Understanding and changing physical activity behaviour in university students: an ecological perspective

This item was submitted to Loughborough University's Institutional Repository by the/an author.

Additional Information:

- Doctoral Thesis. Submitted in partial fulfilment of the requirements for the award of Doctor of Philosophy of Loughborough University.

Metadata Record: https://dspace.lboro.ac.uk/2134/8112

Publisher: © Chun-Ming Chen

Please cite the published version.
This item is held in Loughborough University’s Institutional Repository (https://dspace.lboro.ac.uk/) and was harvested from the British Library’s EThOS service (http://www.ethos.bl.uk/). It is made available under the following Creative Commons Licence conditions.

For the full text of this licence, please go to:
http://creativecommons.org/licenses/by-nc-nd/2.5/
Understanding and changing physical activity behaviour in university students: An ecological perspective

By

Chun-Ming Chen

Submitted in partial fulfilment of the requirements for the award of
Doctor of Philosophy of Loughborough University
May, 2008

© by Chun-Ming Chen, 2008
## Contents

List of figures VI
List of tables VII
Abstract X

Chapter 1 Introduction and rationale 1

Chapter 2 A Systematic Review of Correlates and Intervention on Physical Activity in University Population 8

2.1 Introduction 8
2.2 Method 10
   2.2.1 Review of Studies Published (1973 to September 2004) 10
2.3 Results 11
   2.3.1 Demographic and Biological Factors 12
   2.3.2 Intrapersonal Variables 15
   2.3.3 Interpersonal Variables 20
   2.3.4 Environmental Variables and Policy 21
   2.3.5 Behavioural Attributes 23
   2.3.6 Physical Activity Characteristics 25
   2.3.7 Interventions 26
2.4 Discussion 29

Chapter 3 A Survey of English and Taiwanese University Students to Assess Intrapersonal, Interpersonal and Physical Environmental Influences on Physical Activity 37

3.1 Research Rationale 37
3.2 Literature Review 38
   3.2.1 Physical Activity to Young adults and University Students 38
   3.2.2 Determinants of Physical Activity for Young Adults 40
      3.2.2.1 Key Determinants of Physical Activity for Young Adults 41
   3.2.3 Application of Theories to University Students' Physical Activity Research 45
      3.2.3.1 Ecological Models 45
3.3 Method 47
   3.3.1 Participants and Setting 47
   3.3.2 Measures’ validities and reliabilities 48
3.3.3 Research Questions an Hypotheses 54
3.3.4 Data Analysis 55

3.4 Results 55
3.4.1 The descriptive background of the participants 56
3.4.2 The frequency and percentage of stage of changes for
different participants 56
3.4.3 The preference of physical activities between genders and
nations 56
3.4.4 The correlations between survey variables and actual
physical activity 58
3.4.5 Multiple Regressions 58
3.4.6 Two-way MANOVA 60
3.4.7 Path Analysis 63
3.4.8 One-way MANOVA 63

3.5 Discussion 69
3.6 Conclusions 79

Chapter 4 A Qualitative Study of University Students' Physical Activity 82
Participation in Taiwan using an Ecological Model Approach

4.1 Introduction 82
4.1.1 Correlates of Adults' Physical Activity 82
4.1.2 Applying Qualitative Methods to Physical Activity 83

4.2 Method 85
4.2.1 Data collection 85
4.2.2 Participants and Sampling 86
4.2.3 Procedures 87
4.2.4 Data Analysis 88

4.3 Results 90
4.3.1 The Meaning of the Term "Physical Activity" to University Students 90
4.3.2 Type and Preference for University Students' Physical Activity 92
4.3.3 Reasons for Doing Physical Activity 94
4.3.4 Intrapersonal Variables 95
4.3.5 Interpersonal Variables 102
4.3.6 Environmental Variables 104
4.3.7 New Themes Beyond the Ecological Model 106
Chapter 5  An Intervention to Increase University Students' Physical Activity Using Health-related versus Skill-related PE Curricula and Email Delivery Strategies

5.1 Introduction

5.1.1 Intervention for Promoting Physical Activity

5.1.2 School-based and University-based Physical Activity Intervention

5.1.3 Health-related (lifestyle) Intervention versus Skill-related Intervention

5.1.4 Mediated Interventions for Promoting Physical Activity

5.2 Method

5.2.1 Research Design and Sampling

5.2.2 Measures and Procedures

5.2.3 Data Analysis

5.3 Results

5.3.1 The Correlation between Physical Activity (PA) and Survey Variables at Different Periods of Time

5.3.2 The Shift in Stage of Change among Different Intervention Periods

5.3.3 16-week Intervention Effects

5.3.4 Follow-up Effects

5.4 Discussion

5.4.1 Correlates of University Students' Participation in Physical Activity at different Stages

5.4.2 The Shift of Stage of Change among Different Intervention Periods

5.4.3 The Main Effects of Teaching and Email Intervention

5.4.4 The Simple Main Effects of Teaching and Email Intervention

5.4.5 The Follow-up Survey after the Intervention

5.5 Conclusion

Chapter 6  Overall discussion and conclusion

6.1 A Systematic Review of Correlates and Interventions on Physical Activity in University Population
6.2 A Survey of English and Taiwanese University Students to Assess Intrapersonal, Interpersonal and Physical Environmental Influences on Physical Activity

6.3 A Qualitative Study of University Students' Physical Activity Participation in Taiwan using an Ecological Model Approach

6.4 An Intervention to Increase University Students' Physical Activity Using Health-related versus Skill-related PE Curricula and Email Delivery Strategies

6.5 Conclusion

References

Appendix
List of Figures

Figure 1. The traditional epidemiological model 5

Figure 3.1 Ecological model 46

Figure 3.2 Preferred activities for university students (percentage) 57

Figure 3.3 Path analyses for British male students 64

Figure 3.4 Path analyses for British female students 65

Figure 3.5 Path analyses for Taiwanese male students 66

Figure 3.6 Path analyses for Taiwanese female students 67

Figure 3.7 Differences between stages on self-efficacy, friend support and intention. 69

Figure 4.1 The proposed model of the determinants changing through different stages 111
List of Tables

Table 2.1 Descriptive statistics for studies used in the systematic literature review 12

Table 2.2 Demographic and biological factors associated with physical activity in university students 14

Table 2.3 Intrapersonal variables associated with physical activity in university students 16

Table 2.4 Interpersonal variables associated with physical activity in university students 21

Table 2.5 Environmental variables and policy associated with physical activity in university students 22

Table 2.6 Behavioural attributes associated with physical activity in university students 24

Table 2.7 Physical activity characteristics associated with physical activity in university students 26

Table 2.8 Intervention studies of university students' physical activity 27

Table 3.1 The frequency and percentage of stage of changes for different participates 57

Table 3.2 The relations between correlates and actual physical activity 59

Table 3.3 Multiple Regression Results for Different Groups 59

Table 3.4 Determinants and physical activity level of gender with nation 61

Table 3.5 Differences between stages of change 68

Table 4.1. Example for matrix design and transcription classification for intrapersonal variables 89

Table 5.1 Distribution of different experimental design cells 124
Table 5.2 Correlation between physical activity (PA) levels and survey variables at different periods of time

Table 5.3 The frequency and percentage of stage of changes at different time periods

Table 5.4 Main effects of different teaching levels after 16 weeks' interventions

Table 5.5 Main effects of different email levels after 16 weeks' interventions

Table 5.6 Simple main effects of different teaching levels with email after 16 weeks' interventions

Table 5.7 Simple main effects of different teaching levels without email after 16 weeks' interventions

Table 5.8 Simple main effects of different email levels at health-related teaching method after 16 weeks' interventions

Table 5.9 Simple main effects of different email levels at Skill-related teaching method after 16 weeks' interventions

Table 5.10 Simple main effects of different email levels at control group after 16 weeks' interventions

Table 5.11 Follow up main effects of different teaching levels two months after the interventions

Table 5.12 Follow up main effects of different email levels two months after the interventions

Table 5.13 Follow up simple main effects of different teaching levels with email two months after the interventions

Table 5.14 Simple main effects of different teaching levels without email two months after the interventions

Table 5.15 Simple main effects of different email levels at health-related
teaching method two months after the interventions

Table 5.16  *Simple main effects of different email levels at Skill-related teaching*  
method two months after the interventions

Table 5.17  *Simple main effects of different email levels at control group two*  
months after the interventions
Abstract

Studies have highlighted the prevalence of sedentary behaviours in the university student population and have noted the significant potential for the promotion of physical activity in educational settings for young adults. Following the epidemiological procedure and ecological approach, the main purpose of this thesis focused on the university student population to review the previous research results by a systematic review method (first study), to compare the differences between UK and Taiwanese participants' and relevant effective variables by using a quantitative study method (second study), to have a deeper understanding of the Taiwanese university students' physical activity behaviours by using a qualitative study method (third study), then to evaluate the efficiency of designed interventions in university settings (fourth study). The whole thesis applied the ecological approach to classify the survey variables' effect to university students' physical activity behaviours.

A total of 55 published papers were reviewed and majority of studies were conducted in the US using a cross-sectional design. Finding variables consistently related to university students' physical activity level were female gender (−), attitude (+), self-efficacy (+), perceived barrier (−), family support (+), physical activity and sport history (+). These survey variables were more consistent in the literature and corresponded to previous adults' study. Some survey variables linked to university student were also found in the literature but still need more studies for this target population to come to a robust conclusion. Seven days recall design measurement and stage of changes survey for physical activity levels were more identified and have been more frequent using in the reviewed papers. Also, more studies on different ethnicity, environmental variables and intervention with different methodology such as qualitative study method are needed to enrich the knowledge of university students' physical activity behaviours.
A quantitative survey found both British and Taiwanese males preferred team sports. British females preferred aerobic exercise and swimming. Taiwanese females preferred swimming the most. Taiwanese university students had lower physical activity levels than UK students. The significance of correlating variables to physical activity behaviours were intention, self-efficacy, body expectation, barrier of time, barrier of effort, family support, friend support and neighbourhood environment with unequal effects across gender and nation by path analysis. Survey found predictor variables could explain 29% of the variation in physical activity behaviours for Taiwanese participants comparing to 52% for UK participants. Thus, measurements issue and different study design such as qualitative method are needed for discovering the correlates of Taiwanese participants.

A qualitative study was designed to investigate the factors that might influence university students' physical activity. Study revealed participants mainly engaged in sports or structured exercise for their physical activity which usually happened in a gym or facility setting. Competence or skills make them feel confident to enjoy and commit to their physical activity behaviours. A lack of awareness of health issues or poor fitness for young adults might decrease their need or motivation to participate in physical activity. Barriers existed and had equal effects on both active and sedentary students. Convenient facilities, flexible opening times, and more organized programs were expected to establish and support university students' active life-styles.

Both longitudinal and experimental design methods utilized to test the intervention effects through physical education course designs and messages delivered by emails. Results showed that both skill-related and health-related PE course design, and emails strategies were effective in promoting university students' physical activity levels from baseline with long-term effects. Mediated variables played different roles throughout the teaching methods, emails strategy, and different
study stages with unequal effects. Change in the correlates corresponded to physical activity levels changes through 16 weeks teachings were friend support (health-related teaching) and neighbourhood environment (skill-related teaching); and 16 week email were self-efficacy, enjoyment, and home environment comparing to the control group. Follow-up survey also found that self-efficacy (health-related teaching), enjoyment (health-related), health expectation, barrier of time (-) were enhanced through physical education teachings; and self-efficacy and home environment were changed and corresponded to physical activity levels via email intervention strategy.

*Key words:* physical activity, university students, ecological model, systematic review, quantitative method, qualitative method, intervention.
Chapter 1 Introduction and rationale

After the industrial revolution, mechanization and automation often replaced manual labour. These changes decreased human beings’ need for day-to-day physical activity. Modernization, therefore, led people to a more ‘convenient’ way of living. However, this also caused people to move towards a sedentary lifestyle. A survey in UK partially provided the picture of more sedentary lifestyle, that decline in occupational physical activity had been found between 1991/2 and 2004 (Stamatakis, Ekelund & Wareham, 2007)

This significant change in lifestyle has brought another serious issue concerning the health problems associated with human beings’ inactive lives. Chronic diseases and health risks, such as coronary heart disease and obesity, causing higher mortality, have been found to have strong links to physical inactivity (Blair et al., 1992).

A sedentary life-style is common in industrialised and developed countries; therefore promoting physical activity has become an important issue internationally. To solve this problem, Healthy People 2010 in the USA suggested that participating in regular physical activity is one of the primary factors which can maintain sound health in modern society (USDHHS, 2000). The Global Strategy on Diet, Physical Activity and Health from World Health Organization (2004) also emphasized that physical activity reduces blood pressure, improves the level of high density lipoprotein cholesterol, improves control of blood glucose in overweight people, even without significant weight loss, and reduces the risk for colon cancer and breast cancer among women.

Physical inactivity affects a wide range of diseases and risk factors. Many of these diseases—such as obesity, cardiovascular disease, type 2 diabetes and depression—may occur in the same individual (Chief Medical Officer, 2004). Inversely, people who are physically active reduce their risk of developing major chronic disease—such as
coronary heart disease, stroke and type 2 diabetes – by up to 50%, and the risk of premature death by about 20-30% (Department of Health, Physical Activity, Health Improvement and Prevention, 2004). Unfortunately, the great majority of adults in England didn't participate in physical activity at levels that provide the full range of health benefits (Chief Medical Officer, 2004).

Physical activity not only contributes to good health, but also essential for well-being. Except for the physical health benefits, being physically active can also be conducted for the purpose of having a better body image, getting fit, enjoyment and fulfilling people’s social life. Moreover, participating in physical activity is also relevant to mental health and psychological well-being. Research has revealed that physical activity can positively affect stress, anxiety, mood, and depression, and enhance self-esteem and quality of sleep (Buckworth & Dishman, 2002).

As far as health outcomes are concerned, the first guideline for physical activity in healthy adults was developed to assess whether a person was active enough by reaching the criteria of 60-90% of maximum heart rate reserve or 50-85% of maximum oxygen uptake of intensity, 3-5 days per week of frequency and 15-60 minutes per session of time for promoting aerobic fitness, muscular strength, endurance and enhancing body composition (American College of Sport Medicine ACSM, 1978 & 1990). Nowadays, moderate-intensity and more flexible times for physical activities are encouraged. Hence, taking 30 minutes or two shorter bouts of 15 minutes of moderate intensity physical activities that raise heart rate sufficiently to leave people warm and slightly out of breath, such as brisk walking, climbing stairs, swimming, social dancing, exercise, heavy DIY, heavy gardening and heavy housework were proposed for promoting physical activity in England (Killoran et al., 1994) and have been adopted consistently over the past 10 years and more.

The recommended levels of physical activity can be achieved either by doing all
the daily activity in one session, or through several shorter bouts of activity of 10
minutes or more. The activity can be lifestyle activity or structured exercise or sport, or
combination of these (Department of Health, Physical Activity, Health Improvement
and Prevention, 2004). For the purposes of this thesis, physical activity is defined as any
body movement correlated with positive health outcomes, health-related fitness, and
substantial energy expenditure over the resting levels (Biddle & Mutrie, 2001; Bouchard
& Shephard, 1994).

There are good reasons why studies need to highlight university students' physical
activity. The decline in physical activity levels after high school has caused health
professionals to pay increasing attention on this age group. University students have
been shown to have declining levels of physical activity since their high school years
(Calfas et al., 1994). Only 37.6% of college students participated in regular vigorous
physical activity when compared to 63.7% of high school students (U.S. Department of
Health and Human Services, 1996; Douglas et al., 1997). The university campus
appears to offer a safe environment and good opportunity for encouraging students to
attend physical activities. Unfortunately, there is some evidence showing that
non-students have higher physical activity levels than university students at the same
age because of their work (Puska, 1974). Inadequate physical activity has also been
identified as one of the six priority health risk behaviours and leading health indicators
for college and university populations (Buckworth, 2001; American College Health
Association, 2002).

The Health Survey for England 1991 to 2004 indicated physical activity levels at
work declined over time but there was a consistent and significant upward trend in
regular sports participation among all age groups but particularly pronounced among the
middle and late life age groups, aged 35 to 49 and older (Stamatakis, Ekelund &
Wareham, 2007). In contrast to declines with age seen in western populations such as
Canada, Australia, UK and USA, people aged 45 and older were more likely to be active than younger people in Taiwan (Ku, Fox, McKenna & Peng, 2006). The target group of young people for promoting physical activity in Taiwan is noticeable.

Due to the transition during early adulthood, it is a great chance to establish a long-term physical activity habit through the university environment which can impact on their later adult lifestyle (Keating et al., 2005). Campus environments are easier to be set up to encourage students to adopt a healthy life-style via policy, health and physical education, and various activities or campaigns which can facilitate students improving their physical activity levels.

The Behavioural Epidemiology Framework and Ecological Approach

Epidemiology can be defined as the study of how a disease or health outcome is distributed in populations and what factors influence or determine this distribution. According to the concepts and methods in physical activity epidemiology, there are three goals: (1) to describe the distribution and population of physically inactive behaviour which is correlated to certain disease states; (2) to analyze this descriptive information in order to identify relevant factors that are associated with physical activity; (3) to prevent a sedentary lifestyle by modifying the identified risk factors (Dishman, Washburn & Heath, 2004).

In the case of physical activity, following the epidemiology framework, there are certain procedures to find out and solve the physical inactive problems from describing the phenomenon of a sedentary life style which are strongly linked to certain diseases and its potential risks, finding the explanation of physical inactivity, testing the prediction of physical activity behaviour, and then evaluating the intervention to promote physical activity and prevent the causes of disease in practice.

The ‘wheel model’ (see Figure 1) is one of the three traditional epidemiological models that have been applied to physical activity. It views the development of the
person as intertwined with the environment, and it recognizes that the person develops from a genetic core that is modifiable to varying degrees by the biological, physical, and social environments to which the person is exposed (Dishman, Washburn & Heath, 2004).

![Figure 1. The traditional epidemiological model (The Wheel)](image)


To date, most of the theories or models have been applied to physical activity behaviour with varying success. None fully account for involvement in physical activity (Carron, Hausenblas & Estabrooks, 2003). Using quantitative methodology to test theories and models that focus on individuals can usually only explain 20-40% of the variance in physical activity (Spence & Lee, 2003). A more comprehensive model and a multi-methods research are needed for future studies. The Ecological Model focuses on intrapersonal, interpersonal and environmental variables that affect physical activity behaviour in different ways. The Ecological approach is consistent with the wheel model and has potential to find solutions for improving and preventing sedentary life styles.

Evidence is clear that certain diseases can be affected by a lack of physical activities. The sedentary life style is prevalent across all races, ages and socioeconomic
classes in modern industrialised societies. Motivating people to adopt and maintain sufficient physical activity levels is an important way to prevent disease and to enhance quality of life. It is critical to understand young adults' physical activity behaviours and the correlates of such behaviours during the transition life phase in the university setting. Furthermore, testing effective interventions to promote university students' physical activity levels is also an urgent issue because sufficient evidence is not now available to support a recommendation for college-aged intervention such as physical and health education (Dunn & Blair, 2002)

The thesis is planned to effectively supply a deeper understanding of the target population in order to facilitate behaviour change in university students' population. Following the behavioural epidemiology framework, studies aimed to explore and understand university students' physical activity behaviours by using an ecological approach.

Furthermore, due to most of the studies have been conducted in western countries such as the US, UK, Canada, and Australia, other environments such as Asian aspects required investigation. In order to achieve these aims, the content of the thesis consists of a systematic review of university students' physical activity correlates, a quantitative study to explore the culture differences in correlates of physical activity of students in Taiwan and the UK, a qualitative study to triangulate information concerning physical activity behaviours, and a practical intervention designed to change physical activity levels of students in university settings.

Hence, this thesis aims to contribute to knowledge concerning university students' physical activity. Specifically, it aims to:

a. Use multi-methods research and offer a more comprehensive understanding of university students' physical activity behaviours.

b. Provide results with a Taiwan-related or so-called more 'Asian' perspectives which
can enrich the physical activity study area with more a global aspect.

c. Apply intervention strategies within the university settings and test their efficacy for future recommendation for this target population.

d. Conduct a series of studies that focus on university students.
2.1 Introduction

Physical activity studies have been well documented during the past two decades. Studying "determinants" or correlates of physical activity is an important prerequisite for designing relevant policies and effective programs or so called "intervention" to promote physical activity through understanding the underlying variables that influence physical activity behaviours (Trost et al., 2002). The word 'correlates' reflects factors that are related to participation in physical activity. Sometimes the word 'determinants' is also used. Correlates has now become a more standard term in the literature because many correlates may not be true determinants. Data may show associations but we may not be able to conclude that the links are causal. Buckworth and Dishman (2002) had referred to correlates as "reproducible associations that are potentially causal" (p.191).

Factors associated with physical activity in adults, which have been published in the recent reviews, have concluded that adults’ physical activity participation is influenced by a diverse range of intrapersonal, social and environmental variables (Sallis and Owen, 1999; Trost et al., 2002). Also, biological and demographic correlates such as gender and minority populations can also identify groups at risk of being inactive, behavioural attributes, and physical activity characteristics had been clarified as important types or categories of correlates to physical activity in the review studies (Sallis & Owen, 1999; Trost et al., 2002; Biddle et al., 2005)

Adults' physical activity habits are associated with factors from multiple domains had been well documented according to the available studies to date. However, there is a large range of ages from young adult, middle aged adult to old adult to define "adults" physical activity behaviours and it is difficult to have a clear classification of
age groups in the “adults” population. Due to life development and career transitions, university life can be a clear domain or range to define as a target group and an important life phase for promoting their life-time physical activity habits.

It is comparably easier and vital to establish university students' healthy lifestyle in the campus environment. Researchers suggested that young adulthood may be the time where the opportunity is more significant to adopt regular exercise and to promote physical activity (Rovnial et al., 2002). Studies revealed that a low proportion of university students meet recommended levels of physical activity for health benefits (Wallace et al., 2000; Leslie et al., 1999). University or college life may play a significant phase and have a long term effect on people's physical activity habits after their graduation to start their new career and family with healthy lifestyle.

College-based or university-based interventions via health education and PE aimed to set long-term behavioural patterns during the transition to adulthood. As a matter of fact, most of the studies revealed that young adults had further decrease during the university year or age by some reason (Van Mechelen & Kemper, 1995; Calfas et al., 1994; U.S. Department of Health and Human Services, 1990). This information indicates the risk and the need for interventions that target university-aged young adults. Until now, available studies have provided insufficient evidence to assess the effectiveness of college-based or college-aged interventions such as health education and PE to increase physical activity and fitness (Kahn et al., 2002; Dunn & Blair, 2002).

Preview studies reported reviews of correlates or determinants of physical activity for adults' population does not allow for a clear identification of correlates for university student population. A review study focus on the target group is needed in order to have a comprehensive understanding about factors that associated with university students' physical activity levels. Also, all information will offer a picture of intervention design to promote students' physical activity participation. The purpose of
the present review, therefore, was to focus only on the key population of university students, based on factors correlated to physical activity and the interventions that had been documented for this target population by using a systematic review method. The main objectives of the present review are:

a. Conducting a systematic review to have a comprehensive understanding of the study area and find questions that are needed for future study.

b. to provide a more objective perspective of trends and study questions in this field.

2.2 Method

2.2.1 Review of Studies Published (1973 to September 2004)

This systematic review aims to analysis published studies that focus on university or college students' physical activity and other relevant variables that were correlated to their leisure time physical activity, and the intervention studies which focused on this target population. Papers were identified by conducting computer searches of PsycInfo and SportDiscus databases. Manual searches were also made using the reference lists from recovered articles. Key words used for the computer searches were university students (or college students) and physical activity or exercise. Some criteria had been set up to limit the range for the purpose of the study. Firstly, participants must be university students or college students. Secondly, the systematic review aimed to survey university students' leisure time physical activities excluding PE courses, structured fitness courses and athletic training. In the correlation studies, chosen variables should be linked to leisure time physical activity but not sport or specific exercise behaviour such as attending aerobic dance courses or fitness courses because exercise and sport training studies were typically conducted at gym and supervised by health professionals and coaches mainly for physiological effects survey instead of physical activity. Thirdly, physical activity should be the main dependent variable in intervention studies. Fourthly,
review articles and measurement development articles were excluded. Fifthly, articles should have been in the English language and be published journal articles, but not in another language and/or dissertation.

According to the ecological approach and to be consistent with approach taken by previous review papers (Sallis & Owen, 1999; Trost et al., 2002), apart from demographic & biological factors, variables associated with university students' physical activity were classified as either a) interpersonal variables; b) interpersonal variables; c) environmental variables and policy; d) behavioural attributes; e) physical characteristics; followed by the intervention surveys. Variables were classified as being related or not related to university students' physical activity. Associations were classified as positive “+”, negative “-”, and none “0” according to the individual correlated variables within the studies. Some correlated variables needing more detail explanation from the results were classified as “*”. Studies were initially analyzed by recruited papers by published year, location, measures, sample size, statistic method, and survey variables that linked to physical activity behaviours. A separated table of reference numbers is shown in the Appendix 1.

2.3 Results

Articles (K=55) were conducted in the US (69%), Canada (9%), UK (7%) and in other 9 countries (15%) including 50 correlates studies and 5 intervention studies (see Appendix 1). One paper conducted in both US and China (Chen, 1998), one paper conducted in US with all Nigerian students (Onifade, 1985) and two papers included multiple countries (Allgower, Wardle & Steptoe, 2001; Haase et al., 2004). The years of publication ranged from 1973 to September 2004. The total sample size reviewed was 61,252; with ages ranging from 17-33 (one study reported age range from 17 to 58). A combined study with quantitative and qualitative methods was included (Stone,
Strikwerda-Brown & Gregg, 2002). Other descriptive data for the papers are shown in Table 2.1.

Table 2.1. Descriptive statistics for studies used in the systematic literature review

<table>
<thead>
<tr>
<th>Variable</th>
<th>Summary statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>US(38); UK(4); Finland(1); Canada(5); Australia(3); Germany(1); China(1); Nigeria(1); Cross-counties: 2</td>
</tr>
<tr>
<td>Sample size</td>
<td>Total: n: 61252; range = 31 to 19,298; mean n = 1113</td>
</tr>
<tr>
<td>Study design</td>
<td>Cross-sectional: 48</td>
</tr>
<tr>
<td></td>
<td>Longitudinal or prospective: 7</td>
</tr>
<tr>
<td>Measurement of PA</td>
<td>Self-report: 53; Objective measure: 1, Physical Activity Recall (PAR) interview: 2</td>
</tr>
</tbody>
</table>

Different designs of physical activity measurements had been applied to adults' physical activity studies. Most of the studies used self-report measurements and a few used Physical Activity Recall (PAR) interviews as the primary outcome measure (Sallis et al., 1999; Calfas et al., 2000). Within the literature review, differences in the measurement methods did vary from the length of recall such as seven-day recall; two weeks recall or even for the previous month, and the scoring methods of the measures. Seven days recall design measurement by self-report and interview method and stage of changes survey for physical activity levels were more identified and have been more consistent using in literature. Only one paper used both self-report and Caltrac accelerometer to measure physical activity levels (Dishman, Darracott & Lambert, 1992).

2.3.1 Demographic and Biological Factors (See Table 2.2)

Demographic and Biological factors of physical activity allow researchers and health care professionals to identify groups more at risk for inactivity (Dishman, 1994).
It can include age, gender, ethnicity, socioeconomic status and so on.

Gender was the most consistent demographic correlate of physical activity behaviour for university students with only two out of thirteen papers found no significant differences according to their exercise stages or duration of physical activity per week (Pinto and Marcus, 1995; Stock, Wille & Kramer, 2001). Studies focusing on different age groups continually find that males engage in more vigorous and moderate physical activity than females do (Carron, Hausenblas & Estabrooks, 2003).

