any PA comprised approximately half of each group, and when they were asked why they did not they responded: *'too tired'*, *'exhausted'*, *'no free time to do exercise'*. Being too busy was the most common response.

In order to discover adolescents' existing habits, and whether these could be replaced with better behaviours, adolescents were asked probe questions such as how they usually travelled home. Responses included taking the mini-bus, MTR and walking. A further probe question was *'What do you typically do straight after school?'* this elicited responses such as: *'grab my phone'*, *'music... listening to music all the time'*. At the weekend, the adolescents said that they spent time: *'doing homework'* (this was the general consensus). Other responses were, *'as little as possible ... except doing homework'*, *'eating'*, *'sleeping'*, *'window shopping'* and *'swimming'*. Some students mentioned *'hiking'*, and those that did did so with their parents, but did not do it regularly (i.e. not on a weekly basis).

### **What PA do Adolescents Feel is Feasible for Them to Do?**

While discussing feasible activities adolescents suggested ball games, gym, walking, and yoga. Other suggestions were, *'when you watch tv you can do some exercise'*, *'laughing'*, *'I think when you see the tv... you can move your legs'*. One girl said; *'actually because my home is quite near to the school ... when I um get home in the bus actually I saw a student walking back from the school to my home ... I know that he lives in my estate so actually he walk back home instead of riding the bus ... I can do that too'*. A male in the group said: *'I actually chose not to take the MTR back home because between the MTR and my house is 10*

*minutes' walk up hill so it's quite a good exercise for me ... so I do that every day'. Another student said: 'when I go home I have to take a bus to just arrive at the ground floor of my home I still have to walk for 5 floors to get to my home because there is no lift for the first 5 floors so this is cost about 15 minutes but if I take a bus to arrive at just out of the estate I still have to walk for about 15 more minutes', and another female student added in response, 'well I think I could walk to the next MTR station'. Most students thought that walking up the escalator and going to the next bus stop were good suggestions. Although another student pointed out, 'it really depends on the time I leave school cos yesterday I leave school around 9pm because I have events and I really didn't have any time to do exercise after getting home'. Additional responses were given, such as, 'every Sunday I have to have a math class ... maybe I walk'.*

Finally, one student suggested, *'establish a healthy lifestyle because a lot of people just sleep late at night so they do not have enough energy to do exercise, so I think if you sleep like before 11 o'clock I think it's already a healthy lifestyle that they might have energy to do more sports'.*

### **Adolescents' Perspectives of Why Should we Do PA?**

When asked why LTPA is important, the students returned the following responses: *'avoid disease', 'keep your health', 'make you healthier', 'have good body'. Further suggestions were: 'you can chase the bus in time', 'as a social activity so that you can have more friends', 'endorphins'. 'because it really helps, because before I started playing Wushu I do get ill very often, almost once a month and after I started playing Wushu I actually improved though I still got ill fairly often'. Another student said, 'I think for myself I just feel happier and full of strength after I exercise it's like when you, I don't know it just feels that you are energised'. At one of the schools the PE teacher incentivised adolescents to exercise*

by adding points to their PE class record, and one student said, *'the record of doing exercise can go into the grade point card'*.

### **What are the Barriers and Costs Involved in PA?**

When asked about the barriers to engaging in physical activity, and what they didn't like about exercising, the students offered the following information: *'waste time', 'if too tired you can't do your homework', 'already exhausted', 'muscle sore', 'tired', 'lazy'*. All students agreed they had *no time*. All students responded affirmatively to this point. One girl mentioned she *'didn't like sweating'*, and another female in the other group also said, *'I personally don't like the feeling of sweating because its maybe other people can smell my(me).'* In both groups this statement caused all the girls to positively engage in a discussion in agreement with this point of view.

### **What are the Benefits of Being Really Fit and Healthy?**

Responses to the benefits of being really fit and healthy were *'healthy', 'strong', 'power', 'confident', 'when you work you can work efficiently', 'never sick', 'feel good', 'high self-esteem'*(there was a positive group consensus in both groups to this comment), *'To be surprised that I can overreach or overpass my past limits of doing exercise', 'well I think basically you think yourself looking a lot better maybe if you are super fit'*. All students were in agreement with the view that looking good would be a main benefit to being fit.

### **Overcoming Barriers**

The question about overcoming barriers elicited responses such as the fact that if it is really important and you really want the result you will do it. One student said, *'with determination especially if I care about my physique ... self-image'*. Students were prompted by asking if they would need some kind of plan, how they would make it happen when they did not want to be active? Most students' found this difficult to respond to and some said they had no ideas, but some interesting responses were: *'award yourself when you do it', 'start*

*with a low load ... low loading exercise ... start small*'. They were probed with 'where do you start? How do you start? Why do you start?' responses included: *'looking good', 'group pressure' ... 'follow people'*. Many students agreed with one boy who said, *'I will do it after the examinations'*.

One of the PE teachers shared a story of how she had been a very overweight teenager and how she had lost weight by climbing the stairs to her apartment every day instead of going in the lift. This group of students responded positively to the story. Both groups agreed wholeheartedly with similar suggestions by the teachers and researcher to overcome the lack of time (the most often cited barrier) by climbing the stairs instead of going in the lift, walking instead of going on the minibus, or walking up the escalator instead of standing still. One student added this: *'actually from my housing estate I mean the distance from the MTR station to my housing estate is quite far away and there is a mini bus but I usually don't take it because it is quite expensive so I just every morning and afternoon I just walk from the MTR station to my about 15 minutes'*. Some of the students discussed how they could save money (and get more exercise) by doing this as well.

### **Encouragement through Mobile Phone Messaging**

When asked whether mobile phone prompting would help to encourage more PA, in both groups, several male and female students said 'no' other responses were: *'no this would be ignored', 'not effective', 'it depends on what is the message it's like demanding for exercise will just ignore it', and another student said, 'I would probably say this is not a good idea because as soon as you open your social network you are browsing other things definitely not focusing on those healthy messages ... maybe not ignore but just forget about it and be busy doing other things or maybe do I half-heartedly'*. The general consensus was that this approach would not be attractive to the students.



Students were also asked whether a WhatsApp group to encourage PA would be effective. This suggestion received positive responses and discussions across both groups, especially among the girls. One of the PE teachers translated the general discussion which was in Cantonese as, *'friends is better'*. In the other group, responses included, *'yes I think it is feasible because some of my friends and schoolmates live near my housing estate or in the same housing estate so I think it's possible for us to come out and do exercise together I think it's good for us because we are encouraging each other to be more fit'*. One student suggested that the WhatsApp group should be in conjunction with face-to-face contact with the group (not just conducted through the phone) to benefit most from the positive encouragement. When asked what kind of encouragement would be useful through mobile communication, for example, text, pictures or video, the response was mixed with lots of discussion in both groups which included, *'yes more positive'*, *'funny is important'*, *'fun'*, and *'not fun not good'*.

In one group, after translating the discussion that arose from this question, the teacher said that it was only during PE lessons when the students engaged in PA. This was true for both focus groups. Students were asked what else would motivate them to engage in more PA outside school, and one response was *'the public facilities should be open to all without cost so that is a kind of encouragement for them to go and do exercise.'* When asked about the currently available free public park facilities the general translated response was: *'they want more indoor facilities because it's too sunny'*.

### **Inspirational Role Models, Celebrities, Sportsmen/Woman**

Celebrity role models suggested by both groups were: *Ga Fai, Bruce Lee, Do Man Cha*, but when asked if these people would inspire the students to exercise more, the response was mixed. The majority, however, did not agree that these celebrities would inspire them to do more PA. One student said, *'I think that there aren't many people who are models or idols*

*who are really good at sports in Hong Kong because the culture is not like that ...*'. When considering local celebrities, other students said, *'nah they smoke ... they smoke they drink and that's not the healthy criteria'*, *'yeah they do drugs'*. However, one student had a positive view and said, *'yes a movie star in HK called Cheung Ga Fai and I think he is age is about 40 and he still got it and because he had to act in a movie called unbeatable and he just do a lot of gym and he got a six pack and he just like he lights up peoples life because the people in his age also want to get the six pack and everyone go to the gym'*. Finally, another student said, *'there is a movie star I think it's called Do Ma Chai I think in recent movies he also has a six pack but he was quite fat ... a similar experience with the other he got fitter'*. However, it was agreed, among the adolescents in both groups, that these celebrities (Cheung Ga Fai and Do Ma Chai ) may be helpful for older people, but not perhaps for adolescents.

### **Discussion**

The current study analysed the data from two qualitative focus groups conducted with Hong Kong Chinese adolescents to discover their perceptions of the benefits and barriers to PA as well as ideas for engaging in more PA. In developing interventions to improve PA behaviours, it is important to collect adolescent input regarding factors they consider influential and the difficulties they face in engaging in healthier and more active lifestyles, as well as suggestions for ways to improve PA behaviour. Findings from the current investigation have implications for the development of an intervention program to enhance PA. The findings revealed that the greatest barrier to PA was lack of time. This can be dealt with encouraging walking instead of taking the minibus or trains for short distances, and using stairs or walking up escalators rather than lifts. Adolescents agreed they could accumulate more shorter bouts of exercise by walking further a little more often throughout the day.

The information about finding ways to take extra steps every day is not new but it was generally agreed by all adolescents that it was a feasible way to enhance their daily PA. The 2012 HKLCS report suggests that the general information already available to Hong Kong students about PA is inadequate. The report recommends that schools ensure that the concept of adequate frequency, duration and intensity of PA is understood by all pupils. The report also declared that Hong Kong needs to learn from countries like the USA where several professional health related bodies (e.g. American Heart Association) have joined the National Coalition for Promoting Physical Activity to implement nationwide plans to promote the importance of PA. It is apparent from the findings of this report that as previously mentioned, PA is insufficiently promoted in Hong Kong.

The Hong Kong Bureau of Education (2014) have legislated that 5-8% of the total lesson time per week should be dedicated to physical education. Mak, Ho, Lo, McManus and Lam (2011) reported that mainstream secondary schools in Hong Kong have fairly consistent lesson schedules with PE classes providing two 40-minute sessions per week. However, both schools in the current study received one PE class weekly. Often students could be excused from PE classes if necessary due to academic priority. The PE teachers in both schools encouraged PA but it was evident that most students only engaged in PA during these limited PE classes. Some students engaged in extra-curricular activities but on no more than two days a week.

Nevertheless, the interviews revealed that most of the young people in group one understood the health benefits of engaging in PA, probably as a result of their dedicated PE teachers, but it was clear that the immediate effort and discomfort involved for some (they discussed pain, sweating etc.) outweighed the potential benefits which seemed far out of reach. Group two, who were from a school in a more affluent area and demonstrated more knowledge about the benefits of PA to both physical and psychological health. However,

despite this, and as well as reporting more extracurricular activity than group one, group two still reported the same barriers as group one. The greatest barriers were not having time and having too many responsibilities, particularly with respect to homework. As the aim of this study was to gather PA information specifically to inform an intervention that would teach SRL skills to enhance PA, the barriers cited by students demonstrate the need, not only for encouraging more PA, but to teach skills that can help students overcome the barriers they face to PA. The barriers cited bring to mind the concept of delayed gratification (Mischel, Ebbsen & Zeiss, 1972), which is something that good self-regulators are more capable of than poor self-regulators. In fact, self-regulation is necessary to override the impulse for immediate reward for effort.

Students did have ideas as to how they could do more in their daily lives, such as more active transport, but this would require over-riding their belief that PA not rewarding especially when they were already too busy, and too tired to contemplate exerting the extra effort required for PA. In this regard, and considering the reasons for this current study, improving SRL skills for PA would be a necessary endeavour for Hong Kong adolescents. Baumeister and Heatherton's (1996) research suggests that self-regulating one's behaviour seems to operate as if it depends on a limited resource. Research shows that after individuals have had to exert self-control in order to regulate behaviour, such as spending hours doing homework or studying, they are then vulnerable to breakdowns in any further attempts to exert self-regulation even in other unrelated behaviours (e.g. engaging in extra PA after a long day at school and a couple of hours' worth of homework; Baumeister & Heatherton, 1996). In fact, Baumeister et al. (1994) suggest that the demands of studying, including completing assignments and trying to master a complex amount of material in a short period of time, cause students to use up all of their available self-regulation resources. This means they have less time left for other concerns such as eating properly, being polite, managing

their feelings, and PA. This strength model of self-regulation also suggests that the limited resource can be depleted (Muraven, Tice, & Baumeister, 1998) but it can also be restored and that regular training can increase the strength capacity.

Extrinsic motivators appear to be necessary for adolescents in both groups to embark on what most of them consider being unenjoyable and uncomfortable experiences that waste time that could be spent on homework, or other more enjoyable pursuits. In group one, the young people made useful suggestions as to how to become interested in engaging in PA from a completely disinterested position, for example, starting small and the use of incentives, one student suggested that public facilities should be free to encourage more people to use them. Students also discussed how motivation would come from the thought of looking good and from group pressure. Certainly, looking good and group pressure seem to be important motivators for young people. It is known that social motives are very important motivators for adolescent PA, whereas health is not reliable (Iannotti, Chen, Kololo, Petronyte, Huag & Roberts, 2012).

Although it is known that intrinsic motivation directly predicts effort and persistence in PA in high school students (Ferrer-Caja & Weiss, 2000), and extrinsic motivation can damage long-term persistence (Deci, Koestner & Ryan, 1999), Ryan and Deci (2000) suggest that much of what individuals do is not intrinsically motivated, especially as individuals get older and intrinsic motivation is curtailed by increasing social pressures to engage in unenjoyable activities, such as homework and exams becoming more responsible for health and lifestyle choices. The only students (in group two) that managed this extra effort and persistence and appeared to be intrinsically motivated to engage in extra PA attended structured classes such as Wushu and badminton. One student from group two, who reported more activity than group one, explained that the school provided incentives to students in the

form of grade points for engaging in additional PA (this was confirmed by the PE teacher).

Thus, the external motivation appears to have a positive short-term effect.

As the majority of the young people declared that they only engaged in PA during the PE classes at school, engaging in additional PA would require considerable external motivation. According to self-determination theory, different motivations reflect the degree to which individuals have integrated and internalised the value and the self-regulation of the behaviour in question. Therefore, valuing PA should be an important consideration in interventions.

With regards to the potential of mobile phones to encourage and motivate PA, from the results it appears that text messages from health professionals or teachers would be ignored. However, a WhatsApp group among friends was more interesting to this group. Indeed, peers and friends are known to play an important role in adolescent PA levels (Fitzgerald, Fitzgerald & Aherne, 2012). Preliminary research using WhatsApp to reinforce reading comprehension, concluded by suggesting it may be necessary to create teacher-independent applications (Plana, Escofet, Figueras, Gimeno, Appel & Hopkins, 2013). The Plana et al. (2013) reading reinforcement study also found that the students were satisfied with this technique and felt that the intervention had made a positive impact on their reading habits and on their willingness to read.

Finally, the use of role models to encourage healthy goals was discussed with both groups, and as a result celebrity endorsement was not considered to be something that would positively impact on the students as they considered many to have unhealthy lifestyles. There were examples of celebrities who had gone from being unhealthy and overweight to becoming fitter and more attractive which had encouraged people to go to the gym. This may serve as support for using coping role models, as opposed to mastery role models, being part of an intervention (Schunk & Zimmerman, 1997).

## **Limitations**

The sample size in school one was too large for a focus group, as six to eight members are usually recommended (Krueger, 1994). The PE teacher of the larger focus group had been requested to select a smaller group for the purpose of the interview; however, on the day all participants arrived and expressed interest to participate. Therefore, considering the busy schedules of those involved the researcher made an on-the-spot judgement to proceed. It was considered an important opportunity to include the opinions of all willing participants and it had been made explicit by the teacher that another opportunity would not have been available during the current or the following semester. Sandelowski (1994) suggested that the enquiring and flexible nature of qualitative methods is one in which the researcher should make an informed judgement about the acquisition of rich and in-depth understanding of the participants' experiences. However, due to this limitation it is possible that the opinions of some students were not heard and therefore taken into consideration as due the large number of students only about 85% of them spoke, although every effort was made to include all the students.

The level of English in this particular school was quite low, with some new students from Mainland China less able to express themselves than the local Cantonese speakers. However, the PE teacher who acted as the moderator and was present throughout translated as much of the Chinese discussions that he could into English. As a result, the general feeling of the group was collected through prompting techniques and translations by the teacher, although this may have been insufficient to include all the students due to the teachers influence over them. However, the recording of the interview made it possible for the researcher to ask other Chinese speaking researchers for assistance during the data analysis. In school two, the students are taught in English so the researcher was easily understood and the students were able to express themselves more effectively than the school one.

A further limitation is the insufficient number of focus groups. This was due to very low level of commitment offered by the schools in Hong Kong. However, the two groups came from different communities in Hong Kong and the results show that many of the same opinions were held by both groups. Additionally, the adolescents did not put forward any ideas of how to engage in more vigorous activity than walking. However, their PA level was low and as they said starting gradually might help them overcome the barriers they face to doing any PA at all. Finally, bias may have been introduced by using the PE teachers as moderators. Unfortunately, the schools did not grant access to any other members of staff for this research purpose due to the priority on academic subjects. To minimise risk of bias, discussions were conducted with each PE teacher prior to the interviews.

To conclude, this study gathered qualitative data from young Hong Kong people. Both groups of students had good knowledge about the health benefits of PA, with most students being particularly interested in the aesthetic aspects of being fit. However, the majority of adolescents only engaged in PA during PE lessons. The academic demands on the students were high and the required effort to overcome barriers to engage in more PA seemed to be too much for students under such pressure. Therefore, focusing on encouraging students to find some value in engaging in PA, building self-efficacy, and encouraging more walking to fit into adolescents' busy schedules were important findings from the qualitative focus groups. Finally, novel ways to encourage everyday behaviours, such as through WhatsApp peer groups were considered a worthwhile method of encouraging PA by the Hong Kong adolescents.

The following chapter investigated the implementation of SRL training for PA. However, first it is important to reiterate previous relevant findings and how they have informed the design of the intervention study. In study three it was revealed that Hong Kong students engaged in significantly lower levels of PA than their Scottish counterparts, and that



these higher levels of LTPA were accompanied by significantly lower SRL total scores and significant differences in self-monitoring, self-evaluation and reflection. As SRL and LTPA are significantly and positively associated, these results highlight the need to improve SRL skills and pave the way for an investigation into the impact on SRL skills on levels of PA. In addition to this, the qualitative investigation that has just been reported revealed that two groups of Hong Kong adolescents agreed that most of them only engaged in physical activity during PE lessons.