Being older for male and graduation was inversely associated to their physical activity but there was no difference among year in university to their stages of exercise (Leslie et al., 1999; Calfas et al., 1994; Pinto & Marcus, 1995). Female students who were not working were 23% more likely to be insufficient active than those who were working (Leslie et al., 1999); also non-students seemed to have more physical activities because of their work (Puska, 1974).

Cultural and economic developmental difference was carried out from a cross-cultural survey of twenty three countries that leisure time physical activity was positively associated with national economic development (Haase et al., 2004). Social class on the basis of father’s occupation also positively related to active involvement in movement behaviour (Hendry, 1975).

Diverse results on ethnicity or racial differences emerged in four papers might due to the inconsistent comparisons among different race and ethnicity groups, and different methods of the data analysis. There was no difference among White, Black and Hispanic regarding their vigorous physical activity level. However, black students engaged in moderated physical activity significantly more often than did white students (Douglas et al., 1997). American subjects spent significantly more time participating in physical activity and exercise than did Chinese subjects (Chen, 1998).

African-American respondents reported more regular physical activity habits than
Table 2.2. *Demographic and biological factors associated with physical activity in university students*

<table>
<thead>
<tr>
<th>Correlates</th>
<th>Association</th>
<th>Reference no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genders (male)</td>
<td>++++0+++++0+++</td>
<td>8,11,21,22,24,26,31,32,34,41,44,48,49</td>
</tr>
<tr>
<td>Non-students</td>
<td>+</td>
<td>2</td>
</tr>
<tr>
<td>Race/ethnicity (White, Chinese, African-American)</td>
<td><em>-+</em>*</td>
<td>27,30,44,48</td>
</tr>
<tr>
<td>Social class (higher)</td>
<td>+</td>
<td>3</td>
</tr>
<tr>
<td>Alumni</td>
<td>-</td>
<td>19</td>
</tr>
<tr>
<td>Not working student (female)</td>
<td>-</td>
<td>33</td>
</tr>
<tr>
<td>Year in university</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>Health and fitness</td>
<td>+</td>
<td>6</td>
</tr>
<tr>
<td>Culture and economic development</td>
<td>+</td>
<td>55</td>
</tr>
<tr>
<td>Stable and extraverted personality</td>
<td>+</td>
<td>3</td>
</tr>
<tr>
<td>Aerobic capacity</td>
<td>+</td>
<td>39</td>
</tr>
<tr>
<td>Aging (male)</td>
<td>-</td>
<td>33</td>
</tr>
<tr>
<td>BMI (female)</td>
<td>-</td>
<td>46</td>
</tr>
</tbody>
</table>

+ positive, - negative, 0 no effect, * more detail in the text

Asians or Hispanics (Hall, Kuga & Jones, 2002). A study of 23 countries inactivity in leisure time prevalence survey offered a blueprint or indirect evidence of ethnical or cultural differences with 23% (North-Western Europe and the United States), 30%
(Central and Eastern Europe), 39% (Mediterranean), 42% (Pacific Asian), and 44% (developing countries) (Haase et al., 2004).

It is hard to have a clear picture that race/ethnicity was a consistent correlate of university students' physical activity level due to not only most of the studies were conducted with different measure designs and analysis methods but also the lack of enough studies to support the results. The descriptive prevalence study of different countries couldn't give precise conclusion about the correlate of racial effect either. A comparison study such as cross-countries survey of physical activity levels which expands the environmental and cultural difference may contribute and supplement the knowledge in this area with more international perspectives.

As for the physiological aspect, it was not too surprising to find that physical fitness such as aerobic capacity could predict physical activity stages according to their health and fitness status (Mathes & Battista, 1985; Wallace et al., 2000). Specifically, female students' BMI were related negatively with their current physical activity level (Suminski et al., 2002). As for the psychological aspect, students who had a more stable and extraverted personality were more active (Hendry, 1975).

2.3.2 Intrapersonal Variables (See Table 2.3)

The positive psychological outcome from physical activity has been identified in many aspects (Sallis & Owen, 1999; Biddle & Mutrie, 2001; Carron, Hausenblas & Esabrooks, 2003). Psychobiological benefits of physical activity also applied to university students' study. Participants' physical activity levels were correlated to their body image, self-concept, perceived body attractiveness, self-evaluation, and general physical self-worth positively, whereas, body dissatisfaction, depressive symptoms and stress were negatively correlated to physical activity level (Joesting, 1981; Seggar, McCammon & Cannon, 1988; Haynes & McNamara, 1989; Dzewaltowski, Noble & Shaw, 1990; Davis et al., 1991; Hayes, Crocker & Kowalski, 1999; Allgower, Wardle &
Table 2.3. *Intrapersonal variables associated with physical activity in university students*

<table>
<thead>
<tr>
<th>Correlates</th>
<th>Association</th>
<th>Reference no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude</td>
<td>++0+</td>
<td>1,3,5,49</td>
</tr>
<tr>
<td>Body image</td>
<td>+</td>
<td>4</td>
</tr>
<tr>
<td>Self-concept</td>
<td>+</td>
<td>4</td>
</tr>
<tr>
<td>Well-being (women)</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Ideal-weight discrepancies</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>Body-cathexis</td>
<td>-</td>
<td>9</td>
</tr>
<tr>
<td>Commitment (total PA)</td>
<td>+</td>
<td>10</td>
</tr>
<tr>
<td>Commitment (to high intensity PA)</td>
<td>+</td>
<td>10</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>+</td>
<td>12,13,23,39,45</td>
</tr>
<tr>
<td>Health believe</td>
<td>+</td>
<td>12</td>
</tr>
<tr>
<td>Self-evaluation</td>
<td>+</td>
<td>13</td>
</tr>
<tr>
<td>Body dissatisfaction</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Outcome expectation</td>
<td>++0</td>
<td>16,19,45</td>
</tr>
<tr>
<td>Perceived barrier</td>
<td>++-</td>
<td>16,19,44</td>
</tr>
<tr>
<td>Perceived fitness</td>
<td>+</td>
<td>17</td>
</tr>
<tr>
<td>Shorter-range intention</td>
<td>+</td>
<td>18</td>
</tr>
<tr>
<td>Perceived competence</td>
<td>++</td>
<td>20,49</td>
</tr>
<tr>
<td>Perceived sport competence</td>
<td>+</td>
<td>34</td>
</tr>
<tr>
<td>Lack of time</td>
<td>++</td>
<td>20,47</td>
</tr>
<tr>
<td>Lack of motivation</td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

+ positive, - negative, 0 no effect, * more detail in the text
Table 2.3. *Intrapersonal variables associated with physical activity in university students (continued)*

<table>
<thead>
<tr>
<th>Correlates</th>
<th>Association</th>
<th>Reference no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barrier of health</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Expectation of health</td>
<td>++</td>
<td>20,44</td>
</tr>
<tr>
<td>Perceived obstacles</td>
<td>-</td>
<td>23</td>
</tr>
<tr>
<td>Enjoyment</td>
<td>++</td>
<td>33,49</td>
</tr>
<tr>
<td>Body attractiveness</td>
<td>+</td>
<td>34</td>
</tr>
<tr>
<td>Physical conditioning</td>
<td>+</td>
<td>34</td>
</tr>
<tr>
<td>Self-perception of conditioning</td>
<td>+</td>
<td>42</td>
</tr>
<tr>
<td>Self-perception of physical strength</td>
<td>+</td>
<td>34</td>
</tr>
<tr>
<td>General physical self-worth</td>
<td>+</td>
<td>34</td>
</tr>
<tr>
<td>Depressive symptoms</td>
<td>-</td>
<td>40</td>
</tr>
<tr>
<td>Descriptive norm</td>
<td>+</td>
<td>51</td>
</tr>
<tr>
<td>Prototype similarity</td>
<td>+</td>
<td>51</td>
</tr>
<tr>
<td>Physical activity belief</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Stress</td>
<td>-</td>
<td>12</td>
</tr>
</tbody>
</table>

+ positive, - negative, 0 no effect, * more detail in the text

Steptoe, 2001). Only one correlation study with a sample of college women showed that the number of hours of physical activity was not related to three indicators of psychological well-being including good spirits, life satisfaction and happiness in life
(Seggar, McCammon & Cannon, 1988). However, in the same study found that physical activity did reduce weight discrepancies and improve body-cathexis, the difference between one's actual reported weight and height and the weight and height considered perfect of a woman, and satisfaction or dissatisfaction with body parts (Seggar, McCammon & Cannon, 1988).

Attitude represents an individual's positive or negative evaluation of physical activity. Positive attitude was found to be correlated to university students' higher physical activity levels consistently, with only one study not showing the relationship between attitude and physical activity behaviours of Nigerian students who studied in the US (Sonstroem & Walker, 1973; Hendry, 1975; Onifade, 1985; Braithwaite, McDaniel & Reed, 2003). Also, students who expected to be healthy, more health beliefs, and with more outcome expectations from physical activity were more likely to be active in their life (Haynes & McNamara, 1989; Dishman, Darracott & Lambert, 1992; Calfas et al., 1994; Shifflet, Cator & Megginson, 1994; Hall, Kuga & Jones, 2002).

Although barrier of health did not link to university students' physical activity and exercise adherence, most of the barriers including lack of time, lack of motivation and perceived obstacle had been reported by university students to be hindering their participation in physical activity (Dishman, Darracott & Lambert, 1992; Calfas et al., 1994; Shifflet, Cator & Megginson, 1994; Leighton & Swerissen, 1995; Hall, Kuga & Jones, 2002; Stone et al., 2002). Commitment to physical activity was associated with total physical activity level but it seems more applicable to high intensity (frequency and duration of activity) than moderate and low intensity activities (Deeter, 1988).

Students with more confidence with their skills, sport ability from their successful experience or better perceived physical fitness, physical conditioning and physical strength were more active especially for male samples (Lamb, 1993; Shifflet, Cator &
Intention and enjoyment had been identified as positive and consistent effecting determinants of adult's' physical activity participation (Sallis & Owen, 1999; Trost et al., 2002). Intention is a forerunner for behaviour and it has been emphasized in physical activity theories such as Theory of Reasoned Action and Theory of Planned Behaviour. Only study focused on university students' intention to be active and found that short-range/2 to 3 days intention was a better predictor of physical activity than the longer-range intention/4 weeks (Courtney & McAuley, 1993). Studies found that lower enjoyment of activity could significantly predict insufficiently active for university students and female students were more likely to participate in physical activity based on enjoyment (Leslie et al., 1999; Braithwaite, McDaniel & Reed, 2003).

Five papers had confirmed that Self-efficacy was the strongest and the most consistent intrapersonal variable which was correlated to university students' physical activity behaviour compared to the other variables. The evidence had come from correlation, regression, prediction and structural equation modelling (SEM) analysis methods using university students' physical activity level as well as the predictor of stage of exercise behaviour change (Haynes & McNamara, 1989; Dzewaltowski, Noble & Shaw, 1990; Leighton & Swerissen, 1995; Wallace et al., 2000; Rovniak et al., 2002).

Since the comparative weakness of the relation between subjective norm and intention in the Theory of Planned Behaviour, when comparing to personal factors such as attitudes and perceived behavioural control. Rivis and Sheeran (2003) carried out a study trying to test the potentially stronger social influence variable in planned behaviour; and the prototype, the types of people who engaged in certain health behaviour, to predict health-promoting decisions and exercise behaviour. It was found that descriptive norms, prototype similarity and, past behaviour significantly predicted
university students’ intention and exercise behaviour.

2.3.3 Interpersonal Variables (See Table 2.4)

   Social support might come from parents or family, friends and a significant other such as teacher, trainer and coach. It emerged as a consistently positive correlate to university students’ physical activity behaviours (Allgower, Wardle & Steptoe, 2001; Rovniak et al., 2002). The reviewed studies either focus on the correlation and prediction of physical activity behaviour or the ability to classify different stages of change on social support issues.

   Social support had been found to indirectly predict physical activity through its effect on self-efficacy (Rovniak et al., 2002). Study also revealed that parental support played a vital role for classifying different stages of change (Braithwaite, McDaniel & Reed, 2003). Furthermore, people who reported low levels of social support from family or friends, 48% & 45% for males and 55% & 23% for females, were more likely to be insufficiently active for health benefits than were those reporting high levels of support (Leslie et al, 1999). Low social support was associated with lack of physical activity (Allgower, Wardle & Steptoe, 2001).

   Gender differences appeared with female students being more likely to participate in physical activity based on parental support than male students (Braithwaite, McDaniel & Reed, 2003). Family social support and exercise self-efficacy for physical activity were the best predictors of stage of exercise behaviour change for females. Whereas, friend social support, physical activity history and exercise self-efficacy were significant predictors of stage of exercise behaviour change among males (Wallace et al., 2000).

   Students also reported that having an organized group with which to be active and having active friends would enable participation in physical activity on campus and promote their active life style (Shifflett, Cartor & Megginson, 1994; Stone,
Table 2.4. *Interpersonal variables associated with physical activity in university students*

<table>
<thead>
<tr>
<th>Correlates</th>
<th>Association</th>
<th>Reference no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having an active friend</td>
<td>+</td>
<td>20</td>
</tr>
<tr>
<td>Family support</td>
<td>+++</td>
<td>33,39,49</td>
</tr>
<tr>
<td>Friend support</td>
<td>++</td>
<td>33,39</td>
</tr>
<tr>
<td>Social support</td>
<td>++</td>
<td>40,45</td>
</tr>
<tr>
<td>Organized group</td>
<td>+</td>
<td>47</td>
</tr>
</tbody>
</table>

+ positive, - negative, 0 no effect, * more detail in the text

Strikwerda-Brown & Gregg, 2002).

2.3.4 *Environmental Factors and Policy (See Table 2.5)*

Environment and policy play vital roles for providing environmental opportunities, support, and cues to help people develop healthier behaviours such as physical activity. The university environment may offer a safer and more convenient access to exercise facilities, and more opportunities and facilitating policies for promoting university students' physical activity on campus when compared to other populations. Five studies had investigated the environmental and political issues on campus. Most of the studies employed self-report surveys intending to find out the potential environmental and political variables that can facilitate or hinder university students' physical activity behaviours.

Stone et al. (2002) found that perceived facilitators of participation in physical activity on campus reported by university students were improved facilities, affordable facilities/programs, organized programs being available which were linked to environmental variables and political issues. Inversely, when students perceived barriers...
Table 2.5. Environmental variables and policy associated with physical activity in university students

<table>
<thead>
<tr>
<th>Correlates</th>
<th>Association</th>
<th>Reference no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional policy did not support PA</td>
<td>-</td>
<td>54</td>
</tr>
<tr>
<td>No suitable activities were offered</td>
<td>-</td>
<td>47</td>
</tr>
<tr>
<td>Awareness of facilities available on campus</td>
<td>0+</td>
<td>33,47</td>
</tr>
<tr>
<td>Improve facility</td>
<td>+</td>
<td>47</td>
</tr>
<tr>
<td>Affordable facilities/programs</td>
<td>+</td>
<td>47</td>
</tr>
<tr>
<td>Lack of facilities</td>
<td>--</td>
<td>20,54</td>
</tr>
<tr>
<td>Campus design not support cycling or walking</td>
<td>-</td>
<td>54</td>
</tr>
<tr>
<td>Lack of convenient shopping</td>
<td>-</td>
<td>54</td>
</tr>
<tr>
<td>Proximity of exercise facility to intensity and duration of PA (female)</td>
<td>+</td>
<td>53</td>
</tr>
<tr>
<td>Proximity of exercise facility to frequency of PA (male)</td>
<td>+</td>
<td>53</td>
</tr>
<tr>
<td>Quantity of home exercise equipment</td>
<td>+</td>
<td>53</td>
</tr>
</tbody>
</table>

+ positive, - negative, 0 no effect, * more detail in the text

of no suitable activities were offered and not knowing what facilities or programs were available on campus, that might hinder their participation to physical activities (Stone et al., 2002).

Similar explanation had been found that lack of facilities, campus design that does not support cycling or walking and lack of convenient shopping could be barriers to establish university students' physical activity habit. Also, institutional policies that did not support physical activity with the absence of a physical activity or health requirement, and inadequate intramural opportunities could become their reasons for
being sedentary (Staten et al. 2003). Obviously, environmental preparation and proper policy could be the basic elements to encourage students to have a good start even though it might be just an excuse for not being active. Unavoidably, when people intended to attend physical activity, the idea or question of where it can take place always came first.

Distance to where physical activity can take place might also affect students’ willing to maintain their physical activity levels. Study reported that a lack of nearby facilities influenced students’ adherence to an active lifestyle but no significant correlation between barriers of facility and adherence to physical activity and exercise was found (Shifflett, Cator & Megginson, 1994). Another correlation study found proximity of exercise facilities was related to intensity and duration of physical activity for female and frequency for male but did not mention the relation to physical activity levels. Also quantity of home exercise was related to frequency, intensity and duration of physical activity (Reed & Phillips, 2003). Certainly, convenient facilities may stimulate students’ intention and give them better opportunities for attending physical activity. Actually, there still have a gap between theory and practice. A comparison study revealed that there were no differences of awareness and unawareness of campus facilities between active and inactive students both for females and males (Leslie et al., 1999).

2.3.5 Behavioural Attribute (See Table 2.6)

A history of previous physical activity had a strong effect on university students’ active lifestyle. University (College) students’ previous participation in sports and physical activity at school and youth sport could positively predict current physical activity level (Hendry, 1975; Hall, Kuga & Jones, 2002; Suminski et al., 2002). The physical activity history effect was found to be more significant for men (Wallace et al., 2000). There were some debated results from a study with both a longitudinal design
Table 2.6. *Behavioural attributes associated with physical activity in university students*

<table>
<thead>
<tr>
<th>Correlates</th>
<th>Association</th>
<th>Reference no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical activity and sport history</td>
<td>++++</td>
<td>3, 39, 44, 46</td>
</tr>
<tr>
<td>Trying to lose weight</td>
<td>+</td>
<td>37</td>
</tr>
<tr>
<td>Suicidal behaviour in female (male)</td>
<td>+(-)</td>
<td>43</td>
</tr>
<tr>
<td>Attended PE course in high school (1991 sample)</td>
<td>0(+)</td>
<td>28</td>
</tr>
<tr>
<td>TV viewing of men (TV, computer, video game)</td>
<td>-</td>
<td>46</td>
</tr>
<tr>
<td>Examine stress</td>
<td>-</td>
<td>25</td>
</tr>
<tr>
<td>Eating healthy food</td>
<td>+</td>
<td>29</td>
</tr>
<tr>
<td>Sleep</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>Atypical eating patterns and attitudes associated with eating disorder</td>
<td>*</td>
<td>7</td>
</tr>
</tbody>
</table>

+ positive, - negative, 0 no effect, * more detail in the text

and a time-lag design focusing on the PE effects from school (Eastman et al., 1998).
The best predictor for leisure time physical activity (LTPA) of university students in the longitudinal study was the amount of LTPA engaged in during the high school years.
Enrolment in high school PE courses was related to number of different activities participated in but not to the amount of time devoted to LTPA. Researchers implied that while PE courses do introduce the students to a wide variety of activities, they do very little to install the value of a life-long active lifestyle. In the time-lag study, the 1991 samples' high school PE enrolment predicted the time devoted to LTPA (TOTALTIME)
and the number of activities (NUMBERACT) but not for the sample in 1996.

Although, the benefit of physical activity or exercise for sleep was not proved, physical activity still had positive effects on eating healthy food to university students; and trying to lose weight was associated with participation in vigorous physical activity and strengthening exercise (Youngstedt et al., 2003; Johnson et al., 1998; Lowry et al., 2000). TV viewing behaviour was negatively associated only with male students’ current physical activity levels not females (Suminski et al., 2002). Academic exam stress was found to associate with decrease of university student’s physical activity levels (Steptoe, 1996).

There was a study concerning the association between patterns of physical activity and risk for eating disorder for college students. This study found that eating disorder was correlated with reported hours of jogging per week and exercising alone but not the total number of hours of exercise, hours of swimming, hours of bicycling and hours of other activities (Richert & Hummers, 1986). This study also specified that a larger percentage of the persons potentially at risk for eating disorder, relative to a normal group, reported engaging in jogging.

Different results were found for male and female students about suicidal behaviour and physical activity attendance (Brown & Blanton, 2002). Men who reported low activity had lower suicidal behaviour compared with those who reported no activity. Women who were vigorously active 6 to 7 days a week had two times the odds of suicidal behaviour compared with women reporting no activity. What factors are causing the unexplainable difference between physical activity and a decreased or increased risk of suicidal behaviour needs further investigation.

2.3.6 Physical activity Characteristics (See Table 2.7)

A college students’ survey revealed most of the students participated in Specific Physical Activity (SPA) at light or moderate levels. Few students spent time at severe
(or vigorous) activity or very severe activity (Tam et al., 1996). Attending vigorous physical activities decided the most part of the energy expenditure of participants who were either active or not active. Physical activity such as weight lifting activity was positively associated with current physical activity levels (Suminski et al., 2002).

Table 2.7. Physical activity characteristics associated with physical activity in university students

<table>
<thead>
<tr>
<th>Correlates</th>
<th>Association</th>
<th>Reference no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensity of PA</td>
<td>-</td>
<td>26</td>
</tr>
<tr>
<td>Weight lifting activity</td>
<td>+</td>
<td>46</td>
</tr>
</tbody>
</table>

+ positive, - negative, 0 no effect, * more detail in the text

2.3.7 Interventions (See Table 2.8)

A limited number of studies have applied interventions or examined the effectiveness of an intervention in a university students' population. Only five papers had been identified evaluating the effectiveness of interventions to university students' physical activity or intention to be active. One study aimed to promote interest in physical activity information or to encourage initiation of activity by using stress feedback manipulation. It was found not to be effective for inactive students. The failure might be due to the manipulation not being strong enough to install perceived health risks in the subjects (Haynes & McNamara, 1989).

An experimental design using a stage-matched intervention strategy applied either with information tailored to the stage, a traditional action-oriented brochure or a general health promotion weekly newsletter to three groups of college students (Kennedy et al., 2003). Results showed that the information tailored to the stage group exhibited the
Table 2.8. *Intervention studies of university students' physical activity*

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Association</th>
<th>Reference no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stress feedback manipulation to intention of initiation a physical activity program</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Lower frequency (twice a week to four time a week program)</td>
<td>+</td>
<td>15</td>
</tr>
<tr>
<td>Project GRAD (make change in)</td>
<td>+</td>
<td>35</td>
</tr>
<tr>
<td>1. Social support from friends (women)</td>
<td>+ (total PA)</td>
<td></td>
</tr>
<tr>
<td>2. Self-efficacy for resisting relapse (women)</td>
<td>+ (total PA)</td>
<td></td>
</tr>
<tr>
<td>3. Enjoyment (men)</td>
<td>+ (vigorous exercise)</td>
<td></td>
</tr>
<tr>
<td>4. Self-efficacy for resisting relapse (men)</td>
<td>+ (vigorous exercise)</td>
<td></td>
</tr>
<tr>
<td>5. Change in benefit (men)</td>
<td>+ (moderate exercise)</td>
<td></td>
</tr>
<tr>
<td>Project GRAD (after two years)</td>
<td>0</td>
<td>36</td>
</tr>
<tr>
<td>1. To total PA</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2. Experiential and behavioural processes of change (intention to women)</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

+ positive, - negative, 0 no effect
Table 2.8. *Intervention studies of university students' physical activity (continued)*

<table>
<thead>
<tr>
<th>Correlates</th>
<th>Association</th>
<th>Reference no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mailed interventions for stage of changes</td>
<td></td>
<td>52</td>
</tr>
<tr>
<td>1. Mailed newsletter (tailored to the stage)</td>
<td>+best</td>
<td></td>
</tr>
<tr>
<td>2. Mailed brochure (traditional action-oriented)</td>
<td>+average</td>
<td></td>
</tr>
<tr>
<td>3. General health newsletter</td>
<td>+few</td>
<td></td>
</tr>
</tbody>
</table>

+ positive, - negative, 0 no effect

Most stage movement followed by the traditional action-oriented brochure group and then the health promotion newsletter group. The results offered information that stage-matched and mediated interventions are applicable and effective for promoting and increasing physical activity. Another study revealed sedentary university students who exercised twice weekly were more likely to exercise in their leisure time after termination of the exercise program than individuals who exercised four times a week. Frequency and duration may need to be considered when structuring an exercise program to increase leisure activities (White et al., 1991).

Project GRAD (Graduate Ready for Activity Daily), which is a 16-week health-related university course, tended to change university students’ physical activity outcomes and potential psychosocial mediators. This intervention course was designed to increase physical activity by incorporating behaviour change strategies and exercise science principles which intended to alter psychological and social variables. Data was compared to a health science lecture course which acted as a control group (Sallis et al., 1999).
Results revealed there were no intervention effects on physical activity for men but three of the five physical activity outcomes including leisure time energy expenditure, strength, and flexibility activities and five mediators changed including social support from friends, experiential processes of change, behavioural processes for change, self-efficacy for making time, and self-efficacy for resisting relapse for women. Further investigation mediators linking to behavioural change has the potential improvement in theories and interventions focusing on the target group such as different gender and people in different physical activity levels.

A follow-up survey of Project GRAD using an 18-month post graduation intervention with peer-based phone and mail strategies tended to change physical activity outcomes and potential psychosocial mediators (Calfas et al., 2000). There were no significant intervention effects on long-term physical activity outcomes at two years for either men or women. Only experiential and behavioural processes of change were significantly improved for women over 2 years. Evaluating the ability of the mediators to explain the changes in physical activity behaviours and the validity of the physical activity measurement needs to be noted for the future studies. Also, developing practical and effective approaches for long-term physical activity behaviour change are needed urgently.

2.4 Discussion

Apart from the marital status, occupation, and income issues of adults' physical activity, gender, parents' social class, graduation, and BMI were consistent in previous adults' results. There were some different concerns about university students which were correlated to their demographic and biological factors.

Adults' study revealed that, generally, the nonwhite race were more inactive than other races (Sallis & Owen, 1999; Trost, 2002). They had some different points of view
according to the intensity of the activities, gender, and which race groups that the study focused on for the university students. For example, there was no difference among White, Black and Hispanic students about their vigorous physical activity level but black students engaged in moderate physical activity significantly more often than did White students (Douglas et al., 1997). White female students and African male students were more active than other races in the study of American university students (Suminski et al., 2002).

The most consistent result was that Asian and Chinese students were found to be more inactive in most of the studies. Hence, a comparison study among races should provide more details of their activity content such as intensity categories of vigorous, moderate and light physical activity in order to have a better understood physical activity results. Specific cultural differences, life style, characteristics of Asian and Chinese populations might cause their sedentary behaviour and this needs further investigation. As well as better health and fitness, aerobic capacity and more stable and extraverted personality might cause or was caused by the inactive lifestyle of university students.

The consistent result with adult studies relating to intrapersonal variables were barrier to exercise, expected benefits, lack of time, body image and self-efficacy. Some issues are new from adult's studies such as ideal-weight discrepancies, body-cathexis, general physical self-worth, depressive symptoms, descriptive norm and prototype similarity. They were all correlating to university students' physical activity behaviours respectively.

The association between attitudes and physical activity seems to be weak or to have no link in adult studies. Whereas, positive attitude was seen to be correlated to university students' higher physical activity level consistently, with only one study not showing a relationship between attitude and physical activity behaviours of Nigerian
students who studied in the US (Sonstroem & Walker, 1973; Hendry, 1975; Onifade, 1985; Braithwaite, McDaniel & Reed, 2003). Studies using the construct of Theory of Reasoned Action and Theory of Planned Behaviour may be more applicable to university populations compared to general adults’ groups.

Commitment to physical activity was seen to be associated with total physical activity level but it seems more applicable to higher intensity for both frequency and duration of the activities than moderate and low intensity activities (Deeter, 1988). It might imply that maintenance of physical activities were more vigorous and firm and that people who engaged in moderate activities may find it easier to quit or change.