Therefore the students' PA perceptions and opinions were incorporated into the following intervention programme. In order to promote the value of PA, the intervention was designed with a view to provide a fun and informative environment. In order to promote self-efficacy, the programme was delivered in accordance with the social cognitive model by peer models. All the peer trainers were all well-liked and respected pupils known for their healthy and active lifestyles. Furthermore, the intervention programme focussed on encouraging more walking as this was an activity students identified as a useful way of increasing PA. Finally, prompting behaviours is part of the social cognitive training model and in order to prompt behaviours WhatsApp was incorporated into the intervention as students had considered it more suitable than SMS prompting. As a result, the following chapter describes the development and evaluation of a pilot intervention study designed to examine the effect of teaching SRL skills on the LTPA levels of Hong Kong Chinese adolescents.

## CHAPTER 6 – STUDY 5

### **Self-Regulated Learning Training to Improve Leisure-Time Physical Activity among Hong Kong Chinese Adolescents**

#### **Abstract**

**Purpose** This pilot study examined the effect of teaching SRL skills on leisure-time physical activity (LTPA) in Hong Kong Chinese adolescents.

**Methods** A quasi-experimental design was used (3 X 3 (group by time), eight week training and six week follow-up). Zimmerman's self-regulated learning model was the foundation of the intervention and LTPA behaviours were targeted. Three separate classes of students from one Hong Kong high school ( $n = 98$ ; males = 53; age  $M = 12.35$ ,  $SD = .478$ ) took part. There were two intervention groups and one usual care control group. Peer trainers taught the skills and prompted behaviours through either WhatsApp or face-to-face.

**Results** SRL training resulted in non-significant but practical mean score improvements in self-reported LTPA at follow-up. An ANCOVA on follow-up LTPA, adjusting for baseline LTPA, demonstrated no treatment effect  $F(2,91) = 2.946$ ,  $p = .06$ , partial  $\eta^2 = .06$ . At follow-up, a hierarchical regression model containing all 6 SRL components significantly predicted LTPA ( $\Delta R^2 = .073$ ,  $F(1,88) = 2.626$ ,  $p = .007$ ) and explained 15.2% of the variance in LTPA with self-evaluation ( $p = .035$ ) and reflection ( $p = .007$ ) were significant predictors.

**Conclusions** As a result of teaching learning SRL skills, this pilot study has demonstrated meaningful, but not significant, LTPA changes. SRL skills, particularly reflection, significantly contribute to the prediction of follow-up LTPA. Further research is warranted.

## Background

### Explicit Training of 'Trainable' SRL Skills

Gall (1990) said "*Learning how to learn cannot be left to students. It must be taught*". Pintrich (2002; p. 223) described a real issue for young people in our society "*There is a need to teach metacognitive knowledge explicitly ... we are continually surprised at the number of students who come to college having very little metacognitive knowledge; knowledge about different strategies, different cognitive tasks, and particularly, accurate knowledge about themselves*". Additionally, Bandura (2004) pointed to the necessity to equip individuals with the relevant psychological skills and efficacy beliefs to help them to manage the daily multitude of emotional and social pressures. Many other researchers have echoed the suggestion that metacognitive skills, such as those in SRL, should be taught explicitly in a specific context, in order for SRL to have any impact on performance in any domain (Chen & Singer, 1992; Elliot-Faust & Pressley, 1986; Madsen et al., 1993; Bransford, Brown & Cocking, 2000; Ford, Smith, Weissbein, Gully & Salas, 1998).

Children and young people do not naturally keep their goals in mind or evaluate their own progress. Rather than just assuming they are able to Schunk (2001) suggested that it is necessary to explicitly state goals and to teach individuals how to self-evaluate progress. This is particularly well documented in the educational psychology field, due to the link between metacognitive activity and knowledge acquisition, post-training performance, and self-efficacy (Halpern, 1998; Bransford et al., 2000). More recently, educational psychologists and educators (van der Stel & Veenman, 2014; Borkowski, Carr, Rellinger & Pressley, 2013) have been promoting this explicit and context specific delivery of metacognitive training. Evidence for this can be found in specific academic subjects like biology (Tanner, 2012), other science education (Zohar, 2012; Ben-David & Orion, 2013), and information system learning environments (Goh et al., 2012). Experimental studies have also demonstrated that

students receiving explicit instruction of thinking skills, as well as relatively simple skills related to self-assessment and task selection, achieved much larger gains and a significant increase in the amount of acquired knowledge (Marin & Halpern, 2010; Kostons, van Gog & Paas, 2012).

Skills matter to long-term success and it is crucial for young people to learn how to attain competence in something that is positive and healthy (Dzewaltowski, Estabrooks & Johnston, 2002). However, Van der Stel and Veenman (2014) have suggested that explicit metacognitive training for young adolescents should be domain-specific and that an ability to generalise SRL skills will develop with age. Therefore, the current study focussed on explicitly training SRL skills in a PA behaviour change context, concentrating on *what* and *how* to plan, monitor, evaluate and reflect. This training may prevent the adolescent drop in PA motivation that occurs at crucial development stages (Brodersen et al., 2006; Biddle, Gorely & Stensel, 2004) such as following the move to high school (Stoeger & Ziegler, 2008), and contribute to the continuation of healthy behaviours into adulthood.

**SRL components** Michie and Johnston (2012) suggest that behaviour change interventions ought to identify the intervention's 'active ingredients'. For this reason, this pilot study focussed on six 'trainable' (Boekarts, 1997) components from Zimmerman's model (as conceptualised by Toering et al. (2009, 2011, 2012) which are, planning, self-monitoring, evaluation, reflection, effort and self-efficacy.

*Planning* Many people have good intentions but fail to act on them for various reasons. Golwitzer (1999) devised a planning method, known as 'if-then' planning, which is designed to assist people in dealing with the difficulties of translating goals into action. Bridging the gap between behaviour and intention can be assisted by creating implementation intentions which link anticipated critical situations to goal directed responses. In addition,

goals need to be specific, measurable, achievable, result-focussed and timely (Lock & Latham, 1990).

*Self-monitoring* has been identified as one of the most important PA behaviour change techniques as it not only positively effects self-efficacy for physical activity, but also is associated with positive changes in physical activity (Olander, Fletcher, Williams, Aitkinson, Turner & French, 2013).

*Effort* is commonly accepted within existing conceptual models of self-regulation that goal directed movement across ever changing and challenging situations will not occur automatically or without conscious effort (Bandura, 1986).

*Self-efficacy* is a major mechanism of self-directed behaviour that exerts a strong effect on thought, affect, motivation and action, playing a central role in personal agency (Bandura, 1982, 1986).

*Self-evaluation* is a key metacognitive aspect of SRL necessary for learning, development, improved performance and other behaviours, through its ability to provide evidence that an individual is making progress (or not) towards their goals. The process of self-evaluating plans is crucial for developing strong self-efficacy, which in turn operates on behaviours through the mediating effects of planning, self-monitoring, self-evaluation and reflection (Bandura, 1986; Zimmerman, 2002).

*Reflection* consistently emerges in the performance literature as the key component in self-regulation. Zimmerman (1986, 2000b) and Mezirow (1991) reasoned that as a result of frequent use of reflection, individuals are generally better able to understand themselves and what it takes to improve future performances based on their previous knowledge and experience.

## The 'how' of SRL Skill Learning

According to studies in the SR training area (Kitsantas & Zimmerman, 2000; Schunk & Zimmerman, 1997) the model of sequential skill acquisition suggests that new skills become self-regulated in four sequential levels, observation, emulation, self-control, and self-regulation. The first two levels focus on social learning experiences that prepare learners to attain higher levels of skill on their own. An observation level of skill is achieved when modelling experiences provide a learner with a clear image of how a skill should be performed. At the emulation phase, a novice player learns from experiences in close proximity to a model, and from social feedback. At the self-control level, students learn from self-directed practice to achieve automaticity in their technique, observers must compare their practice efforts with personal standards acquired previously from a model's performance.

### Modelling

The teaching methods used to teach self-assessment and task selection skills have also been found to enhance the effectiveness of SRL (Kostons, Gog & Paas, 2012). A feature of the social cognitive theory, which will be instrumental in the application of the current training, is modelling. Bandura's social learning theory posits that people learn from one another, via observation, imitation, and modelling (Bandura, 1962). Bandura (1963, 1977) uses the concept of modelling, rather than instruction, to impart knowledge, where a live model performs and describes the methods for the desired behaviour and demonstrates how the participant should carry out the behaviour.

Much of how students at school are taught at school emphasise the teacher's role as a model (Kumpulainen, & Wray, 2002). Schunk and Zimmerman, (1997; p. 11) point out that *"Although adult models can teach students self-regulatory skills, students' self-efficacy for learning may be aided better by observation of similar peers. In turn, self-efficacy can sustain motivation for skill improvement."* Therefore, the current study has made use of peer

modelling, more specifically, an approach known as peer-mediated instruction (PMI) whereby peers of the target students are trained to provide the necessary training, which may be educational, behavioural or social (Chan, Lang, Rispoli, O'Reilly, Sigafos & Cole, 2009). The peer tutors are chosen by the teacher, trained to demonstrate and deliver certain information, and observed during this process. An important advantage of this approach, particularly as the target population concerned is an adolescent one, is that it takes advantage of the positive potential of peer pressure, which is a strong motivator through which good behaviour can be encouraged. Additionally, students may be less intimidated by their peers than they are by their teachers, or a professional who may be a stranger. This has the benefit of creating a learning environment where the learners are more engaged thereby acquiring learning more effectively (Ackerman, 2012). A range of studies have demonstrated PMI's effectiveness (Chan et al., 2009; Fuchs & Fuchs, 2005; Flood, Wilder, Flood & Masuda, 2002). In the Chan et al. (2009) systematic review of studies using the PMI approach, 91% of the 42 studies were effective for all participants.

### **Prompting SRL**

Prompting SRL involves reminding learners to make plans for goals, complete self-monitoring and evaluation tasks, and also stimulating reflective thinking that drives SRL engagement. Cleary, Plattern and Nelson (2008) and Peters and Kitsantas (2010) have found that the use of self-regulatory skills can be effectively prompted. A longitudinal study (Sitzmann & Ely, 2010) examined how self-regulatory interventions affect the cyclical relationships among self-regulatory processes, learning and attrition. The authors found that prompting self-regulation throughout the training increased learning and reduced attrition, relative to a control group. In addition, the effect on learning was fully mediated by time on task. This intervention also moderated the effect of learning on subsequent self-regulatory activity and attrition. Thus, when trainees were prompted to self-regulate, learning

performance had less of a positive effect on subsequent self-regulatory activity and less of a negative effect on subsequent attrition.

### **WhatsApp to prompt SRL**

Based on the results from the qualitative investigation (Chapter 5), WhatsApp was chosen as a method to prompt SRL skills and give feedback to encourage adherence to self-monitoring of participants' daily steps. WhatsApp (WhatsApp Inc.; a proprietary, cross-platform messaging subscription service for smartphones) is currently the biggest messaging mobile phone application in the world, with 350 million monthly active users (Souppouris, 2013). According to the media and business analysts, teenagers are increasingly making use of messenger applications such as WhatsApp. The best examples of this trend come from Asia, for example, 'WeChat' in China has approximately 200 million users.

Limited academic research exists regarding WhatsApp, however; the amount of work is promising, for example, at the 14<sup>th</sup> annual conference on World Wide Web applications, a paper was presented entitled "A comparative study of student experiences of ubiquitous learning via mobile devices and learner management systems at a South African university" (Bere, 2013). Students created ubiquitous spaces via virtual platforms on WhatsApp and the Blackboard learning management system, and the students' experiences of both were compared. Results indicated that most students preferred the WhatsApp platform to the learning management system. Most students also perceived that the ubiquitous nature of WhatsApp was beneficial to their learning. Ngaleka and Uys (2013) also recently used WhatsApp in a preliminary study to facilitate coursework outside the classroom. Significant collaboration and learning were found to take place without the influence of the lecturer.

Intille (2004) draws attention to the 'just-in-time' persuasive influences that motivate behaviour change and that these influences are possible through mobile technology. In the mobile health (m-health) area, Ackerman (2012) discusses how mobile technology has



positively impacted on patients' compliance doing exercise in the case of cardio rehabilitation, through mobile reminders and encouragement, compared to before m-health when there was no extension of face-to-face consultation with medical professionals.

Closely related to m-health is mobile learning (m-learning). The aim of m-learning is '*... highly situated, personal, collaborative, and long-term; in other words, truly learner-centred learning*' (Naismith, Lonsdale, Vavoula & Sharples 2004, p. 36). With m-learning, learners may be continually in motion, and it is this ubiquity that enables learners to learn the right thing at the right time, and in the right place (Peng, Su, Chou & Tsai, 2009). Recent research using mobile technology to improve children's self-regulation skills in education (Sha, Looi, Chen & Zhang, 2011; Goh et al., 2012) has delivered promising results. Sha et al. (2011) have conceptually linked m-learning with SRL theory (Zimmerman, 1986). The authors propose that SRL knowledge and skills are seen as both a precursor and the desired outcome of m-learning in which handheld computers should be used as cognitive and metacognitive tools for learners (Chen, Tan, Looi, Zhang & Seow, 2008).

In terms of increasing PA with mobile technology, strategies that foster personal agency, motivation and competence, as well as cognitive self-regulation, through new technologies may be effective in increasing healthy eating and PA behaviours in schoolchildren and should be explored (Contento, Koch, Lee, Sauberli & Calabrese-Barton, 2007). A recent meta-analysis (Fanning, Mullen & McAuley, 2012) concluded that mobile technology is an effective platform with which to influence PA behaviours, producing a combined effect size of  $g = 0.54$  (95% CI = 0.17 to 0.91,  $p = .01$ ). The authors recommend the use of theoretically grounded interventions.

The current pilot, quasi-experiment focusses on teaching SRL skills to Hong Kong Chinese adolescents and to examine its effect on LTPA. The primary outcome was LTPA. The self-regulatory skills, based on Zimmerman's theory (1986), included planning, effort,

self-monitoring, self-evaluation, reflection, and self-efficacy. Social (peer) modelling was used to impart the skills with the additional use of WhatsApp to prompt the persistence of the behaviours and learned skills beyond the intervention period. The following hypotheses were tested: 1. Self-regulated learning training will have a positive impact on levels of Hong Kong Chinese adolescent LTPA at follow-up. 2. Self-regulation variables, particularly reflection will significantly predict adolescent LTPA at follow-up. 3. Frequent WhatsApp behaviour prompting will be more effective compared to irregular face-to-face behaviour prompting on follow-up LTPA.

## Methods

### Design

A quasi-experimental design, a 3 X 3 (group by time) eight week plus six week follow-up intervention based on Zimmermann's self-regulated learning model was conducted. The allocation of students to intervention or control groups was not random; instead the allocation decisions were made according to practical aspects dictated by the timetabling of PE lessons. Based on the duration of interventions included in the systematic review (study 2; minimum = four weeks, maximum = two years), as well as the time allocated by the school, an eight week duration was the most commonly used and was considered appropriate for the current study. The systematic review revealed that the number of sessions delivered varied from one session to 24, three sessions was the second most common number of sessions and as a result the current programme considered three 90 minute sessions to be appropriate.

### Participants

A convenience sample of secondary school students ( $n = 98$ ; males = 53; mean age  $M = 12.35$ ,  $SD = .478$ ) from three first year secondary school classes were recruited through an existing network of Hong Kong PE teachers. The high school was a government funded, English-medium (teaching language was English) secondary school. Furthermore, two groups

of six students, one group for each experimental group, were selected by the PE teacher to take part in the study as peer trainers and gave their consent at the first meeting with the researcher. The male and female peer students were older than the participants in this study, one group was from second year (mean age = 13.6; females = 50%) and the other group was from fourth year (mean age = 14.8; females = 100%). *A priori* sample size calculation was calculated with G\*Power (G\*Power 3.1.3), and considering a repeated measures ANOVA, with within (3 groups), between (3 x time) and interaction effects, an estimated medium effect size ( $f=.25$ ) and a power calculation ( $p = 0.8$ ), G\*Power recommended a sample size of 42.

## Measures

Subjective LTPA was measured by the Godin Leisure-Time Questionnaire (Godin & Shephard, 1985) has been validated in a number of studies with adolescents (Hagger, Chatzisarantis, Culverhouse et al., 2003; Neumark-Sztainer, Paxton, Hannan et al., 2006; Matthews & Moran, 2011). The Godin questionnaire has demonstrated test-retest reliability of 0.84 (Sallis, Buono, Roby, et al., 1993; Jacobs, Ainsworth, Hartman, et al., 1993).

SRL was measured with the short SRL-SRS-C (Pitkethly & Lau, 2015) measured six components of self-regulation, the Cronbach's  $\alpha$  coefficients for which are as follows: planning = .84, self-monitoring = .7, effort = .86, self-efficacy = .71; self-evaluation = .9, reflection = .82 (test-retest ICC's ranged from .66 - .82 for all 6 subscales).

Testing for the self-reported measures, for all groups, was conducted three times: 1) at baseline, 2) at the end of 8 week programme, and 3), and follow-up testing was conducted 6 weeks after the programme ended.

Social validity is a construct which is important in school psychology research and practice. This construct was measured with a scale of 11 questions to determine the extent to which the teachers found the intervention acceptable, appropriate and effective (Finn &

Sladeczek, 2001; see result table 6.6). Finn and Sladeczek describe how there is not one comprehensive social validity scale, and as such the one used in the current study was constructed according to suggestions from the review, as well as consideration of the aims of the current intervention. One PE and one class teacher answered questions on a likert scale (very much so, yes, a little bit, not very much), for example, 'I felt comfortable with the programme being implemented in my class', 'I feel the skills are valuable and necessary for the children.'

Further qualitative information was gathered from participants at post and follow-up testing to determine their overall perception of the training programme. This consisted of 14 yes/no questions, for example, 'Did you enjoy taking part in this programme?', 'Do you think you will continue to think about how to take more steps or being more active?'

## **Procedure**

Ethical approval was received from Hong Kong Baptist University. Consent was sought, and given, by the school principal, and parents. All students assented at the beginning of the study. Practical aspects of incorporating the training programme into the school schedule were discussed with the PE teacher and the head teacher. These discussions confirmed the appropriateness of the intervention duration and the number of sessions to include in the programme.

**Peer trainers** Prior to the intervention, the peer group training was conducted over six sessions (3 sessions for each peer trainer group) over one month. Two separate peer training programmes were taught, one for each intervention group. The training involved teaching the whole programme to the peer trainers and explaining how they should deliver it to the younger students. The peers were given detailed scripts to follow for this purpose. The WhatsApp group peer trainers were required to train skills to students over four weeks, instruct the students on how to use the pedometers and logbooks, followed by continued

WhatsApp prompting of students, for the remaining four weeks. The No-WhatsApp group peer trainers trained SRL skills and use of the pedometers and logbooks over four weeks, followed by continued face-to-face prompting of students, for the remaining four weeks.