A study of university students’ physical activity also reminded us that short-range/2 to 3 days intention was a better predictor of physical activity than the longer-range intention /4 weeks (Courneya & McAuley, 1993). It may be interesting that intention can be decreased or changed upon the time. The sedentary people may still maintain high levels of intention to do exercise due to some reason. Knowledge, normative beliefs and value of exercise outcome might enforce people’s intention in different ways. The point is how to convert the intention into real action and how to help them cross the gap.

Interpersonal variables which have been reviewed in this study revealed the significant role of social support. The significance of the role played by support from family and friends was consistent with previous adult studies. The effect can directly or indirectly influence university students’ physical activity (Rovniak et al., 2002). Also, having active friends might create an atmosphere of exercise habits to stimulate their motivation and intention from a social aspect (Shifflett, Cartor & Megginson, 1994). Moreover, students reported having an organized group with which to be active would enable participation in physical activity on campus and promote their active lifestyle (Strikwerda-Brown & Gregg, 2002). The intervention strategies concerning social
support can be done via a PE course, exercise or sport club and organized sports or activities from the sub-unit of university such as PE centre or relevant departments.

Physical environment factors emerged as the most needed study area and most concerned variables in physical activity research recently. There was also insufficient evidence to identify several new environmental correlates of physical activity in adult studies (Trost et al., 2002). Physical environment factors referred to university students' physical activity levels mainly focused on facility issues in this review.

Awareness of the facilities had unequal effects in two studies (Leslie et al., 1999; Stone et al., 2002). Students reported that not knowing what facilities were available was one of the greatest barriers. Improving and constructing more affordable and convenient facilities may facilitate university students' motivation and intention to be active and offer them more opportunities to engage in exercise (Reed & Phillips, 2003; Staten et al., 2003; Shifflett, Cator & Megginson, 1994; Stone et al., 2002). These results might also imply that university students were still referring to physical activity as an exercise or sport that must take place in certain exercise or sport facilities. A variety of physical activities should be emphasized and added to university students' active life but not just traditional sports or constructed exercise.

University policy such as the design of the campus and the offering of suitable activity programs will be very helpful in establishing university students' active life. Most of the students might engage their physical activities in the campus environment. Some environmental variables may not be so significant to university students such as enjoyable scenery, hilly terrain, urban location, and heavy traffic in adult studies. However, some potential variables still need to be further tested in terms of their effects on university students such as living status (on/off campus), perceived safety of the campus, and satisfaction of the facilities and so on.

A history of physical activity extended the behaviour into university life with a
strong effect on university students' physical activity level (Hendry, 1975; Hall, Kuga & Jones, 2002; Suminski et al., 2002). One can presume that the significance of an active life style for the university phase can also contribute to their active life after graduation. Previous physical education courses affected university students' physical activity level in a certain way (Adams & Brynteson, 1992). However, more life-long design PE courses may be more effective in terms of students' leisure time and physical activity level but not just the wide variety of activities (Eastman et al., 1998).

Some other behavioural attributes had inconsistent results between male and female students for suicidal behaviour and TV viewing. The gender differences and possible determinants need further investigation. Although university students' eating disorder behaviour did not correlate to the total number of hours of exercise and other physical activities such as swimming and cycling but it correlated to jogging and exercising alone (Richert & Hummers, 1986). Future research may focus on the motive and expectation of the participants. Seeking the main reason and the preferences why certain people are attending the certain physical activities, in order to have insight into the connection.

Referring to physical activity characteristics, it can affect the results of the measures. Peoples' attendance to vigorous physical activities did not mean that they will be benefited the same as those attending moderate or light physical activities, and vice versa. Relevant studies focusing on the effects of physical activity level on variables of interest should consider the specific physical activity categories independently.

Also, many studies referred to the measurement problems. A multiple correlations from the regression indicated that the set of psychological variables including outcome expectation, perceived barriers (OEV/Barriers) and self-efficacy explained 26% of the variation in MET-h reported in a 7-days diary but were unrelated to Caltrac accelerometer counts (Dishman et al., 1992). Study results from Sarkin et al. (2000)
using different measurements showed that the type of measurement as well as the 
scoring protocol affected prevalence estimates for meeting the physical activity 
guidelines. It indicated the difficulty of comparing physical activity levels across studies 
using different measures. Future studies should consider not only the validity and 
reliability of the measurement but also consistency when comparing with other studies.

More intervention studies should be applied and tested to improve university 
students' physical activity levels. Strategies applied to promote university students' 
physical activity levels seemed to be more effective with stage-matched and mediated 
method (Kennnedy et al., 2003). Project GRAD, an intervention designed as a lecture 
course which intended to alter psychological and social variables to increase physical 
activity by incorporating behaviour change strategies and exercise science principles 
(Sallis, 1999). Although the results were not so promising for university students' 
physical activity behaviours, it still has some positive effects on potential mediator 
variables, especially to female students. As well as the follow-up survey of Project 
GRAD by peer-based phone and mail strategies was not very successful.

There was still insufficient evidence to assess the effectiveness of university-based 
interventions due to the small number of studies. The only strong conclusion from 
intervention studies were lower frequency (twice a week to four times a week program) 
and Mailed newsletters tailored to the stage which were more effective for university 
students. There was a lack of empirical intervention designs to directly test their effects 
on students' physical activity changes. Classroom education or lectures such as Project 
GRAD design targeted the variables changes can only have indirect effects on physical 
activity behaviours. Educational strategies such as practical PE course design not only 
may alter the effective variables but also can offer the real physical activity 
opportunities which may be more effective than a single lecture method. Also, in 
modern society, mailed interventions such as new information technologies with
website design and email information delivery may be more effective by means of mutual communication, less time consuming, less cost, and wider spread than tradition newsletter and brochure.

Following the criteria that had been set up for recruiting papers, only a few studies were identified for the systematic review. Hence, only some of the correlated variables could have strong evidence to support their relationship to university students' physical activity levels such as gender, ethnicity, self-efficacy, outcome expectation, perceived barrier, family support, and physical activity history (more than 3 papers). Limited intervention studies also caused the difficulty for comparing their efficacy and to come to a robust conclusion. Due to the reviewed paper ranging from 1973 to 2004, the results from the earlier years may not be so applicable to present university settings. However, the significant findings from the systematic review of university students' physical activity and the important issue for future studies are concluded as following:

1. All identified study papers in the systematic review were all located either in US or other western countries. More non-western perspectives or cross-cultural study designs are needed.

2. Comparatively, Asian university students and female students seemed more sedentary and had justified the immediate need of studies to this target group. Finding out the correlated variables which may link their physical activity behaviour and the potential solutions to promote their physical activity levels are vital for future studies.

3. University students' previous physical activity and sport history had strong links to their physical activity levels according to this systematic review. Adults' studies also revealed that adulthood physical activity history is strongly connected to their physical activity levels but not the history in childhood (Trost et al., 2002; Sallis & Owen, 1998). Therefore, it indicated the significance of maintaining university
students' physical activity habits. It can play a vital role which can bridge the continuity of active behaviours to establish adulthoods' life-time active habits.

4. Correlated variables which had been identified in university students' study findings were corresponded to adults' studies. However, inadequate studies were found to provide robust support for the conclusion as adult results for this target group. However, selected variables such as attitude, self-efficacy, perceived barriers, family support, physical activity and sport history, which were strongly correlated to university students' physical activity levels, are modifiable and can be applicable to intervention study design as mediating variables.

5. Different physical activity measures and designs have been applied in these studies. Utilizing measurement which can precisely estimate participant's physical activity levels and satisfy the comparability to other studies is needed.

6. Since only quantitative studies have been considered in this review, different research methods (e.g., qualitative) may help to provide a deeper understanding of participants' physical activity behaviour.

7. More university-based intervention studies and experimental study designs are needed as only a few studies are available. Physical education course design may be an efficient method in university (educational) settings to strengthen students' modifiable variables such as self-efficacy, outcome expectation, friend support, perceived barriers and awareness of the university facilities, all of which have been found to be correlated with university students' physical activity levels. Longitudinal surveys are also needed to test their long-term effects.

8. A mailed intervention tailored to the stages of change had been found to be effective with university students' physical activity. Technology, such as email, may be a potential method for effective intervention.
Chapter 3 A Survey of English and Taiwanese University Students to Assess Intrapersonal, Interpersonal and Physical Environmental Influences on Physical Activity

3.1 Research Rationale

Before industrialization, physical activity was integrated into human being's daily lives. Nowadays, people need to have purposeful physical activity such as exercise or sport to increase energy expenditure for preventing chronic diseases and obtaining a better quality of life. Investigations have found that physical activity levels decline starting at around 18 to 24 years old as young people make the transition into adulthood (USDHHS, 2000). Promoting and maintaining higher levels of physical activity for young adults must be emphasized.

University students have more control over their lifestyles and will be the future leaders and decision makers who will influence policy and environment in physical activity. Unfortunately, even though the university campus provides facilities and a suitable environment for exercise, the greater proportion of university students still do not engage in enough physical activity to reach the recommended level required to maintain health (Wallace et al., 2000; Leslie et al., 1999). Since physical inactivity is a population-wide problem, physical activity promotion aims to assist physically inactive people to adopt and maintain regular physical activity. University environment is a key place to encourage people to be involved in more physical activity and to learn how to adopt physical activity.

It is also an ideal environment to create group-based interventions for promoting people's physical activity behaviour. Effective intervention strategies for increasing people's physical activity must be based on good quality antecedent research. Research to date has focused on multiple dimensions of influences to explain health behaviours and design effective interventions. Theories of health behaviours such as Theory of
Planned Behaviour and Transtheoretical Model which concerned with psychological variables or social influences have been well developed in the past decade. Recently, the environmental issues have played a leading role in health behaviour research, and the ecological model holds promise in explaining physical activity behaviours (Sallis & Owen, 1998). However, all these significant theories and models still have not been widely tested in the Asian population to date in the literatures.

The present study attempted to identify cultural differences, by using a demographic survey and preliminary test of the relevant theory and model, with correlated variables to UK and Taiwan university students. The chosen theories and models had been supported in physical activity studies which have mainly been conducted in western university student and adult samples. Survey variables were based on either their strong link to physical activity behaviour or their significant roles in relevant theories. In particular, the Theory of Planned Behaviour, Transtheoretical Model and Ecological Model and their relevant variables were applied in this study. The aim was to provide an insight for researchers to target future interventions for the population of university students.

3.2 Literature Review

Since university students' physical activity literatures had been broadly discussed in previous systematic review, following reviews added some significant results from young adults and general adults' studies. Especially, content focused on the correlated variables that had been highlighted to be promising to young people. Also, the variables that were significant to theories and models that had been successfully applied to adults' studies.

3.2.1 Physical Activity to Young adults and University Students

Participating regularly in moderate to vigorous physical activity has been
associated with better health-related fitness and higher quality of life. Inversely, research shows over 50% of those over 20-years of age to be insufficiently active (Booth et al., 1997). Descriptive epidemiology of physical inactivity in adult Australians has revealed that physical activity declines rapidly with age, especially those aged 25-39 who were 2.18 times more likely to be physically inactive than those under the age of 25 (Owen & Bauman, 1992). A longitudinal survey of habitual physical activity found during the adolescent period (13-16 years) the decrease in physical activity for females was 3%, followed by a 5% increase in their early 20s, followed by 10% decrease in their late 20s. In males, a 20% decrease during adolescence, a 5% increase in their early 20s, and a 16% decrease in their late 20s have been found (Van Mechelen & Kemper, 1995).

The period young adults are in college and university may play a vital role in future active lifestyles. Stage of change data showed more than 50% of university students as inactive, including the precontemplation, contemplation, and preparation stages (Wallace et al., 2000). Similar results emerged from four college campuses; 40% of students were insufficiently active (Leslie et al., 1999). Self-perceived physical activity level decreased both in moderate and vigorous physical activity from high school to college according to a self-report cross-sectional survey by Calfas et al. (1994). Furthermore, surveys found that 63.7% of high school students and only 37.6% of college students participated in regular vigorous physical activity respectively (U.S. Department of Health and Human Services, 1996; Douglas et al., 1997). Only 46% of adults aged 18-25 years continue an active lifestyle beyond secondary school (U.S. Department of Health and Human Services, 1990).

The decline of physical activity in university students may be due to many reasons. Low levels of friend and family social support and low enjoyment have been found to be associated with insufficiently active college students (Leslie et al., 1999).
Insufficiently active young adults (18-39yrs) prefer walking, group and doctor’s support, and perceived no time and no motivation as the most frequently cited barriers to participant in leisure-time physical activity (Booth et al., 1997). Physical activity levels are normally different among racial groups (Crespo et al., 2000). A cross-sectional study revealed that female and Asian peoples’ physical activity are normally lower than male and other race people for adolescent and the older adult stage but a study also found that there were few ethnic differences in physical activity for high school students (McGuire et al., 2002; Kathryn et al., 2002; Booth et al., 2000; Sallis et al., 1996).

University students have similar backgrounds and living conditions to engage in physical activity. To find out the differences between gender and race (nations) and understanding the correlated variables which may link to university students’ physical activity is not only to provide the information about how to encourage students to be more active, but also to offer the direction for establishing university policy. Furthermore, colleges and universities are a vital environment and phase to establish active lifestyle and exercise behaviour for young adults but few theory-base studies have been conducted in order to examine the characteristics associated with regular exercise in this population (Wallace et al., 2000).

3.2.2 Determinants of Physical Activity for Young Adults

Identifying the influences on physical activity is challenging work because the significant variables may vary by age, sex, social group, living environment and socioeconomic status. Understanding the factors that are associated with physical activity behaviours is vital for developing effective interventions to promote physical activity in specific populations. Established theories, models and hypotheses may help researchers to focus on variables which are believed to be among the most highly related to physical activity (Sallis & Owen, 1998). Besides, finding variables from theories will be the most effective way to explain behaviours.
Due to most of the finding results in the systematic review for university population were corresponded to adults' studies, following review mainly based on the adults' physical activity studies. Sallis and Owen (1998) and Trost et al. (2002) summarized the strongest linking variables to physical activity in adults and divided variables into three categories including intrapersonal, interpersonal and physical environment variables based on the ecological model. In order to have a comprehensive understanding, correlated variables were chosen by their consistency to physical activity behaviour for young people and their significant roles in theories and models. Following reviews were organized mainly based on the Ecological Model categories.

3.2.2.1 Key Correlates of Physical Activity for Young Adults

Intrapersonal

Intrapersonal (psychological) variables including self-efficacy, intention, enjoyment, barriers and outcome expectation were most consistent variables that correlated to adults' physical activity behaviours and had frequently been applied to relevant theories and models.

Self-efficacy

Self-efficacy is the confidence to execute a course of action. According to Bandura's (1977; 1986) social cognitive theory, self-efficacy indicates a person's confidence in his or her ability to do specific physical activities in specific circumstances (Sallis & Owen, 1998). Normally, circumstances include external factors such as continuing to exercise in poor weather, and internal factors such as maintaining exercise when in a bad mood. People who have higher confidence in their ability to exercise are assumed to be more active than people who lack the confidence to do so.

Self-efficacy has become the strongest determinant of physical activity in many studies throughout all ages for adolescents (Trost et al., 1997; Winters, Petosa & Charlton, 2003), university students (Wallace et al., 2000; Leslie et al., 1999; Rovniak et
al., 2002), adults (Sallis, Hovell, Hofstetter, & Barrington, 1992; Troped et al., 2003) and older adults (McAuley et al., 2003). Physical activity self-efficacy emerged as the most consistent correlate of physical activity behaviours in Trost et al.'s (2002) review. 

**Intention**

Theory of Planned Behaviour (TPB) proposes that intention is the immediate antecedent of behaviour (Ajzen, 1991). The model suggests that the proximal predictor of behaviour is an individual’s stated intention to perform the target behaviour in a given context and at a given time (Hagger, et al., 2001). Hausenblas et al. (1997) carried out a meta-analysis with a large effects size (1.09), from intention to behaviour. Another Meta-analytic review concluded that TPB exhibited good fit with the corrected correlation matrices with the path analysis of 72 studies, but self-efficacy and past behaviour are important additions to the model (Hagger et al., 2002).

Reviews from Trost et al. (2002) and Sallis and Owen (1998) both found intention to exercise correlated positively with physical activity. In other words, people process a strong intention to be physically active. That intention is supposed to translate into behaviour or implies a determined willingness to take this action. Also, applying Self-determination theory revealed that exercise regulations, including external, introjected, identified and intrinsic regulation of exercise behaviour, were strongly correlated with greater intentions to exercise for female university students and staff (Wilson & Rodgers, 2003).

**Enjoyment**

Enjoyment may be the basic incentive for people continuing with physical activity. It has been found that enjoyment of physical education was one of the strongest determinants of children’s physical activity in grades 4 to 12 (Sallis, Prochaska, Taylor, Hill & Geraci, 1999). It is also positively correlated to physical activity level for college students (Hall, Kuga, & Jones, 2002).
Barriers

Barriers for attending exercise were a negative influence for physical activity (Sallis et al., 1992). Four factors were found in Calfas et al.'s (1994) study of exercise barriers for college students and alumni including aversiveness of activity, inconvenience, worries and competing demands. Three categories had been classified by USDHHS (2000) about the main barriers for American adults for physical activities including lack of time, lack of access to convenient facilities and lack of safe environments in which to be active.

Expectation

Individuals may be motivated to participate in physical activity to improve their health status, receive social approval, and experience self-satisfaction (Dzewaltowski, 1994). Positive and negative outcomes both correlated to physical activity levels for university students (Rovniak et al., 2002). For college students doing exercise, men ranked, in order, health, fitness, attractiveness, tone, mood, enjoyment, and weight control. Women ranked health, fitness, tone, mood, weight control, attractiveness, and enjoyment (Hall et al., 2002). Maintainers reported physical/psychological health aspects of activity to be more of a benefit than did contemplators, actives or relapsers (Calfas et al., 1994).

Interpersonal

Social and cultural factors may include all the significant others that affect or support people engaging and maintaining physical activity. The support frequently and directly comes from family (parents and spouse), friends, physician, or program staff or instructor. Modeling is also another aspect of social influence.

A study of university students found family social support for physical activity for females and friend social support for physical activity for males were the best predictors of exercise stage (Wallace et al., 2000). A meta-analysis by Carron, Hausenblas and
Mack (1996) indicated that social support from family members and important others, such as physicians and colleagues, have a moderate effect on intention. It means social support plays an important role on people's intentions to be physically active.

The physical environment

Prevailing environmental factors include weather, living area, and convenient facilities. More environmental influences are now appearing in recent research studies. Creating an active environment is thought to directly facilitate people's physical activity levels by offering more opportunities and options in their daily routine. The mechanism of the influences by environmental factors to various types of physical activities still requires a more comprehensive understanding (Trost et al., 2002). Obviously, safe and attractive scenery for outdoor activities, convenient access to exercise facilities and programs, and exercise equipment at home may all encourage people to involve themselves in active lifestyles.

The period of university student's physical activity may be the critical milestone for establishing and maintaining the goal of active lifestyles. Since determinants for physical activities also vary for different subgroups, attending university may be the first time for young adults to leave the family and experience their new life. New environments may prevent them being more inactive (e.g. unaware of the facilities and other competing activities) or may encourage them to be more active (e.g. more leisure time, exercise facilities and preference options).

Health-related behaviour research had varied focusing from individual-level factors to multiple levels and the interactions between variables, such as the ecological model, to explain behaviours. Understanding the factors that are correlated with physical activity behaviours is important in developing effective interventions for university students. It may be more important to identify the modifiable variables including self-efficacy, perceived barriers, perceived benefits, enjoyment of activity, and
social support to guide the intervention for young people (Sallis & Owen, 1998).

Environmental variables also had been emphasized of their importance of creating an active setting for physical activity. It was expected to be the basic requirement and also the strongest link to physical activity behaviour.

3.2.3 Application of Theories to University Students' Physical Activity Research

No single variable explains physical activity behaviour (Sallis, Hovell, Hofstetter, & Barrington, 1992). An important starting point for the understanding and promotion of health-related exercise and physical activity is the study of its theory (Biddle & Nigg, 2000). There were many theories and models that have been applied to the study of physical activity and exercise behaviour. Some theories and models were primarily focused on individual psychological determinants such as the theory of planned behaviour and the transtheoretical model. The newly reported studies tend to have a broad “ecological” approach that emphasizes the social systems, public policies and especially environment factors as multiple level influences on physical activity behaviours (Sallis & Owen, 1998; Trost et al., 2002). The following introduction will mainly focus on Ecological Model that links to physical activity behaviours.

3.2.3.1 Ecological Model

Human behaviours take place in various behaviour settings and the ecological model attempts to explain the interrelations between environments and behaviours. Researchers believed environmental factors led people to the sedentary lifestyle in the first place. If the environment did not change, the investigator should not expect physical activity interventions that try to change intrapersonal and social variables to have long-term effects (Sallis & Owen, 1996).

The Ecological model specifies that intrapersonal variables, interpersonal and cultural variables, and physical environments can all influence behaviour (Sallis, Bauman, & Pratt, 1998). It explains physical activity behaviours by multiple dimensions
and multiple levels of influence on behaviour (See figure 3.1). Since ecology refers to
the interrelations between organisms and their environments focusing on the nature of
people's transactions with their physical and sociocultural surrounding (environments)
and the behaviour environment typically means the space outside the individual (Sallis
& Owen, 1996). Hence the ecological model also emphasizes the interactions between
intra-individual (person) and extra-individual (environment) factors. The model is
shown as Figure 3.1.

Figure 3.1. Ecological model
The unique contribution of ecological models is the identification of physical environment factors that include the natural environment such as weather, climate and geography and constructed environments such as homes, architectural features, and local communities, and also information, entertainment, and technological environments that may affect behaviour (Sallis & Owen, 1998). Sometimes, environments can be classified as social and cultural or physical environments and as actual or perceived environments. Social and cultural environments include family, friends, communities, organizations, institutions, and public policies, which may create an environmental atmosphere supporting or hindering physical activity behaviours.

Sallis and Owen (1996) listed five principles about the ecological model to apply in research and health promotion including multiple dimensions of influence on behaviours, interactions of influences across dimensions, multiple levels of environment influences, how environments directly influence behaviours, and behaviour-specific ecological models. Basically, ecological models imply that environment and policy variables can add explanatory value above that provided by intrapersonal and interpersonal factors (Sallis, Bauman, & Pratt, 1998), or once individual dispositions such as cognitive constructs are accounted for, a relationship should still exist between extra-individual factors (environment) and physical activity (Spence & Lee, 2003).

The review variable had been found their significant roles to adults' physical activity behaviours but few had applied to university students' population. Especially, most of the results were conducted in western countries. More Asian perspectives results are needed to test their efficacy to supplement the breach or gap.

3.3 Method

3.3.1 Participants and Setting

The ethical clearance was approved by Loughborough University Ethical Advisory
Committee with the original title of "Determinants of University Students' Physical Activity: Intrapersonal, Interpersonal and Physical Environments Influences" before recruiting the data (See Appendix 2). Two convenience samples were recruited in two universities with similar campus size and student population size. Participants were asked to complete a battery of self-report measures with demographic details, a physical activity checklist, physical activity stage, and variables that were significant to adult's results to examine the multiple levels of influence that may link to university students' physical activity behaviours.

Invitation letters were sent to university staff by email in UK. Only one reply offered the opportunity to collect data in a quiet class room twice before teaching courses. Part of the UK sample was asked to complete the questionnaire through email due to their late arrival to the course. The invitation letter was also sent to the Taiwanese university staff by email, with data collected in Taiwan. Two PE teaching staff offered the opportunity for students to complete questionnaires in a quiet classroom before their teaching course.

3.3.2 Measures' validities and reliabilities

All English measurements applied the expert validity method and translation-back-translation procedures in order to make sure the content equivalence for the Chinese version to original design and the construct validity was identified with original measures (See Appendix 3). The procedures included: 1) translate English version into Chinese version by researcher; 2) A bi-linguist back-translate the Chinese version into English; 3) An UK professor with expertise in physical activity research and measurement development re-examined the back-translated measures and inappropriate items were clarified ; 4) The identified inappropriate items then went through whole the procedures again until the expert had the agreement with the translation which were consistent and corresponded to the original measures with 48
validity for survey variable measures.

The pre-test of the Chinese and English questionnaires was conducted by inviting four Taiwanese students and two English students who were studying in the English university to complete all measurements and to test whether they fully understood the questionnaires, seeking their feedback of the layouts and testing the administered time (average about 20 minutes) for two measurements. The original measurement details and scoring protocols are described as follows.

**Physical activity level**

The adult literature using subjective self-report measures range from single item global assessments to detailed activity inventories (Trost et al., 2002). Also, from the result of systematic review in this thesis, seven day recall design measurement by self-report and interview method, and stage of changes survey for physical activity levels, were identified and had been consistently used in the literature. Hence, a modified 7-day recall measurement of the Self-Administered Physical Activity Checklist (SAPAC) and stages of change measure were used to assess physical activity levels. The SAPAC has been shown to have acceptable levels of test-retest reliabilities and validities for fifth grade girls and boys (Sallis et al., 1996). The 7-day recall format contained three categories of physical activities and one category of sedentary activities. Participants indicated what kind of activities they had participated in from a list of 28 physical activities in the past 7 days and specified other activities that were not on the list. Each item included the number of times and the average minutes they had participated. Physical activity levels were estimated using the energy expenditure data for the classification of energy costs of human physical activities that had been listed by Ainsworth et al (1993). The calculation of energy cost was estimated by multiplying the body weight in kilogram (kg) by the METs value and duration of activity. For example, a 60 kilogram student cycling at 4 METs for 40 minutes costs \(4 \text{MET} \times 60 \text{kg body}\)
weight) * (40mins/60mins) = 160 Kcal energy expenditure. When single activity energy expenditure was estimated, the cost will multiply it by frequency (how many times) in the past seven days. A total PA level was summed up by different activities listing in the SAPAC. Considering the same intensity of physical activity may be perceived differently by participants’ own feeling as a subjective intensity level. Furthermore, the general description of intensity with vigorous, moderate and light was not corresponded to the SAPAC description. The intensity was mainly decided either with the medium strength or the average cost of the energy expenditure. For example, the list of tennis activities included general, doubles, and singles three categories with 7METs, 6METs and 8METs in SAPAC. When student identified tennis as one of his/her activities, the intensity will be applied 7METs for calculation. Handball had 2 categories with general and team with cost 12METs and 8METs respectively in SAPAC. The intensity of handball applied to the calculation was 10METs.

Stages of change

Stage of physical activity behaviour were described in the Transtheoretical Model and includes precontemplation, contemplation, preparation, action and maintenance stages (Marcus, Rakowski & Rossi, 1992; see Appendix 3). The definitions of the stages are explained as below:

Precontemplation: I am currently not physically active and I don’t intend to start being physically active in the next 6 months.

Contemplation: I am currently not physically active, but I am thinking about starting to be physically active in the next 6 months.

Preparation: I am currently physically active occasionally, but not on a regular basis.

Action: I am currently physically active on a regular basis but I have only begun doing so within the last 6 months.

Maintenance: I am currently physically active on a regular basis and have done so for
longer than 6 months.

Intrapersonal variables

Self-efficacy

A 5-item self-efficacy scale, each utilizing an 11-point scale (1 = not at all confident and 11 = very confident), assessed respondents' confidence under different situations to persist with exercise. Marcus et al (1992) reported 0.90 test-retest reliability and internal consistency with a Cronbach's alpha coefficient of 0.76. The example item is shown as below.

YOUR PHYSICAL ACTIVITY CONFIDENCE:

a. When I am tired

Intention

Hagger et al.'s. (2001) 3-item intention scale, each utilizing a 7-point scale (1 = extremely unlikely and 7 = extremely likely), assessed respondents' intention of participating in leisure time physical activity. The Cronbach's alpha reliability coefficient of 0.77 exhibited adequate internal consistency. A 7-point scale was utilized. The example item is shown as below.

YOUR INTENTION TO PHYSICAL ACTIVITY:

a. I intend to participate in vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight.