The researcher instructed and reminded the peer trainers to send the messages to the group daily. Messages reminded participants to wear their pedometers and complete their logbooks and contained encouraging statements *'remember your pedometer today'*, *'how many steps do you think you can take today?'*, *'we can do this together!'* The no-WhatsApp group were prompted face-to-face by peers - peers were instructed to approach them when they saw them during school hours to remind them to wear their pedometers and complete their logbooks. They used similar encouraging statements such as *'how many steps do you think you can take today?'*, *'remember to wear your pedometer'*, *'we can do this together!'*

**Intervention and control groups** The WhatsApp and the no-WhatsApp groups both received SRL skill training. The groups were organised as follows:

- Group A (WhatsApp group;  $n = 32$ ): Self-regulation training taught by peers, plus team challenge (Walk to London). The 'walk to London' challenge focused on reaching 10,000 steps per day by means of a virtual walk to from Hong Kong to London (there is a distance of 5994 miles to London, 30 participants, walking 10,000 steps a day for 8 weeks will accumulate approximately 6720 miles (at 2500 steps per mile for the average 5' 0" adolescent); 10,000 to 11,700 may be associated with 60 minutes of MVPA (Tudor-Locke et al., 2011). Peers prompted students daily within a WhatsApp group.
- Group B (No-WhatsApp group;  $n = 33$ ): Self-regulation training taught by peers only. The no-WhatsApp group were encouraged to meet a daily goal of 10,000 steps per day. Peers prompted students face-to-face when they saw them at school.

- Group C (Control group;  $n = 33$ ): Control group for comparison purposes only (no training was given apart from the normal curriculum lessons)

Participants in both intervention groups were encouraged to consider their involvement as a group challenge. Students were informed that step totals would be calculated and the top three highest achievers would receive a prize at the end of the intervention. Logbooks (see appendices) and pedometers were given to participants in both intervention groups, and detailed instructions of how to complete them were given during the training sessions. The logbooks were designed with a planning sheet, space to write their daily/weekly step totals; perceived self-efficacy, perceived effort scores, and space to answer self-evaluative and reflective questions. Students were also encouraged and prompted to record their goal setting, perceived self-efficacy, step counts (self-monitoring), effort scores, self-evaluation, and reflections daily. Logbooks were collected after week eight.

### **Self-Regulation Training Programme**

As previously mentioned, the SRL training aspect followed the model of the development of self-regulatory competencies which predicts that competence will develop in 4 stages: observation, emulation, self-control and self-regulation. Therefore, the time period made available to this research by the participating school, which included the follow-up period, was divided accordingly. The 90 minute PE lessons were scheduled once within a cycle of seven consecutive days. The training was delivered over three PE lessons. The first 5 weeks of the intervention incorporated the observation and emulation stages, making use of peer modelled instruction, practice and feedback. The subsequent three weeks became the self-controlled stage, and the last six weeks (follow-up period) became the self-regulated stage.

Self-regulatory skill training focussed on the directing the six SRL strategies towards improving LTPA by taking more daily steps. In the first meeting, a positive team spirit, and a

united goal of achieving 10,000 steps a day was created, as well as stimulating the belief that students can achieve this goal individually and as a team. This was repeated at each session. The methods used to teach and stimulate each SRL variable are described below.

**Self-efficacy** Initial discussions to target self-efficacy were conducted with the students following Bandura's (19887) model (see figure 6.1). The modelling process provided positive vicarious experience as well as successful personal experiences, positive feedback and encouragement. The peer models introduced a discussion in which the students were encouraged to think and talk about, a) a time where they had succeeded at something, b) where they had seen a movie or watched a friend or family member succeed at becoming healthier, losing weight, or recovering from illness, c) the 'muscle test' is a physical demonstration that involves an individual concentrating on positive thoughts whilst holding an arm out in front of them. Another individual must try to push the arm down against the person's force. This is then repeated with the individual thinking negative thoughts. The results of this demonstration typically reveal that positive thinking increases the ability to keep a strong arm from being pushed down. This demonstration was introduced as a playful and memorable tool to encourage positive thinking and social persuasion, as well as enhancing emotional and physiological states. Additionally, self-efficacy was prompted throughout the programme through completion of the logbooks, for example the accountability questions in the 'if-then' planning sheets. This prompting attempted to build on students' successful experiences which would in turn enhance self-efficacy.

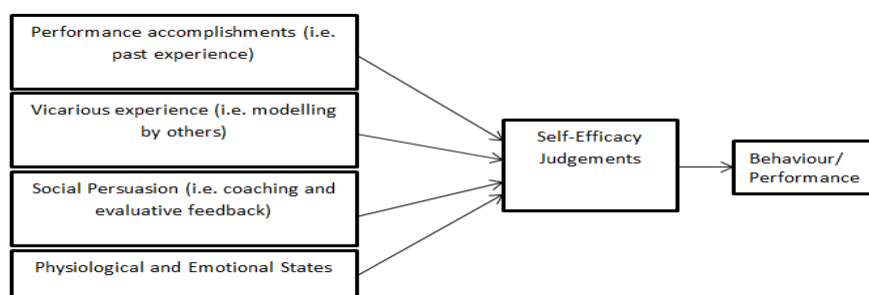


Figure 6.1. Bandura's (1987) model depicting the origins of self-efficacy.

**Planning** Positive imagery and mental rehearsal were integral to the training sessions (through PETTLEP training; Holmes & Collins, 2001). Peer trainers taught students to follow the PETTLEP steps when discussing, considering and setting the desired goals and plans for making these happen. Guided by Golwitzer's (1999) implementation intentions adolescents were taught to set effective goals and plans, by setting weekly goals and breaking them into smaller pieces by using the logbook planning sheets.

**Effort** The concept of effort was discussed within the self-efficacy discussions, it was also prompted daily, and recorded in the log books, for example 'how far can you get us today?' is an example of a message delivered in the WhatsApp group. Similarly, the no-WhatsApp group were encouraged face-to-face at school.

**Self-monitoring** Peer trainers taught the students how to use pedometers every day to achieve their step target goals. Depending on the stage of development, the WhatsApp group peer trainers sent out WhatsApp messages to ensure that students remembered their pedometers in the morning. Students were encouraged to record their step counts in the log books daily. The no-WhatsApp group were reminded at school.

**Self-evaluation** Depending on the stage of development, peer trainers sent group WhatsApp prompts to encourage students to evaluate their progress, by completing the logbook. The no-WhatsApp group were reminded at school.



**Reflection** At the end of each week, for the first eight weeks, reflection was prompted through WhatsApp messages which encouraged students to complete the reflective questions in the log book. This also had the potential effect of stimulating self-efficacy through step-by-step personal accomplishments. The no-WhatsApp group were reminded at school.

**Conceptualising SRL for Adolescents** The cyclical nature of SRL exists due to the dynamic interaction of personal, environmental and behavioural factors. Figure 6.2 is a simple conceptual diagram in a format which is easy for adolescents to understand. This diagram acted as a symbol of the process of change, during the training. This diagram was also printed on the cover of the logbooks as a reminder of how to continue the process. Stoeger and Ziegler, (2008) found that students receiving SR training performed better on exams than those that did not receive training. In fact these students were greatly benefited by seeing a depiction of a cyclical model of SRL which had guided the training.

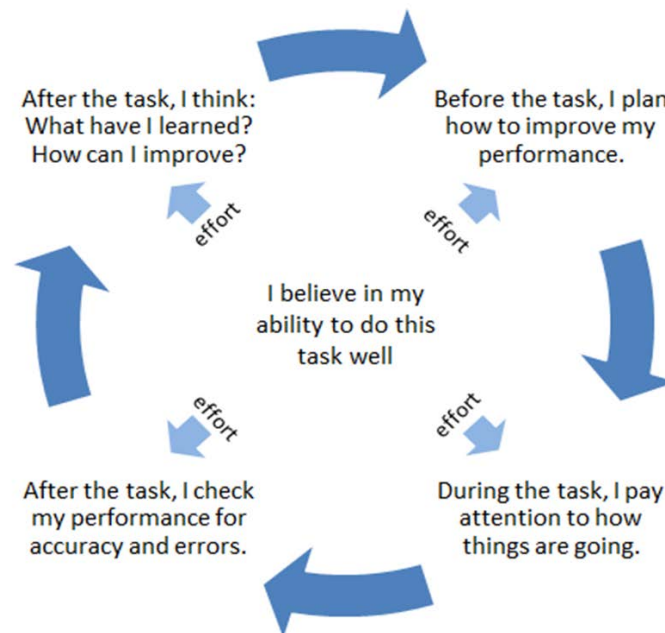


Figure 6.2. A conceptual model representing the six components of SRL.

## Analyses

All data analyses were conducted with SPSS (version 21.0). Initially, descriptive statistics and correlation analyses were conducted on self-report data. Means and standard deviations for all relevant variables were produced. Light, moderate and vigorous intensity self-report LTPA scores were summed to create total LTPA scores at baseline, post and follow-up. Pearson correlations, among gender, and all self-regulation components at baseline, post and follow-up time points were conducted. Gender differences for LTPA and SRL scores were conducted with independent t-tests.

A mixed ANOVA compares the mean differences between groups that have been split on two independent variables to determine if there was an interaction effect between factors on the dependent variable. As such, to assess the overall temporal effects of the intervention, a mixed design 3 (group) x 3 (intervention times) ANOVA was conducted. All necessary assumptions were tested including: outliers, normality, homogeneity of variances (as assessed by Levene's test ( $p > .05$ )), and equality of covariance. *Post hoc* Sidak corrections were obtained. These are considered similar to but less conservative than Bonferroni, especially considering the potential loss of power the Bonferroni delivers (Field, 2009; p. 402).

An ANCOVA on the follow-up LTPA data was conducted to determine whether there were any statistically significant differences between the adjusted population means of the three independent groups. An ANCOVA was considered necessary in this case to control for any potential confounding effects from baseline LTPA across groups. The independent variable was group, the dependent variable was follow-up LTPA, and the covariate was baseline LTPA. All necessary assumptions were tested, including: outliers, linear relationships between the covariate and the dependent variable for each level of the independent variable, homogeneity of regression slopes, normality of group and overall

model residuals (as assessed by a Shapiro-Wilks test ( $p < .05$ )), homoscedasticity, and homogeneity of variance (as assessed by Leven's test ( $p = .519$ )).

To simultaneously assess group differences among all six SRL variables i.e. planning, self-monitoring, effort, self-efficacy, self-evaluation and reflection at follow-up, a mixed MANOVA with repeated measures was conducted. All necessary assumptions were tested, including outliers (including multivariate outliers), multicollinearity, linear relationships between all variables for the independent variable, and homogeneity of variance-covariances matrices. Pillai's trace test statistic (denoted V) was used as it was considered most robust with respect to any violations of the assumptions of multivariate ANOVA. It is particularly useful when sample sizes are small or unequal, and offers the greatest protection against Type I errors with small sample sizes (Field, 2009; p. 604).

In order to examine the potential contribution from each SRL variable in predicting LTPA hierarchical multiple regression (HMR) was conducted. Bivariate correlations were examined and HMR was conducted at each time point (pre, post and follow-up). Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, homoscedasticity, multicollinearity, Tolerance and VIF values, independence of residuals, outliers, leverage points, and Cook's Distance values.

Logbooks were collected post-test and assessed for the quality of the entries to understand the engagement of the students with the process of SRL throughout the programme. A measure of social validity was Teacher Social Validity Rating Scale, and this data together with qualitative data to explore participants perceptions of the programme were analysed using a framework approach. Ritchie and Spencer's (1994) framework analysis is suited to analysing cross-sectional descriptive data and enables the capture of different aspects of the phenomena under investigation (Ritchie & Lewis, 2003). Tables were created to illustrate the qualitative findings. Participant yes/no responses to were sorted according to

the corresponding question into a data file, which was then analysed for percentage of responses. Any elaborations added by participants were qualitatively assessed within a framework.

Objective LTPA was measured with ActiGraph GT3X and GT3X+ models (Pensacola, FL). Adolescents were instructed to wear the accelerometers by fastening the belt around the hips and keeping the accelerometer positioned at the right hip, for seven consecutive days from waking until bedtime. Participants were also instructed to avoid wearing it during water based activities. At baseline, and at post-test a subsample of adolescents was asked to wear the accelerometers. Due to the high loss of accelerometer data (mainly due to non-wear and permission not being granted for follow-up data collection), too few adolescents had full data (around 15 for each group). It was therefore decided not to present results for the accelerometer data. This type of problem has also been confronted and reported similarly elsewhere in the literature (for example Prins et al., 2012).

## Results

Descriptive data for self-reported total LTPA, and participant numbers throughout the intervention, are presented in table 6.2. The mean age of participants was 12.35,  $SD = .478$ . There were 53 males and 45 females. The absentee rate was less than 2 % for the total of students in both intervention groups for each training session. There were no dropouts. There were no significant total LTPA differences between groups at baseline  $F(2,97) = 1.088, p = .341$ . There were no significant differences in LTPA at baseline between males ( $M = 49.32; SD = 25.89$ ) and females ( $M = 43.29; SD = 24.89; p = .25$ ). In addition, there were no significant group differences in total SRL score at baseline  $F(2,95) = 2.971, p = .06$ ; and no significant differences in baseline total SRL score between males ( $M = 95.32; SD = 12.37$ ) and females ( $M = 96.51; SD = 12.14; p = .63$ ).

Both experimental groups demonstrated an increase in total LTPA mean scores at post-test, and again at follow-up. The control group demonstrated an increase in total LTPA mean scores at post-test and a decrease at follow-up. The frequency of moderate and vigorous intensity activity on 0, 3 and 7 days of the week is presented in table 6.1.

Table 6.1

*Frequency of self-reported moderate and vigorous intensity LTPA on days of the week.*

Time	Days	Moderate LTPA (Valid %) (n = 98)	Vigorous LTPA (Valid %) (n = 98)
Baseline	0	16.3	5.1
	3	12.2	13.3
	7	10.2	4.1
Follow-up POST?	0	17.9	10.5
	3	15.8	16.8
	7	17.9	4.2

Table 6.2

*Means and standard deviations for self-report total LTPA score by group*

	Baseline LTPA			Post LTPA			Follow-up LTPA		
	M	SD	n	M	SD	n	M	SD	n
WhatsApp group	42.44	24.33	32	43.31	18.34	32	43.94	27.26	32
No-WhatsApp group	52.00	29.49	33	60.97	27.11	32	63.03	28.15	31
Control group	45.41	22.23	33	48.53	25.53	33	47.50	23.03	32

Correlations between all SRL components at baseline, post and follow-up time points are presented in table 6.3.

Table 6.3

*Correlations between total LTPA and self-regulatory components (n = 98)*

	Planning (n = 95)	Self-Monitoring (n = 95)	Effort (n = 95)	Self-Efficacy (n = 95)	Self-Evaluation (n = 95)	Reflection (n = 95)
Baseline LTPA	.113 (n = 95)	.131 (n = 95)	.141 (n = 95)	.249* (n = 95)	.014 (n = 95)	-.094 (n = 95)
Post LTPA	.100 (n = 95)	.101 (n = 95)	.088 (n = 95)	.179 (n = 95)	.147 (n = 95)	.151 (n = 95)
Follow-up LTPA	.191 (n = 95)	.065 (n = 95)	.142 (n = 95)	.167 (n = 95)	.040 (n = 95)	.274** (n = 95)

Note. \*\* ( $p < .01$ ); \* ( $p < .05$ ).

## LTPA

### Mixed ANOVA (3 x 3) for Overall Intervention Effects on Self-Reported LTPA

All tested assumptions were met apart from equality of covariance, as Box's test of matrices was violated ( $p = .04$ ). There was no statistically significant group by time interaction effect on total LTPA,  $F(4,182) = .719$ ,  $p = .580$ , partial  $\eta^2 = .016$ . No effect of time was found,  $F(2, 182) = 1.946$ ,  $p = .146$ , partial  $\eta^2 = .021$ . A significant effect for group was found,  $F(2, 91) = 4.818$ ,  $p = .01$ , partial  $\eta^2 = .096$ . After Sidak corrections, the WhatsApp group ( $M = 43.229$ ;  $SD = 3.582$ ) and the no-WhatsApp group ( $M = 58.667$ ;  $SD = 3.700$ ), revealed a significant mean difference of total LTPA 15.437, 95% CI [-27.96, -2.91],  $p = .01$ . The mean difference of total LTPA between the no-WhatsApp group and the control group ( $M = 47.146$ ;  $SD = 3.582$ ) was not significant, 11.521, 95% CI [-1.00, 24.05],  $p = .08$ . The mean difference between the WhatsApp group and the control group was not significant, 3.917, 95% CI [-16.24, 8.41],  $p = .83$ . Figure 6.3 illustrates these findings.

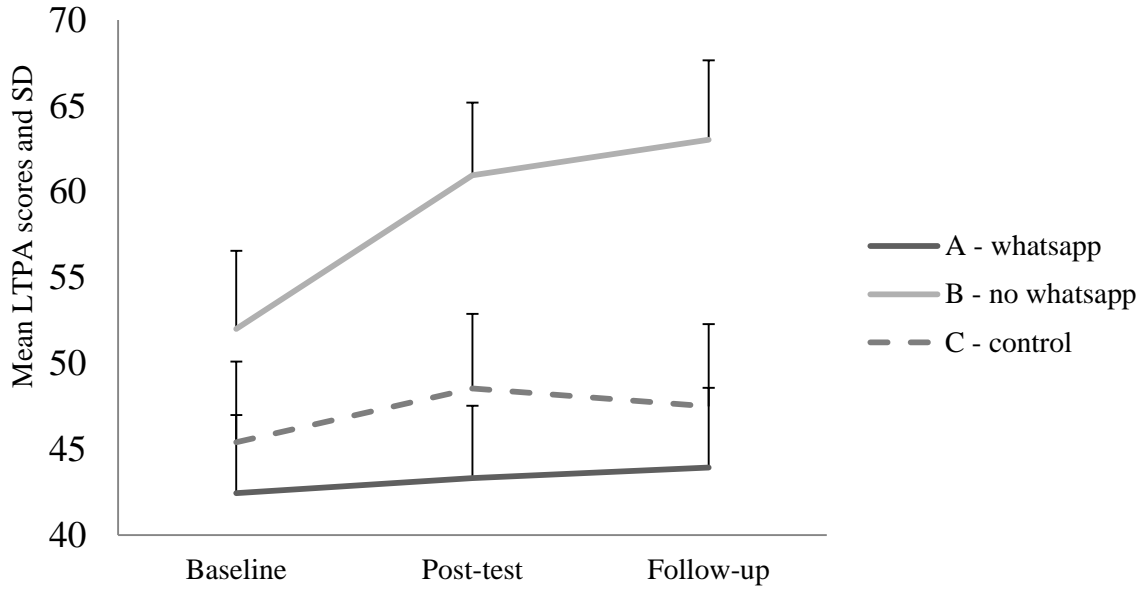


Figure 6.3 Total LTPA demonstrating the estimated marginal means and standard error from the mixed ANOVA analysis

**Intervention Effect on Follow-Up Self-Reported LTPA** All assumptions were met, including homogeneity of regression slopes as the interaction term was not statistically significant,  $F(2,53) = .102, p = .903$ . The effect of baseline LTPA was significant ( $p < .0005$ ). An ANCOVA demonstrated no group differences for total LTPA at follow-up, after adjusting for baseline total LTPA  $F(2,91) = 2.946, p = .061, \text{partial } \eta^2 = .06$ . At post-test, controlling for baseline LTPA ( $p < .0005$ ) the group differences were not significant ( $F(2,93) = 12.915, p = .059, \text{partial } \eta^2 = .06$ .)

### SRL

There were eight outliers, although none were extreme outliers, and two multivariate outliers. All were retained in the analysis. There were a slight deviation from normality as assessed by the Shapiro-Wilks test ( $p < .05$ ), but this was considered acceptable. The results of the mixed MANOVA with repeated measures revealed no interaction effect for time and group for all six SRL variables ( $V = .22; F(24,164) = .854, p = .66; \text{partial } \eta^2 = .11$ ). For all six SRL variables there were no significant group differences in ( $V = .18; F(12,176) = 1.428,$

$p = .16$ ; partial  $\eta^2 = .09$ . There was a significant effect for time ( $V = .70$ ;  $F(12,81) = 15.734$ ,  $p = .0005$ ; partial  $\eta^2 = .70$ ). Analysis of the separate univariate ANOVAs revealed reflection ( $F(2, 184) = 137.774$ ,  $p = .0005$ , partial  $\eta^2 = .60$ ) to be the only significant variable. No other SRL variables were significant i.e. planning  $p = .69$ ; self-monitoring,  $p = .59$ ; effort,  $p = .11$ ; self-efficacy,  $p = .92$ ; self-evaluation,  $p = .41$ . Pairwise comparisons revealed differences lay between baseline and the post-test ( $p = .0005$ , 95% CI[-1.616, -1.146]), and baseline and the follow-up test ( $p = .0005$ , 95% CI[-1.683, -1.113]), but not between post-test and follow-up ( $p = .865$ , 95% CI[-.226, .125]).

Table 6.4

*Mean total scores for baseline, post-test and follow-up SRL*

	Baseline SRL score mean and standard deviation	Post-test score mean and standard deviation	Follow-up score mean and standard deviation
WhatsApp group	91.88 (12.83) ( $n = 32$ )	96.78 (13.95) ( $n = 32$ )	95.94 (18.37) ( $n = 32$ )
No-WhatsApp group	99.00 (10.79) ( $n = 33$ )	98.18 (15.75) ( $n = 33$ )	103.23 (13.94) ( $n = 31$ )
Control group	96.61 (12.24) ( $n = 33$ )	97.76 (12.94) ( $n = 33$ )	97.41 (18.41) ( $n = 32$ )

## SRL and LTPA

**Hierarchical Multiple Regression** All assumptions tested were met. Multiple regression analyses, at each time point, were examined to assess the ability of the SRL variables to predict LTPA. At baseline, only the model containing self-efficacy significantly predicted total LTPA ( $\Delta R^2 = .130$ ,  $F(1,96) = 14.343$ ,  $p = .001$ ), self-efficacy explained 13% of the variance in LTPA. At post-test, none of the six SRL components predicted total LTPA. At follow-up, the model containing all six SRL components significantly predicted total LTPA ( $\Delta R^2 = .073$ ,  $F(1,88) = 2.626$ ,  $p = .007$ ) and explained 15.2% of the variance. In this model, self-evaluation ( $p = .035$ ) and reflection ( $p = .007$ ) were significant predictors (see table 6.5).



Table 6.5  
HMR for follow-up light, moderate and vigorous intensity LTPA

Model	B	SE	Beta	t	R <sup>2</sup>	Δ R <sup>2</sup>
1					.028	.028
Constant	31.112	12.425		2.504*		
Self-efficacy	7.235	4.430	.167	1.633		
2					.038	.010
Constant	26.766	13.226		2.024*		
Self-efficacy	2.338	6.750	.054	.346		
Planning	6.656	6.920	.150	.962		
3					.038	.000
Constant	27.466	14.222		1.931		
Self-efficacy	2.773	7.476	.064	.371		
Planning	7.090	7.626	.160	.930		
Effort	-1.061	7.647	-.023	-.139		
4					.056	.018
Constant	31.659	14.520		2.180*		
Self-efficacy	3.048	7.449	.070	.409		
Planning	14.121	9.291	.318	1.520		
Effort	-.804	7.619	-.018	-.105		
Self-monitoring	-9.145	6.960	-.215	-1.314		
5					.078	.023
Constant	40.048	15.508		2.582*		
Self-efficacy	3.886	7.423	.090	.523		
Planning	20.307	10.140	.457	2.003*		
Effort	-.408	7.575	-.009	-.054		
Self-monitoring	-8.779	6.919	-.206	-1.269		
Self-evaluation	-8.287	5.620	-.225	-1.475		
6					.152	.073
Constant	15.085	17.481		.863		
Self-efficacy	4.025	7.161	.093	.562		
Planning	18.519	9.804	.417	1.889		
Effort	.612	7.317	.013	.084		
Self-monitoring	-10.218	6.696	-.240	-1.526		
Self-evaluation	-11.902	5.577	-.323	-2.134*		
Reflection	11.568	4.190	.305	2.761**		

Note: B, unstandardised coefficients; SE, standard error; Beta, standardised coefficients; \*  $p < .01$ ; \*\*  $p < .01$ ; R<sup>2</sup>

In addition, the contribution of SRL to total LTPA was investigated among the SRL intervention groups only. These results followed a similar pattern to the findings for all three groups. That is to say, at baseline, only the model containing self-efficacy significantly predicted total LTPA ( $\Delta R^2 = .144$ ,  $F(1,63) = 10.595$ ,  $p = .002$ ) and explained 14.4% of the variance in LTPA. At post-test, none of the six SRL components predicted LTPA. At follow-up, the model containing all six SRL components significantly predicted total LTPA ( $\Delta R^2 = .121$ ,  $F(1,56) = 2.634$ ,  $p = .057$ ) and explained 20.2% of the variance in total LTPA, with reflection emerging as the only significant predictor in this model ( $p = .005$ ).

**Qualitative Data** Logbooks were thoroughly examined and the amount of valid engagement with the process and adherence to logbook completion was estimated. The percentage of returned logbooks was 55% for both intervention groups. The logbooks were assessed by one PE teacher and the researcher for the quantity and quality of entries over the programme. This process involved examining the percentage of logbook engagement through at least 70% of the programme. All entries (goal setting and planning, self-recorded step counts, and participants' responses to the self-evaluation and reflection questions) were analysed. The PE teacher, who was familiar with students' handwriting as well as their typical standard of homework completion, was particularly helpful during this analysis. Some participants had not genuinely engaged with the logbooks but had instead completed the entries with the same, or similar, entries for each week. Finally, both the PE teacher and the researcher calculated that 61% of the WhatsApp and 33% of the no-Whatsapp group had returned good quality logbooks.

Adolescents answered additional structured qualitative questions at post-test. This information was examined to gain a deeper understanding of the adolescents' perceptions of the intervention. Students were given the opportunity to comment on the programme through a set of yes or no questions. Overall, 59% of the WhatsApp and 74% of the no-Whatsapp groups reported that they enjoyed the programme. Most participants recognised the importance of the SRL skills (70% WhatsApp and 81% no-Whatsapp). Finally, 57% of WhatsApp and 77% of the no-Whatsapp group said they would continue to take more steps every day.

**Teacher Social Validity Rating Scale** Two teachers (one PE and one general class teacher) involved in the programme completed social validity rating scales to determine their perceptions of the programme. Eleven questions were answered on a 4-point Likert scale: 1. 'not very much', 2. 'a little bit', 3. 'yes' and 4. 'very much so'. Overall the teachers'

responses were positive, apart from one negative rating for the efficacy of the peer training method. Table 6.6 below illustrates the teachers' perceptions of the programme.

Table 6.6  
*Teachers' social validity rating scale*

Question	PE teacher	One class teacher
I have noticed a general increase in physical activity in my students	Yes	A little bit
Have you observed any other behavioural improvements as a result of the training programme? If so, please comment. (no comments were entered)	Yes	A little bit
I felt comfortable with the programme being implemented in my class	Very much so	Yes
I feel the skills are valuable and necessary for the children	yes	A little bit
I feel that the children will continue to benefit from the programme in the future	yes	A little bit
I feel that the children will be able to use the skills they have learned in other areas of their lives. If you think this, please add any comments.( no comments were entered)	yes	A little bit
Did you notice if the programme was effective in enhancing the children's' general physical activity?	yes	A little bit
The peer training aspect was an effective method to teach the programme to enhance the children's' general physical activity	yes	Not very much
I feel that other teachers would benefit from using this intervention	A little bit	A little bit
I enjoyed participating in this intervention	Very much so	A little bit
This intervention had an overall positive effect on the children's behaviour	Yes	A little bit

## Discussion

The primary aim of the current study was to examine the impact of peer-modelled, self-regulation training on levels of adolescent LTPA. Both experimental groups showed continued practical improvements in mean self-reported total LTPA scores at follow-up. Adolescents in the intervention groups appeared to develop self-regulation according to Zimmerman's development of self-regulation model throughout the study, and reflection has demonstrated a significant time effect. Additionally, at follow-up a regression model containing all six self-regulation components significantly predicted total LTPA, in particular,

self-evaluation and reflection were significant predictors. The effectiveness of WhatsApp prompting is not immediately evident from the slight improvements in self-reported results. However, there is evidence to support the future assessment of this prompting method further with attention to the limitations of this study. Teachers and students perceived the intervention to be beneficial.

**Hypothesis 1: Self-Regulated Learning Training will have a Positive Impact on Hong Kong Chinese Adolescents on follow-up LTPA.**

Overall, the current intervention had a non-significant but meaningful effect on adolescents' LTPA, demonstrated by the improvement trend at follow-up for the intervention groups but not for the control group after an intervention of minimal PA intensity (three 90 min sessions). Research suggests that interventions that manipulate aspects of self-regulation with the aim of improving PA are of positive benefit, despite non-significant results. For example, Araújo-Soares et al. (2009) targeted variables from social cognitive theory, self-regulation theory, and planning as evidenced mediators of PA change through a school-based intervention, using an intervention and a control group with a pre, post, follow-up design, and found no significant differences at post-test. However, at 9 month follow-up the intervention group reported significantly more self-reported moderate to vigorous intensity PA. Araújo-Soares et al. suggest that an inexpensive classroom-based intervention could potentially deliver a moderate increase in PA to a large number of adolescents producing substantial health promotion effects. Similar non-significant findings reported by Shilts, Horowitz, and Townsend (2009) show that guided goal-setting may be a viable strategy for the promotion of PA among adolescents. Similarly, targeted social cognitive variables demonstrated meaningful and practical changes in PA (Contento, Koch, Lee, Sauberli & Calabrese-Barton, 2007) among high school students. Ruiz et al. (2006) have illustrated the clinical significance of moderate to vigorous PA per week in improving cardiovascular fitness and there is also a

growing body of evidence demonstrating the linear relationship between PA and health (Hallal et al., 2006). Therefore, any LTPA improvement is beneficial.

In the current study, during the final phase of SRL development, as predicted by Zimmerman's development of self-regulation model, the students in the current study appear to have started to develop SRL skills. Firstly, the MANOVA found a significant time effect for reflection and secondly the regression models found a significant prediction of LTPA at follow-up by SRL skills. This had improved from baseline where only self-efficacy had any effect on LTPA. Thus, the increase in self-regulated learning skills, particularly reflection, over time had in turn, an effect on students' LTPA. Bandura (2004, p. 151) said, "*Health habits are not changed by an act of will. It requires motivational and self-regulatory skills*". Bandura (2004) went on to suggest that individuals *have to learn* to monitor their health behaviour, set proximal goals to motivate and guide behaviour, create incentives and enlist social support to sustain effort. It is known that learning results in changes in behaviour by means of intervening experiences (Schunk, 2001), and by integrating behavioural and cognitive processes that take place in a social context (Bandura, 1962, 1977). Therefore, learning may actually occur without a direct or instant change in behaviour, as the learner observes and makes decisions as a result of what has been observed and experienced (Grusec, 1992). Additionally, Morgan, Pangrazi, and Beighle (2003; p.36) argued "*that learning about physical activity and developing self-management skills are more important than the actual number of steps children accumulate.*"

At baseline, adolescents reported only 10% of daily moderate intensity LTPA. The regression model at baseline shows that only self-efficacy predicted LTPA, which suggests that simply having self-efficacy beliefs about PA is insufficient for students to engage in healthy levels of PA. After training and the proposed four stage development of self-regulatory competencies (observation, emulation, self-control and self-regulation), LTPA

improvement can be seen by the fact that students reported daily moderate intensity LTPA almost doubled (18% compared to 10% at baseline). A regression model at follow-up highlighted the importance of the contribution of all six self-regulation skills (particularly reflection), by their combined prediction of LTPA. This suggests that self-efficacy may have more impact on behaviour change when combined with the training of other self-regulation skills.

Baumeister, Heatherton and Tice (1994) suggested that beliefs (such as self-efficacy beliefs) are insufficient to overcome behavioural inertia because they are only passive evaluations of behaviour. Moreover, Bandura (2004) has recommended that it is vital not only to focus on self-efficacy beliefs but also to equip people with the relevant psychological skills to allow them to deal with the mental and social pressures that accompany daily life. This may be especially important at the adolescent stage of life, as having the right psychological tools as well as the belief that one is capable of dealing with various pressures will ultimately help to guard against unhealthy behaviour choices (Bandura, 2004). Thus, the practical importance of teaching self-regulation skills is supported by the current findings.

It should be noted that a key factor in the failure of any significant changes in self-regulated PA could be a lack of desire to achieve the outcome (Zimmerman, 2008). To some students in the current study, engaging with the logbooks and being more active may have been a desirable and valued outcome while to others it may not have been. To self-regulate well, individuals have to value the activity (Bandura, 1986). Students should also feel that they have achieved a certain goal as a result of their own efforts and abilities to take more pride in their achievements, a perception which has the potential drive further progressive action. These types of self-reactions are especially critical when people feel a poor performance was their responsibility, but not when they believe they did not have the ability, or external circumstances were outside their control (Weiner, 1986). Thus, if the students did

not value the goal or feel particularly autonomous within this intervention, the outcome would have been less important to them and they would, therefore, apply less effort.

Furthermore, in Hong Kong Chinese culture, being physically active is downgraded in favour of academic achievement. In an academic context, some self-regulation theorists from constructivist approaches (Paris, Byrnes & Paris, 2001) have emphasised cultivating students' academic identities to enhance motivation for academic achievement. Steinberg, Dornbush and Brown (1992) noted that students who identify themselves in non-academic terms often reject academic accomplishment as either secondary or even completely opposed to their social reference group, as well as their own personal goals. The reverse of this type of group identification may be true in the case of the current study, where a particular group may have not identified with physical activity accomplishments and thus not have engaged wholeheartedly with the intervention. Bandura (1989) refers to the importance of the collective comparison which operates in social systems organised around a collective principle, where self-appraisal is based on the person's contribution to group achievement and adheres to the standard adopted by the group. Another point to note is Ho's (2004) finding that despite low SRL scores Hong Kong students' competitive learning index was the highest of all the measured 33 countries. Ho suggests that Hong Kong students may be driven predominantly by extrinsic motivation through prevailing cultural attitudes. Therefore, in the current study, the fact that there was even a slight increase in mean score LTPA, a pursuit that is very much downplayed compared to academic achievement, bodes well for the potential of further SRL-for-LTPA training studies and this warrants further attention.

Another reason for the non-significant LTPA increases may be attributed to the intense academic pressure that the students were under as exams were unavoidable around post-testing and at follow-up testing. According to many self-regulatory control studies (Baumeister & Heatherton, 1996) the necessary extra effort required to engage in PA during

the busy exam period may not have been possible for the students. Baumeister and colleagues (2007) suggest that self-regulatory control operates as though it depends on a limited resource (such as blood glucose levels e.g. Gailliot, Plant, Butz, & Baumeister, 2004). This may be vulnerable to failure after exerting effort into other self-regulatory behaviours (Baumeister & Heatherton, 1994). Biological evidence for this theory has been demonstrated with advances in neuroscience research (Heatherton & Wagner, 2011). Thus, the demands of managing a number of subjects, mastering a considerable amount of information in a relatively short period of time, and completing projects within deadlines means that students may use up their limited self-regulatory resources, having less available for other concerns such as engaging in PA (Baumeister, Schmeichel & Vohs, 2007).

**Hypothesis 2: Self-Regulation Variables, Particularly Reflection will Predict Adolescent LTPA at follow up.**

Reflection has clearly emerged as the most influential SRL variable in the current study. Not only did reflection (along with self-evaluation) contribute to the prediction of follow-up LTPA, it was also the only SRL variable to demonstrate a time effect in the MANOVA analysis. The importance of reflection in learning has been stressed by Ertmer and Newby (1996), as it provides the critical link between knowledge and control of the learning process, which enables thoughts to be translated into action (Ertmer & Newby, 1996). Reflection is the ability to appraise what has been learned and integrate it with past knowledge and experiences to improve present and future action (Ertmer & Newby, 1996; Mezirow, 1991; Peltier, Hay & Drago, 2006; Zimmerman, 2000b). Therefore, reflection plays an important part in development (Jonker et al., 2012). From an educational perspective, reflection facilitates the problem solving process that results in effective learning (Dewey, 1933). Applying this to adolescents in a PA context, students who received the training in the current study were able to comprehend newly acquired knowledge and skills, such as



planning to take more daily steps, daily monitoring the number of steps taken, and are then able to reflect on this process so as to improve their step count the following day. It is possible for these skills to be applied in a variety of situations (Peltier, Hay & Drago, 2006). For example, to take their fitness to the next level, instead of focussing on daily steps, adolescents may decide to join a fitness or sport club.