Enjoyment

Frederick and Ryan (1993) developed the motivation for sport and exercise scale. The Enjoyment factor contains six items with a 5-point scale, each utilizing a 5-point scale (1 = strongly disagree and 5 = strongly agree). For individual sport participants this was higher than for the fitness group and was related to positive psychological outcomes. The Cronbach alpha coefficient was 0.88 for the enjoyment factor as a
FEELINGS OF DOING PHYSICAL ACTIVITY:

a. It's fun.

Barriers

A 5-point design questionnaire, each utilizing a 5-point scale (1 = strongly disagree and 5 = strongly agree), of 14 items with three subscales including time, and barriers of effort and obstacles was developed by Steinhardt and Dishman (1989) to evaluate the perceived barriers to physical activity for university students. Internal consistency for each of the three subscales ranged from .47 for the obstacles subscale to .73 and .78 for the effort and time scales. Test-retest Pearson correlation coefficients were .74, .73, and .70, respectively for the time, effort and obstacles subscales. Barrier of effort was negatively related to 7-Day recall at term outset for college students. The example item is shown as below.

YOUR BARRIERS TO PHYSICAL ACTIVITY:

a. Lack of motivation

Expected outcome

A scale with total of 12 items, each utilizing a 5-point scale (1 = strongly disagree and 5 = strongly agree), assessed respondents' positive outcome value of physical activity. Steinhardt & Dishman (1989) developed the expected outcome of physical activity scale including three subscales of expectancy of psychology, body image and health benefits. The degree of internal consistency ranged from 0.7 to 0.78. Test-retest Pearson correlation coefficients were 0.81, 0.89, and 0.66, respectively for the three subscales. The example item is shown as below.

YOUR REASONS FOR PHYSICAL ACTIVITY:

a. Stay in shape.

Interpersonal variables (Social and cultural environment)
An abbreviated version of the social support and exercise survey (Sallis, 1988), 13 items utilizing a 5-point scale (1 = none and 5 = very often), that was modified from a previous scale (Sallis et al., 1987), included family and friend participation and family rewards and punishment (an optional scale). All factors were significantly correlated with a vigorous exercise measure. Test-retest reliabilities ranged from 0.55 to 0.79 and internal consistencies (coefficient alpha) ranged from 0.61 to 0.91. The example item is shown as below.

**YOUR SOCIAL SUPPORT for EXERCISE:**

a. Exercised with me

**Physical environment**

Forty-three self-report items developed by Sallis et al. (1997), each utilizing either with an answer of yes or no (1 = yes and 0 = no), were used to assess environmental variables in different behaviour settings. The basic idea of the measure is to quantify the extent to which environments contain resources that facilitate or hinder physical activity. These items yielded three subscales to evaluate different levels of perceived environments including home environment, neighbourhood environment and convenient facilities. Partial support for subscales reliability and construct validity has been described in the research. The home equipment subscale was moderately associated with frequency of both strength and vigorous exercise. Since few measurements of environment variables have been published to date, this study applied this measurement to assess participants' perceived physical environment. The example items are show as below.

**PLEASE INDICATE WHICH ITEMS YOU HAVE IN YOUR TERM-TIME HOME, GARDEN/YARD:**

a. Bicycle

**PLEASE INDICATE WHICH OF THE FOLLOWING APPLY TO YOUR**
IMMEDIATE NEIGHBOURHOOD:

a. Dogs those are unattended

FOR EACH OF THESE PLACES WHERE YOU CAN EXERCISE, PLEASE INDICATE IF IT IS ON A FREQUENTLY TRAVELLED ROUTE OR WITHIN A 5-MIN DRIVE FROM YOUR TERM-TIME HOME.

a. Aerobic dance studio

3.3.3 Research Questions and Hypotheses

Apart from the descriptive analyses of preference and physical activity stage survey, this study also aimed to define the differences between nations and gender, and the relationships between survey variables to physical activity levels by theoretical construction within the university settings.

The specific research questions and hypotheses of this study were:

a. What is the preference discrepancy of physical activities between nations and gender?

b. What is the prevalence rate of active/sedentary behaviour, stages of change distribution, both in UK and Taiwan universities with different gender?

c. Are there any differences in physical activity levels and survey variables between nations and gender?

d. To what extent the significant correlated variables in adults’ physical activity studies can apply to the target groups and to predict university students’ physical activity behaviours, especially to Taiwan students?

e. Can relevant theories or models which had been broadly tested in western adults’ studies be applied to both UK and Taiwan university students?

Apart from the descriptive survey, this study will analyze five null hypotheses as following:

H₀: There are no differences in university students’ physical activity levels between
nations and gender.

H_{0}: There is no correlation between university students’ physical activity levels and survey variables.

H_{1}: The survey variables can not predict university students’ physical activity levels through intention which was proposed by Theory of Planned Behaviour.

H_{4}: There are no differences in survey variables by different stages of change.

3.3.4 Data Analysis

a. Percentage frequency was applied to test the sedentary/active prevalence based on stage categories of university students. Also, percentage frequency analyses were used to test the distribution of preferred activity based on genders, nations and physical activity stages.

b. Pearson’s correlation analyses were used to test the preliminary relations between survey variables and physical activity levels.

c. Multiple regressions were used to evaluate the total shared variance of determinants in physical activity levels.

d. A two-way MANOVA was used to test the effects of gender and nations on physical activity determinants and physical activity levels.

e. Path analyses were conducted to examine the pattern of relationships among the variables, whether paths are effective via participants’ intention to physical activity behaviour which is basically based on the theory of planned behaviour?

f. A one-way MANOVA tested the effects of stage of change on intrapersonal and interpersonal variables.

3.4 Results

A manual check with the questionnaires was conducted. Questionnaires with blank sections, lack of necessary information, only one single or same answers, and all
questions finished within 10 minutes (minimum finishing time was about 20 minutes or more for Taiwanese and English students during the pre-test) were rejected. Statistical checks such as frequency and means to detect invalid values for categorical variables (for example, gender or year of study) or error in data entry were conducted to check for invalid values during data cleaning procedures.

3.4.1 The descriptive background of the participants

The UK sample consisted of 100 students recruited from a university in the English midlands including 44 males and 56 females (mean age=22.4±4.5yrs). 62% reported attending an exercise or sport club or class at least once a week. 46% of the participants reported a decrease and 41% reported an increasing of exercise participation comparing to their time in secondary school.

The Taiwan sample consisted of 309 students from a university in the middle of the island and included 162 males and 147 females (mean age=20.1±1.3yrs). 74.8% of these students had attended an exercise or sport club or class at least once a week. Compared to their time in secondary school, exercise participation was reported a decrease was 58.9% of the sample and an increase was 26.9%.

3.4.2 The frequency and percentage of stage of changes for different participants

The proportion of participation in each stage was shown as Table 3.1. A normality tendency appeared in the total sample that most of the participants centralized in preparation stage. Most of the UK students were active with nearly 50% at maintenance and action stage. Taiwanese sample were comparably more sedentary than UK sample by the stage of change survey.

3.4.3 The preference of physical activities between genders and nations

The preferred activities for different nations and gender are shown in Figure 3.2. Both British and Taiwanese males preferred team sports. British females preferred aerobic exercise and swimming. Taiwanese females preferred swimming the most.
Table 3.1. *The frequency and percentage of stage of changes for different participants*

<table>
<thead>
<tr>
<th>Stages</th>
<th>Precontemplation</th>
<th>Contemplation</th>
<th>Preparation</th>
<th>Action</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage</td>
<td>Percentage</td>
<td>Percentage</td>
<td>Percentage</td>
<td>Percentage</td>
</tr>
<tr>
<td></td>
<td>(Frequency)</td>
<td>(Frequency)</td>
<td>(Frequency)</td>
<td>(Frequency)</td>
<td>(Frequency)</td>
</tr>
<tr>
<td>Total Sample</td>
<td>4.4% (18)</td>
<td>15.2% (62)</td>
<td>49.6% (203)</td>
<td>16.6% (68)</td>
<td>14.2% (58)</td>
</tr>
<tr>
<td>UK Male</td>
<td>6.8% (3)</td>
<td>13.6% (6)</td>
<td>29.5% (13)</td>
<td>11.4% (5)</td>
<td>38.6% (17)</td>
</tr>
<tr>
<td>UK Female</td>
<td>1.8% (1)</td>
<td>12.5% (7)</td>
<td>37.5% (21)</td>
<td>16.1% (9)</td>
<td>32.1% (18)</td>
</tr>
<tr>
<td>Taiwan Male</td>
<td>2.5% (4)</td>
<td>11.1% (18)</td>
<td>51.9% (84)</td>
<td>22.2% (36)</td>
<td>12.3% (20)</td>
</tr>
<tr>
<td>Taiwan Female</td>
<td>6.8% (10)</td>
<td>21.1% (31)</td>
<td>57.8% (85)</td>
<td>12.2% (18)</td>
<td>2.0% (3)</td>
</tr>
</tbody>
</table>

Figure 3.2. Preferred activities for university students (percentage)
3.4.4. The correlations between survey variables and actual physical activity

A preliminary correlation test had conducted to have a better understanding of the variables which were linking to actual physical activity level at different participation categories (See Table 3.2.). The results showed that only intention and friend support were two most consistent linking variables to all categories. Most of the intrapersonal and interpersonal variables had linked to physical activity levels in different categories but environmental variables seemed weak with the connections to physical activity levels. Only convenient facility was significantly correlated to Taiwanese female students' physical activity levels.

3.4.5. Multiple Regressions

Since there was an interaction of gender by nation, the multiple regression analyses of physical activity determinants linked to actual physical activity levels were conducted by four different category groups. The correlations of physical determinants and actual physical activity by different groups have diverse results (see Table 3.3.). Only intention and friend support have consistent positive correlations with actual physical activity. Multiple regression analysis (see Table 3.3.) of British males revealed that the strongest determinant of actual physical activity was intention (β=0.42, t=2.58, p<.05); and of British females was the barrier of time (β=0.28, t=2.43, p<.05), barrier of effort (β=-0.32, t=-2.43, p<.05), self-efficacy (β=0.39, t=2.76, p<.01), friend support (β=0.36, t=3.03, P<.05), and neighbourhood environment (β=-0.36, t=-2.99, P<.01).

Multiple regression analysis for Taiwanese males revealed that the strongest determinants of actual physical activity were friend support (β=0.27, t=3.33, p<.01), body expectation (β=-0.20, t=-2.15, p<.05) and intention (β=0.15, t=1.99, P<.05); and of Taiwanese females only intention was significant (β=0.26, t=2.87, p<.01).

Intention became the strongest and most consistent variable in the multiple
Table 3.2. The relations between correlates and actual physical activity

<table>
<thead>
<tr>
<th>Determinants</th>
<th>Total (UK)</th>
<th>Male (UK)</th>
<th>Female (UK)</th>
<th>Male (Taiwan)</th>
<th>Female (Taiwan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SELF-EFFICACY</td>
<td>.352**</td>
<td>.503**</td>
<td>.406**</td>
<td>.116</td>
<td>.177*</td>
</tr>
<tr>
<td>INTENTION</td>
<td>.419**</td>
<td>.471**</td>
<td>.388**</td>
<td>.301**</td>
<td>.374**</td>
</tr>
<tr>
<td>ENJOYMENT</td>
<td>.209**</td>
<td>.283</td>
<td>.269*</td>
<td>.273**</td>
<td>.052</td>
</tr>
<tr>
<td>BARRIER OF TIME</td>
<td>.041</td>
<td>-.374**</td>
<td>.358**</td>
<td>.005</td>
<td>-.007</td>
</tr>
<tr>
<td>BARRIER OF EFFORT</td>
<td>.040</td>
<td>-.106</td>
<td>-.266*</td>
<td>.271**</td>
<td>.118</td>
</tr>
<tr>
<td>BARRIER OF OBSTACLES</td>
<td>-.247**</td>
<td>-.039</td>
<td>-.028</td>
<td>.000</td>
<td>-.025</td>
</tr>
<tr>
<td>PSYCHOLOGIC EXPECTATION</td>
<td>.172**</td>
<td>.072</td>
<td>.238</td>
<td>-.263**</td>
<td>-.270**</td>
</tr>
<tr>
<td>BODY IMAGE EXPECTATION</td>
<td>.152**</td>
<td>-.138</td>
<td>.210</td>
<td>-.145</td>
<td>-.194**</td>
</tr>
<tr>
<td>HEALTH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXPECTATION</td>
<td>.298**</td>
<td>.053</td>
<td>.205</td>
<td>-.093</td>
<td>-.161</td>
</tr>
<tr>
<td>FAMILY SUPPORT</td>
<td>.077</td>
<td>.129</td>
<td>.355**</td>
<td>.164*</td>
<td>.099</td>
</tr>
<tr>
<td>FRIEND SUPPORT</td>
<td>.385**</td>
<td>.452**</td>
<td>.437**</td>
<td>.409**</td>
<td>.193*</td>
</tr>
<tr>
<td>HOME ENVIRONMENT</td>
<td>-.050</td>
<td>.134</td>
<td>.175</td>
<td>.050</td>
<td>-.014</td>
</tr>
<tr>
<td>NEIGHBOURHOOD ENVIRONMENT</td>
<td>.109*</td>
<td>.109</td>
<td>-.136</td>
<td>-.127</td>
<td>.156</td>
</tr>
<tr>
<td>CONVENIENT FACILITY</td>
<td>.042</td>
<td>.040</td>
<td>.103</td>
<td>-.113</td>
<td>.232**</td>
</tr>
</tbody>
</table>

**p<.01 *p<.05

Table 3.3. Multiple Regressions for Different Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>R</th>
<th>R²</th>
<th>F</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male (UK)</td>
<td>0.72</td>
<td>0.52</td>
<td>2.14</td>
<td>0.043</td>
</tr>
<tr>
<td>Female (UK)</td>
<td>0.81</td>
<td>0.65</td>
<td>4.73</td>
<td>0.000</td>
</tr>
<tr>
<td>Male (Taiwan)</td>
<td>0.54</td>
<td>0.29</td>
<td>4.22</td>
<td>0.000</td>
</tr>
<tr>
<td>Female (Taiwan)</td>
<td>0.48</td>
<td>0.23</td>
<td>2.75</td>
<td>0.001</td>
</tr>
</tbody>
</table>
regressions that linked to actual physical activity levels in three groups, although not British females.

3.4.6. Two-way MANOVA

A two-way MANOVA testing of physical activity determinants showed the significant effect for gender (Wilks', $F(1,379)=3.72$, $P<.01$), nation (Wilks', $F(1,379)=190.45$, $P<.01$) and a gender by nation interaction (Wilks', $F(1,379)=4.90$, $P<.01$). The groups' means and standard deviations are shown in Table 3.4.

A one-way MANOVA with four procedures of selecting cases by gender and nation tested the simple main effect of the interaction.

The UK sample (Wilks', $F(1,78)=2.14$, $P<.05$), males scored higher self-efficacy and physical activity level than females and females had higher body image expectation and health expectation than males.

The Taiwan sample (Wilks', $F(1,288)=6.56$, $P<.01$), males scored higher body image expectation, health expectation, barrier of effort, self-efficacy, friend support, and physical activity level than females. Females scored higher barrier of obstacles than males.

In the male sample (Wilks', $F(1,185)=58.51$, $P<.01$), British males scored higher for psychology expectation, body image expectation, health expectation, self-efficacy, neighbourhood environment, intention and physical activity level, and lower barrier of effort, barrier of obstacles and home environment than Taiwanese males.

In the female sample (Wilks', $F(1,180)=192.43$, $P<.01$), British females scored higher psychology expectation, body image expectation, health expectation, barrier of time, self-efficacy, friend support, neighbourhood environment, intention and physical activity level, and lower barrier of obstacles, family support, home environment than Taiwanese female students.

Post-hoc univariate Scheffe tests showed a significant multivariate main effect of
Table 3.4. Determinants and physical activity level of gender with nation

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>British</th>
<th></th>
<th>Taiwanese</th>
<th></th>
<th>Total</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>PHYSICAL ACTIVITY (Kcal/week, estimated by SAPAC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4422</td>
<td>3847</td>
<td>2227</td>
<td>2214</td>
<td>2705</td>
<td>2796</td>
</tr>
<tr>
<td>Female</td>
<td>2860</td>
<td>2020</td>
<td>1100</td>
<td>1056</td>
<td>1549</td>
<td>1563</td>
</tr>
<tr>
<td>Total</td>
<td>3591</td>
<td>3099</td>
<td>1686</td>
<td>1842</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SELF-EFFICACY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>32.98</td>
<td>9.49</td>
<td>26.57</td>
<td>8.01</td>
<td>27.94</td>
<td>8.73</td>
</tr>
<tr>
<td>Female</td>
<td>27.34</td>
<td>9.13</td>
<td>22.88</td>
<td>8.11</td>
<td>24.02</td>
<td>8.58</td>
</tr>
<tr>
<td>Total</td>
<td>29.95</td>
<td>9.67</td>
<td>24.80</td>
<td>8.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INTENTION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>16.84</td>
<td>4.99</td>
<td>14.16</td>
<td>4.24</td>
<td>14.73</td>
<td>4.53</td>
</tr>
<tr>
<td>Female</td>
<td>16.62</td>
<td>4.13</td>
<td>13.17</td>
<td>3.85</td>
<td>14.05</td>
<td>4.19</td>
</tr>
<tr>
<td>Total</td>
<td>16.72</td>
<td>4.52</td>
<td>13.68</td>
<td>4.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENJOYMENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>24.21</td>
<td>4.71</td>
<td>23.46</td>
<td>6.78</td>
<td>23.62</td>
<td>6.39</td>
</tr>
<tr>
<td>Female</td>
<td>22.48</td>
<td>5.05</td>
<td>22.78</td>
<td>6.00</td>
<td>22.70</td>
<td>5.76</td>
</tr>
<tr>
<td>Total</td>
<td>23.27</td>
<td>4.95</td>
<td>23.13</td>
<td>6.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BARRIER OF TIME</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>12.17</td>
<td>3.43</td>
<td>11.04</td>
<td>3.36</td>
<td>11.29</td>
<td>3.40</td>
</tr>
<tr>
<td>Female</td>
<td>13.04</td>
<td>3.23</td>
<td>10.62</td>
<td>3.52</td>
<td>11.23</td>
<td>3.60</td>
</tr>
<tr>
<td>Total</td>
<td>12.65</td>
<td>3.33</td>
<td>10.83</td>
<td>3.44</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BARRIER OF EFFORT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>14.56</td>
<td>4.62</td>
<td>17.52</td>
<td>4.25</td>
<td>16.89</td>
<td>4.49</td>
</tr>
<tr>
<td>Female</td>
<td>16.32</td>
<td>4.15</td>
<td>16.13</td>
<td>4.98</td>
<td>16.18</td>
<td>4.77</td>
</tr>
<tr>
<td>Total</td>
<td>15.51</td>
<td>4.44</td>
<td>16.85</td>
<td>4.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BARRIER OF OBSTACLES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7.00</td>
<td>2.85</td>
<td>12.92</td>
<td>3.35</td>
<td>11.65</td>
<td>4.05</td>
</tr>
<tr>
<td>Female</td>
<td>7.82</td>
<td>2.38</td>
<td>13.65</td>
<td>3.06</td>
<td>12.16</td>
<td>3.86</td>
</tr>
<tr>
<td>Total</td>
<td>7.44</td>
<td>2.63</td>
<td>13.26</td>
<td>3.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSYCHOLOGIC EXPECTATION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>17.41</td>
<td>3.53</td>
<td>8.79</td>
<td>3.28</td>
<td>10.62</td>
<td>4.85</td>
</tr>
<tr>
<td>Female</td>
<td>18.24</td>
<td>3.59</td>
<td>9.30</td>
<td>2.98</td>
<td>11.58</td>
<td>5.01</td>
</tr>
<tr>
<td>Total</td>
<td>17.83</td>
<td>3.58</td>
<td>9.04</td>
<td>3.15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3.4. *Determinants and physical activity level of gender with nation (continue)*

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>British Mean</th>
<th>British SD</th>
<th>Taiwanese Mean</th>
<th>Taiwanese SD</th>
<th>Total Mean</th>
<th>Total SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BODY IMAGE EXPECTATION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>14.11</td>
<td>6.30</td>
<td>8.63</td>
<td>3.06</td>
<td>9.80</td>
<td>4.56</td>
</tr>
<tr>
<td>Female</td>
<td>16.20</td>
<td>2.76</td>
<td>7.29</td>
<td>2.51</td>
<td>9.56</td>
<td>4.67</td>
</tr>
<tr>
<td>Total</td>
<td>15.23</td>
<td>4.82</td>
<td>7.98</td>
<td>2.89</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HEALTH EXPECTATION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>12.51</td>
<td>2.11</td>
<td>4.58</td>
<td>1.79</td>
<td>6.27</td>
<td>3.75</td>
</tr>
<tr>
<td>Female</td>
<td>13.56</td>
<td>1.36</td>
<td>3.90</td>
<td>1.12</td>
<td>6.37</td>
<td>4.38</td>
</tr>
<tr>
<td>Total</td>
<td>13.07</td>
<td>1.81</td>
<td>4.26</td>
<td>1.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FAMILY SUPPORT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>17.23</td>
<td>7.35</td>
<td>18.23</td>
<td>7.17</td>
<td>18.01</td>
<td>7.20</td>
</tr>
<tr>
<td>Female</td>
<td>15.12</td>
<td>6.44</td>
<td>19.26</td>
<td>7.41</td>
<td>18.21</td>
<td>7.37</td>
</tr>
<tr>
<td>Total</td>
<td>16.10</td>
<td>6.92</td>
<td>18.72</td>
<td>7.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FRIEND SUPPORT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>24.79</td>
<td>10.28</td>
<td>24.60</td>
<td>8.44</td>
<td>24.64</td>
<td>8.84</td>
</tr>
<tr>
<td>Female</td>
<td>25.30</td>
<td>8.58</td>
<td>21.37</td>
<td>7.71</td>
<td>22.38</td>
<td>8.10</td>
</tr>
<tr>
<td>Total</td>
<td>25.04</td>
<td>9.36</td>
<td>23.05</td>
<td>8.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HOME ENVIRONMENT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2.95</td>
<td>1.68</td>
<td>4.83</td>
<td>2.45</td>
<td>4.43</td>
<td>2.43</td>
</tr>
<tr>
<td>Female</td>
<td>3.08</td>
<td>2.35</td>
<td>4.66</td>
<td>2.51</td>
<td>4.26</td>
<td>2.56</td>
</tr>
<tr>
<td>Total</td>
<td>3.02</td>
<td>2.06</td>
<td>4.75</td>
<td>2.48</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NEIGHBOURHOOD ENVIRONMENT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>10.44</td>
<td>1.61</td>
<td>9.24</td>
<td>1.65</td>
<td>9.50</td>
<td>1.71</td>
</tr>
<tr>
<td>Female</td>
<td>10.34</td>
<td>1.85</td>
<td>8.90</td>
<td>1.89</td>
<td>9.27</td>
<td>1.98</td>
</tr>
<tr>
<td>Total</td>
<td>10.39</td>
<td>1.73</td>
<td>9.07</td>
<td>1.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CONVENIENT FACILITY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>8.70</td>
<td>4.78</td>
<td>8.40</td>
<td>3.55</td>
<td>8.46</td>
<td>3.84</td>
</tr>
<tr>
<td>Female</td>
<td>8.30</td>
<td>4.70</td>
<td>8.04</td>
<td>3.51</td>
<td>8.12</td>
<td>3.84</td>
</tr>
<tr>
<td>Total</td>
<td>8.48</td>
<td>4.71</td>
<td>8.22</td>
<td>3.53</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

gender could be attributed to self-efficacy and physical activity with males scoring higher than females and the barrier of obstacles with females scoring higher then males.
Furthermore, the nation multivariate main effect could be attributed to most of the determinants except enjoyment and convenient facilities. The Taiwanese sample reported a higher barrier of effort, barrier of obstacles, family support, and home environment than the British sample. British students reported higher psychology expectation, body image expectation, health expectation, barrier of time, self-efficacy, intention, friend support, neighbourhood environment, and physical activity levels than the Taiwanese students.

3.4.7 Path Analysis

The first step of path analysis used multiple regressions with all the determinants to predict physical activity level. Another multiple regression analysis with all determinant variables predicted intention in order to exam the influential paths of physical activity based on the theory of planned behaviour. Analyses were divided into four categories by nations and gender. The prediction of determinants of intention was not significant only for British female students. (See Figures 3.3-3.6 for all analyses).

3.4.8 One-way MANOVA

A one-way MANOVA tested the differences in intrapersonal variables and social support between different stages of change. The result revealed the significant effect of stages (Wilks’, $F_{(4,1436)}=6.887$, $P<.01$). The means of variables within different stages are shown in Table 3.5.

The results revealed that those in the maintenance stage have more expectation, lower barrier of obstacle, more family support, and more enjoyment than other stages.
Figure 3.3. Path analyses for British male students

64
Figure 3.4. Path analyses for British female students
Figure 3.5. Path analyses for Taiwanese male students
Figure 3.6. Path analyses for Taiwanese female students.
Table 3.5. Differences between stages of change

<table>
<thead>
<tr>
<th>Stages</th>
<th>Precontemplation (PC)</th>
<th>Contemplation (CO)</th>
<th>Preparation (PR)</th>
<th>Action (AC)</th>
<th>Maintenance (MA)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EXPECTATION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychologic</td>
<td>12.65</td>
<td>11.98</td>
<td>10.08</td>
<td>10.32</td>
<td>14.18</td>
</tr>
<tr>
<td>Body Image</td>
<td>9.09</td>
<td>10.03</td>
<td>8.95</td>
<td>10.14</td>
<td>11.01</td>
</tr>
<tr>
<td>Health</td>
<td>6.18</td>
<td>6.03</td>
<td>5.62</td>
<td>6.19</td>
<td>9.36</td>
</tr>
<tr>
<td><strong>BARRIER</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>10.65</td>
<td>11.21</td>
<td>11.37</td>
<td>11.33</td>
<td>11.05</td>
</tr>
<tr>
<td>Effort</td>
<td>12.88</td>
<td>14.77</td>
<td>16.67</td>
<td>18.92</td>
<td>16.42</td>
</tr>
<tr>
<td>Obstacles</td>
<td>12.41</td>
<td>12.03</td>
<td>12.48</td>
<td>12.08</td>
<td>9.38</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>17.29</td>
<td>21.13</td>
<td>25.41</td>
<td>28.47</td>
<td>33.30</td>
</tr>
<tr>
<td>Family Support</td>
<td>12.94</td>
<td>15.74</td>
<td>18.65</td>
<td>19.10</td>
<td>19.21</td>
</tr>
<tr>
<td>Friend Support</td>
<td>14.09</td>
<td>18.69</td>
<td>23.24</td>
<td>28.41</td>
<td>27.16</td>
</tr>
<tr>
<td>Enjoyment</td>
<td>20.00</td>
<td>20.16</td>
<td>23.46</td>
<td>24.77</td>
<td>24.54</td>
</tr>
<tr>
<td>Intention</td>
<td>9.24</td>
<td>11.30</td>
<td>14.12</td>
<td>16.51</td>
<td>17.94</td>
</tr>
</tbody>
</table>

The variables of self-efficacy, friend support and intention adapted to the stage of changes which reinforced their significance from sedentary to active. The change of variables seems more applicable with the transtheoretical model. The tendency of changes is shown as Figure 3.7.
3.5 Discussion

The survey found that UK students were more active than Taiwanese students. Nearly 50% of UK students, including female participants, were categorized into action and maintenance stages. However, there is still a lot of potential for UK students at the preparation stage to move forward to an active lifestyle. Most of the Taiwanese students were distributed at the preparation stage for both male and female students. It means the immediate need of Taiwanese students is for assistance in the promotion of their physical activity levels. Policy or education should empower and strengthen students' intrapersonal, interpersonal, and environmental supports for establishing their healthy and active lifestyle.