Reflection emerging as a significant predictor is in line with other research with adolescents. Cleary and Zimmerman (2001) and Kitsantas and Zimmerman (2002) found that experts used significantly more self-reflective strategies (including self-evaluation and reflection) than non-experts or novices. Toering et al. (2009) also found reflection to be the key component in distinguishing elite from non-elite athletes. Jonker et al. (2010) demonstrated the value of reflection by showing that the top 1.0% of athletes discriminated themselves from their peers (in the top 2.5%) by their increased use of reflection.

Self-evaluation also emerged as a significant predictor of LTPA in the current study and is included in Zimmerman's self-reflective phase. Progress feedback is essential. The self-evaluations or reactions to cognitive judgements, attributions and progress will affect self-efficacy and motivation for further goal-directed behaviour (Schunk, 2003). It has long been understood that self-evaluation can improve performance. Lan (1996) found that student's use of self-evaluation was significantly correlated with final course grades. Considering that children and young people do not naturally keep their goals in mind and evaluate their progress, Schunk (2001) suggested that it is necessary to explicitly state goals and to teach individuals how to self-evaluate progress.

The current study can be said to support the cyclical aspect of Zimmerman's (2000b) three phase SRL model (forethought, performance and self-reflection). For example, without the benefit of planning, self-monitoring monitoring and evaluation, there would be less to evaluate and reflect upon to make the necessary LTPA behaviour changes. As such, the effect

of reflection is stronger with the significant contribution of all six variables as they emerged in regression model. According to phase one of the self-regulation model, students in the current study strategically planned their week in terms of how to go about taking the required number of steps. At the end of each week, in accordance with the third reflective phase, students were encouraged to answer reflective questions, such as, ‘*What have I learned over the last week*’, and ‘*How can I improve next week?*’ These questions were designed to extract the learning that had taken place. It was at this point each week that the students were encouraged to plan the next weeks’ activity. As Zimmerman (2000b; p.14) pointed out, self-regulation “... *refers to self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals*”.

### **Hypothesis 3. Frequent WhatsApp prompting will have More Effect than Face-to-Face Prompting of LTPA on Follow-Up LTPA.**

The current study was unable to determine the effectiveness of the WhatsApp group. A significant difference between the intervention groups suggests that the WhatsApp group did not perform very well, although the WhatsApp group PA score was above baseline at follow-up. However, considering the collective group effect that has been discussed (Bandura, 1989), social desirability may have affected the willingness of participants in this study to conduct more LTPA than the group deemed acceptable.

Upon inspection of the mean SRL scores across time points, despite no significant group SRL score differences the WhatsApp group started with the lowest mean SRL score and it appears that the WhatsApp group made the greatest SRL score gains from baseline to follow-up. This started to decrease, although not to baseline levels. This finding could suggest that the WhatsApp prompting was successful in encouraging SRL behaviours which led to their continued PA improvement. Although very limited research exists using WhatsApp for learning in any context, Bere (2013) compared students’ experiences of

creating ubiquitous spaces via virtual platforms on WhatsApp and the Blackboard learning management system. Results indicated that most students preferred the WhatsApp platform to the learning management system and also perceived that the ubiquitous nature of WhatsApp was beneficial to their learning. Ngaleka and Uys (2013) also recently used WhatsApp in a preliminary study to facilitate coursework outside the classroom and found significant collaboration and learning had taken place without the influence of the lecturer.

Furthermore, when analysing the logbooks, although an equal number of logbooks were returned by each intervention groups as requested at the end of the intervention, the quality of the entries in the WhatsApp group was 61% compared to 33% in the no-WhatsApp group. The logbooks had been specifically designed (if completed every day) to continue the self-regulation training, which was prompted by WhatsApp or in person depending on the intervention group. According to the proactive nature of good self-regulators, engagement with the daily completion of the logbook may be said to be a behavioural correlate of self-regulation in this study, although from the combination of the SRL and the PA results, the positive influence of Whatsapp may be more evident at post-test. However, this study was concerned with a more persistent effect of SRL training on PA, as such the potential off using WhatsApp for more persistent effects require further research. Nevertheless, despite the limitations of this study, small PA improvements are still meaningful and important in the daily lives of those individual adolescents. As Rosenthal (1990) stated small amounts of statistical variance can still result in big practical differences.

### **Limitations**

Regarding limitations to this study, firstly, for the considered practical aspects of conducting this study within a high school setting, this was a non-randomised controlled study (quasi-experiment), thus, threatening internal validity and meaning that any intervention effects are more likely to be related to chance. As such, the ability to make

strong conclusions regarding intervention efficacy is difficult. Nevertheless, it can be said that there was limited threat to external validity due to the programme being delivered in an ecologically valid manner that is considered important. Additionally, suitable statistical methods were used to account for the effects of confounding variables.

Furthermore, in practical terms the eight week duration of the programme should be longer, or the number of session should be increased. Clearly more time with the students would potentially have resulted in better quality training and further PA improvements. However, the intervention studies presented in study two, included intervention durations that ranged from 4 weeks to two years, and training sessions ranging from one session to 24 sessions. For example, Shimon et al. (2009) found that one ten-minute session over four weeks was sufficient to find a significant increase in daily steps. Whereas, Contento et al., (2010) conducted 24 lessons over eight to ten weeks and found no significant effect on PA.

Elsewhere, in the educational SRL training literature, a meta-analysis of SRL training studies in primary school children (Dignath, Buettner & Langfeldt, 2008) investigated SRL training programme effects on various academic performance outcomes (mathematics; reading and writing; other performance; cognitive or metacognitive strategies; motivational strategies). Apart from the 'other performance' category (e.g. science and social science), the authors found no significant impact of the length of the training. For the 'other performance' category, the interventions had significantly higher effects with a decreasing number of months. This effect did not occur when investigating the impact of the number of training sessions. Despite the inconsistency in the literature with respect to SRL training duration, the current duration is still considered a limitation, as the Hong Kong students may have needed longer to engage with the idea of SRL and extra LTPA. However, it should be noted that practical aspects that had to be navigated within this study were considerable and the eight week duration with three training sessions was the most feasible for students, teachers and the

researcher. Bandura (2004, p. 158) noted that health prevention programmes in schools are *'grudgingly allowed in schools, they try to do too much, with too little time, in too short a time ...'* This was the case in this particular study, and in addition to the time allocated for the study, the time allocated for PE lessons is insufficient. Students in this study receive only one PE lesson in each cycle of seven consecutive school days (less than one session per week). As detailed elsewhere in this thesis, the importance of PA is clearly not a high a priority in Hong Kong.

Inherent in the design is an element of inconsistency of the two peer groups' delivery of the training to the experimental groups. This may have affected the groups' level of acquired knowledge, self-efficacy and motivation to work through the programme. Schunk, Hanson and Cox (1987) suggested that when students observe a self-regulated strategy demonstrated by a model, they may not be motivated to emulate this behaviour if they perceive the model to be dissimilar to themselves. However, despite this limitation, efforts were made to control the effect of the peer training. For example, the training that was delivered to both groups of peers was exactly the same for both groups, and of similar content (see appendices G & H). The peers were also given scripts to follow whilst conducting the training with students to ensure that all students received the same information.

The use of WhatsApp in this study was limited in a number of ways. Firstly, the WhatsApp group was not an autonomously initiated group and not all of the students in each group necessarily got on well with each other. This would have affected the willingness of students to read the messages and as a result be prompted to complete the log books and be influenced by the encouragement provided. Measurement limitations include social desirability concerns as a result of self-report tools. This is an unavoidable issue in research. However, the measurement used demonstrated valid psychometrics for use in the sample used in this study.

## **Future research**

In terms of future research, in light of meaningful changes in self-reported PA and observed differences in self-regulatory behaviour, replication of this study is recommended. Tailoring SRL interventions for low active students should be done with a randomised controlled trial designs with the students blinded to the intervention aims. Ideally, future replication would be performed in different schools to avoid any treatment contamination. This training should also be conducted with older adolescents, and those from different countries to further explore the practical aspects of delivering and using self-regulated learning for behaviour change interventions. Furthermore, considering the important predictive role played by reflection, practitioners and researchers should focus on how best to include reflection training and in addition, to examine its effects on adherence to PA.

The effect of WhatsApp requires further investigation, due to its potential influence on prompting PA behaviour at post-test, but further investigation is required on its potential for persistent PA effects. Furthermore, incorporating measures of academic achievement may be really useful to raise the value of PA by establishing positive links between SRL, PA and academic achievement. This may be particularly useful in contexts where PA is culturally discouraged in favour of academic pursuits such as Hong Kong. Finally, according to other related models of self-control (e.g. 'ego depletion model; Baumeister et al., 1998), when young people are under pressure from heavy academic loads their ability to self-regulate is diminished. Therefore, in addition to teaching practical SRL skills it would be very useful to incorporate measures and strategies to improve emotional regulation (via executive function) through heart rate variability training (e.g. Fagundo et al 2013).

In summary, the current pilot study has several strengths through the use of a strong theory based programme and contained the four essential elements of an effective preventative programme (Bandura, 2004): a) information about health risks and benefits, b)

self-management skills, c) the building of self-efficacy and d) social support. It also followed Zimmerman's model of the development of self-regulation and the findings demonstrated support for this model. The practical and meaningful results have contributed to the literature in terms of the importance of planning self-efficacy, self-evaluation and reflection for improved PA behaviour change. Additionally, this pilot study also explored the use of WhatsApp which provided a way of prompting the desired behaviours outside of school hours and beyond the initial peer training. However, regarding the effectiveness of the WhatsApp aspect of this pilot study, replication is recommended with attention to several limitations before any strong conclusions can be made. Another strength of this pilot study is the qualitative aspect which highlights that the majority of the students found the programme enjoyable and important. The social validity of the programme was further confirmed as the programme was well received by the teachers involved, and the qualitative aspects raised are considered especially useful for further development (Heron & Smyth, 2010).

## **Conclusions**

In conclusion, inactivity is a critical issue in today's society, and using aspects from Zimmerman's theory of self-regulation model, it has been possible to examine the underlying strategies that adolescents use to negotiate their complex social worlds. Overall, this pilot study has demonstrated non-significant but meaningful effects on LTPA by teaching adolescents how to self-regulate, and that better self-regulated adolescents are likely to engage in more LTPA than adolescents with lower self-regulated learning skills. Importantly, as self-regulated learning skills are amenable to training, further research is highly recommended.

## CHAPTER 7- GENERAL DISCUSSION

Firstly, this discussion will summarise the main findings from each chapter in this thesis, and highlight the strengths of this research. Subsequently, the major contribution of this work to the literature will be discussed, followed by overall limitations, recommendations, and conclusions.

### Summary

Chapter one began by illustrating the global issue of inactivity, and describing early attempts to improve the activity levels of our young people. The chapter continues with how research aiming to enhance the physical activity behaviour of young people has turned its attention to the examination of the psychological correlates of PA behavior (e.g. Baronowski, Anderson, Carmack, 1998). Particularly important to focus on are those *modifiable* psychological correlates of PA behaviour that can be targeted through interventions (e.g. Biddle & Fuchs, 2009). A particular set of variables that sit neatly under the heading 'psychological correlates of PA' are social-cognitive variables (Matthews & Moran, 2011) for example, self-efficacy and self-regulation, which are known to influence self-directed behaviour change in a variety of health behaviours, including PA (Bandura, 2004).

Chapter two went on to demonstrate the importance of self-regulation, namely, that it is known to be a major process in psychological functioning (Schmeichel & Baumeister, 2004), enabling people to navigate their social worlds more effectively. Crucially, self-regulation is required to override impulses to seek immediate gratification for behaviour (e.g. Mischel, 1978). For example, sedentary game playing behaviour may be more instantly gratifying for adolescents than finding the effort and energy required for engaging in PA, which many adolescents find uncomfortable and unenjoyable. Volitional PA engagement is difficult to start (especially with a limited history of PA involvement) and to persist with, especially during adolescence. Self-regulation skills may be particularly valuable during this



challenging time in life where many demands, particularly academic demands, are expected to be met. Self-regulation is associated with better performance in a variety of domains, for example, self-regulation skills can help adolescents deal with the challenges and may help elite youth athletes combine a sport career with education (e.g. Jonker et al., 2011). Good self-regulation skills are also said to be important for engagement in PA (e.g. Toering et al., 2012).

Chapter two also reviewed related studies that had examined or manipulated the effect of self-regulatory components and adolescent PA behaviours. This review demonstrated positive associations between SR components and PA, and experimental research demonstrated improved PA behaviours as a result of the contribution of SR components. The heterogeneity of studies however, highlighted the variety of potential SR variables and perspectives from which to examine them. The review highlighted a gap in the literature specifically regarding a focus on self-regulated learning from Zimmerman's (1986, 2000) model and PA during adolescence. Zimmerman's model is important during adolescence as it attempts to explain *how* individuals are able to make improvements through a systematic method of learning how to adapt to ever changing environments (Schunk, 2001). Furthermore, the available Western SRL and PA research is limited and none exists among Chinese adolescents. Self-regulation features in Western adult health (see Kitsantas & Zimmerman, 2000b; Maes & Karoly, 2005) and weight management (see Kitsantas, 2000; Teixeira, Mata, Williams, Gorin & Lemieux, 2012). China, particularly Hong Kong, has a reputation for having some of the most inactive children and young people in the world (e.g. Adab & Macfarlane, 1998) this has not improved in recent years according to Hong Kong statistics (HKLCS, 2012). Therefore, it seemed a reasonable next step to see whether the concept of SRL is applicable to Chinese adolescents to enable further investigation.

To begin to address this issue, chapter three documents the validation of a Chinese version of the English SRL-SRS questionnaire. The concept of SRL has been only been investigated in an education-specific domain in an Asian context. Prior to this current research, there was only an English SRL questionnaire that was designed to measure a general tendency for SRL that could be applied across domains , for example, sports, academic achievement, and of course, PA. Therefore, this Western concept of SRL required to be examined and validated in a Chinese sample. Results demonstrated that the SRL-SRS-C is a valid time-efficient measure of SRL that fits the original English version's six factor structure based on Zimmerman's (1986) theory. This paper has been published which demonstrates its contribution to the literature and confirms that a general tendency for SRL is evident in a non-Western culture. The fact that this measure is now available to other researchers makes it possible to also conduct cross-cultural research.

With a validated Chinese measure of SRL, it was now possible to examine Hong Kong and Scottish adolescents' general tendencies for self-regulated learning and how these were related to LTPA. The two parallel cross-sectional studies revealed small but positive and significant contributions of all six self-regulation components to PA. More specifically, in both Hong Kong and Scottish samples self-efficacy contributed solely to moderate levels of LTPA, whereas, all six components, particularly self-efficacy and reflection, contributed to vigorous intensity activity. Self-efficacy is well documented to contribute to PA behaviours, but to the best of the researcher's knowledge, this is the first time that reflection has been highlighted as a significant contributor of PA among adolescents either in Hong Kong and Scotland. So it can be said that higher levels of self-regulated learning are weakly but significantly associated with higher levels of PA in both Chinese and Scottish adolescent samples. In addition, Scottish students engaged in significantly more PA than the Chinese

students which was accompanied by significantly higher self-monitoring, self-evaluation and reflection.

In chapter five, focus groups were conducted with Hong Kong adolescents to inform the design of a quasi-experimental pilot study to improve LTPA through teaching SRL skills. The focus of the discussions related specifically to PA behaviours. Despite the limitations of this study, important information was revealed. Such as, Hong Kong adolescents engage in very little PA. According to recent government statistics with 12.8% of adolescent boys and only 4.2% of adolescent girls were classified as physically active (HKLCS, 2012). This was confirmed by the majority of the sample of students in the focus groups who said they only engaged in PA during school PE lessons, which were not even conducted once a week. During the interviews, adolescents discussed many barriers to PA, particularly the high demand for their time from academic work, and the psychological and physical issues they felt about engaging in PA. As a result of their suggestions for increasing PA, such as walking instead of taking short bus or train rides, and taking stairs and walking on escalators, the plan for the intervention study could include a relevant PA focus. All the students seemed overwhelmed with academic pressure; therefore, as well focusing on improving PA levels in an intervention, developing self-regulation skills to improve their ability to navigate their environments would also be beneficial.

In chapter six, the pilot quasi-intervention taught SRL skills (planning, self-monitoring, self-evaluation and reflection and the motivational components included effort and self-efficacy) to improve Chinese adolescents LTPA. Results demonstrated non-significant but meaningful LTPA improvements. The positive LTPA trend persisted at follow-up for both intervention groups but not for the control group. These meaningful improvements corresponded with adolescents' SRL development throughout the intervention, as Zimmermans' (1986) theory postulates. At follow-up, all self-regulation variables

contributed significantly to LTPA, with reflection doing so significantly. These findings add weight to previous findings in the current thesis, that self-regulation, and particularly reflection, play an important role in adolescent LTPA.

### **Strengths: The Importance of SRL and Reflection**

The cyclical nature of a combination of self-regulatory processes, play a pivotal role in single, individual behaviour. In addition, self-regulatory processing has been found to be more predictive of success than either technical knowledge or years of experience (Cleary & Zimmerman, 2001; Kitsantas & Zimmerman, 2002). Due to the importance of SRL, it has been suggested that it can play an important role in increasing adolescent PA levels (Matthews & Moran, 2011; Toering et al., 2012). Therefore, a particular strength of the current research is that it has consistently demonstrated both in two samples in study three and four, that SRL is significantly related to levels of PA. Another strong finding is that reflection has consistently emerged as the key SRL component in the SRL and PA relationship.

At this point it seems pertinent to reiterate how reflection impacts on behaviour and the important role that it plays in improved performance. Reflection refers to adaptive or defensive inferences, and an individual's ability to apply previous experience to improve subsequent performance in an effective, goal-directed way (Mezirow, 1991; Peltier, Hay & Drago, 2006; Zimmerman, 1986, 2000b). From an educational perspective, reflection facilitates the problem solving process that results in effective learning (Dewey, 1933). According to Zimmerman's (1986, 2000b) model, in order to improve behaviour or performance, reflective learners self-observe performance against their current or previous performance, or the performance of other people (evaluation). They will then relate the reason(s) for their successes and failures to their self-observed performance, and feel either

satisfied or dissatisfied with their performance. Next, they will adapt their decisions and behaviours accordingly and plan new or improved strategies for future improvement.