The descriptive statistics revealed that most of the male students prefer team sports, whereas most female students prefer aerobic activities and swimming. Bourdeaudhuij
and Sallis (2002) found that competition was a significant perceived benefit only for young men and health was the most significant perceived benefit for young women participating in physical activity. Markland and Hardy (1993), in a study with 18-25 years old adults, also found that males reported more competition and social recognition motivation, and females reported more weight management motivation to attend exercise. Since team sports contain more elements of competition and aerobic and swimming aim to improve health, this maybe why male participants prefer team sports and female participants prefer aerobic and swimming in this study. The intervention for encouraging university students to participate in different types of physical activity should consider the gender preferences such as team sports for males and aerobic and swimming for females. Since competition and health are structured by different elements, education such as physical education in the university setting in Taiwan may provide an important opportunity for intervention to test the effects of skill-related teaching (which focus on the skill and competition element) and health related teaching (which focus on the health issues) to promote university students' physical activity levels.

The correlates of university students' participation in physical activity

Most variables were correlated to physical activity levels when all the participants were taken into consideration. Intention and friend support were the most consistently correlated variables to physical activity levels across groups.

The debatable issues are that British females who had higher barrier of time also had higher physical activity levels; Taiwanese males who had higher barrier of effort and lower expectation of psychological benefit also had higher physical activity levels; and Taiwanese females who had higher expectations of psychological benefit and body image have negative correlation to their physical activity levels. All these results were counter-intuitive. An alternative explanation for the unexpected results is that students
who do not involve themselves in enough physical activity set lower levels of physical activity expectations, therefore they experience lower perceived barriers to reach these levels and finally it is easier for them to reach these levels. On the other hand, students who maintained higher physical activity levels might have been used to the perceived benefit of physical activity but it is more difficult for them to maintain the higher physical activity levels due to the difficulties resulting from perceived higher barriers.

By using standard multiple regression analysis, all predictors (determinants) were entered into the analysis to ascertain the total shared variance between the dependent variable and all independent variables. The multiple regression result for British males revealed that all the predictors could explain 52% of the variation but only intention is a significant predictor and associated with physical activity level. In this case, other determinants that might predict may have been decreased by the overlapped variance.

Multiple regressions with the British female sample revealed all the predictors could explain 65% of the variation. Barrier of time, barrier of effort, self-efficacy, friend's support and neighbourhood environment were all significant predictors of physical activity levels. Leslie et al. (1999) found that social support from family and friends has become the vital determinant for university students who participated in physical activity; but the result that family support was a stronger factor for females was partly identical with the results of the present study. Likewise, multiple regressions with the Taiwanese sample revealed lower predictive power of the determinants in association with physical activity. All the determinants in the Taiwanese male sample explained only 29% of the variation and 23% in the Taiwanese female sample. The significant predictors were friend support, body expectation and intention for the male sample; and intention was the only significant predictor for the female sample.

In this study, variables were recruited following the ecological model structure and the significance in adult studies (Sallis & Owen, 1998; Trost, 2002). Due to the fact that
most of the significant variables were collected from studies conducted in American and European countries and considering the racial differences (Douglas et al., 1997; Chen, 1998; Hall, Kuga & Jones, 2002); predictive variables might not be so applicable to Asian or Taiwanese participants. Some variables such as attitude, perceived competence, physical activity history, and commitment were also found to be significantly correlated in the university population (Sonstroem & Walker, 1973; Hendry, 1975; Wallace et al., 2000; Deeter, 1988). Future studies need to find out more influential determinants for Taiwanese samples.

**Gender and nation differences**

The results of MANOVA revealed that males have higher self-efficacy and physical activity levels than females, and females have higher barrier to engaging in physical activity. These results partly conform to previous studies where self-efficacy was strongly associated with higher levels of physical activity for university students (Roviak et al., 2002) and a greater proportion of female students were classified at lower physical activity stages, such as precontemplation, contemplation, preparation and action when compared to male students (Wallace et al., 2000).

Most of the determinants and physical activity levels were different between the British and Taiwanese samples, except enjoyment and convenient facility. Even though Taiwanese students perceived higher family support, home environment and lower barrier of time, most of the variables seemed to support that British students maintain higher physical activity levels. The results are similar to previous studies with adolescents where Asian boys and girls were found to spend less time in physical activity compared to other populations (McGuire et al., 2002; Kathryn et al., 2002).

According to the systematic review results, different measurement designs had been applied to university students' physical activity estimation. Seven days recall design were more identified in the previous studies. The SAPAC design basically
estimated the physical activity levels through the sum of the all kind of physical activities that has been listed in the questionnaire in order to have a more precise estimation. However, the questionnaire assessing physical activity contained some activities that might be less applicable to Taiwanese students such as cricket, gymnastics, hockey, netball, rugby, and water sports. All these activities produced a higher energy expenditure score for the British sample. Most of the Taiwanese participants might just follow the questions without specifying their real activities, although the questionnaire allowed participants to specify their different physical activities that were not listed in the questionnaire. Finding out more details of Taiwanese students’ activities type is essential for assessing their real physical activity level.

Based on the interaction between gender and nation, the study might be more concerned about the simple main effect of MANOVA. After dividing all participants into four groups: British male, British female, Taiwanese male and Taiwanese female, study found that:

In this study, physical activity levels both emerging higher levels in UK and Taiwan male groups when comparing the differences between genders was expected due to the fact that they also possessed better self-efficacy. Especially, for Taiwanese males, higher outcome expectation of body image and health, friend support with lower barrier of obstacles might all facilitate their physical activity behaviours without too much effort to overcome their barriers. The results were corresponded to previous studies that self-efficacy has been found to exhibit the strongest determinant of physical activity in many studies throughout all ages (Trost et al., 1997; Winters, Petosa & Charlton, 2003; Wallace et al., 2000; Leslie et al., 1999; Rovniak et al., 2002; Sallis, Hovell, Hofstetter, & Barrington, 1992; Troped et al., 2003; McAuley et al., 2003).

Studies also found that students who expected to be healthy, more health believe, and with more outcome expectation from physical activity were more likely active in
their life (Haynes & McNamara, 1989; Dishman, Darracott & Lambert, 1992; Calfas et al., 1994; Shifflet, Cator & Megginson, 1994; Hall, Kuga & Jones, 2002). Although, British female students' health and body expectation is higher than male students', the power of effectiveness might be reduced or not as strong as self-efficacy. So, self-efficacy has become the vital issue in gender difference not only in the UK but also in Taiwan. Promoting self-efficacy for females may play an important role for female students to attend more physical activities.

Considering the nations, both UK male and female students have higher physical activity levels than Taiwan male and female students along with better self-efficacy, more psychology expectation and body image expectation, neighbourhood environment, and intention to be involved in physical activities. This result corresponded with previous studies that found that Chinese and Asian people normally had lower physical activity levels or were in the nonexercise stages (Chen, 1998; Hall, Kuga & Jones, 2002; Suminski & Petosa, 2002). For Taiwanese students, enhancing their self-efficacy, having better knowledge about the benefit of physical activities, having a safer environment and encouraging more intention may all be applicable for promoting their physical activity levels.

Studies could not prove all the positive variables to be found in people who had higher physical activity levels and all negative variables to be found in people who had lower physical activity levels. The point is which variable may most influence their physical activity. The only variable that did not appear in the MANOVA differences between nation and gender in this study is enjoyment of physical activities. That may have resulted from the same background of education and experience of physical activity for university students. Leslie et al. (1999) found that insufficiently active university females reported lower enjoyment of physical activity than the active university females, concluding that enjoyment is important for university students in
order to adopt physical activity, especially for females. The study assumed that enjoyment would have an effect on physical activity at the adoption stage when people started and tried to engage in physical activity. Furthermore, enjoyment may be more strongly related to maintenance of physical activity (Motl et al., 2001).

The MANOVA differences between nations and gender were found most in intrapersonal variables and interpersonal variables but not environmental variables by gender. Since most of the university students, both British and Taiwanese, normally live on campus or near campus, the environment provided by the university (e.g., sport facilities) is similar for both samples, thus diminishing differences in the perceived environment.

The path of effects to physical activity (the preliminary test of Theory of Planned behaviour)

In this study, intention became the best predictor of physical activity levels except for British females. Unexpectedly, only expectation of body image, barrier of effort and friend support affected physical activity through intention for the Taiwanese female sample. The most important variable, self-efficacy, only appeared in the path analysis for the British female sample and affected physical activity directly. Although intention, in this study, significantly correlated to physical activity, its explanation of the variation is quite low (R=0.15-0.42). Leslie et al. (2003) mentioned that young adults do not think as clearly about intention to engage in moderate-intensity activity as they do for vigorous activity. Especially, males tend to do more traditional exercise; hence they believe physical activity must be defined as more vigorous physical activity and exercise but not as moderate activity such as walking. This may be the reason why intention cannot successfully predict all participants’ physical activity.

Differences between stages of change

The results of the study verified the assumptions of the transtheoretical model that
the status of the different determinants changed by different stages, and not only self-efficacy (Nigg & Courneya, 1998; Prochaska & Marcus, 1994), but also friend support and intention. Marcus et al. (1992) also found precontemplators scored the lowest and those in Maintenance scored the highest on the self-efficacy measure. Applying the behaviour change strategies (process of changes) of the transtheoretical model may be useful for developing effective intervention to promoting lower stages university students physical activity level to higher stages.

Considering all the results, this study tried to find out the constructions of university students' physical activity behaviours that might correlate to the possible determinants by ecological approaches. Applying the ecological model to physical activity behaviours, the study must focus on the interrelations between physical environment and behaviour. Obviously, students' daily routine takes place on campus and so does most of their physical activity. Sallis et al. (1997) suggested that participants from one geographic area might result in lower variation in the way they attempt to explain the environmental effects; also, sample size does not permit the exploration of subgroup differences in associations between physical activity and environment scales.

Sufficient differences of environmental variables were only found between nations. Hence, this research focused on different nations but the same environments, differences were eliminated, and intrapersonal and interpersonal variables became the main predictors of physical activity levels. For instance, British males scored higher levels of physical activity and self-efficacy than British females at the same time. Taiwanese males who scored higher physical activity levels than Taiwanese females revealed higher body image expectations, health expectations and, self-efficacy as well.

Environmental differences only could be found by genders. Considering the effects of environment to physical activity, neighbourhood environment seems to have a
stronger link to university students than home environment in the simple main effect results. By the multiple analysis result, relationships between physical activity and environmental variables did not support the ecological model as well as this study expected. Similar results that were also found in specific studies showed that the physical environment appeared to have only a weak direct influence on physical activity behaviour (Giles-Corti & Donovan, 2002). Hofstetter, Hovell and Sallis (1990) also found that perceived environments could not predict self-efficacy, the strongest predictor of physical activity. Meanwhile, awareness of facilities available on campus was not significantly associated with insufficient student activity (Leslie et al., 1999).

Furthermore, Troped et al. (2003) found recreational physical activity only correlated to sidewalk and traffic for community adults but not other environmental variables such as perceived safety, street light, and enjoyable scenery and so on. After adjusting for demographic, individual and interpersonal factors, all environmental variables were not related to recreational physical activity. In this study, physical activity measures included various types of activity that would not likely be influenced by the variables that this study focused on. For instance, when students were interested and attended only one to two activities such as team sports, the main influence may be from the facilities and companies. It is likely that different types of environmental variables influenced different types of physical activity.

The design of too many variables in one environmental scale (category) probably decreased the predictive power of the vital variables; also, unspecific physical activity might not elicit the influences of environment variables. For example, safety might be applicable only to outdoor activities but not all types of physical activities (Humpel, Owen, & Leslie, 2002). That may be the reason why the initial design of the perceived environment variables only correlated to vigorous exercise (Sallies et al., 1997). Humpel, Owen, and Leslie (2002) emphasized that combining several physical
environment items into an “overall” measure and comparing the total score to physical activity were inherent difficulties for the past study. Hence, identification and separation of the environmental items are suggested for future studies.

Individual behaviour patterns may be determined more by perception of environment than environment itself (Spence & Lee, 2003). It might also imply the equal importance of perceiving a positive or negative environment to a person’s physical activity behaviours. But, correlations have sometime been stronger with objectively assessed environmental variables than with self-perception because environment may have a direct effect on behaviour that is not mediated by perceptions (perceived environment) (Sallis & Owen, 1996). Furthermore, this study found that there was no association between perceived environments and objective environments, and it was suggested that investigation of environmental variables should use objective measures whenever possible (Sallis, Bauman, & Pratt, 1998).

Normally, the barriers of physical activity were expected to be negatively correlating to activity level. Concerning the environmental factors, some people who perceived barriers of time or few convenient facilities may also do exercise at home like jumping rope, push-ups, sit-ups, or other home activities. It also can maintain their physical activity to a considerable level. For instance, the Taiwanese sample revealed higher perceived home environment than the British sample. It may imply that Taiwanese students prefer to or tend to have physical activity at home environment more frequently and their physical activity level may also be higher than the students who used to do exercise occasionally in specific facilities. British samples perceived a better neighbourhood environment than Taiwanese students. That may imply that British students were used to engage in physical activity out of home.

Although this cross-sectional study intended to survey and compare different cultures, the following limitations may be the possible shortcomings of this study:
a. Due to the small numbers of participants in the UK university, the results of UK students may not be representative. Hence, the generalization may be limited for UK students.

b. This study was only conducted in two universities which are well known for having good sport facilities and environments.

3.6 Conclusions

This descriptive survey found a preference discrepancy between nations and gender. The survey also found that nearly 50% of British students were at the active categories (action and maintenance stages). However, only 34% and 14% Taiwanese male and female students were active. Within this research study, four hypotheses were tested to see the differences, correlation and application of theory and model of survey variables to UK and Taiwanese university student population. Most of the null hypotheses were rejected. The study found that there were differences of physical activity levels and some survey variables between nations and gender. Correlations were found between survey variables and university student's physical activity levels through the multiple regression analyses for different survey groups. The uptrend of self-efficacy, friend support and intention among different physical activity stages revealed that Transtheoretical Model was partly supported.

University students maintaining regular physical activity behaviour not only benefit with mental and physical health but also correlate to other health behaviours (Johnson et al., 1998). Promoting university students' physical activity aims not only to improve quality of life but also to altering the behaviour towards a healthy life-style in general. Identifying determinants in specific populations will enable more personalized intervention (Buckworth & Dishman, 2002). This study tried to identify the possible
main determinants of university students' physical activity through the context of the ecological approach.

As a whole, Taiwanese university students revealed lower physical activity levels than British university students. Female students also had lower physical activity levels than males. Promoting physical activity levels on specific populations, especially Taiwanese students, should be the focus for further study. The explanation of the variation in physical activity for the British sample was more than 52% by the predictive variables in this study but less than 29% for the Taiwanese sample. Seeking out effective determinants for Taiwanese students is essential for future research. Environmental factors have recently attracted more attention in physical activity studies. The newly reported studies tend to take a broader "ecological" approach focusing more on environmental factors (Trost et al., 2002). In this study, the correlation between perceived environment variables to physical activity was weak. Many reasons may have caused these unexpected results, such as the design of the questionnaire itself, the definitions of physical activity for university students, the types of activities they participated in, and the places that physical activities frequently took place. Furthermore, an objective measure of environment variables is needed to be incorporated along with the perceived measure in future studies.

Hence, the following suggestions are proposed:

a. There is still a lot of potential for promoting university student's active life style due to most of the students did not execute their thought to participant regular physical activities. Intervention designs such as physical education to test the efficacy of competition emphasis and health emphasis courses for university students is needed to fulfill their different needs to facilitate and execute their thought.

b. Variables that tried to explain the variance in physical activity in this study revealed considerable differences between nations and gender. A comparatively small amount
of variance was explained by the determinants in the present study for both Taiwanese males and females. Further study should use more qualitative methodology such as interviews, which are necessary for finding out the potential determinants that may mainly influence university students' physical activity behaviour.

c. Identifying the types, preferences and places that physical activity take place and finding out the influential variables will be a more precise way to predict participants' physical activity levels.

c. Future research needs to examine and amplify the differences of environmental variables, such as students who are living at home, renting a house off campus and living on campus; then examine the differences of environmental effects on physical activity.
Chapter 4  A Qualitative Study of University Students' Physical Activity Participation in Taiwan using an Ecological Model Approach

4.1 Introduction

An adequate level of daily physical activity has been suggested for people to possess a healthy lifestyle and to gain the benefits of mental health in adults (ACSM, 1990; Biddle, Fox & Boutcher, 2000). Also, the majority of studies have shown that active life styles or physical activity are associated with positive health benefits and that this will become a key issue for public health. Young adulthood may be the time where the opportunity is more significant to adopt regular exercise and to promote physical activity (Rovniak et al., 2002).

University students can have easy and convenient access to exercise facilities or environments on campus compared to other populations. The campus environment also provides accessible, convenient, and safe facilities, as well as opportunities to encourage university students to be active. However, research has shown that awareness of campus facilities was not significantly different between sufficiently and insufficiently active students in college and only 46% of adults aged 18-25 years continue an active lifestyle beyond secondary school (Leslie et al., 1999; U.S. DHHS, 1990).

Moreover, a low proportion of university students meet recommended levels of physical activity for health benefits (Wallace et al., 2000; Leslie et al., 1999). Studies have also revealed that female and Asian people's physical activity are normally lower than males and other races at adolescence, as well as for university students and older adults (McGuire et al., 2002; Kathryn et al., 2002; Hall et al., 2002; Booth et al., 2000).

4.1.1 Correlates of Adults' Physical Activity

Adults' participation in physical activity is influenced by a diverse range of
personal, social, and environmental factors. It means no single variable can explain physical activity behaviour comprehensively (Sallis, Hovell, Hofstetter, & Barrington, 1992). To date, psychological variables have been found to have unequal importance in different age and gender subgroups. For example, competition was a significant variable only for young men, and health was the most significant variable for young women but did not appear in the other groups (De Bourdeaudhuij & Sallis, 2002).

Review studies found social support consistently correlated with adult's physical activity (Sallis & Owen, 1999; Trost et al., 2002). Social support has also played an important role in people's intentions to be active according to a meta-analysis by Carron, Hausenblas and Mack (1996). Nevertheless, social support might vary during different stages of life. For example, family support may be considered important in childhood and in older adulthood when compared to young adulthood. Friend support may be vital for teenagers and in young adulthood for physical activity and exercise.

Studies of environmental determinants of health behaviours are now increasing. The available evidence suggested that access to facilities, satisfaction with facilities, neighbourhood safety, access to exercise equipment at home, and frequently observing others exercise may be important factors affecting people's physical activities (Trost et al., 2002). However, it seems after adjusting for individual and social environmental factors, the physical environment still only has a relatively weak direct influence on behaviours (Giles-Corti & Donovan, 2002).

4.1.2 Applying Qualitative Methods to Physical Activity

Applying relevant theories can be an important starting point in understanding the promotion of health-related exercise and physical activity (Biddle & Nigg, 2000). Theories and models such as the theory of planned behaviour and the transtheoretical model were primarily focused on individual psychological determinants to physical
activity behaviour.

Nowadays, more research regarding environmental issues has been carried out in physical activity studies but the influence of the physical environment upon participation remains a high priority area for future research (Trost et al., 2002). Researchers have suggested that an environmental modification must be complemented by strategies that aim to influence individual and social environmental factors to support physical activity (Giles-Corti & Donovan, 2002). Although the 'ecological model' emphasizes that environmental variables are important for developing long-term effects on physical activity intervention (Sallis & Owen, 1996). It also specifies that intrapersonal, interpersonal and cultural variables could all influence behaviour (Sallis, Bauman, & Pratt, 1998). In other words, an ecological model tends to explain physical activity behaviours through multiple dimensions or multiple levels of influence with more comprehensive aspects.

However, using quantitative methodology to test theories and models that focus on individuals can usually only explain 20-40% of the variance in physical activity (Spence & Lee, 2003). Qualitative methods have been suggested for additional understanding of particular subgroups and factors that affect behaviours such as minority women and children (Masse et al., 2002; Im & Choe, 2001; Veitch et al., 2006). Qualitative methods can fulfil the information about physical activity issues at different life stages such as the university students' subgroup and population. To date, the majority of physical activity studies were conducted using a quantitative approach to examine relevant issues. Compared with quantitative methods, there are fewer published studies applying qualitative methods in physical activity research.

In order to enrich our understanding of this field, and to add to the findings from quantitative studies, qualitative research is justified. Masse et al. (2002) specified three
reasons for using qualitative methodology in physical activity research. Firstly, carefully conducted qualitative research can contribute by providing insights into factors that are mediating variables. Secondly, qualitative formative research can be used to assist in intervention designs. Thirdly, combining qualitative and quantitative data makes it possible to triangulate information from different sources and allows more insight into factors that influence physical activity.

For the time being, few qualitative methods have been applied to physical activity research, meanwhile, qualitative methods such as interviews also emerged in this domain to fill the gaps in our knowledge regarding physical activity research (Wilbur et al., 2003; Eyler et al, 2003, Cousins, 2003). Using both qualitative and quantitative research methods can strengthen physical activity research in developing theories and interventions. The potential of mutual aid between quantitative and qualitative methods allow researchers to better understand the factors that mediate behaviour, to help develop theories that can be used in research and interventions, enable better definitions of items measuring mediating variables to be developed (Masse, et al, 2002).

Therefore, the aim of this study was to develop a comprehensive understanding of university student’s physical activity behaviour by using a qualitative methodology according to an ecological framework (Sallis & Owen, 1999). Furthermore, this study not only applied relevant factors that may affect university students’ physical activity levels but also concerned the potential themes or factors that may emerge from this study.

4.2 Method

4.2.1 Data collection

The most common sources of data collections in qualitative research are interviews,
observations, and researcher-designed instruments (Thomas & Nelson, 1990). Observation is more suitable for coding of certain categories of behaviour. In order to allow the participants to describe the role of physical activity in their life, what is meaningful or important to them by using their own words rather than be restricted to predetermined categories, and allow the evaluator to probe for more details and ensure that participants are interpreting questions the way the were intended, in-depth interviews with semi-structured questions (see Appendix 4) were conducted in a quiet classroom or consulting room to explore interesting or unexpected themes or influences on physical activity which were raised by participants. Moreover, face-to-face interviews can focus on certain survey groups, such as active students and sedentary students, and allow the interviewer to have the flexibility to use their knowledge and expertise to explore interesting or unexpected ideas or themes raised by participants. Specifically, interviews attempted to identify key intrapersonal, interpersonal and physical environmental variables, based on the ecological model.

4.2.2 Participants and Sampling

By using theoretical sampling methods, a qualitative study should either focus on the level of the groups to be compared or directly focus on specific persons (Flick, 2002). For example, sampling strategies of interview with maintenance and precontemplation groups may find more details of their different characters. Also, considering genders, physical activity levels and different environments to classify different group’s characters can also be applied for doing qualitative research. The sampling strategy aims to maximize the variation between interviewing groups especially focus on the different physical activity levels (maintenance or action stage vs. contemplation or precontemplation stage) and gender (male students vs. female students).

In this study, participants were selected randomly through questionnaires assessing
physical activity levels according to stage of physical activity level including maintenance and action stage to contemplation and precontemplation. The study was conducted at one urban and one rural university in Taiwan and all participants were selected with balance of genders, those who lived on campus and off campus and different physical activity stages.

The invitation was made by letter and phone to two Taiwanese university staff members to collect data in Taiwan and to seek the appropriate participants. After using the stages of change questionnaire to classify 325 Taiwanese university students into different physical activity stage categories, 16 students were identified to participate in this study according to their demographic background and physical activity stages of research criteria and their willing to be interviewed. They were assigned into a matrix consisting of physical activity levels (active/inactive) and gender (male/female). To allow for better generalizing of results, students who lived both on and off campus as well as in urban and rural settings were also considered. Participants’ mean age was 19.87 years (SD= 1.48).

4.2.3 Procedures

Pilot-test of the interview questions with eight university students (four males and four females) who were not included in this study were conducted and discussed during a PE course to confirm that the questions were appropriate and comprehensive before conducting the main interviews. Face-to-face interviews took place in a quiet area, such as classroom or consulting room. A detailed introduction made sure all the participants understood the questions and the meaning of physical activity. Main interviews lasted on average 30 minutes or more in length and consisted of 13 semi-structured questions with follow up queries. Prompts and probes were used where necessary to encourage more detailed responses. Interviews were audio taped with the permission of participants for later data analysis.
According to the ecological model, three domains of the questions consisted of intrapersonal variables such as self-evaluation, enjoyment, intention, barrier, motive, expectation which emphasize the individual level; interpersonal variables such as social environment and social support which emphasize the social environment level; and physical environments. For every answer, additional probes and follow up questions were also proposed in order to find out the new themes of their physical activity during interviewing.

4.2.4 Data Analysis

Interviews were transcribed and analyzed by undertaking the thematic analysis method (Boyatzis, 1998). All of the interview data were transcribed verbatim in Chinese. Each participant was requested to verify their interviews by reading the transcriptions that had been transcribed by the interviewer in order to make sure that the whole interview had been correctly documented.

Since ecological models assume multiple levels of influence on behaviour, the theory codes were divided into four coding categories including intrapersonal variables, interpersonal variables, environmental variables and unclassifiable variables to classify their significance to university students' physical activity behaviours. Interview transcripts were analyzed mainly by conceptualizing meaningful phrases, sentences or short paragraphs into different category cells according to their physical activity stages and gender. When all transcriptions had been analyzed into cells, sub-categories in each cell were re-organized by different sub-categories such as the concepts of self-efficacy, enjoyment, barriers for the intrapersonal category respectively.

From the raw textual data, themes were established by a hierarchical thematic analysis procedure. The matrix design was shown as Table 4.1. The sentences with participant's identifying numbers were arranged for the analysis procedure purpose. Two researchers reviewed the transcriptions independently and double coding the data
Table 4.1. Example for matrix design and transcription classification for intrapersonal variables

<table>
<thead>
<tr>
<th>Intrapersonal issues</th>
<th>Active</th>
<th>Inactive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enjoyment</td>
<td>Enjoyment</td>
</tr>
<tr>
<td>Male</td>
<td>1. When I was doing physical activity, I feel excellent and happy (4).</td>
<td>1. I don't have time for any physical activity (7).</td>
</tr>
<tr>
<td></td>
<td>2. .....()</td>
<td>2. .....()</td>
</tr>
<tr>
<td></td>
<td>Barrier</td>
<td>Expectation</td>
</tr>
<tr>
<td></td>
<td>Expectation</td>
<td>Self-efficacy</td>
</tr>
<tr>
<td></td>
<td>Self-efficacy</td>
<td>Self-efficacy</td>
</tr>
<tr>
<td>Female</td>
<td>Enjoyment</td>
<td>Enjoyment</td>
</tr>
<tr>
<td></td>
<td>Barrier</td>
<td>Barrier</td>
</tr>
<tr>
<td></td>
<td>Expectation</td>
<td>Expectation</td>
</tr>
<tr>
<td></td>
<td>1. Exercise can give me health and maintain my proper weight (9).</td>
<td>1. I am not confident for doing exercise (2).</td>
</tr>
<tr>
<td></td>
<td>2. .....()</td>
<td>2. .....()</td>
</tr>
<tr>
<td></td>
<td>Self-efficacy</td>
<td>Self-efficacy</td>
</tr>
</tbody>
</table>

into the theme categories. Also, two researchers were allowed to discuss all transcriptions that were not similarly categorized, until the agreement had been set. The identified number for the participants were 4, 8, 10, 16 for active male students; 5, 7, 14, 15 for inactive male students; 1, 3, 9, 11 for active female students; and 2, 6, 12, 13 for inactive female students. All quotes were initially inspected and those related to
physical activity were select for subsequent analysis.

4.3 Results

In order to have a comprehensive understanding, this section will have a descriptive analysis of university students' physical activity and their preferred physical activities in the beginning. The following part applies the ecological model to construct and explain the main determinants that may affect university students' physical activity behaviours separately.