Several adolescent performance related studies have found reflection to be the key component in distinguishing elite from non-elite athletes (Toering et al., 2009) as well as between international and national level athletes across a range of team and individual sports. It is suggested that reflection may facilitate the development of the domain specific characteristics that are important for realising one's full potential (Jonker et al., 2010). In a follow-up study, Jonker, Elferink-Gemser, de Roos, and Visscher, (2012) examined the relationship of the use of reflection among junior international and national level athletes with their attained senior competitive level 2.5 years later. Results revealed that, regardless of junior competitive level, number of training hours, and years of sport experience, the later senior internationals reported using reflection more frequently 2.5 years previously than their later senior national peers. Furthermore, the athletes who increased in competitive level from junior national to senior international level had similar scores to their junior international peers who made a successful transition to senior international level. The junior internationals that decreased in competitive level to senior national level had similar scores to peers who were nationals as juniors and remained nationals as seniors. In addition, athletes who were initially identified as less gifted (in other words junior nationals) and were able to improve sufficiently during their development years to become senior internationals, reported using reflection comparatively often. Considering these findings in the light of the current adolescent physical activity research, it is suggested that as reflection seems to have a predictive value for athletes it may also play a similar role in a PA context. This could have some important applications in future research.

## **Implications of the Current Thesis for Future Research**

Self-regulation development does not occur naturally, but rather only in inspiring environments in which goal- setting and appropriate feedback play a crucial role (e.g. Boekarts & Corno, 2005). Children and young people do not intuitively keep their goals in mind and evaluate or reflect on their progress, and they can easily over or underestimate their own capabilities if goals are not explicit. Therefore, it is necessary to explicitly state goals and to teach individuals how to self-evaluate progress (Chen & Singer, 1992; Schunk, 2001). Throughout this thesis, it has emerged that higher levels of SRL are significantly and positively associated with higher levels of PA. Therefore, due to the trainable nature of SRL an implication here is that more can be done to improve physical activity behaviours through enhanced SRL skills. Therefore, it is suggested that it is important to focus on explicit teaching of planning, monitoring, self-evaluation and reflection, and to do so in an environment that can help to instil self-efficacy to drive the required effort to achieve explicit PA goals. With this understanding, the current thesis findings imply that the effect of researching SRL and adolescent PA further may be a pertinent area to continue to develop in the future.

## **Recommendations**

Randomisation can be an in education research as it can be difficult to randomise individuals within a school-based study hence the use of quasi-designs. However it is recommended to address this issue by using an RCT design in order to fully assess the effect of SRL training on PA. This design will confirm any potential treatment effects with greater certainty. One possible RCT design could involve randomly allocating students to one of two after school activity clubs, rather than a design involving school classes. Additionally, enlisting the support from a community based extra-curricular youth centre would be another possibility. This design could focus on a targeted adolescent populations (i.e. girls or boys,

low-active, underserved youth) who attend community-based youth groups. Cluster randomisation by randomising groups to the treatment, or examining groups in different schools may be other viable options. Future studies must extend SRL training on PA for a longer period of time for greater effect and with larger sample sizes, and preferably with strong collaborative support from the schools involved.

### **Practical Application of the Results**

The predictive value of reflection may be useful, not only in identifying adolescents with higher reflective or self-regulative abilities (through SRL scores), but also by identifying adolescents with lower self-regulative or reflective abilities and intervening accordingly. In terms of PA specifically, PE teachers could use the SRL questionnaire to with their students. By assessing students' total and component scores, teachers would have an indication of students' SRL tendencies and be able to intervene accordingly. The focus on the six SRL aspects would be a beneficial addition to the content of PE lessons to encourage lifelong PA behaviours. Initially, SRL improvements could be focused on one area, and subsequently applied to other areas. As adolescents mature beyond 12 years old they are able to use self-regulated skills consciously and to apply these skills in other performance domains (e.g. Van der Stel & Veenman, 2008) including music training, sport and health enhancing PA. Overall, assessing and training self-regulated learning ability at an early stage could result in enhanced proactive capacity and achievement of potential.

### **Future research**

Longitudinal cross-section studies would be useful to examine the underlying patterning of SRL related to PA processes in the same population over time. In addition, further cross-cultural research would add to the limited existing findings, particularly with populations that are known to be inactive. Future experimental research could target low-

active adolescents and tailor SRL-PA interventions to develop the necessary skills for overcoming PA barriers.

Young adolescents may still require substantial ‘other-regulation’, such as parental regulation but further SRL-PA experimental research needs to be conducted with them before the drop in PA levels and as they are more able to generalise SRL skills to other areas of their lives. Furthermore, it would also be useful to examine the effect of SRL-PA training with older adolescents who may be under greater academic pressure and are likely to benefit from SRL-PA skill training. In addition, SRL training of similar content would be useful to examine in Western adolescents. Future research could also consider incorporating techniques from other related models of self-control, such as ego depletion (Baumeister, Bratslavsky, Muraven & Tice, 1998). When young people are stressed and under academic pressure and other responsibilities their ability to self-regulate is diminished. As well as teaching SRL skills it would be useful to incorporate measures of and strategies to combat ‘ego depletion’. For example, it has been found that positive affect can counteract ego depletion (Tice, Baumeister, Shmuckli & Muraven, 2007). Using heart rate variability biofeedback training to improve executive function and thereby greater control over arousal levels as was found in adolescents with eating disorders (Fagundo et al., 2013). Additional emotional regulation skills may provide young people with extra benefits and the ability to replenish cognitive resources which they can spend on further self-regulatory effort for PA. Combining this with the training of pragmatic SRL skills would enable young people to plan and successfully execute these plans and learn by reflection on the progress and results of these plans. Finally, similar SRL and PA interventions could also consider using additional measures of academic achievement. It may be that better self-regulating adolescents who engage in higher levels of PA may also perform better at school. A soimilar link has been established elsewhere, for example Jonker et al. (2009) found that talented athletes were high



self-regulators and also high academic achievers. Any link between PA and academic achievement would be highly beneficial in the Asian context where PA is culturally discouraged in favour of academic pursuits.

### **Limitations**

Research in this area is at a very early stage, and certainly, longitudinal studies and higher powered experimental research is warranted before strong conclusions can be made. Use of the Godin PA questionnaire is limited as this questionnaire gathers very limited PA information. The non-probability sampling methods, particularly in the qualitative and the pilot intervention study, mean that the generalisability of the results is not possible. The cross-cultural aspect of this research is limited in its scope, and requires further extensive investigation not only comparing other cultures, but other age groups, and importantly further repeated measures to investigate underlying patterns of the SRL processes.

The focus groups were imbalanced in participant number and two groups may be insufficient to draw conclusions from the whole Hong Kong adolescent population. In addition, the presence of the PE teachers during the interviews introduces bias into the interviews. Caution must also be taken when addressing future SRL intervention research. The quasi-experimental design of the intervention offers valuable insight into this developing area, but is limited as it is not possible to determine whether any of the non-significant practical PA improvements observed and commented on are due to a planned treatment effect.

### **Conclusions**

Self-regulation research addresses the content of diverse learning tasks. This thesis has contributed to an understanding of how self-regulated learning variables play a key role in an adolescent physical activity context. Higher levels of self-regulated learning are significantly associated with higher levels of PA, and reflection appears to play a key role in

this relationship. As a result of SRL training meaningful improvements in PA have been demonstrated and positive changes in proactive capacity. Self-regulated skills may not necessarily occur naturally, and as adolescence is a time of increasing independence, learning a set of skills that can help them navigate through ever changing environments is crucial. Adolescents may become better at engaging in PA if they are explicitly trained in self-regulated leaning skills, in a PA context. Including a focus on reflection could develop self-awareness so that young people can become more aware of their strengths and weaknesses. The resulting psychological changes of such training, may positively impact on chronic inactivity, through improved psychological functioning and lower incidences of self-regulation failure.

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## APPENDICES

### A. SRL-SRS Questionnaire

Instructions: Read each statement and indicate how much it is true for you by ticking the relevant box

		<b>1 Almost never</b>	<b>2 Sometimes</b>	<b>3 Often</b>	<b>4 Almost always</b>
1	I determine how to solve a problem before I begin.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	I check how well I am doing when I solve a task	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	I keep working even on difficult tasks.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	If I persist on a task, I will eventually succeed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	I carefully plan my course of action to solve a problem.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	I check my work while doing it.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	I put forth my best effort when performing tasks.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	I know how to handle unforeseen situations, because I can easily think of strategies to cope with things that are new to me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	I think through in my mind the steps of a plan I have to follow.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	While doing a task, I ask myself, how well I am doing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	I concentrate fully when I do a task.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	I am confident that I could deal efficiently with unexpected events.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	I ask myself questions about what a problem requires me to do to solve it, before I do it.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	I correct my errors.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	I don't give up even if the task is hard.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	If I am in a bind, I can usually think of something to do.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	I imagine the parts of a problem I still have to complete.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	I check my accuracy as I progress through a task.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

19	I work hard on a task even if it is not important.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	I remain calm when facing difficulties, because I know many ways to cope with difficulties.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	I figure out my goals and what I need to do to accomplish them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	I judge the correctness of my work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23	I work as hard as possible on all tasks.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24	I always manage to solve difficult problems if I try hard enough.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25	I clearly plan my course of action to solve a problem.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26	I work hard to do well even if I don't like a task.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	It is easy for me to concentrate on my goals and to accomplish them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28	I develop a plan for the solution of a problem.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	I can solve most problems if I invest the necessary effort.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30	If I am not really good at a task I can compensate for this by working hard.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31	When I am confronted with a problem, I usually find several solutions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32	I am willing to do extra work on tasks in order to learn more.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33	No matter what comes my way, I am usually able to handle it.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34	I ask myself questions about what a problem requires me to do to solve it, before I do it.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

		Never	Rarely	Sometimes	Often	Always
35	I look back and check if what I did was right.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36	I make sure I complete each step.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37	I double-check to make sure I did it right.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38	I check to see if my calculations are correct.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39	I stop and rethink a step I have already done.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40	I look back to see if I did the correct procedures.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

41	I look back at the problem to see if my answer makes sense.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42	I check my work all the way through the problem.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
43	I think about my past experiences to understand new ideas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
44	I reappraise my experiences so I can learn from them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
45	I try to think about how I can do things better next time.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
46	I think about my actions to see whether I can improve them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
47	I try to think about my strengths and weaknesses.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## B. SRL-SRS-C

### Self-Assessment Questionnaire (自我評估問卷)

Instructions: Read each statement and indicate how much it is true for you by ticking the relevant box

指引: 細閱以下每一陳述句，並在最能反映你情況的空格內填上「✓」

		<b>1</b> <b>Almost</b> <b>never</b> (近乎從 不)	<b>2</b> <b>Sometimes</b> (有時)	<b>3</b> <b>Often</b> (經常)	<b>4</b> <b>Almost</b> <b>always</b> (近乎總 是)
1	I determine how to solve a problem before I begin. 在開始前，我會決定如何解決問題	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	I check how well I am doing when I solve a task 當我解決問題時，我會檢視我做得有多好	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	I keep working even on difficult tasks. 即使面對困難的任務，我仍會繼續努力	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	If I persist on a task, I will eventually succeed. 如果我繼續努力，我最終都會成功	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	I carefully plan my course of action to solve a problem. 我仔細規劃我的行動以解決問題	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	I check my work while doing it. 當我正在進行任務的時候，我會檢視我的工作	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	I put forth my best effort when performing tasks. 在工作時，我會付出我最大的努力	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	I think through in my mind the steps of a plan I have to follow. 計劃每一步驟時，我會深思熟慮	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	While doing a task, I ask myself, how well I am doing. 當我進行一項任務時，我會問自己做得有多好	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	I concentrate fully when I do a task. 我會集中全力去完成一項任務	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	I ask myself questions about what a problem requires me to do to solve it, before I do it. 在解決難題前，我會問自己需要做甚麼	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	I don't give up even if the task is hard. 即使是很困難的任務，我也不會放棄	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	If I am in a bind, I can usually think of something to do. 如果我陷入了困境，我通常能夠想到需要做的事	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	I imagine the parts of a problem I still have to complete. 我會想像我需要解決的問題的每一部份	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	I work as hard as possible on all tasks. 我會盡我所能去做每一件事	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	I always manage to solve difficult problems if I try hard enough. 如果我盡力嘗試，我總是能解決各種難題	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	I clearly plan my course of action to solve a problem.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



	我清晰地計劃我的行動來解決問題				
18	I develop a plan for the solution of a problem.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	我會計劃解決問題的方法				
19	I can solve most problems if I invest the necessary effort.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	如果投放所需的努力，我能解決大部份的難題				

		Never (從不)	Rarely (很少)	Sometimes (間中)	Often (經常)	Always (總是)
20	I look back and check if what I did was right.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	我會檢視過去的事有沒有做對					
21	I make sure I complete each step.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	我會確保我完成每一個步驟					
22	I double-check to make sure I did it right.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	我會重複檢查以確保我做好每件事					
23	I check to see if my calculations are correct.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	我會檢視自己的估計是否正確					
24	I stop and rethink a step I have already done.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	我會停一停，再想一想自己所做過的每一個步驟					
25	I look back to see if I did the correct procedures.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	我會檢討過去所做的程序是否正確					
26	I look back at the problem to see if my answer makes sense.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	我會檢討在問題中所提出的答案是否合理					
27	I check my work all the way through the problem.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	在解決難題時，我會全程檢視我的工作					

		Strongly agree (非常同意)	Agree (同意)	Neutral (中立)	Disagree (不同意)	Strongly disagree (非常不同意)
28	I think about my past experiences to understand new ideas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	當我學習新知識時會想起我過去的經驗					
29	I reappraise my experiences so I can learn from them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	我會總結我的經驗以便從中學習					
30	I try to think about how I can do things better next time.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	我嘗試去思考下次如何可以把事情做得更好					
31	I think about my actions to see whether I can improve them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	我回想我過去所做的，以檢視如何作出改善					
32	I try to think about my strengths and weaknesses.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	我嘗試思考我的優點與缺點					

### C. Godin Leisure-Time Exercise Questionnaire (Godin & Shephard, (1985)

#### Godin 閒暇時間運動問卷

Considering a 7-Day period (a week), how many times on average do you do the following kinds of exercise for more than 15 minutes during your free time (write on each line the appropriate number)?  
回想過去七天(一星期)，在你的閒暇時間裡平均有多少次進行下列的運動多於 15 分鐘? (在下列各行寫上適當的數字)

Type of Exercise (運動類型)

Times per week (次數/星期)

1a) STRENUOUS EXERCISE (HEART BEATS RAPIDLY) 劇烈運動 (心跳很快)

(e.g. running, jogging, hockey, rugby, soccer, vigorous swimming, vigorous long distance cycling, vigorous hiking, judo, karate, gymnastics, ballet, competitive popular dance)

\_\_\_\_\_

(例如: 跑步, 緩步跑, 曲棍球, 欖球, 足球, 強力游泳, 強力長途騎單車, 強力行山, 柔道, 空手道, 體操, 芭蕾舞, 競技性流行舞蹈)

a) MODERATE EXERCISE (NOT EXHAUSTING) 適度運動 (不感到精力耗盡)

\_\_\_\_\_

(fast walking, baseball, tennis, badminton, easy swimming, tai chi, non-competitive popular and folk dancing)  
(快速步行, 棒球, 網球, 羽毛球, 輕鬆游泳, 太極, 非競技性流行及民間舞蹈)

b) MILD EXERCISE (MINIMAL EFFORT)

\_\_\_\_\_

輕量運動 (最小勞力)

(yoga, archery, bowling, golf, easy walking)

(瑜珈, 射箭, 保齡球, 高爾夫球, 輕鬆步行)

2. Considering a 7-Day period (a week), during your leisure-time, how often do you engage in any regular activity long enough to work up a sweat (heart beats daily)? (Please indicate your choice below with a cross ×)

回想起過去七天(一星期)，在你的閒暇時間裡，你是否經常參與任何足以令你流汗 (心跳加快) 的常規活動? (請在適當的空格內填上"X")

OFTEN (經常)

SOMETIMES (間中)

NEVER/RARELY (永不/極少)

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

**D. Logbook (page 1 NB. pages 1 & 2 pages are duplicated 8 times in the logbook)**

Page 1

**WEEK 1 GOAL**

List specific behaviours that you believe are achievable.	<i>When</i> will you have completed this by?	What can be seen that shows you are progressing?	Who else will be involved in meeting the goal?	'If-then' planning. If 'X' happens (that prevents goal being achieved) then I will do 'Y'.
First Step				
Second Step				
Third Step				
Fourth Step				

## E. Logbook Page 2

STEP COUNT

EFFORT SCORE

Monday \_\_\_\_\_ Monday \_\_\_\_\_  
Tuesday \_\_\_\_\_ Tuesday \_\_\_\_\_  
Wednesday \_\_\_\_\_ Wednesday \_\_\_\_\_  
Thursday \_\_\_\_\_ Thursday \_\_\_\_\_  
Friday \_\_\_\_\_ Friday \_\_\_\_\_  
Saturday \_\_\_\_\_ Saturday \_\_\_\_\_  
Sunday \_\_\_\_\_ Sunday \_\_\_\_\_

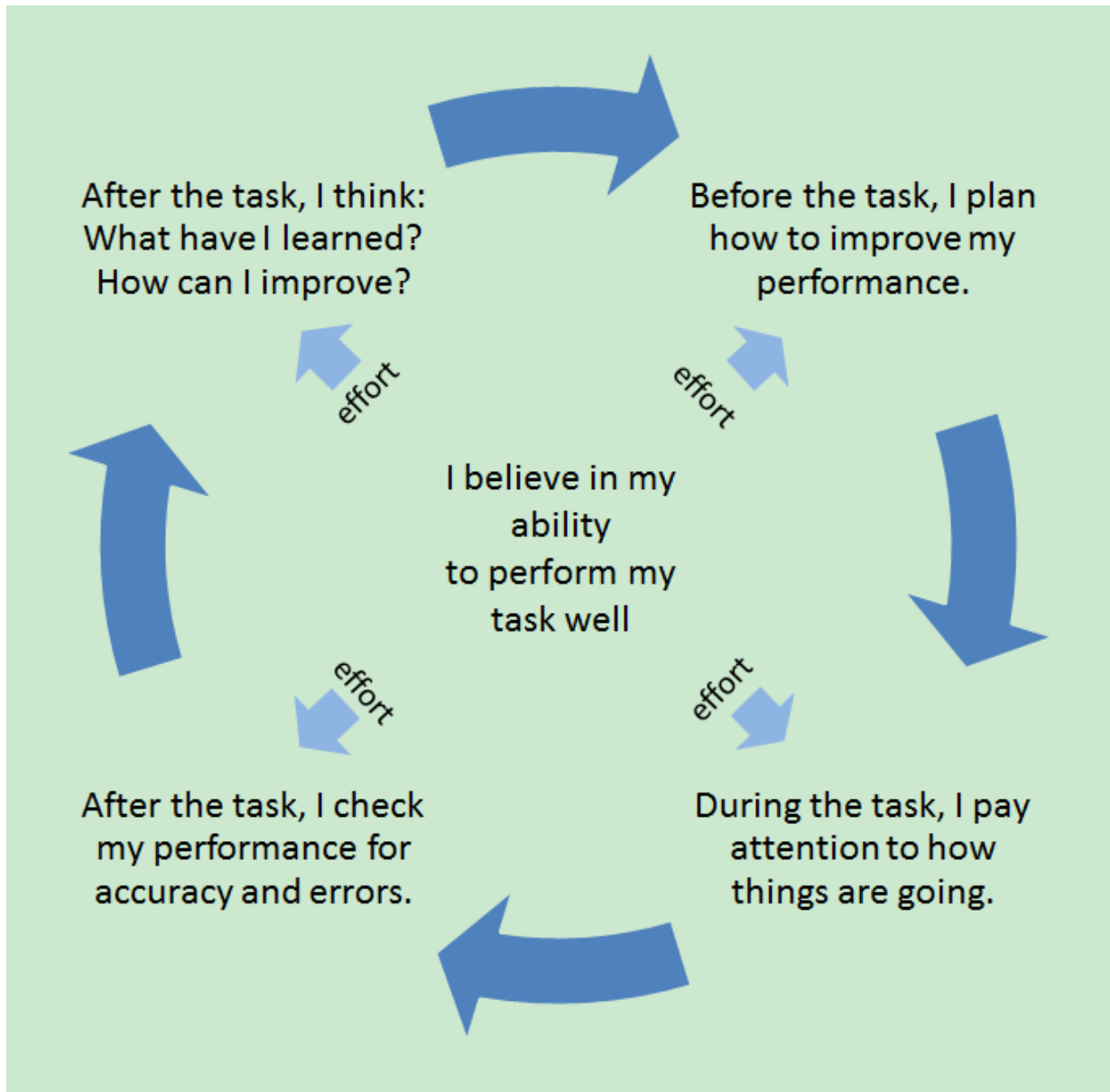
WHAT DID I DO REALLY WELL?	WHAT DID I DO ... NOT SO WELL?
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	
Sunday	

I BELIEVE I CAN ACHIEVE THIS WEEK'S GOAL BECAUSE ...

OVER THIS LAST WEEK, I HAVE LEARNED ...

HOW CAN I IMPROVE MY PERFORMANCE TOWARDS MY GOAL NEXT WEEK?

**F. Star Cycle (Front cover of logbook)**



## G. WhatsApp group (WhatsApp) Peer Trainer Pack

### BELIEVE YOU CAN ... SESSION 1

You will give all the students a demonstration and directions on how to use pedometers (It's important they all use one of the University's pedometers), and logbooks, and set up the WhatsApp group (we need permission from the teacher to do this in class).

#### 1. DO and say THIS...

Ok so for the next couple of months we have been set a very special challenge, and you have been lucky enough to have been selected for this. Our challenge is to **WALK ALL THE WAY TO LONDON!!!** Hands up who thinks we can do this without leaving Hong Kong??? We are going to take as many steps as we can and we will add them all up, and with all of us working together, we should make it.

So first of all ...

Pedometer wearing instructions:

- EVERY MORNING, after you are dressed, push the reset button on the pedometer so that it is set to '0'.
- Clip the pedometer, upright, to your waistband, at your hip making sure it is against your body.
- Wear it ALL day, except in water
- Take it off at bedtime
- Don't touch the reset button during the day, or you will lose your count.
- The pedometer will not work in a coat or trouser pocket, keep it clipped to your hip
- Alert one of the peer trainers if the battery in the pedometer needs to be replaced.
- If you have worn it really well for the first week it will be easy to estimate your steps if you forget it one day, but remember to keep them as they are university property

#### 2. SAY THIS...

As you can see ... 10,000 STEPS A DAY times 7 = 70,000 steps a week

Multiply this by 8 weeks = 560,000 steps or 210 miles... EACH

Multiply this by 30 students (for example) we get 16,800,000 steps as a group or around 6700 miles, and it is nearly 6000 to London from Hong Kong.

SO THIS IS OUR TARGET!!! (it is crucial here that you are excited about this opportunity, because some students may think 'who cares' ... if you think this is a great idea, they are more likely to.)

\*\*\*\*To do this all you need to do, is count steps and write in your logbook everyday\*\*\*\*

SAY THIS...

Get them to look at the star cycle on the front of their logbooks and explain that this is how we will get the job done, by planning before the week starts, checking as we go and at the end of the day, and looking back over the previous week to see what we have learned and how we can improve. We are also going to believe that we can do this, and try as hard as we can to count our 10,000 steps, with our pedometers, and complete our logbooks EVERY DAY!! ... YES!!!

#### 3. SAY THIS...

Logbook introduction:

THERE WILL BE 3 PRIZES FOR PROPER COMPLETION OF LOGBOOKS AND PROPER USE AND CARE OF UNIVERSITY PEDOMETERS AT THE END OF TERM  
BRING IT WITH YOU TO PE CLASS EVERY WEEK

- Each double page is one week
- Set goals first and look at them daily
- Enter daily information on the second of the double pages
- The last 2 questions will be answered on a Sunday
- The next week's goals will be entered on a Sunday, after answering the last 2 questions

#### 4. SAY THIS...Goal setting detail ...

In the logbook every week, the target is 70,000 steps ... it is very important to break this down into pieces each week and plan what you will do to achieve this ...

... SO ... what do we need to do to take as many steps as possible in one day???? How can we take more steps??? If we are going to succeed we have to set goals each week for getting more steps .... Give me some more suggestions

\*\*\* SUGGEST THIS to be written in the first space...

...use the loop at the corner of your logbook to hang it up near your bed so you can see this in the morning and before you go to bed to add in the daily details

5. ASK THIS ... ask them for suggestions and someone write all of them on the board/note ... here are some examples of goals if they have nothing to say:

... Walk to the next bus stop/MTR station

...walk home if not too far instead of getting the mini bus ...

... Eat and drink healthily so you have more energy ...

... Get together with a friend to do any of the above

... Get to bed an hour earlier so that you have more energy, if late nights are normal

...if you have not covered a lot of distance during the day you can march at home to your favourite song to add to the step total for the day

(Feel free to come up with your own ideas too...)

6. ASK THIS ... Have the students open the logbook and in the first box add their first goal (hang it up by their bed), then ...when they will accomplish this by, sign of progress, who is involved, and what will you do if you don't get this done? How will you make it happen if you forget, you are busy? Etc (the log book prompts)

7. ASK THIS ... Then, in the first part of the second inner page have them write a reason why they will achieve their goal this week

8. TELL THEM THIS ...The second inner page needs to be completed before they go to bed at night, it takes 2 minutes, add the step counts, effort score, what went well and what didn't

9. TELL THEM THIS ..... ON SUNDAY COMPLETE THE LAST QUESTIONS AND SET A GOAL FOR THE NEXT WEEK ACCORDING TO YOUR PROGRESS SO FAR

○ FINALLY, TELL THEM THAT THE LOGBOOKS WILL BE CHECKED BY YOU AT THE NEXT PE SESSION AND, BY THE TEACHER, SO THEY MUST REMEMBER TO DO WHAT IS REQUIRED THROUGHOUT THE COMING WEEKS OF THE PROGRAMME... AND REMEMBER THERE ARE PRIZES FOR DOING THIS WELL!!!

\*\*\* If there is time show them the muscle test from the beginning of session 2

## Session 2

1. Ask the students about difficulties in completing the log book and counting steps, I will be there so it's ok if you are struggling to answer respond.

Logbook and pedometer reminder:

THERE WILL BE 3 PRIZES FOR PROPER COMPLETION OF LOGBOOKS AND PROPER USE AND CARE OF UNIVERSITY PEDOMETERS AT THE END OF TERM  
BRING IT WITH YOU TO PE CLASS EVERY WEEK

- Each double page is one week
- Set goals first and look at them daily
- Enter daily information on the second of the double pages
- The last 2 questions will be answered on a Sunday
- The next week's goals will be entered on a Sunday, after answering the last 2 questions

You will have added up the step counts submitted through WhatsApp so someone needs to have already counted these and tell them how far they have all walked as a group, and compare this to the estimated total i.e. around 70,000 X 30 + students = 2,100,000 steps, which equals around 995 miles!!!!!!!! YIPEE!!!!!!!!

2. Even if you have done the muscle test in session 1, start with it this session, as follows:  
Muscle testing DO THIS...

1. First ask for a volunteer, or use another peer trainer.

2. Ask them to hold out their strong arm, straight in front of them, at shoulder height, 3. Make a fist, and hold it really strong.

4. You stand to their side and try to lower their strong straight arm by pushing down on it with 2 fingers.

5. You will find that you won't be able to.

6. Ask them to relax and shake it off.

7. Ask them to lift their arm again, the same as before, and think of really good happy thoughts, ask them to say over and over in their heads ' I am amazing, I am fantastic, I can do anything etc ' over and over...

8. Look at their face, and when you see that they are really into it, attempt to push their arm down as you did before.

9. You will find that you won't be able to.

10. Now have them relax, and again shake off.

11. Get them to get their arm ready again and this time ask them to think of not so happy thoughts, ask them to say over and over again in their heads ' I am a failure, I am not good enough, I am a failure, I am not good enough etc' over and over ...
12. Look at their face, and when you see the change push their arm down as you did before.
13. This time their arm power will 'short circuit' or even drop right down, as soon as they realise they will recover the strength but you and they will feel the difference.
14. To emphasise this, repeat the positive one.
15. Now get them to try this in pairs, so they can all feel it.

#### DO THIS...

Then, have a quick chat about how negative thinking affects your body, how can we get anything done, if we have negative and harmful thoughts floating around our heads? If we become much more aware of the things we have floating around in our heads ALL the time, we could start to control it, and be much stronger, both physically and mentally ... and as a result **ACHIEVE MORE!!!!!!**

#### 3. After this do the lemon test:...DO THIS...

Have you tried the lemon test? With your eyes closed, imagine that you have a big juicy lemon in front of you. Pick it up and feel the waxy skin and the weight of it in your hand. Look at the shape and bright yellow colour. Can you smell that freshness? Now, put it on a chopping board in front of you and take a sharp knife and cut through the middle of it. See the lemon juice squirting out as you do so. Feel the lemon again in your hands and smell that fresh, lemony, zesty smell. Now, bring half of it up to your nose and smell again, then tilt your head back and bring the lemon up to your mouth and squeeze some of the lemon juice into your mouth. Can you taste that tanginess?? What happens as you taste the juice? Now, open your eyes. Are you salivating slightly? But, hang on, tell me, where is the lemon? That's right! There is no lemon. You tricked your brain into thinking there was one though, and it went ahead and geared your physiology and chemistry up to be ready to start to digest that lemon.

4. DO THIS... Now ask them to think about something that they really want to do (it can be sport related, win a race, score a goal, or something they want to do, like go to the beach, ride a skateboard, go shopping with their friends, go on holiday ... bake a cake, whatever they want)

- Tell them to pick something (positive not negative!!)
- Have them picture it in their minds. Eyes open or closed as long as they do it.
- Now, without talking out loud, are they calm or excited in the image of them doing what would really like to do
- Have them see what are they wearing in the image
- If they are outside are they inside or outside, is it warm, sunny, raining?
- If inside, does the room have windows, are they open or closed are the lights on or off
- What can you hear? Smell? Are you holding something can you feel it?
- Are you moving or standing still?
- If you are moving can you feel your heart beat and your muscles moving?
- If you are still can you also feel your heart beat and the ground underneath your feet?
- Or if you are sitting can you feel yourself pushing down on the chair?
- Look at the colours in you environment, can you see them, can you make them brighter?
- Are you already good at this?
- If you are see yourself doing it really well?
- If it is something you want to do then watch yourself get better and better at it, watch your mistakes, and rewind, and then redo it with new understanding
- Are you happy or just focused and calm, excited? What mood are you in? how do you feel?
- Can you see yourself? Or are you looking out of your own eyes in this image?

5. Now go over goal setting to make sure they can pick some individual goal for the new week. What do they need to do this week in order to achieve 10,000 a day?

For example.....

- Get up earlier?
- Go to bed earlier?
- Eat better?
- Drink more water?
- Wear the pedometer?



- Remember to record the details in the book?

Any other goals they can add into their logbooks??? Get them to make suggestions and complete week 2, or add to it if they have not got the logbook with them, get them to write some down and add to the log books later.

- Ask them if what was easy about the process?
- Ask them how hard they really tried? Could they try harder?
- Ask them what was difficult?
- Ask them what they have learned?
- Ask them what they can improve upon?
- Get them to look at the star cycle on the front of their logbooks every day.
- Tell them that the logbooks will be checked by you at the next PE session, and by the teacher, so they must remember to do what is required throughout the weeks of the programme.
- **ASK IF THEY CAN REMEMBER TO SEND IN THEIR WEEKLY STEP COUNTS AND WE CAN CHART THE PROGRESS TOWARDS LONDON ON A MAP.**

### Session 3

1. Ask the students about difficulties in completing the log book and counting steps, I will be there so it's ok if you are struggling to answer respond.

Logbook and pedometer reminder:

- **THERE WILL BE 3 PRIZES FOR PROPER COMPLETION OF LOGBOOKS AND PROPER USE AND CARE OF UNIVERSITY PEDOMETERS AT THE END OF TERM**
- **BRING IT WITH YOU TO PE CLASS EVERY WEEK**
- Each double page is one week
- Set goals first and look at them daily
- Enter daily information on the second of the double pages
- The last 2 questions will be answered on a Sunday
- The next week's goals will be entered on a Sunday, after answering the last 2 questions

You will have added up the step counts submitted through WhatsApp so someone needs to have already counted these and tell them how far they have all walked as a group, and compare this to the estimated total i.e. around  $140,000 \times 30 + \text{students} = 4,200,000$  steps, which equals around 1988 miles!!!!!!!  
YIPEE!!!!!!! (just a rough calculation here...)

2. Quick repeat of muscle testing:

Muscle testing **DO THIS...**

- First ask for a volunteer, or use another peer trainer.
- Ask them to hold out their strong arm, straight in front of them, at shoulder height, 3. Make a fist, and hold it really strong.
- You stand to their side and try to lower their strong straight arm by pushing down on it with 2 fingers.
- You will find that you won't be able to.
- Ask them to relax and shake it off.
- Ask them to lift their arm again, the same as before, and think of really good happy thoughts, ask them to say over and over in their heads ' I am amazing, I am fantastic, I can do anything etc ' over and over...
- Look at their face, and when you see that they are really into it, attempt to push their arm down as you did before.
- You will find that you won't be able to.
- Now have them relax, and again shake off.
- Get them to get their arm ready again and this time ask them to think of not so happy thoughts, ask them to say over and over again in their heads ' I am a failure, I am not good enough, I am a failure, I am not good enough etc ' over and over ...
- Look at their face, and when you see the change push their arm down as you did before.
- This time their arm power will 'short circuit' or even drop right down, as soon as they realise they will recover the strength but you and they will feel the difference.
- To emphasise this, repeat the positive one.
- Now get them to try this in pairs, so they can all feel it.

3. DO THIS...

Then, have a quick chat about how negative thinking affects your body, how can we get anything done, if we have negative and harmful thoughts floating around our heads? If we become much more aware of the things we have floating around in our heads ALL the time, we could start to control it, and be much stronger, both physically and mentally ... and as a result **ACHIEVE MORE!!!!!!**

Remind them of the lemon test:...DO THIS...

- Now ask them to imagine all the ways of achieving 10,000 steps a day
- Have them picture it in their minds. Eyes open or closed as long as they do it.
- Now, without talking out loud, are they calm or excited in the image of them doing what they need to do to take more steps
- Have them put a big smile on their face
- Have them put positive words in their minds , and if they are thinking negative words ...change them in to positive ones ...remember the muscle testing
- Have them see what are they wearing in the image
- If they are outside are they inside or outside, is it warm, sunny, raining?
- If inside, does the room have windows, are they open or closed are the lights on or off
- What can you hear? Smell? Are you holding something can you feel it?
- If you are moving can you feel your heart beat and your muscles moving?
- Maybe you are preparing something for walking ...imagine writing down in your logbook every day, see the big number of steps as you read it on your pedometer and see yourself writing this into your logbook
- If you are still as you do this ... can you also feel your heart beat and the ground underneath your feet?
- Or if you are sitting can you feel yourself pushing down on the chair?
- Look at the colours in you environment, can you see them, can you make them brighter?
- Are you already good at doing this?
- If you are, see yourself doing it really well?
- If it is something you want to do then watch yourself get better and better at it, watch your mistakes, and rewind, and then redo it with new understanding
- Are you happy or just focused and calm, excited? What mood are you in? How do you feel?
- Can you see yourself? Or are you looking out of your own eyes in this image?

4. Now go over goal setting to make sure they can pick some individual goal for the new week. What do they need to do this week in order to achieve 10,000 a day?

For example.....

- Get up earlier?
- Go to bed earlier?
- Eat better?
- Drink more water?
- Wear the pedometer?
- Remember to record the details in the book?

Any other goals they can add into their logbooks??? Get them to make suggestions and complete week 2, or add to it if they have not got the logbook with them, get them to write some down and add to the log books later.

- Ask them if what was easy about the process?
- Ask them how hard they really tried? Could they try harder?
- Ask them what was difficult?
- Ask them what they have learned?
- Ask them what they can improve upon?
- Get them to look at the star cycle on the front of their logbooks every day.
- Tell them that the logbooks will be checked by you at the next PE session, and by the teacher, so they must remember to do what is required throughout the weeks of the programme.
- Ask if everyone is receiving the WhatsApp group messages?
- **ASK IF THEY CAN REMEMBER TO SEND IN THEIR WEEKLY STEP COUNTS AND WE CAN CHART THE PROGRESS TOWARDS LONDON ON A MAP.**

## MANAGEMENT AND SCHEDULING

- You have session plans to follow, so make sure you are familiar with them

- We must write a list of all your names, phone numbers and email addresses, and set up a WhatsApp group between us
- we need to design a ROTA OF DUTIES
- I will set up a separate WhatsApp group with you (trainers only) so I can prompt you with instructions for sending evening and weekend messages prompting students' upkeep of logbooks
- You will create a WhatsApp group for the students (I will be a silent member too)
- Introduce the concept of London walk an accumulated 10,000 steps a day. This is a really important part of your role, as all s1's must be encouraged to continue to count steps and complete the logbooks. THANK YOU!!!!
- Map to chart progress of walk (weekly updated)? I will gather accumulated totals via WhatsApp and add to the map

Peer training schedule:

Week 1 - 5: The emphasis in the first 2 weeks will be the peer trainers' *showing* the content, and the students following the peers' demonstrations.