4.3.1 The Meaning of the Term "Physical Activity" to University Students

The term "physical activity" has been broadly used in health promotion policy and health studies. However, terms such as physical activity, exercise and leisure are perceived and interpreted differently by people differing in gender, class, and sociocultural factors (Tudor-Locke et al., 2003). In this study, most of the Taiwanese students considered physical activities as exercise or sports. When the interviewer asked them about their physical activity levels with the term of "physical activity" but not exercise or sport, participants still felt strange and unfamiliar with the term in the beginning. The term of "physical activity" normally appeared in the academic purpose but is not part of their everyday vocabulary. After some further interpretation and discussion, quite a few students considered if they intended to maintain their physical activity levels they needed to go to a gym or stadium to exercise or attend sports training. It was found that young adults may not think as clearly about their intention to engage in moderate-intensity activity as they do for vigorous activity, which is usually planned and structured (Leslie et al., 2003).

Physical activity has been well defined as occurring in human's daily lives. However, when researchers talk about planned or scheduled physical activity and give participants some limitations, like frequency, intensity, and time, the term physical
activity seems more relevant to exercise or sport behaviour. In other words, exercise and sports are still more acceptable to the general population and specific studies. Focus groups of African-American and American Indian women revealed that physical activity were frequently associated with structured exercise and the perception of being “in really good shape” and/or in good health. Participants might focus on physical activity as regular, intentional, and beyond the typical movement of daily life (Tudor-Locke et al., 2003).

Furthermore, based on the Theory of Reasoned Action and the Theory of Planned Behaviour, intention is correlated with exercise behaviour and strenuous physical activity (Smith & Biddle, 1999). Researchers have strongly suggested that when these two theories are applied, the behaviours must be clearly specified (Godin, 1994; Ajzen, 2002). Therefore, it might be the reasons why using quantitative methodology to test theories and models that focus on individuals can usually only explain 20-40% of the variance in physical activity (Spence & Lee, 2003).

When a study has been designed, the physical activity behaviour must be clearly defined and well understood by participants. In this study, exercise or physical exercise seems more acceptable and understandable by many university students. Even though the researchers considered they were broadly conducting physical activity studies, the definition from the participants’ point of view must be confirmed clearly in order to facilitate a better and deeper view of the behaviour. Behaviours of physical activity might be more predictable if one focuses on limited classes of behaviours (Baranowski, Anderson & Carmack, 1998).

Most participants tended to describe their physical activities in terms of exercise or sport. Active students maintain their physical activity by attending structured physical activities such as sports clubs or exercise clubs, or by their established customs such as housework. They were also confident with their physical fitness and competence, and
showed interest in their physical activity. Inactive participants could not describe in
detail or precisely what kind of physical activities they were doing. They might give
themselves an inactive stereotype to impute to the university department they attended.
For example, male students who studied mathematics and physics are supposed to be
more active than male students who study music or literature.

Meanwhile, active students considered themselves to have higher physical activity
levels than the other students. They either attended the exercise club or had their own
exercise habits that were established before they attended university. Whereas, inactive
students did not think their physical activity level was obviously lower than the other
students. They thought most of the students were at the same level of physical activity.
They also preferred some inactive recreation in their leisure time.

4.3.2 Type and Preference for University Students' Physical Activity

Participants' preference contained many kinds of exercise or so called planned or
structured physical activities, such as ball games, dance, jogging, swimming, walking or
cycling. Only one female student who lives with her family maintained her physical
activity level by doing daily housework. It means that most of the participants
responded to all questions according to their experience, which linked to their thought
to one of their main exercise or sport activities. It may be hard for them to really think
about the definition of all possibilities, "bodily movement produced by skeletal muscles
that results in energy expenditure", that have been broadly used in the studies
(Caspersen et al., 1985; Corbin et al., 2000).

Active students normally stick to the same type of physical activities that they
preferred. They maintain their physical activity behaviours mainly because they felt
competent at this exercise or sport; afterwards, the enjoyment can come up followed by
their confidence. It can be the achievement or self-confidence they had reached in their
experience which makes them stick to this exercise or sport.
"I am interested in badminton. ....This sport suits me very much but other 
sports frustrate me all the time.... I chose badminton to be my main exercise because I 
am really good at it." (1)

"Being confident about the exercise that you attend is very important. ....I liked 
basketball very much before. Since I am really too short to play basketball, I can not 
have any achievement in it. I do believe people prefer attending exercise that they have 
predominance or confidence to do it. That is why I like dance so much now."

"Those who had no confidence about their capability in sport are generally 
inactive". (9)

"I feel I am pretty capable in sport. I am specialized in every kind of ball game." (16)

Furthermore, active students put exercise in their regular schedule and thus it 
became a routine activity. Studies have revealed that young male adults perceive 
competition and social recognition as a benefit from physical activity. The main reason 
for young female adults attending physical activity was weight management and health 
(Bourdeaudhuij & Sallis, 2002; Markland & Hardy, 1993). In the present study, male 
students were active in terms of the reasons of competence, fitness, enjoyment, 
achievement, body image, health, and friendship. Female students were active in terms 
of the reasons of interest, fitness, weigh control, friendship, health and competence.

Inactive students had few preferences for physical activities. They attended 
different types of exercise. They started doing this kind of exercise because they were 
interested in or curious about this exercise in the beginning.

"I hate running and jogging because I can not have any pleasure from them." (2)

"If I need to choose one exercise, I prefer badminton because even (if?) I still can 
not have any achievement from it; at least, it is interesting to me." (7)

"I once attended a dancing club. I was curious about it in the beginning." (13)
They were more passive for attending their physical activities. So, their physical activities were temporary and could be shifted by some reasons. Sometimes, it depended on who invited them to do that kind of exercise. The types of their physical activities are changeable by the people who exercised with them.

4.3.3 Reasons for Doing Physical Activity

College students have given different reasons for doing exercise. Men ranked order in health, fitness, attractiveness, tone, mood, enjoyment, and weight control. Women ranked order in health, fitness, tone, mood, weight control, attractiveness, and enjoyment (Hall et al., 2002). In this study, active students can describe alternative benefits from physical activities that can motivate them to do exercise. Interesting, company, friendship, anti-depress, good mood, bodybuilding, lose weight, achievement motivation, against diseases, performance, relaxation, fun, improving skill, maintaining fitness and health and modeling can all stimulate their thought to do exercise.

"I can get more close to my friends through exercise. Since I do exercise very often, I am more willing to try other activities. Exercise also can release my stress from study, change my mood, and let my life have more fun." (1)

"Exercise can give me a healthy body, help me to prevent diseases, give me a good fitness to improve my skill. In the same time, you can meet friends who have something in common." (16)

Inactive students have described fewer motivations for attending exercise including interesting, lose weight, masculinity, friends' invitation, kill time, fitness, bodybuilding, and modeling.

"Once I wanted to lose my weight by doing exercise but it did not last too long." (2)

"Either friends have invited me or I want to kill time, otherwise, I will never do exercise myself." (6)

"To me, exercise only can help me to lose some weight, nothing else." (12)
The reasons for them not attending exercise are just like barriers to them including no achievement, negative image, no confidence, inheritance, lazy, no pleasure, no time, no company, tiredness, no interest, no fitness, obesity and illness. There was also some motivations for inactive students to attend more exercise including interesting, convenient facilities, doctor’s advice, and curious about the exercise.

A well organized program which can satisfy students’ curiosity and interest them may encourage inactive students to attend physical activity. Adding some professional advice and convenient facilities can facilitate students’ physical activity behaviour.

4.3.4 Intrapersonal Variables

Understanding the factors that control physical activity behaviours will give researchers a clear picture and direction to intervene more effectively. Psychological variables have been examined more than the other categories in the ecological model. This section selected the most important intrapersonal variables that have been documented in adult studies and the second study.

Enjoyment

Enjoyment may be the initial incentive for people continuing with physical activity. It positively correlated to physical activity level for college students (Hall, Kuga, & Jones, 2002). Calfas et al. (1994) found maintainers revealed higher enjoyment of physical activity than contemplators, actives and relapsers. Also, students and males reported more enjoyment of physical activity than alumni and females. Compared to insufficiently active university students, sufficiently active students enjoy more physical activities (Leslie et al., 1999). Motl et al. (2001) also believed that enjoyment may be more strongly related to maintenance of physical activity because it is a proximal influence of behaviour and provides an immediate reinforcement for being physically active.

In the present study, active students could describe more detail about their feeling
during and after physical activity. They have more positive thoughts and feelings when doing exercise.

"I felt pleasure, happy, and relaxed when I was doing exercise. It can also release my stress."(1)

"It does not matter how exhausted I was. In the end, I felt great!"(3) "I never forced myself to do exercise. I enjoy it."(16)

They think although physical activity consumes their energy it also produces their energy to be more active in their daily life.

"I like to get sweaty when I am doing exercise. Although exercise may exhaust me but after all it also made me feel vigorous to do my study and help my sleep."(4)

Sometimes, exercise can change their mood.

"I like jogging. I felt happy to get sweaty. Exercise can change me into a good mood."(11)

Inactive students attended exercise because that kind of exercise might stimulate their interest in the beginning but it will not last too long. They did not completely say no to do exercise but always have some negative thought in their mind.

"I hate running or jogging. It is extremely boring."(2)

"I felt exhausted when I was doing exercise. The tiredness will last for a long time."(7)

"I do not feel happy after I finish my exercise. I considered it as though I just finished work."(12)

"Exercise is hard work to me. I prefer my sedentary life style."(14)

Active students felt that physical activities were full of pleasure, enjoyment and happiness. They could do exercise any time even when they were tired. Physical activities also had a functional effect to change their mood or recovered themselves from tiredness. Negative thoughts always link to physical activities for inactive students.
Boring, exhausting and hard work were all of their feelings towards physical activities. Creating enjoyment and changing their stereotype of physical activity may be an incentive for them to attend exercise.

Self-efficacy

People who have higher confidence in their ability to exercise are assumed to be more active than people who have a lack of confidence to do so. Based on previous studies, self-efficacy has become the strongest determinant of physical activity in many studies in all age groups (Trost et al., 1997; Winters, Petosa & Charlton, 2003; Sallis, Hovell, Hofstetter, & Barrington, 1992; Troped et al., 2003; McAuley et al., 2003; Wallace et al., 2000). Self-efficacy emerged as the most consistent correlate of physical activity behaviours (Trost et al., 2002). Self-efficacy also had a large impact on adoption and maintenance of regular physical activity among university students (Leslie et al., 1999; Rovniak et al., 2002).

Self-efficacy represents the summary of a person's confidence in his or her ability to do specific physical activities in specific circumstances (Sallis & Owen, 1998). Active students who possess more positive thought can always find time to do exercise. They seldom change their exercise timetable. They even used exercise to change their bad mood or try alternative physical activities in bad weather to maintain their physical activity levels.

"When I felt extremely tired or stressed, I might postpone my exercise for one or two days then start it again. Normally, I follow my own training schedule or plan to do exercise."(1)

"I could always find the way to overcome barriers to do exercise and maintain my regular exercise habit."(3)

"Exercise has become my habit. I will not change my regular exercise either when in a bad mood or due to bad weather."(10)
"I postpone my exercise only when I am injured. Doing exercise will not occupy me too much for other daily activities." (16)

Inactive students easily give up on physical activity when they are in a bad mood, in bad weather or they feel tired.

"Tiredness can kill my thought for doing any physical activity." (2)

"I am more passive for doing exercise. I never think about doing exercise of my own accord." (7)

"I was not interested in any exercise at all. Do not even mention about in bad weather, bad mood or when I was busy." (13)

"I am quick to give up the thought of doing exercise. I have no willpower for it." (14)

"I do not think exercise is so important to me...... I may psychologically think do not waste my time and find something more meaningful to me." (15)

Within the interviews, the study found the majority are not only concerned about their confidence for doing exercise under specific circumstances but also their capability or competence to do specific physical activity or their main exercise. Education may need to teach inactive students to be more confident about their skills for doing exercise that they want to attend. It the other way, maybe do not emphasize on the skills too much and help them to realize that physical activity is important to their health and can easily happen in their daily life but not only in sport area.

**Intention**

Theory of Planned Behaviour proposed that intention is the immediate antecedent of behaviour (Ajzen, 1991). Intention to exercise has been correlated positively with physical activity levels in many studies (Trost et al., 2002; Sallis & Owen, 1998). A survey applying Self-determination theory to female university students and staff revealed that exercise regulations, including external, introjected, identified and
intrinsic regulation of exercise behaviour, were strongly correlated with greater intentions to exercise (Wilson & Rodgers, 2003). It is easy for active students to find reasons to stimulate them attending or maintaining different physical activities.

"I hope I can have better performance in the competition with well prepared fitness."(3)

"I can choose and learn more kinds of exercise in my PE courses when compared to high school. I am always interested in learning new exercises."(1)

Sometimes, media and environment can affect their thoughts to do exercise.

"After I watch the sport programs on TV, I feel like doing more exercise."(9)

"I am moving to a new campus with a swimming pool nearby. I am looking forward to starting my new exercise there." (16).

Inactive students' intention was more instrumental and passive. Generally, they intended to engage in physical activities either because they feel interested or they felt fun when doing that kind of physical activity in the beginning but this motivation will be gone with no enjoyment in the end. Sometimes, they are practicing some sport or exercise in order to pass their PE evaluation because attending PE courses is compulsory for first year and second year university students. Sometimes, students have to reach a certain skill and knowledge levels which was requested by the PE teacher in order to gain the credits. Also, intention for doing physical activities can vary or vanish for many reasons.

"Only when I have to practice to pass the PE evaluation or my friends invite me to do exercise. Otherwise, I will never do exercise."(2)

"Sometimes, I think exercise can release my stress from study but now I have other social activities to relax myself. I think it is ok not doing exercise for me."(6)

Environment can have some stimulation to inactive students.

"When I was just new here on campus, I was quite excited about the perfect
facilities. I thought it was a good time to start my exercise plan. Since the courts were always full, I gave up in the end.”(12)

“I even attended the dancing club. It was very interesting to me in the beginning. Unfortunately, it did last too long.”(13)

“I made up my mind for doing exercise to lose my weight, change my figure, and give me confidence to make friends but the plan only lasted for three days.”(14)

“When I found I was in a very bad fitness condition after the fitness test, I seriously thought that I needed to do exercise. However, I am just too lazy and without the willpower to do that.”(15)

Active students had a stronger intention to attend physical activity or exercise than sedentary students. Active students intend to increase or maintain their physical activity levels because they try to improve their skill, to learn different exercises and to possess good fitness and health. Sedentary students do not intend to do any exercise or consider that exercise is not important to their daily life.

Barriers

Research has found that, especially for young males, lack of motivation, lack of interest, and the discipline to be active are the main barriers for being physically active (De Bourdeaudhuij & Sallis, 2002). Barriers negatively correlated with physical activity levels for college students also reflect these findings (Hall et al., 2002). Normally, if people had developed strong habitual activity patterns, they had apparently moved into a commitment phase to overcome barriers (O’Brien Cousins, 2003). In the present study, active students also expressed a full array of barriers but they did not affect their physical activity so much. Except some uncontrollable incidents can postpone active students’ physical activities, they always find time, space and company to do exercise. Most of the barriers are external factors such as exams and injury. Sometimes they felt that they do not have time to do exercise, hence, they cherished doing exercise because
they do not think they always have enough time to do it.

"Nothing can easily stop my exercise. Only once I was wounded by a car accident."(1)

"Only injury and exams can postpone my exercise timetable."(16)

"Only my club or team stopped their training season. I may stop my exercise as well because I could not find anyone to do exercise with."(3)

"Only during the exam period or when I was ill. Otherwise, I will not stop my exercise easily."(4)

"Finding only 30 minutes a day to do some exercise is not so difficult to me. Even if I am tired or have no time, I still can find a chance to do exercise."(10)

Inactive students do not exactly have barriers of time for doing exercise but they prefer some activities they like, such as singing, video (pc) games. Most of them think it is difficult for them to find someone to do exercise with or few people have invited them to do exercise (no company).

"I always feel tired when I was doing exercise. How can I do exercise when I am tired?"(2)

"I think being lazy is my main problem. I always have tomorrow for doing exercise but not today. I do not like physical training either."(5)

"I already have some other activities to attend. I really have no motivation to do exercise."(6)

"When I have time, I really want to be relaxed and have a good rest. Exercise can only exhaust me."(7)

"I could not maintain my exercise plan for too long. Study and other activities occupied too much of my time. So, I give up exercise first."(12)
"I do not think I like the other people who really fancy dance so much. I also think I do not have any potential for dance even though I liked it in the beginning."

(13)

"Why do I need to exhaust myself by exercising? Obese is not so bad all the time. Since I am fat, so, I do not want to do exercise. If I am 70 kilogram now, I will do any exercise."

(14)

"I am too lazy and have no willpower to do exercise. I do have plenty of time to do exercise but it just can last too long."

(15)

Barriers can exist for both active and inactive students. Active students could find the way to solve their barriers and still attend physical activity but inactive students were easy to give up their thought for doing exercise when they faced barriers. It is hard to say that inactive students have more barriers than active students but the differences of how they managed and dealt with the barriers.

4.3.5 Interpersonal Variables

Social influences played a significant role in most of the physical activity studies. A supported social environment motivates and encourages people to attend and maintain physical activity. Social support might come from family, friends, and significant others or a role-model such as teacher, program staff, and athletes.

Stahl et al. (2001) found that social environment was the strongest predictor of being physically active for a middle age group in an international study. People that perceived low social support from their personal environment, such as friends/acquaintances, spouse/family/relatives, work place, and school may be more sedentary than those who reported high social support. Furthermore, social variables that affected young adults' physical activity included social support by significant others and encouragement for males and encouragement and modeling for females (De
A prospective social cognitive model of young adults' exercise behaviours also emphasized that social support could affect young adults' physical activity through self-efficacy, self-regulation and outcome expectations (Rovniak, et al., 2002).

Friend support is essential for university students' physical activity in this study. Students feel like they can not do exercise without company. They always invite friends to do exercise. Furthermore, friend support is more effective when it takes the form of actual exercise and not just encouraging or talking to them about doing exercise. An investigation of insufficiently active Australians aged 18 to 39 years old showed that more than 40% of the participants wanted to be able to exercise with a group but only 22% preferred advice from health professionals (Booth et al., 1997). Family influence on students' physical activity is comparatively weak at the university stage because most of the students do not live with their family. Most of them seldom do exercise or talk about exercise with their family.

Active students had more support from their family and friends. The support might shift from family support to friends support after they attended university.

"My parents always encouraged me to do exercise when I lived with them before. ....... Now, I only stay with my family in the holiday period. They want me to have more rest but not doing exercise. At the moment, I think I really need to find some friends to exercise with to make me more active."(16)

"There were some people who really like to do exercise together. Friend support was the most essential social support for me to do exercise before university. I think the situation is the same now. It is important for me to have company to do exercise. .... Although, people sometimes talked to you about exercise, the point is if they are actually doing exercise with you."(3)

Inactive students obviously had less support from their family and friends.
"No body! Maybe all my friends do not like exercise so much. No one ever talked to me about exercise."

"......... Even when people talk to me about exercise or sport to me sometimes but they do not really want me to do exercise with them. We are extremely different kinds of people in terms of exercise."(5)

"Only PE teachers talked to me about exercise and encouraged me to have some exercise. If my classmates want to do some exercise, they will never think about inviting me."

"I really can not find anyone to do exercise with me or encourage me to do exercise. How can I do exercise with them without adequate skill and fitness. We belong to different life style groups."

"It is difficult for me to find someone to do exercise with. How can I do exercise alone?" (14)

Finding friends to do exercise together was more important than family support during the university period. University students always had sub-cultures or sub-groups in their university life. University students who had the same interests always gathered together. Inactive students normally could not involve themselves into the active student groups. Active students always invited active students for doing exercise together. Inactive students really needed someone to exercise with them or have someone give them good advice for doing exercise. Otherwise, the inactive students would be more and more sedentary in the vicious circle.

4.3.6 Environmental Variables

The ecological model emphasizes the effects of physical environmental variables that may affect peoples' physical activity level. Living area, convenient facility, safety, short distance, attractive scenery and home environments all certainly facilitate physical activity behaviour.

Although perceived physical and policy environment was not strongly associated
with participation in physical activity in adults or vigorous exercise in high school students (T. Stahl, et al., 2001; Zakarian, et al., 1994), Researchers still believed that physical environment plays an essential role and is the most appropriate factor for an efficient intervention for people to be active (Sallis & Owen, 1998). Leslie et al. (1999) suggested that attractiveness of facilities, convenience of programs and barriers to the use of campus facilities need to be considered because university students may choose to exercise in other settings or environments, which may be more convenient and attractive to use.

In the present study, the majority of students considered that school or university settings represented the best and most convenient place for doing exercise. It might be the strongest environmental determinants (e.g., to live nearby the school and its facilities) that accounted for the higher physical activity levels or for establishing regular exercise habits for Taiwanese students. Also, lived nearby the park, public open area where people can do exercise were all correlated to their physical behaviour and thought. During their university life, most of the students' physical activities still took place in school or on campus, both in their university term or their vacation. Few people used the facilities out of school or out of campus such as a park or private exercise facilities for doing exercise. Convenient facilities and equipments found in the school became the most important environment variable for students to do exercise.

“I never do exercise out of school. .... School can offer me more available courts and better facilities for doing exercise. Convenience and safety are also the reasons why I like to do exercise in campus.” (1)

“Even though I do not live on campus; I was still doing exercise here. You can not find any place with comprehensive facilities like the university. When I visited my family, I still workout at the school nearby my house.” (9)
"I always exercise on campus. I could not find a better place for me to be involved in any physical activity because workouts on campus cost less and make me feel safer." (11)

"I do not know where can I do exercise apart from university campus." (10)

"I hope the facilities on campus can have more flexible opening times and less limitation so that most of the students can workout any time they want." (5)

Living in a more active environment might slightly affect students' physical activity behaviours by watching other people doing exercise.

"I could always find people doing exercise in the park and it is quite near my house. I think that you will not feel strange to do exercise in a crowd. I was thinking I may feel more comfortable to have some exercise in a crowd" (12)

Convenient facilities, a flexible opening timetable, nice weather, and more activity space and opportunity on campus become the most important issues for students to get involved in exercise.

4.3.7 New Themes beyond the Ecological Model

Genetic factors may influence behaviours through many paths including the experienced pleasantness of physical activity (Baranowski et al., 1998). Genetic effects explained a considerable amount of variation in sport participation and leisure time physical activity in a twin’s study, which was greater in males than in females (Maia et al., 2002). A sedentary or active behaviour might be inherited from parents or be established from a family sedentary life style or history.

"Of course, some sporty girls they do like exercise but it is not my type. They are born athletes" (2)

"I belong to the so called sporty type girls. I have a good condition of my physical fitness."(3)
“Both I and my brother are good at sports and enjoy exercise very much. We both attend sport teams since primary school.” (4)

“My father is really good at running. My athletic skills and exercise habits might have been inherited from him.” (8)

“My father plays golf and my brother plays basketball regularly. We all felt uncomfortable without doing exercise.” (10)

“I am fat. Actually, all my parents and relatives are fat. They do not think fat is a problem in my family. So, they do not encourage me to do exercise. A sedentary life is normal in my family. My parents are very afraid that I will get an injury by doing exercise. I am totally not an exercise person” (14)

The environment or self-limitation was not so encouraging for obese students or over weight students doing physical activities. It has become a stereotype of certain subgroups such as obese people and females that are not so acceptable in exercise or sport domain like the others. Furthermore, the ideology might rationalize their sedentary behaviours for preventing injury, taunts, and embarrassment. Whereas, active students normally have a more positive image due to their good fitness and sporty skills that enforced their exercise behaviours.

4.4 Discussion

More specific physical activity such as walking and stair use that has been described more precisely by researchers as the dependent variable received more connection than the general idea of physical activity explained by other variables such as perceived environment and more successful environmental interventions (Humpel et al., 2004; Sallis, et al., 1998). At the same time, most of the correlates studies that had focused on individual dispositions only explain 20-40% of the variation in physical...
activity (Spence & Lee, 2003). As matter of fact, using questionnaires to assess daily energy expenditure to indicate people's physical activity levels has been measured mainly by exercise or so called scheduled or planned physical activities. Sometimes it seems to be difficult for the participants to recognize, identify or differentiate among the differences of such ambiguous terms as physical activity, physical exercise, exercise and sport. It is necessary to understand what kind of physical activity they had been doing that may link to their psychological functions.

There are several interesting findings that should be highlighted. Maia, et al. (2002) found that genetic factors has a moderate to high effects in predicting physical activity scores in both sport participation and leisure-time physical activity levels. One participant presumed his sedentary life style was inherited from his parents. All his family considered their obesity is quite normal and the sedentary life style is acceptable in his family.

It seems unnecessary to link the competence with the broad term of physical activities; it might be better associated with specific exercises or sports. For instance, housework, walking, cycling for transportation or recreation, and other physical activities, they do not need specific skills to be accomplished. Competence does not play an essential role of attending those kinds of physical activities. On the contrary, the attitude, beliefs, and the will to be involved in those physical activities might be the main contributing factors to engage in physical activity. The point is when students consider their physical activities in terms of exercise, the competence of the skill may affect their motivation to attend exercise.

Accessing the enjoyment could be based on the past experiences of physical activities that people have attended. It does not mean that the precontemplators do not experience enjoyment or self-efficacy of the specific physical activity, but their attitudes and beliefs might dominate their thought and behaviour.
Intention for attending physical activities refers to the future, the next fortnight, but the physical activity level refers to the past, the past seven days. Using future intention to predict or explain past behaviour might produce some logical fallacy. Different stages of change may have different levels of intention for attending physical activities. If researchers try to understand the influence of intention to engage in physical activity behaviours, they must firstly access participants' intention, then their physical activity levels, employing a longitudinal study.

In the present study, inactive students' might have considered exercise as one of their leisure activities or as hard work but not as their daily routine. Some of them might still enjoy doing exercise or might have intention to do exercise sometimes. They might have also realized the benefits of doing exercise but they could easily give up their intention or plan. According to the health belief model, people will not seek health behaviours unless they possess a minimal level of health motivation and knowledge, view themselves as potentially vulnerable to the health problem, view the condition as threatening, are convinced of the efficacy of the 'treatment', and see few difficulties in undertaking the action (Biddle & Nigg, 1999). For instance, smoking and alcohol are easily thought as of inappropriate behaviours for health, but inactivity is not considered to have threatening consequences, such as heart disease and diabetes, or a negative image like the defect of poor fitness, and aging to young people.

If the main reason for people to be active is to be more fit and healthy, then actually most people especially young people do not realize they are at the risk of inactivity until they experience unfit and unhealthy conditions or intend to improve or maintain their fitness for specific purposes such as maintaining and improving their skills. A statement like below may need to be concerned:

"I have no motivation to do exercise. I psychologically do not think it is necessary
for me. Exercise is not so important to me at the moment. (15)"

In other words, young people may feel no commitment for doing exercise or they do not perceive doing physical activity as an immediate necessity to maintain their health.

Welk (1999) proposed a model to understand the factors influencing physical activity behaviour for children. The model emphasized the psychological determinants including cognitive and affective variables called "Is it worth it?" and perceived competence and self-efficacy called "Am I able?" that affected children’s physical activity. Having applied the model to the present study, it was found that active university students possessed higher perceptions of competence and self-efficacy about their physical activity. They also possessed more confidence to engage in physical activity reinforcing the "Am I able?" factor and stronger beliefs and attitudes with positive value reinforcing the "Is it worth it?" factor.

The significant determinants may vary throughout the stages of change of physical activity levels. Supposedly, environment might be the basic and original variables for the precontemplator and contemplator to move on to the next stage, then, social support adds to the preparation and psychological variables add to action and maintainer. Social support might take many forms, such as encouragement and support from a significant person or the people who can exercise with. Since active students had referred more frequently to their competence, self-efficacy, and enjoyment for doing their physical activity and inactive students had focused more frequently on the barriers and interest for doing exercise, intrapersonal variables might shift from attitudes and cognitions to conquer the barriers, to enjoyment of the activity; then self-efficacy and competence are strengthened, as well as their confidence to maintain their exercise behaviour. The proposed model is shown as Figure 4.1.
The attitudes of physical activity and the opportunity for doing exercise seem to have played a vital role for university students to attend physical activities. A facilitated environment such as convenient and affordable facilities and programs, add to the needs and intention for doing exercise and can encourage and help sedentary students to adopt physical activity and then apply it to their daily routine. University students experience a whole new life style with more free and flexible time, meeting new people, leaving their family and becoming more independent. Their social support from friends, 

**Figure 4.1.** The proposed model of the determinants changing through different stages
classmates, group activities, and teachers all can affect their motivation for doing exercise.

Due to the study purpose and the limited recruiting participants of the qualitative study, there are some limitations of the results:

a. The participants were selected and focused on Taiwanese university. The analysis results may not generalize to other country due to the cultural differences.
b. In order to expend the differences of physical activity levels for study purpose, the preparation stage students who did not attend regular exercise were not be included and analyzed in this study.

4.5 Conclusion

According to the qualitative study results, university students are needed to be further educated because young adults might be over confident about their body and health condition. Life development in the young adulthood period, such as university age, may not be easy to handle the risk of sedentary behaviour. University students lack adequate warnings to remind them that sedentary behaviours or inactive life styles can cause health risk at any stage of their life. Education is still needed to establish their attitude and self-efficacy and offer them the possible social and environment supports.

The key findings from this qualitative study are:

a. Active students stuck to certain activities as their frequent physical activity due to their competence. Inactive students might need to be encouraged to choose specific activities that are easier for them to execute with enjoyment. General physical activities, such as active living, are also encouraged for both active and inactive students to increase physical activity levels.

b. University students defined their physical activity mainly based on specific
activities they are doing. When applying variables to predict general physical activities as a whole may decrease their power to explain the variance in physical activity.

c. University students normally overestimated their physical activity levels and underestimated the potential risks for being sedentary since they do not perceive immediate health problems. Health and physical education are needed to educate them to take this issue seriously.

d. Correlated variables may have unequal roles for developing active habits during different stages. Intervention designs may consider their specific importance in different stages. For example, enjoyment, attitude and environment supports are basic incentives to attract inactive students. Then, social support bridges them into more active stages. Establishing self-efficacy with competence and enjoyment is vital for the maintenance stage.

e. Barriers existed both in active and inactive students. Sometimes, active students might perceive higher barriers for reaching their aims. Inactive students might not experience any barriers due to no intention to do any physical activities.

f. Social support is relatively important to inactive students. Seeking supportive social environments from friends, PE teacher and coach are important in university settings.

g. Physical activity teaching not only supplied learning opportunities for certain skills but also affected inactive students' motive and reason to practice. A designed PE course may be a promising group-based intervention in university settings.

This qualitative study offered an in-depth understanding of active and sedentary behaviours which mainly focused on selected Taiwanese university students.
Comparison of cultural differences might be restricted to limited numbers and the study design.

However, applying qualitative methods in this study tended to explore the potential and deeper issues that may affect university students' physical activity behaviours by adaptable and flexible communication strategies. It can help in the development of hypotheses and supplement quantitative studies.

Exercise behaviours are quite different from sport participation. Exercise behaviours are conducting mainly for health and enjoyment concerns, often with social support in an encouraging way. It does not restrict to specific skill levels but the supporting environments whether it can easily integrate the behaviour into people's daily healthy life-style or not. Sport participation is popular for a young generation, especially for males, but is more restricted by skill limitations and peer support. If students can be confident about their sport competence, sport might play an important role in young people to maintain higher physical activity levels in university settings. However, moderate intensity activities with flexible time and accessible facilities are also suggested.

Intervention designs which aim to offer varied activities, strength self-efficacy, motivation, competence, and knowledge, create friends' support and enjoyment, and decrease barriers may all be promising to promote university students' physical activity. University campus settings offer a good opportunity to conduct a group-based intervention for preventing sedentary behaviours. Policies such as PE in Taiwan not only intended to increase energy expenditure in class but also expected to establish students' active habits out of class. Information and knowledge can be introduced through well designed PE courses. PE teachers can also play an important role as a social supporter in many ways. Since most of the students either considered that
skill-related elements which was more connected to competition for male and active students, or health related element of which was more connected to enjoyment and health to female or inactive students, PE course designs with different emphases should be tested to see their effectiveness for promoting students’ physical activity.

This study found the majority concerned their capability or competence to do specific physical activity or their main exercise or sport. Education may need to teach inactive students to be more confident about their skills for doing physical activities that they want to attend. It the other way, maybe do not emphasize on the skills too much and help students to realize that physical activity is important to their health and can easily happen in their daily life. The intervention design using PE courses which aim to build up students’ specific sport skills or competence or aim to attract students’ motive of interests and health can empower students’ ability to conduct the physical activities they have chosen.

New media through Internet or website has an ideal avenue and important channel for tailored, interactive intervention delivery to the large population of sedentary individuals (Marcus et al., 2000; Marcus et al., 2007). In the modern society Internet using habits are prevalent especially for young population especially for students. Using Internet became part of students’ daily life and therefore, Internet using has become the most popular and convenient way for information searching and important means of communication for young generations. Media technologies such as email, website and blog which can be easily accessed in university environments may be an important channel to university populations for promoting students’ physical activity behaviours through mutual information transmitting and knowledge building. Internet may become a powerful and efficacious mediator for educating and reminding students to proceed to an active life style.
5.1 Introduction

Inadequate physical activity is one of the six health risk behaviours for college students (Buckworth, 2001). Even though university is an important setting for promoting physical activity behaviours, there are still few studies that have evaluated university-based interventions focusing on this target population. Environments such as schools (or university) are well placed to promote healthy lifestyles, including physical activity, and physical education has the potential to reach large numbers of children of all backgrounds and abilities (Biddle & Mutrie, 2001).

School-based physical education has been found as an effective intervention in increasing levels of physical activity and improving physical fitness in elementary school and high school students but there is still insufficient evidence to assess the effectiveness of college-based (or university-based) health education and PE interventions to increase physical activity behaviour and fitness (Kahn et al., 2002). Interventions to promote university students' physical activity are at the early stage and overall results of physical activity interventions to the university setting were not very encouraging. More studies on various physical activity interventions in this population are needed (Keating et al., 2005).

5.1.1 Intervention for Promoting Physical Activity

Dunn and Blair (2002) had suggested six types of interventions are recommended for translation and dissemination: point-of decision prompts, community-wide education, school physical education, community social support, individual health behaviour, and enhanced access. Other interventions such as classroom-based health
education, behavioural and social support interventions in family settings, mass media campaigns, college-aged physical and health education, and classroom-based health education that focus on reducing television viewing still need sufficient evidence from more studies to support recommendation levels. Kahn et al. (2002) also developed three categories of physical activity interventions in their review article including informational approaches which aimed to change knowledge and attitudes, behavioural and social approaches which aimed to teach people behavioural management skills and to create social environment, and environmental and policy approach which aimed to change the structure of physical and organizational environments.

Laitakari and Miilujmpalo (1998) have also suggested that effective promotion of physical activity needs to be realistic, enable lasting habit change and select an activity with the best chances of success in behavioural terms, and needs to tailor the activity to the clients, give “space” such as freedom of choice. “Interventions based on the principles of behaviour modification, delivered to healthy people in a community, are associated with large effects, particularly when the interventions are delivered to groups using mediated approaches or when the physical activity is unsupervised, emphasizing leisure physical activity of low intensity, regardless of the duration or frequency of participation” that was proposed and emphasized in a meta-analysis study by Dishman and Buckworth (1996).

Interventions based on the Transtheoretical Model that emphasized the concept of processes of change utilizing matching treatment or different strategies to different stages should be more effective in promoting physical activity. In other words, interventions are based on the assumption that different strategies are needed to motivate a sedentary person to begin an exercise program and to assist an active person in maintaining an exercise routine (Buckworth, 2000). A meta-analytic review of 127 intervention studies revealed that the most effective characteristics of interventions were
behaviour modification, mediated approaches, low- to moderate-intensity goals and active leisure (Dishman & Buckworth, 1996; Sallis & Owen, 1998).

A Meta-analysis of college students' physical activity behaviours studies found that only 3 experimental studies which focused on increasing physical activity among college students (Keating et al, 2005). Combining school-based research findings to limited university-based interventions may give some inspiration to the design of an intervention for the university population. The following review of studies combines the results of school and university studies.

5.1.2 School-based and University-based Physical Activity Interventions

The potential of schools to promote physical activity has been stated in policy documents in many countries (Biddle & Mutrie, 2001). It is assumed that students can be socialized into a healthy lifestyle through physical education or health education curricula because the aims of PE curricula are supposed to develop the active lifestyles in adulthood. Evidence also showed that past experience in school physical education may guide adolescents' future expectations of sport and exercise (Coakley & White, 1992). School-based interventions have mainly been conducted in primary/elementary school such as project of CATCH (Child and Adolescent Trial for Cardio vascular Health) by McKenzie et al. (1996). And, most of the school-based interventions among elementary and high school students were successful (Kahn et al., 2002).

However, a review study in youth had found that school-based interventions were typically successful at improving knowledge and attitudes toward physical activity, increasing physical activity during physical education classes but not typically successful at increasing out-of-school physical activity (Stone, McKenzie, Welk & Booth, 1998). Even though most of the intervention studies focused on adolescents and kids in school settings, interventions to increase physical activity in or through schools have met with mixed success or still have not been properly evaluated (Biddle & Mutrie,
University students had more flexible time for engaging in physical activities. It is important to examine if the university-based interventions such as a PE course can have a significant effect on university students' physical activity level during their leisure time. A Project GRAD (Graduate Ready for Activity Daily) was an intervention designed to change college students' physical activity self-efficacy, social support, outcome expectations, barriers, enjoyment and experiential and behavioural processes of change through a cognitive-behavioural intervention course. Although, there were no significant intervention effects on physical activity outcomes within two years, only experiential and behavioural processes of change were significantly improved for women participating in a two years intervention program.

However, the university-based Project GRAD intervention, originally developed for university students, had significant effects on sedentary adolescent females' cardiovascular fitness, lifestyle activity, and physical activity levels (Calfas et al., 2000; Jamner et al., 2004). Due to the fact that limited results have been published; there was insufficient evidence available to assess the effectiveness of university-based health education and PE interventions to increase physical activity behaviour and fitness (Kahn et al., 2002). Especially, more experimental designs are encouraged (Keating et al., 2005).

5.1.3 Health-related (lifestyle) Intervention versus Skill-related Intervention

Students graduating from colleges with higher physical education activity requirements demonstrated more positive exercise attitudes and behaviours (Adam & Brynteson, 1992). However, the objectives, content and delivery of health-related exercise in schools are often confused and sometimes PE has failed groups in the promotion of lifetime of physical activity (Biddle & Mutrie, 2001). In addition to addressing knowledge, motor skill, and affective outcomes, physical education provides
opportunities for children to engage in physical activity (McKenzie et al., 2001). Physical education is a very important context for the development of health-related behaviours (Biddle & Mutrie, 2001). Noticeably, most of the university PE course designs were focusing on skills learning to enhance students sport ability in Taiwan. Emphasizing on sport or skill competence development might help young adults to establish their self-efficacy and confidence in order to adhere or execute sport behaviours. Whether it will translate to health-related behaviours or not, still needs more studies to be conducted.

Scholars have suggested that a PE course in school should allow participants to make choices and have some involvement in decision-making procedures, and allow for individual interpretation of success for the maximization of enjoyment to promote students' autonomy and competence (Biddle & Chatzisarantis, 1999). Also, the Centres for Disease Control and Prevention (1997) recommended that physical education be provided through a curriculum that focuses on the enjoyment of physical activity and provides opportunities for students to develop the knowledge, skills, and confidence to initiate and maintain an active lifestyle.

Calfas et al.'s (1994) survey of college students and alumni showed that the most preferred course format was a course led by a professional, with mailed videotapes, mailed courses, and mailed written materials. Results also found that face-to-face and mediated intervention methods were more accepted by these target groups. And, active subjects also preferred a physical activity hotline more than non-actives did. They were willing to spend one to two hours per week for a semester intervention. But, whether these types of data make a detectable difference in the efficacy of interventions is still an empirical question.

A study by Brynteson and Adams (1993) found some evidence that college courses designed to promote lifetime physical activity may have long-term effects. Lifestyle
physical activity intervention can also significantly increase the median of energy expenditure with daily life activities and change the proportion of participants from sedentary stage to active stage in work-site environment (Titze et al., 2001).

Therefore, a more flexible and enjoyable PE course, without too much of a skill requirement, seems to have more efficacy for promoting students' long term physical activity effects into active lifestyle. A comparison study of lifestyle physical activity intervention with a traditional structured exercise prescription approach found both of them were effective for increasing physical activity and fitness over a 6 month period in initially sedentary men and women after a six month follow-up design (Kohl et al., 1998; Dunn et al., 1998). Researchers believe lifestyle physical activity interventions can have both short-term and long-term effects in selected sedentary populations. It can also be efficacious in helping individuals to meet the established public health criterion for physical activity (Dunn et al., 1998).

Dunn and colleagues (1998) defined lifestyle physical activity as “the daily accumulation of at least 30 minutes of self-selected activities, which includes all leisure, occupational, or household activities that are at least moderate to vigorous in their intensity and could be planned or unplanned activities that are part of everyday life.” Lifestyle intervention’s goal can be accumulated in 30 minutes of moderate physical activity daily, with the activity integrated into each individual’s daily routines to increase convenience (Sallis & Owen, 1998).

5.1.4 Mediated Interventions for Promoting Physical Activity

Successfully influencing physical activity levels in the whole population will require the development of effective interventions that can be provided to large numbers of people at low cost (Marcus et al., 1998). Media-based physical activity interventions may become the most potential and efficacious strategy to provide large number of people information for reaching that criteria.
Mediated intervention such as media of mass communication is likely to be most effective in influencing the knowledge and attitudes of those who are at the earlier stages of the exercise adoption process, particularly precontemplators and contemplators (Sallis & Owen, 1998). Also, Mediated interventions had been found more effective than a face-to-face or a combination program to increase physical activity levels (Dishman & Buckworth, 1996).

Media-based interventions were usually delivered by mail or telephone, and few examples of mass media programmes (Sallis & Owen, 1998). Moreover, information using technology such as computer-based or website-based intervention to promote physical activity has attracted more attention in recent studies.

New media technologies, such as the internet, may be suited to promote physical activity in modern society. A comparison study of print versus website physical activity programs to promote staff in a university found that a print physical activity program can increase the total amount of physical activity for those who were inactive at baseline and that a website physical activity program can be associated with a decrease in the average time spent sitting on a weekday (Marshall et al., 2003). Another comparison of website and print media for physical activity promotion among adolescent girls documented that both interventions had significant changes in physical activity self-efficacy and intention. However, print media were still more efficient than website media for adolescent girls in this study (Marks et al., 2006). Lack of time was the main barrier of using physical activity promotion website but not trouble using the internet, lack of interest in using the internet, or lack of interest in changing their activity level in a worksite participants' intervention study (Sciamanna, 2002).

Studies suggested that capitalize newer technologies for population-based physical-activity promotion such as using internet as an intervention need to be developed (Marcus et al., 2000; Calfas et al., 2000). A review article by Marcus et al.
(1998) suggested using media messages with more contacts and intervention tailored to the target audience were most effective on physical activity behaviour. Furthermore, comparing different forms and intensities of media-based physical activity intervention still need to be investigated. Applying mass media interventions have the potential to play a major role in promoting physical activity, but more studies are needed to make that potential reality (Sallis & Owen, 1998).

The quantitative survey study in this thesis showed that preferences were different by gender and country. Most of the male students preferred team sports, which emphasized more competition or skill-related issues, and female students preferred swimming and aerobics, which emphasized health issues. Different PE course designs with different emphases on skills or health may offer a good opportunity to promote students' physical activity. Mediated approaches for influencing physical activity are encouraging in modern society; especially website delivery strategies may have sound effects on young adults and play an important role in university settings. Hence, the present study investigated the efficacy of a health related (lifestyle) PE course and a skill-related PE course and examined the efficacy of a new mediated method (email) to promote university students' physical activity levels and the potential mediated variables.

5.2 Methods

5.2.1 Research Design and Sampling

An intervention trial was conducted for one semester 16 weeks long during the experimental period. Six departments' with first year 198 University students had been assigned into six research design cells (2 * 3) including 2 curricula (health-related vs. skill related), with or without email deliveries, and were also compared to the control groups.
All participants needed to attend the compulsory PE course according to the university policy in Taiwan. The assignment to intervention groups was made by students' original selection to the PE courses. Control groups were students who chose to attend the volunteer training for servicing the intercollegiate athletic meetings on their own will during the academic term instead of PE courses. A total of 21 participants had dropped out during the intervention period due to dropping the course during the term, no email reply at the beginning, missing data at the end, and injury during the intervention period. At the end of the study, participants included 79 males and 98 females assigned to different experimental groups in a between subjects design. The distribution of each design cell with gender is shown as Table 5.1.

Table 5.1. Distribution of different experimental design cells

<table>
<thead>
<tr>
<th>Teachings</th>
<th>Skill-related PE</th>
<th>Health-related PE</th>
<th>Control groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>With email</td>
<td>23(M11, F12)</td>
<td>29(M9, F20)</td>
<td>29(M4, F25)</td>
</tr>
<tr>
<td>Without email</td>
<td>37(M36, F1)</td>
<td>33(M12, F21)</td>
<td>26(M7, F19)</td>
</tr>
</tbody>
</table>

M=Male, F=female

Participants within the email groups were asked to respond to the first arriving email to confirm the access of email and allowed them to have feedback for further requests during the intervention period. Participants who rejected to attend the study or no reply in the beginning were not recruited in the study.

5.2.2 Measures and Procedures

Participants were asked to complete the short form of the self-administered International Physical Activity Questionnaire (IPAQ, http://www.ipaq.ki.se/) Taiwanese version (IPAQ-Taiwan) as the baseline of their physical activity levels, and after the
intervention and follow up period. Also, the study applied the stages of change scale to assess their physical activity stage. The IPAQ-Taiwan had been shown to have a good validity and reliability (Liou et al., 2003). The English version of the IPAQ is show in Appendix 5.

The calculation of energy cost of IPAQ-Taiwan was guided by the guideline of data processing and analysis of the IPAQ with continuous scores:

- Walking MET-minutes/week = 3.3 * walking minutes * walking days
- Moderate MET-minutes/week = 4.0 * moderate intensity activity minutes * moderate days
- Vigorous MET-minutes/week = 8.0 * vigorous intensity activity minutes * vigorous-intensity days

Total physical activity MET-minutes/week = sum of Walking + Moderate + Vigorous MET-minutes/week scores.

It is also necessary to fully understand the relationships between theoretical mediators and physical activity and the impact of interventions on these mediating variables should be examined to see if the intervention changes the mediating variables (Baranowski et al., 1998). Therefore, intrapersonal, interpersonal and environment variables, according to the ecological model, were tested in the beginning as baseline and after the intervention to see the possible changes. Except the PA measure, all measurements and chosen variables were consistent with the second study (see Appendix 3). A two-month follow-up survey was conducted to assess the longer term effect of the intervention.

Skill-related PE curriculum had been designed with more traditional PE course content. It involved four popular competitive sports with high body skill movements including basketball, soccer, softball and volleyball. The skill-related PE course emphasized skill development and requirements for the sport. The aim was to enforce the students' abilities in every sport. The health-related PE course, on the other hand,
placed an emphasis on a more flexible course which had been discussed with the students at the beginning of the term which was considered to integrate physical activity into their daily life. The design was based on the accessibility, enjoyment, health orientation, and seasonal considerations within the university environment. The health-related PE course included swimming (water activities), badminton (the most popular activity for both genders on campus), physical fitness (body building, pilates, cycling and aerobic dancing) and recreational sport (golf and bowling). In order to assure the criteria, quality and insistency of intervention (teachings) designs, all teaching groups are taught by one PE teacher following the designed curriculums. The course content summary is shown as Appendix 6.

Information deliveries utilized emails as a one page newsletter format (see appendix 7 for the translated email titles and example) which was sent once a week for motivating physical activity behaviours by using a theoretical framework based on Social Cognitive Theory (SCT) and the Transtheoretical (stages-of-change) Model (TTM). Marcus et al. (1998) had a comprehensive explanation about the intervention strategies derived from SCT and TTM: “Social Cognition Theory places an emphasis on the importance of the individual’s ability to control her/his own behaviour and on how changes in the individual, the environment, or in both can produce changes in behaviour”. “Transtheoretical Model integrates current behavioural status with a person’s intention to maintain or change his or her pattern of behaviour.”

All of the information delivered by email was designed by integrating psychological theories and models, especially SCT and TTM which were suggested in Marcus, Forsyth and Blair’s (2003) book for physical activity intervention strategies. The SCT emphasized self-efficacy, outcome expectations, reinforcement and observational learning of the participants by suggestions of finding suitable skill level sport or exercise, setting achievable goals, identifying benefits, tangible rewards, and
social support. The TTM stressed the matching of strategies to stages of change by
cognitive strategies, such as increasing knowledge, being aware of risks, caring about
consequences to others, comprehending benefits and increasing healthy opportunities;
and by behavioural strategies, such as substituting alternatives, enlisting social support,
rewarding yourself, committing yourself, reminding yourself. According to the
Ecological Model, environmental issues were also vital in the information such as
improving the awareness of the campus environment for physical activity.

5.2.3 Data Analysis

Statistical comparisons between the intervention and the control groups were
divided into two parts. The first part intended to classify the effects of the experimental
designs right after the end of the intervention. The second part tried to see the changes
in how participants maintained their physical activity levels as a follow up survey. A 3
(type of class) x 2 (email/no-email) ANCOVA, with baseline scores as the covariate, is
applied to assess changes after baseline in physical activity levels, psychological
variables, interpersonal variables and environmental variables. Summary differences are
reported as estimated marginal means for standardizing changes for possible covariate
(baseline) imbalances between groups.

5.3 Results

21 participants had dropped out during or after the intervention period due to the
missing data, incomplete questionnaire and withdrew from the middle of the term. 177
participants completed the intervention period and completed the IPAQ and
questionnaires in the end. A follow-up survey completed for the 177 participants after
two months of the intervention.

5.3.1 The Correlation between Physical Activity (PA) and Survey Variables at Different
**Periods of Time**

At the baseline period, self-efficacy, intention, friend support and perceived convenient facility were all correlated to university students' PA level positively. Barrier of time was negatively correlated to PA as well.

After the intervention, self-efficacy, enjoyment, family support, friend support, home environment and perceived convenient facility were all positively correlated to university students' PA. Barrier of time still negatively correlated to PA after the intervention. At this period, enjoyment and family support had added to the correlation, and the connection between PA and intention became weak at this period when compared to the baseline.

The follow up survey had found that intention emerged again into the correlation equation, also the body expectation were positively correlated to PA at the follow up period. Family support got back to the baseline situation. The correlation revealed that self-efficacy, intention, enjoyment, body expectation, barrier of time (negative), friend support, home environment and convenient facility all correlated to university student PA. All results are shown in Table 5.2.

The most consistent correlated variables were self-efficacy, barrier of time, friend support and convenient facility. Survey variables including psychological expectation, health expectation, barrier of effort, barrier of obstacles, and neighbourhood environment did not correlate to university students' physical activity during at different period of time. The correlation results did not show the effects of the intervention but the information of different survey variables played an important role at different stages.

**5.3.2 The Shift in Stage of Change among Different Intervention Periods**

Distributions of participants in different stage of changes are reported in Table 5.3. At the baseline period, only 25.3% of participants were at the active stages who participated in regular physical activity. At the preparation stage, 45.2% of the
participants attended some physical activities but not meeting the criteria to be active. And, 28.6% participants were sedentary without any physical activity.

After the intervention, larger percentages of participants were at active stages when compared to baseline, from 25.3% to 33.1%. More participants attended some activity at the preparation stage, from 45.2% to 51.7%. Only 14.6% of the participants were sedentary.

Two months after the intervention, an even larger percentage of participants were at the active stage when compared to the baseline and after the intervention, from 25.3%,
33.1% to 35.4%. Participants who were at the preparation stage had shifted to active stages and sedentary stages. A smaller percentage of 47.8% of participants were at the preparation stage when compared to the intervention period but still maintain a larger percentage when compared to baseline. Percentages of sedentary participants had no big differences between the intervention and follow-up stage, 14.6% to 16.3%, but obviously smaller than 28.6% at the baseline.

Table 5.3. *The frequency and percentage of stage of changes at different time periods*

<table>
<thead>
<tr>
<th>Stage of changes</th>
<th>Precontemplation Percentage (Frequency)</th>
<th>Contemplation Percentage (Frequency)</th>
<th>Preparation Percentage (Frequency)</th>
<th>Action Percentage (Frequency)</th>
<th>Maintenance Percentage (Frequency)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>3.9% (7)</td>
<td>24.7% (44)</td>
<td>45.2% (81)</td>
<td>22.5% (40)</td>
<td>2.8% (5)</td>
</tr>
<tr>
<td>Intervention</td>
<td>0.6% (1)</td>
<td>14.0% (25)</td>
<td>51.7% (92)</td>
<td>26.4% (47)</td>
<td>6.7% (12)</td>
</tr>
<tr>
<td>Follow-up</td>
<td>1.7% (3)</td>
<td>14.6% (26)</td>
<td>47.8% (85)</td>
<td>27.5% (49)</td>
<td>7.9% (14)</td>
</tr>
</tbody>
</table>

5.3.3 16-week Intervention Effects

The main effects results after the intervention are shown in Table 5.4 and Table 5.5. The results revealed that both health-related and skill-related teaching groups had higher physical activity levels compared to the control group. Also, health-related teaching group had more friend support than the control group and the skill-related teaching group had perceived better neighbourhood environment than the control group after different teaching interventions.