Week 6 to 8 the students can *show you* what they know.

\*\*\*\*AFTER SESSION 1 the daily WhatsApp prompts will begin. These are to encourage students to complete the logbook, and to share step counts with the group (detailed below).

Week 9 on: There will be no formal sessions (and no WhatsApp prompting, see below) the students will go about their normal lives but the WhatsApp group prompting will continue (see scheduling below).

#### FREQUENCY AND MANAGEMENT OF PEER WHATSAPP PROMPTING:

\*\*\*Between the 6 of you and myself as a silent member, decide on the order that you take responsibility for sending the messages

Week 1 to week 5: DAILY WhatsApp message from peers to students as soon as the goals are in the logbooks.

- AM message (around 7.30am, before school, preferably before students leave home, so they will remember to put on the step counter): 'Remember to start you step counter! We're going to London/Paris!! Let's go!!!'
- PM messages (around 8pm): 'Remember to go through you logbook!' It will take 5 minutes! Text in with any issues.' 'How far to London/Paris have we gone today, people? Send in your counts.'
- Weekly Sunday message (around 7/8 pm): 'It's time to write a couple of sentences for the last 2 questions, and then to set your goals for next week according to your progress so far. We are doing this!!!! So exciting!'

NB!! As you, the peer trainers see fit, these messages can be reworded to keep them fresh, relevant and genuine, but they must be sent every day for 6 weeks (not the last 2 weeks ). Alternate the duty between 6 you, according to the rota of duties which has been sorted out beforehand. I will remind you.

Week 6 to 8: These 2 week require less prompting so logbook reminder three times via WhatsApp (Monday, Wednesday and Sunday)

- MONDAY & WEDNESDAY AM message (around 7.30am, before school, preferably before students leave home, so they will remember to put on the step counter): 'Remember to start you step counter! We're going to London/Paris!! Let's go!!!'
- PM messages (around 8pm): 'Remember to go through you logbook!' It will take 5 minutes! Text in with any issues.' 'How far to London/Paris have we gone today, people? Send in your counts.'
- SUNDAY message (around 7/8 pm): 'It's time to write a couple of sentences for the last 2 questions, and then to set your goals for next week according to your progress so far. We are doing this!!!! So exciting!'

Week 9 on: NO PROMPTING AT ALL. Respond to issues and keep any conversations going, but no prompting. Your job is over. Well done!

#### ROTA

Each of you pick a number from 1 to 6. And remember this number. Below is a rough rota we will use to divide the duties of sending out daily WhatsApp messages. According to this number method each of you will do this around 6 times over the 7 weeks:

Week1: Monday (1), Tuesday (2), Wednesday(3), Thursday(4), Friday(5)

Week2: Monday(6), Tuesday(1), Wednesday(2), Thursday(3), Friday(4)

Week3: Monday(5), Tuesday(6), Wednesday(1), Thursday(2), Friday(3)

Week4: Monday(4), Tuesday(5), Wednesday(6), Thursday(1), Friday(2)

Week5: Monday(3), Tuesday(4), Wednesday(5), Thursday(6), Friday(1)

Week6: Monday(2), Tuesday(3), Wednesday(4), Thursday(5), Friday(6)

Week7: Monday(1), Tuesday(2), Wednesday(3), Thursday(4), Friday(5)

Week8: Monday(7), Tuesday(8), Wednesday(1), Thursday(2), Friday(3)

Week 9 on: nothing required

## H. No-WhatsApp group Peer Trainer Pack

### BELIEVE YOU CAN ... SESSION 1

You will give all the students a demonstration and directions on how to use pedometers (It's important they all use one of the University's pedometers), and logbooks, and set up the WhatsApp group (we need permission from the teacher to do this in class).

#### 1. DO and say THIS...

Ok so for the next couple of months we have been set a very special challenge, and you have been lucky enough to have been selected for this. Our challenge is to walk 10,000 STEPS EVERY DAY!! Hands up who thinks we can do this??? We are going to take as many steps as we can and add them all up... YOUR PROGRESS WILL BE COMPARED TO OTHER STUDENTS AROUND THE WORLD, SO THE CHALLENGE IS TO REPRESENT HONG KONG IN THE BEST LIGHT, BECAUSE HONG KONG IS BEHIND AT THE MOMENT AND THEY CAN MAKE A DIFFERENCE (it is crucial here that you are excited about this opportunity, because some students may think 'who cares' ... if you think this is a great idea, they are more likely to.)

So first of all ...

Pedometer wearing instructions:

- EVERY MORNING, after you are dressed, push the reset button on the pedometer so that it is set to '0'.
- Clip the pedometer, upright, to your waistband, at your hip making sure it is against your body.
- Wear it ALL day, except in water
- Take it off at bedtime
- Don't touch the reset button during the day, or you will lose your count.
- The pedometer will not work in a coat or trouser pocket, keep it clipped to your hip
- Alert one of the peer trainers if the battery in the pedometer needs to be replaced.
- If you have worn it really well for the first week it will be easy to estimate your steps if you forget it one day, but remember to keep them as they are university property

#### 2. SAY THIS...

As you can see ... 10,000 STEPS A DAY times 7 = 70,000 steps a week

**SO THIS IS OUR CHALLENGE AND OUR TARGET!!!**

**\*\*\*\*To do this all you need to do, is count steps and write in your logbook everyday\*\*\*\***

SAY THIS... Get them to look at the star cycle on the front of their logbooks and explain that this is how we will get the job done, by planning before the week starts, checking as we go and at the end of the day, and looking back over the previous week to see what we have learned and how we can improve. We are also going to believe that we can do this, and try as hard as we can to count our 10,000 steps, with our pedometers, and complete our logbooks EVERY DAY!! YES!!!

#### 3. Logbook introduction:

SAY THIS...

- THERE WILL BE 3 PRIZES FOR PROPER COMPLETION OF LOGBOOKS AND PROPER USE AND CARE OF UNIVERSITY PEDOMETERS AT THE END OF TERM
- BRING IT WITH YOU TO PE CLASS EVERY WEEK
- Each double page is one week
- Set goals first and look at them daily
- Enter daily information on the second of the double pages
- The last 2 questions will be answered on a Sunday
- The next week's goals will be entered on a Sunday, after answering the last 2 questions

#### 4. Goal setting detail ...SAY THIS...

In the logbook every week, the target is 70,000 steps ... it is very important to break this down into pieces each week and plan what you will do to achieve this ...

... SO ... what do we need to do to take as many steps as possible in one day??? How can we take more steps??? If we are going to succeed we have to set goals each week for getting more steps .... Give me some more suggestions

**\*\*\* SUGGEST THIS to be written in the first space NOW...**

...use the loop at the corner of your logbook to hang it up near your bed so you can see this in the morning and before you go to bed to add in the daily details

5. ASK THIS ... ask them for suggestions and someone write all of them on the board/note ... here are some examples of goals if they have nothing to say:

... Walk to the next bus stop/MTR station

...walk home if not too far instead of getting the mini bus ...

... Eat and drink healthily so you have more energy ...

... Get together with a friend to do any of the above

... Get to bed an hour earlier so that you have more energy, if late nights are normal

...if you have not covered a lot of distance during the day you can march at home to your favourite song to add to the step total for the day

(Feel free to come up with your own ideas too...)

6. DO THIS ... Have the students open the logbook and in the first box add their first goal (hang it up by their bed), then ...when they will accomplish this by, sign of progress, who is involved, and what will you do if you don't get this done? How will you make it happen if you forget, you are busy? Etc (the log book prompts)

7. SAY THIS ... Then, in the first part of the second inner page have them write a reason why they will achieve their goal this week

8. TELL THEM THIS ...The second inner page needs to be completed before they go to bed every night, it takes 2 minutes, add the step counts, effort score, what went well and what didn't

9. TELL THEM THIS ..... ON SUNDAY COMPLETE THE LAST QUESTIONS AND SET A GOAL/s FOR THE NEXT WEEK ACCORDING TO YOUR PROGRESS SO FAR

○ FINALLY, TELL THEM THAT THE LOGBOOKS WILL BE CHECKED BY YOU AT THE NEXT PE SESSION AND, BY THE TEACHER, SO THEY MUST REMEMBER TO DO WHAT IS REQUIRED THROUGHOUT THE COMING WEEKS OF THE PROGRAMME. ... AND REMEMBER THERE ARE PRIZES FOR DOING THIS WELL!!!

\*\*\* If there is time show them the muscle test from the beginning of session 2

## Session 2

1. Ask the students about difficulties in completing the log book and counting steps, I will be there so it's ok if you are struggling to answer respond.

Logbook and pedometer reminder:

- THERE WILL BE 3 PRIZES FOR PROPER COMPLETION OF LOGBOOKS AND PROPER USE AND CARE OF UNIVERSITY PEDOMETERS AT THE END OF TERM
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- Set goals first and look at them daily
- Enter daily information on the second of the double pages
- The last 2 questions will be answered on a Sunday
- The next week's goals will be entered on a Sunday, after answering the last 2 questions

Ask if they have entered the number of steps in their logbooks and how close they have come to achieving the total? Hands up who achieved 70,000? 60,000? 50,000? Etc Give LOTS OF PRAISE for achievements and positive encouragement to do more, so they can beat their personal best. They will report to you guys each week in PE class how they have done.

2. Even if you have done the muscle test in session 1, start with it this session, as follows:  
Muscle testing DO THIS...

1. First ask for a volunteer, or use another peer trainer.

2. Ask them to hold out their strong arm, straight in front of them, at shoulder height, 3. Make a fist, and hold it really strong.

4. You stand to their side and try to lower their strong straight arm by pushing down on it with 2 fingers.

5. You will find that you won't be able to.

6. Ask them to relax and shake it off.

7. Ask them to lift their arm again, the same as before, and think of really good happy thoughts, ask them to say over and over in their heads 'I am amazing, I am fantastic, I can do anything etc ' over and over...

8. Look at their face, and when you see that they are really into it, attempt to push their arm down as you did before.

9. You will find that you won't be able to.

10. Now have them relax, and again shake off.



11. Get them to get their arm ready again and this time ask them to think of not so happy thoughts, ask them to say over and over again in their heads ' I am a failure, I am not good enough, I am a failure, I am not good enough etc' over and over ...
12. Look at their face, and when you see the change push their arm down as you did before.
13. This time their arm power will 'short circuit' or even drop right down, as soon as they realise they will recover the strength but you and they will feel the difference.
14. To emphasise this, repeat the positive one.
15. Now get them to try this in pairs, so they can all feel it.

#### DO THIS...

Then, have a quick chat about how negative thinking affects your body, how can we get anything done, if we have negative and harmful thoughts floating around our heads? If we become much more aware of the things we have floating around in our heads ALL the time, we could start to control it, and be much stronger, both physically and mentally ... and as a result **ACHIEVE MORE!!!!!!**

#### 3. After this do the lemon test:...DO THIS...

Have you tried the lemon test? With your eyes closed, imagine that you have a big juicy lemon in front of you. Pick it up and feel the waxy skin and the weight of it in your hand. Look at the shape and bright yellow colour. Can you smell that freshness? Now, put it on a chopping board in front of you and take a sharp knife and cut through the middle of it. See the lemon juice squirting out as you do so. Feel the lemon again in your hands and smell that fresh, lemony, zesty smell. Now, bring half of it up to your nose and smell again, then tilt your head back and bring the lemon up to your mouth and squeeze some of the lemon juice into your mouth. Can you taste that tanginess?? What happens as you taste the juice? Now, open your eyes. Are you salivating slightly? But, hang on, tell me, where is the lemon? That's right! There is no lemon. You tricked your brain into thinking there was one though, and it went ahead and geared your physiology and chemistry up to be ready to start to digest that lemon.

#### 4. DO THIS... Now ask them to think about something that they really want to do (it can be sport related, win a race, score a goal, or something they want to do, like go to the beach, ride a skateboard, go shopping with their friends, go on holiday ... bake a cake, whatever they want)

- Tell them to pick something (positive not negative!!)
- Have them picture it in their minds. Eyes open or closed as long as they do it.
- Now, without talking out loud, are they calm or excited in the image of them doing what would really like to do
- Have them see what are they wearing in the image
- If they are outside are they inside or outside, is it warm, sunny, raining?
- If inside, does the room have windows, are they open or closed are the lights on or off
- What can you hear? Smell? Are you holding something can you feel it?
- Are you moving or standing still?
- If you are moving can you feel your heart beat and your muscles moving?
- If you are still can you also feel your heart beat and the ground underneath your feet?
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For example.....

- Get up earlier?
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- Drink more water?
- Wear the pedometer?

- Remember to record the details in the book?

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DO THIS...

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have floating around in our heads ALL the time, we could start to control it, and be much stronger, both physically and mentally ... and as a result **ACHIEVE MORE!!!!!!!**

3. Remind them of the lemon test:...DO THIS...

Now ask them to imagine all the ways of achieving 10,000 steps a day

- Have them picture it in their minds. Eyes open or closed as long as they do it.
- Now, without talking out loud, are they calm or excited in the image of them doing what they need to do to take more steps
- Have them put a big smile on their face
- Have them put positive words in their minds , and if they are thinking negative words ...change them in to positive ones ...remember the muscle testing
- Have them see what are they wearing in the image
- If they are outside are they inside or outside, is it warm, sunny, raining?
- If inside, does the room have windows, are they open or closed are the lights on or off
- What can you hear? Smell? Are you holding something can you feel it?
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- If you are still as you do this ... can you also feel your heart beat and the ground underneath your feet?
- Or if you are sitting can you feel yourself pushing down on the chair?
- Look at the colours in you environment, can you see them, can you make them brighter?
- Are you already good at doing this?
- If you are, see yourself doing it really well?
- If it is something you want to do then watch yourself get better and better at it, watch your mistakes, and rewind, and then redo it with new understanding
- Are you happy or just focused and calm, excited? What mood are you in? How do you feel?
- Can you see yourself? Or are you looking out of your own eyes in this image?

4. Now go over goal setting to make sure they can pick some individual goal for the new week. What do they need to do this week in order to achieve 10,000 a day?

For example.....

- Get up earlier?
- Go to bed earlier?
- Eat better?
- Drink more water?
- Wear the pedometer?
- Remember to record the details in the book?

Any other goals they can add into their logbooks??? Get them to make suggestions and complete week 2, or add to it if they have not got the logbook with them, get them to write some down and add to the log books later.

- Ask them if what was easy about the process?
- Ask them how hard they really tried? Could they try harder?
- Ask them what was difficult?
- Ask them what they have learned?
- Ask them what they can improve upon?
- Get them to look at the star cycle on the front of their logbooks every day.
- **FINALLY, TELL THEM THAT THE LOGBOOKS WILL BE CHECKED BY YOU AT THE NEXT PE SESSION AND, BY THE TEACHER, SO THEY MUST REMEMBER TO DO WHAT IS REQUIRED THROUGHOUT THE COMING WEEKS OF THE PROGRAMME.**

## MANAGEMENT AND SCHEDULING

You have session plans to follow, so make sure you are familiar with them

- We must write a list of all your names, phone numbers and email addresses so I can remind you what to do, as you will see below we need to design a **ROTA OF DUTIES**

- Please note!!!! After the 3 sessions Ms Li will allow you to briefly talk to the s1's every PE lesson, to give them positive encouragement and praise for their efforts, and to remind them to keep counting steps and complete the log books.
- Also daily you will find the students around the school and check that they are wearing their pedometers and completing their logbooks. Also, give them encouragement. THIS IS A REALLY IMPORTANT PART OF YOUR ROLE, they all look up to you, and you will be able to encourage them to continue to count steps and complete the logbooks. THANK YOU!!!!

#### Peer training schedule:

Week 1 - 5: The emphasis in these 2 weeks will be the peer trainers' *showing* the content, and the students following the peers' demonstrations.

Week 6 - 8 the students can *show you* what they know. There will be no formal sessions, the students will go about their normal lives (you will speak to them each PE lesson and check how they are doing reminding them that they must count steps and complete log books. Also remind them that there will be prizes for best completed and proper use and care of university pedometers)

Week 9 on: no sessions at all (and no more checking in recess/lunchtime or PE class)

#### FREQUENCY AND MANAGEMENT of Peer prompting:

\*\*\*\*NB!! As you, the peer trainers see fit, locating the s1's at school recess and or lunchtime, must be done once EVERY DAY, for the first 4 weeks, and every 2/3 days from weeks 4-8. Alternate the duty between 6 you, according to the rota of duties which has been sorted out beforehand. I will remind you.

Week 1 to week 5: Sessions in PE class weeks 1 to 3. In addition, EVERY DAY, according to your rota, please locate groups of your s1's, at recess or lunchtime, and encourage their step counting and their logbook completion. Remember to praise them for their efforts.

Week 6 to 8: MONDAY, WEDNESDAY AND FRIDAY (and in PE sessions), please locate groups of your s1's, at recess or lunchtime, and encourage their step counting and their logbook completion. Remember to praise them for their efforts, and remind them there are prizes to be won for best performance.

Week 9 on: Have no deliberate contact with students at all, if you do speak to them, by all means engage in general chat, but refrain from discussing their progress. Your job is over. Well done!

#### ROTA

Each of you pick a number from 1 to 8. And remember this number. Below is a rough rota we will use to divide the duties of finding and reminding students at recess and lunchtime. According to this number method each of you will do this around 5 times each over the 7 weeks:

Week1: Monday (1), Tuesday (2), Wednesday(3), Thursday(4), Friday(5)

Week2: Monday(6), Tuesday(7), Wednesday(8), Thursday(1), Friday(2)

Week3: Monday(3), Tuesday(4), Wednesday(5), Thursday(6), Friday(7)

Week4: Monday(8), Tuesday(1), Wednesday(2), Thursday(3), Friday(4)

Week5: Monday(5), Tuesday(6), Wednesday(7), Thursday(8), Friday(1)

Week6: Monday(2), Tuesday(3), Wednesday(4), Thursday(5), Friday(6)

Week7: Monday(7), Tuesday(8), Wednesday(1), Thursday(2), Friday(3)

Week8: Monday(7), Tuesday(8), Wednesday(1), Thursday(2), Friday(3)

Week 9 on: nothing required

## CURRICULUM VITAE

Academic qualifications awarded to the author, Ms. PITKETHLY Amanda Jane:

- Bachelor of Science (BSc) degree in Sport and Exercise Science- Psychology pathway (with distinction and awarded University Class medal) from Edinburgh Napier University, Edinburgh, Scotland, UK, June 2010.
- Master of Science (MSc) in Performance Psychology from the University of Edinburgh, November, 2011.

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