The main effect of email treatment showed that the email group had higher physical activity level, self-efficacy, enjoyment, and better perceived home environment compared to the no-email group. There were five variables which had interaction results
<table>
<thead>
<tr>
<th>Variables</th>
<th>Health related (a) Adjusted mean (Mean)</th>
<th>Skill related (b) Adjusted mean (Mean)</th>
<th>Control group (c) Adjusted mean (Mean)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Activity (MET-min/week)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4187 (4507)</td>
<td>3894 (3919)</td>
<td>2640 (2462)</td>
<td>a = b &gt;c**</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>28.9 (29.8)</td>
<td>27.0 (27.0)</td>
<td>27.7 (27.0)</td>
<td>Ns</td>
</tr>
<tr>
<td>Intention</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12.3 (11.8)</td>
<td>14.6 (14.6)</td>
<td>10.8 (10.9)</td>
<td>Interaction Email*Teaching</td>
</tr>
<tr>
<td>Enjoyment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24.2 (24.8)</td>
<td>23.7 (23.7)</td>
<td>22.1 (21.4)</td>
<td>Ns</td>
</tr>
<tr>
<td>Psychological Expectation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.4 (7.1)</td>
<td>7.5 (8.0)</td>
<td>8.4 (8.1)</td>
<td>Interaction Email*Teaching</td>
</tr>
<tr>
<td>Body expectation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.2 (7.3)</td>
<td>6.4 (6.5)</td>
<td>7.0 (6.9)</td>
<td>Ns</td>
</tr>
<tr>
<td>Health expectation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.1 (4.3)</td>
<td>4.0 (4.1)</td>
<td>3.8 (3.7)</td>
<td>Interaction Email*Teaching</td>
</tr>
<tr>
<td>Barrier of time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10.7 (10.5)</td>
<td>10.7 (10.7)</td>
<td>11.1 (11.1)</td>
<td>ns</td>
</tr>
<tr>
<td>Barrier of efforts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>15.6 (15.4)</td>
<td>17.7 (17.5)</td>
<td>16.1 (16.1)</td>
<td>Interaction Email*Teaching</td>
</tr>
<tr>
<td>Barrier of Obstacle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>13.8 (13.8)</td>
<td>14.2 (14.3)</td>
<td>13.3 (13.2)</td>
<td>Ns</td>
</tr>
<tr>
<td>Family support</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>31.1 (31.3)</td>
<td>31.2 (31.3)</td>
<td>30.1 (29.8)</td>
<td>ns</td>
</tr>
<tr>
<td>Friend support</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>39.2 (39.2)</td>
<td>38.4 (38.6)</td>
<td>36.9 (35.6)</td>
<td>a &gt; c*</td>
</tr>
<tr>
<td>Home environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.6 (6.7)</td>
<td>7.2 (7.3)</td>
<td>6.1 (5.9)</td>
<td>Ns</td>
</tr>
<tr>
<td>Neighbourhood environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9.4 (9.4)</td>
<td>9.8 (9.9)</td>
<td>8.9 (8.9)</td>
<td>b &gt;c**</td>
</tr>
<tr>
<td>Convenient facility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>13.2 (13.6)</td>
<td>13.8 (14.5)</td>
<td>11.0 (10.1)</td>
<td>Interaction Email*Teaching</td>
</tr>
</tbody>
</table>

*P<.05  **P<.01
Table 5.5. Main effects of different email levels after 16 weeks' interventions

<table>
<thead>
<tr>
<th>Variables</th>
<th>Email (a) Adjusted mean (Mean)</th>
<th>No email (b) Adjusted mean (Mean)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Activity (MET-min/week)</td>
<td>4148 (4350)</td>
<td>3000 (2855)</td>
<td>a &gt; b**</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>29.1 (29.3)</td>
<td>26.7 (26.2)</td>
<td>a &gt; b*</td>
</tr>
<tr>
<td>Intention</td>
<td>12.4 (12.1)</td>
<td>12.7 (12.2)</td>
<td>Interaction</td>
</tr>
<tr>
<td>Enjoyment</td>
<td>24.6 (24.8)</td>
<td>22.1 (22.0)</td>
<td>a &gt; b**</td>
</tr>
<tr>
<td>Psychological Expectation</td>
<td>7.7 (7.1)</td>
<td>7.8 (7.8)</td>
<td>Interaction</td>
</tr>
<tr>
<td>Body expectation</td>
<td>6.9 (6.9)</td>
<td>6.8 (6.9)</td>
<td>Ns</td>
</tr>
<tr>
<td>Health expectation</td>
<td>4.1 (4.2)</td>
<td>3.8 (3.8)</td>
<td>Interaction</td>
</tr>
<tr>
<td>Barrier of time</td>
<td>10.6 (10.8)</td>
<td>11.0 (11.0)</td>
<td>ns</td>
</tr>
<tr>
<td>Barrier of efforts</td>
<td>15.9 (15.7)</td>
<td>17.1 (17.0)</td>
<td>Interaction</td>
</tr>
<tr>
<td>Barrier of Obstacle</td>
<td>14.0 (14.2)</td>
<td>13.5 (13.3)</td>
<td>Ns</td>
</tr>
<tr>
<td>Family support</td>
<td>30.3 (30.5)</td>
<td>31.4 (31.7)</td>
<td>ns</td>
</tr>
<tr>
<td>Friend support</td>
<td>38.2 (38.2)</td>
<td>37.8 (37.5)</td>
<td>ns</td>
</tr>
<tr>
<td>Home environment</td>
<td>7.2 (7.3)</td>
<td>6.1 (5.9)</td>
<td>a &gt; b*</td>
</tr>
<tr>
<td>Neighbourhood environment</td>
<td>9.5 (9.6)</td>
<td>9.2 (9.2)</td>
<td>Ns</td>
</tr>
<tr>
<td>Convenient facility</td>
<td>13.9 (14.5)</td>
<td>11.4 (10.9)</td>
<td>Interaction</td>
</tr>
</tbody>
</table>

*p<.05  **p<.01
by two ways ANCOVA after the sixteen weeks' intervention. The simple main effects are shown in Table 5.6, 5.7, 5.8, 5.9, 5.10.

Table 5.6. Simple main effects of different teaching levels with email after 16 weeks' interventions

<table>
<thead>
<tr>
<th>Variables</th>
<th>Health related (a) Adjusted mean (Mean)</th>
<th>Skill related (b) Adjusted mean (Mean)</th>
<th>Control group (c) Adjusted mean (Mean)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention</td>
<td>10.3 (10.3)</td>
<td>15.6 (15.6)</td>
<td>10.9 (10.9)</td>
<td>b&gt;a=c**</td>
</tr>
<tr>
<td>Psychological Expectation</td>
<td>6.7 (6.4)</td>
<td>8.3 (8.8)</td>
<td>8.2 (7.9)</td>
<td>b=c&gt;a*</td>
</tr>
<tr>
<td>Health expectation</td>
<td>4.4 (4.3)</td>
<td>4.4 (4.5)</td>
<td>3.6 (3.5)</td>
<td>a=b&gt;c*</td>
</tr>
<tr>
<td>Barrier of efforts</td>
<td>13.7 (14.0)</td>
<td>17.1 (16.8)</td>
<td>16.9 (16.8)</td>
<td>b=c&gt;a**</td>
</tr>
<tr>
<td>Convenient facility</td>
<td>15.1 (14.5)</td>
<td>14.4 (15.2)</td>
<td>13.6 (13.6)</td>
<td>Ns</td>
</tr>
</tbody>
</table>

**P<.01 *P<.05

Within the email group, the simple main effects revealed that the skill-related teaching groups had higher intention than health-related teaching group and control group, both skill-related teaching group and control group had higher psychological expectation and barrier of efforts than health-related teaching group, and teaching groups had higher health expectation than control group after the intervention.

Within the no-email group, the simple main effects revealed that both teaching groups had higher intention and barrier of efforts than control group, health-related teaching group and control groups had higher psychological expectations than skill-related group, the control group had higher health expectations than the skill-related teaching group, and the skill-related teaching group had better perceptions.
Table 5.7. Simple main effects of different teaching levels without email after 16 weeks' interventions

<table>
<thead>
<tr>
<th>Variables</th>
<th>Health related (a)</th>
<th>Skill related (b)</th>
<th>Control group (c)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adjusted mean (Mean)</td>
<td>Adjusted mean (Mean)</td>
<td>Adjusted mean (Mean)</td>
<td></td>
</tr>
<tr>
<td>Intention</td>
<td>14.1 (14.2)</td>
<td>13.6 (13.5)</td>
<td>10.9 (10.9)</td>
<td>a=b&gt;c**</td>
</tr>
<tr>
<td>Psychological Expectation</td>
<td>8.2 (8.0)</td>
<td>6.7 (7.1)</td>
<td>8.5 (8.3)</td>
<td>a=c&gt;b*</td>
</tr>
<tr>
<td>Health expectation</td>
<td>3.8 (4.1)</td>
<td>3.6 (3.6)</td>
<td>4.0 (3.8)</td>
<td>c&gt;b*</td>
</tr>
<tr>
<td>Barrier of efforts</td>
<td>17.6 (17.5)</td>
<td>18.2 (18.2)</td>
<td>15.3 (15.4)</td>
<td>a=b&gt;c**</td>
</tr>
<tr>
<td>Convenient facility</td>
<td>10.9 (12.2)</td>
<td>13.3 (13.7)</td>
<td>8.5 (6.9)</td>
<td>b&gt;a&gt;c**</td>
</tr>
</tbody>
</table>

**P<.01  *P<.05

Table 5.8. Simple main effects of different email levels at health-related teaching method after 16 weeks' interventions

<table>
<thead>
<tr>
<th>Variables</th>
<th>Email (a)</th>
<th>No email (b)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adjusted mean (Mean)</td>
<td>Adjusted mean (Mean)</td>
<td></td>
</tr>
<tr>
<td>Intention</td>
<td>11.2 (10.3)</td>
<td>12.8 (14.2)</td>
<td>Ns</td>
</tr>
<tr>
<td>Psychological Expectation</td>
<td>6.5 (6.4)</td>
<td>8.0 (8.0)</td>
<td>a&lt;b **</td>
</tr>
<tr>
<td>Health expectation</td>
<td>4.5 (4.3)</td>
<td>3.9 (4.1)</td>
<td>Ns</td>
</tr>
<tr>
<td>Barrier of efforts</td>
<td>13.9 (14.0)</td>
<td>18.0 (17.5)</td>
<td>a&lt;b **</td>
</tr>
<tr>
<td>Convenient facility</td>
<td>14.8 (14.5)</td>
<td>11.7 (12.2)</td>
<td>a&gt;b**</td>
</tr>
</tbody>
</table>

**P<.01  *P<.05
Table 5.9. Simple main effects of different email levels at Skill-related teaching method after 16 weeks' interventions

<table>
<thead>
<tr>
<th>Variables</th>
<th>Email (a) Adjusted mean (Mean)</th>
<th>No email (b) Adjusted mean (Mean)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention</td>
<td>15.2 (15.6)</td>
<td>14.0 (13.5)</td>
<td>Ns</td>
</tr>
<tr>
<td>Psychological Expectation</td>
<td>8.4 (8.8)</td>
<td>7.2 (7.1)</td>
<td>a&gt;b*</td>
</tr>
<tr>
<td>Health expectation</td>
<td>4.5 (4.5)</td>
<td>3.6 (3.6)</td>
<td>a&gt;b**</td>
</tr>
<tr>
<td>Barrier of efforts</td>
<td>16.8 (16.8)</td>
<td>18.2 (18.2)</td>
<td>a&lt;b*</td>
</tr>
<tr>
<td>Convenient facility</td>
<td>14.2 (15.2)</td>
<td>14.7 (13.7)</td>
<td>Ns</td>
</tr>
</tbody>
</table>

**P<.01  *P<.05

Table 5.10. Simple main effects of different email levels at control group after 16 weeks' interventions

<table>
<thead>
<tr>
<th>Variables</th>
<th>Email (a) Adjusted mean (Mean)</th>
<th>No email (b) Adjusted mean (Mean)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention</td>
<td>10.9 (10.9)</td>
<td>10.9 (10.9)</td>
<td>Ns</td>
</tr>
<tr>
<td>Psychological Expectation</td>
<td>7.9 (7.9)</td>
<td>8.3 (8.3)</td>
<td>Ns</td>
</tr>
<tr>
<td>Health expectation</td>
<td>3.4 (3.5)</td>
<td>3.9 (3.8)</td>
<td>a&lt;b*</td>
</tr>
<tr>
<td>Barrier of efforts</td>
<td>16.9 (16.8)</td>
<td>15.3 (15.4)</td>
<td>Ns</td>
</tr>
<tr>
<td>Convenient facility</td>
<td>12.7 (13.6)</td>
<td>7.7 (6.9)</td>
<td>a&gt;b**</td>
</tr>
</tbody>
</table>

*P<.05  **P<.01
of convenient facilities than the health-related teaching group followed by the control group after the sixteen weeks intervention.

Within the health-related teaching group, the email group had better perceived convenient facility than the no-email group. The no-email group had higher psychological expectations and barrier of efforts than the email group after the sixteen weeks intervention.

Within the skill-related teaching group, the email group had higher psychological expectations, health expectations and lower barrier of efforts than the no email groups after the sixteen weeks intervention.

Within the control group, the no teaching group, the email group had better perceived convenient facility and lower health expectations than the no-email group after the sixteen weeks intervention.

5.3.4 Follow-up Effects

The main effects results, two months after the intervention, are shown in Table 5.11 and Table 5.12. The results revealed that both the health-related and skill-related teaching groups had higher physical activity levels, health expectations, barrier of obstacles and lower barrier of time when compared to the control group. Also, the health-related teaching group had higher self-efficacy, enjoyment and lower family support than the control group, and the skill-related teaching group had perceived a better home environment than the health-related teaching group and the control group. The health-related teaching group had higher body expectations when compared to the skill-related teaching group and the control group two months after different teachings. The main effect of email treatment two months after the intervention showed that the email group had higher physical activity levels, self-efficacy, and a better perceived home environment compared to the no-email group.
Table 5.11. *Follow up main effects of different teaching levels two months after the interventions*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Health related (a) Adjusted mean (Mean)</th>
<th>Skill related (b) Adjusted mean (Mean)</th>
<th>Control group (c) Adjusted mean (Mean)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Activity</td>
<td>3037 (4009)</td>
<td>3605 (3628)</td>
<td>2972 (2732)</td>
<td>a = b &gt; c*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MET-min/week</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>30.0 (30.6)</td>
<td>28.3 (28.2)</td>
<td>27.1 (26.6)</td>
<td>a &gt; c*</td>
</tr>
<tr>
<td>Intention</td>
<td>13.1 (13.1)</td>
<td>13.3 (13.5)</td>
<td>11.8 (11.2)</td>
<td>Interaction</td>
</tr>
<tr>
<td>Enjoyment</td>
<td>25.1 (25.4)</td>
<td>23.6 (23.5)</td>
<td>22.8 (22.6)</td>
<td>a &gt; c*</td>
</tr>
<tr>
<td>Psychological Expectation</td>
<td>9.2 (8.8)</td>
<td>9.2 (9.7)</td>
<td>9.0 (8.7)</td>
<td>Interaction</td>
</tr>
<tr>
<td>Body expectation</td>
<td>9.5 (9.4)</td>
<td>7.4 (7.4)</td>
<td>7.8 (7.7)</td>
<td>a &gt; b = c**</td>
</tr>
<tr>
<td>Health expectation</td>
<td>5.6 (5.8)</td>
<td>5.5 (5.5)</td>
<td>4.8 (4.8)</td>
<td>a = b &gt; c*</td>
</tr>
<tr>
<td>Barrier of time</td>
<td>10.2 (10.0)</td>
<td>10.9 (11.0)</td>
<td>12.4 (11.3)</td>
<td>a = b &lt; c **</td>
</tr>
<tr>
<td>Barrier of efforts</td>
<td>15.2 (15.0)</td>
<td>16.4 (16.3)</td>
<td>16.7 (16.6)</td>
<td>Interaction</td>
</tr>
<tr>
<td>Barrier of Obstacle</td>
<td>14.2 (14.3)</td>
<td>14.4 (14.5)</td>
<td>13.0 (13.0)</td>
<td>a = b &gt; c*</td>
</tr>
<tr>
<td>Family support</td>
<td>30.9 (30.6)</td>
<td>32.3 (32.4)</td>
<td>35.0 (34.5)</td>
<td>c &gt; a*</td>
</tr>
<tr>
<td>Friend support</td>
<td>38.3 (38.2)</td>
<td>38.4 (38.5)</td>
<td>35.6 (34.9)</td>
<td>Interaction</td>
</tr>
<tr>
<td>Home environment</td>
<td>7.3 (7.3)</td>
<td>8.2 (8.2)</td>
<td>6.9 (6.7)</td>
<td>a = c &lt; b*</td>
</tr>
<tr>
<td>Neighbourhood environment</td>
<td>9.3 (9.3)</td>
<td>9.0 (9.0)</td>
<td>9.4 (9.4)</td>
<td>Ns</td>
</tr>
<tr>
<td>Convenient facility</td>
<td>14.5 (14.9)</td>
<td>15.2 (15.7)</td>
<td>12.4 (11.7)</td>
<td>Interaction</td>
</tr>
</tbody>
</table>
Table 5.12. *Follow up main effects of different email levels two months after the interventions*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Email (a)</th>
<th>No email (b)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adjusted mean (Mean)</td>
<td>Adjusted mean (Mean)</td>
<td></td>
</tr>
<tr>
<td>Physical Activity (MET-min/week)</td>
<td>3770 (3973)</td>
<td>3083 (2894)</td>
<td>a &gt; b**</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>29.5 (29.8)</td>
<td>27.4 (27.0)</td>
<td>a &gt; b**</td>
</tr>
<tr>
<td>Intention</td>
<td>12.6 (13.4)</td>
<td>12.8 (11.7)</td>
<td>Interaction Email*Teaching</td>
</tr>
<tr>
<td>Enjoyment</td>
<td>24.3 (24.4)</td>
<td>23.3 (23.2)</td>
<td>ns</td>
</tr>
<tr>
<td>Psychological Expectation</td>
<td>9.4 (9.4)</td>
<td>8.9 (8.8)</td>
<td>Interaction Email*Teaching</td>
</tr>
<tr>
<td>Body expectation</td>
<td>8.1 (8.1)</td>
<td>8.4 (8.3)</td>
<td>Ns</td>
</tr>
<tr>
<td>Health expectation</td>
<td>5.4 (5.5)</td>
<td>5.2 (5.2)</td>
<td>Ns</td>
</tr>
<tr>
<td>Barrier of time</td>
<td>11.1 (10.9)</td>
<td>11.3 (11.3)</td>
<td>ns</td>
</tr>
<tr>
<td>Barrier of efforts</td>
<td>15.6 (15.4)</td>
<td>16.6 (16.6)</td>
<td>Interaction Email*Teaching</td>
</tr>
<tr>
<td>Barrier of Obstacle</td>
<td>14.2 (14.4)</td>
<td>13.6 (13.4)</td>
<td>Ns</td>
</tr>
<tr>
<td>Family support</td>
<td>31.8 (31.4)</td>
<td>33.7 (33.6)</td>
<td>ns</td>
</tr>
<tr>
<td>Friend support</td>
<td>37.3 (37.3)</td>
<td>37.6 (37.3)</td>
<td>Interaction Email*Teaching</td>
</tr>
<tr>
<td>Home environment</td>
<td>7.9 (8.0)</td>
<td>6.9 (6.8)</td>
<td>a &gt; b**</td>
</tr>
<tr>
<td>Neighbourhood environment</td>
<td>9.3 (9.3)</td>
<td>9.2 (9.2)</td>
<td>Ns</td>
</tr>
<tr>
<td>Convenient facility</td>
<td>15.0 (15.4)</td>
<td>13.1 (12.7)</td>
<td>Interaction Email*Teaching</td>
</tr>
</tbody>
</table>

*P<.05  **P<.01
There were five variables which had interaction results by two ways ANCOVA after the sixteen weeks intervention. The simple main effects are shown in Tables 5.13, 5.14, 5.15, 5.16, 5.17.

Table 5.13. Follow up simple main effects of different teaching levels with email two months after the interventions

<table>
<thead>
<tr>
<th>Variables</th>
<th>Health related (a) Adjusted mean (Mean)</th>
<th>Skill related (b) Adjusted mean (Mean)</th>
<th>Control group(c) Adjusted mean (Mean)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention</td>
<td>12.8 (13.2)</td>
<td>14.4 (14.7)</td>
<td>13.2 (13.4)</td>
<td>a&lt;b *</td>
</tr>
<tr>
<td>Psychological Expectation</td>
<td>8.4 (8.2)</td>
<td>10.5 (11.0)</td>
<td>9.3 (9.0)</td>
<td>a&lt;b **</td>
</tr>
<tr>
<td>Barrier of efforts</td>
<td>13.7 (13.9)</td>
<td>15.8 (15.6)</td>
<td>17.2 (17.2)</td>
<td>b=c&gt;a**</td>
</tr>
<tr>
<td>Friend support</td>
<td>36.3 (37.0)</td>
<td>38.6 (37.9)</td>
<td>37.0 (36.8)</td>
<td>ns</td>
</tr>
<tr>
<td>Convenient facility</td>
<td>16.3 (15.8)</td>
<td>15.4 (15.9)</td>
<td>14.4 (14.4)</td>
<td>a&gt;c*</td>
</tr>
</tbody>
</table>

**P<.01 *P<.05

Within the email group, the simple main effects revealed that the skill-related teaching groups higher intention and psychological expectations than the health-related teaching group, both the skill-related teaching group and the control group had higher barrier of efforts than the health-related teaching group, and the teaching groups had better perceived convenient facility than the control group two months after the intervention.

Within the no-email group, the simple main effects revealed that both teaching groups had higher intention than the control group, the health-related teaching group had higher psychological expectations than the skill-related group, and the skill-related teaching group had a better perceived of convenient facilities than the health-related
Table 5.14. **Simple main effects of different teaching levels without email two months after the interventions**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Health related (a) Adjusted mean (Mean)</th>
<th>Skill related (b) Adjusted mean (Mean)</th>
<th>Control group (c) Adjusted mean (Mean)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention</td>
<td>13.3 (13.0)</td>
<td>12.0 (12.1)</td>
<td>10.2 (10.3)</td>
<td>a=b&gt;c**</td>
</tr>
<tr>
<td>Psychological Expectation</td>
<td>9.9 (9.8)</td>
<td>7.8 (8.2)</td>
<td>8.8 (8.5)</td>
<td>a&gt;b**</td>
</tr>
<tr>
<td>Barrier of efforts</td>
<td>16.8 (16.7)</td>
<td>17.0 (17.0)</td>
<td>16.1 (16.1)</td>
<td>Ns</td>
</tr>
<tr>
<td>Friend support</td>
<td>33.6 (33.6)</td>
<td>33.6 (33.7)</td>
<td>33.6 (33.7)</td>
<td>ns</td>
</tr>
<tr>
<td>Convenient facility</td>
<td>12.4 (13.5)</td>
<td>15.1 (15.5)</td>
<td>10.4 (9.2)</td>
<td>b&gt;a&gt;c**</td>
</tr>
</tbody>
</table>

**P<.01  *P<.05

Table 5.15. **Simple main effects of different email levels at health-related teaching method two months after the interventions**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Email (a) Adjusted mean (Mean)</th>
<th>No email (b) Adjusted mean (Mean)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention</td>
<td>12.5 (13.1)</td>
<td>14.0 (13.0)</td>
<td>ns</td>
</tr>
<tr>
<td>Psychological Expectation</td>
<td>8.2 (8.1)</td>
<td>9.8 (9.7)</td>
<td>a&lt;b*</td>
</tr>
<tr>
<td>Barrier of efforts</td>
<td>13.8 (13.9)</td>
<td>16.9 (16.7)</td>
<td>a&lt;b**</td>
</tr>
<tr>
<td>Friend support</td>
<td>28.7 (28.7)</td>
<td>33.7 (33.6)</td>
<td>a&lt;b**</td>
</tr>
<tr>
<td>Convenient facility</td>
<td>16.0 (15.8)</td>
<td>13.1 (13.5)</td>
<td>a&gt;b**</td>
</tr>
</tbody>
</table>

*P<.05  **P<.01
Table 5.16. Simple main effects of different email levels at Skill-related teaching method two months after the interventions

<table>
<thead>
<tr>
<th>Variables</th>
<th>Email (a) Adjusted mean (Mean)</th>
<th>No email (b) Adjusted mean (Mean)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention</td>
<td>13.3 (14.7)</td>
<td>13.8 (12.1)</td>
<td>ns</td>
</tr>
<tr>
<td>Psychological Expectation</td>
<td>10.8 (10.9)</td>
<td>8.4 (8.2)</td>
<td>a&gt;b**</td>
</tr>
<tr>
<td>Barrier of efforts</td>
<td>15.6 (15.6)</td>
<td>17.0 (17.0)</td>
<td>ns</td>
</tr>
<tr>
<td>Friend support</td>
<td>38.8 (37.9)</td>
<td>38.2 (39.1)</td>
<td>ns</td>
</tr>
<tr>
<td>Convenient facility</td>
<td>15.3 (15.9)</td>
<td>16.3 (15.5)</td>
<td>Ns</td>
</tr>
</tbody>
</table>

**P<.01  *P<.05

Table 5.17. Simple main effects of different email levels at control group two months after the interventions

<table>
<thead>
<tr>
<th>Variables</th>
<th>Email (a) Adjusted mean (Mean)</th>
<th>No email (b) Adjusted mean (Mean)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention</td>
<td>11.9 (12.3)</td>
<td>10.6 (10.3)</td>
<td>ns</td>
</tr>
<tr>
<td>Psychological Expectation</td>
<td>9.0 (9.3)</td>
<td>8.5 (8.4)</td>
<td>Ns</td>
</tr>
<tr>
<td>Barrier of efforts</td>
<td>17.2 (17.2)</td>
<td>16.1 (16.1)</td>
<td>Ns</td>
</tr>
<tr>
<td>Friend support</td>
<td>36.5 (36.8)</td>
<td>33.5 (33.3)</td>
<td>ns</td>
</tr>
<tr>
<td>Convenient facility</td>
<td>13.5 (14.4)</td>
<td>10.0 (9.2)</td>
<td>a&gt;b**</td>
</tr>
</tbody>
</table>

**P<.01  *P<.05
teaching group followed by the control group two months after the intervention.

Within the health-related teaching group, the no-email group had higher psychological expectations, friend support and barrier of efforts than the email group. The email group perceived more convenient facilities than the no-email group two months after the intervention.

Within the Skill-related teaching group, the email group only had higher psychological expectations than the no email groups two months after the intervention.

Within the control group, the no teaching group, the email group only had perceived more convenient facilities than the no-email group two months after the intervention.

5.4 Discussion

5.4.1 Correlates of University Students' Participation in Physical Activity at Different Stages

The correlations revealed that self-efficacy, barrier of time, friend support and perceived convenient facility had strongly correlated to university students' physical activity level. Self-efficacy has been proved as the strongest and most consistent intrapersonal effect to physical activity behaviour (Trost et al., 2002; Sallis & Owen, 1999). Most of the efficient behavioural theory had applied self-efficacy as a vital variable such as Social Cognitive Theory and the Planned Behaviour Model. Self-efficacy can be the main effective variable or mediator to physical activity behaviour. Friend support has become the most important social variable for university students instead of family support before the university life. Lack of family support and restrictions did not affect their physical activity attendance when compared to adolescents and children (Gyurcsik et al., 2006).

Researchers suggested that lack of time is an excuse rather than a barrier (Carron, Hausenblas & Estabrooks, 2003). The point is if they meant to have some physical
activities they would find time to do so. For example, university students have more flexible time to attend different social activities. They still considered social invitation during workout time was the biggest barriers for attending physical activity (Gyurcsik et al., 2006).

Environment issues have been emphasized for promoting physical activity. It seems reasonable that more convenient facilities being offered at university provided more opportunities and flexible time to attend physical activity. However, it also implied that most university students might prefer to have their physical activities at certain exercise facilities instead of home or neighbourhood environment.

Intention is reflected in a person’s willingness and how much effort he or she is planning to exert to perform the behaviour (Carron, Hausenblas & Estabrooks, 2003). Intention was a strong connection between university students' physical activity level at the baseline and the follow-up survey but not after the intervention. This incomprehensible result might come from the approaching exam near the end of the term: Since the questions asked their intention in the next fortnight, most of the students might be stressed by the intensive exam during the last two weeks of the academic term. Their intention for doing exercise might be back to normal level when the exam is finished.

5.4.2 The Shift of Stage of Change among Different Intervention Periods

The distribution of stage of changes had a significant change from the baseline to the end of the intervention and the follow-up survey. The changes were from ten percent more of contemplation stage people had moved forward to preparation stage then to action and maintenance stage. It meant the contemplation participants had actualized their intention into real physical activity behaviours and more people became active after the intervention. The effects maintained at least for two months time. Even more people were active at the follow-up survey. There was only a minor decrease at
preparation stage but still had higher percentage than the baseline. The results partly supported that the PE teaching intervention and email strategy were efficient to promote university students physical activity and had moved them to a more active stage.

5.4.3 The Main Effects of Teaching and Email Intervention

In this study, both health-related and skill-related teaching groups had higher physical activity levels compared to the control group after the sixteen weeks intervention. These results mainly showed their out-of-PE physical activity levels. Furthermore, the health-related teaching groups obtained more friend support than the control group. A study of Australian college students reported low levels of social support from either family or friends were more likely to be insufficiently active for health benefits than those with high levels of support (Leslie et al., 1999). The improvement of friend support had played a vital role as a potential mediator for the health-related teaching group to reach higher physical activity levels. Also, the skill-related teaching group had perceived a better neighbourhood environment than the control group. It might be due to the safety for doing certain exercise or sport at a certain place or facility within the university environment according to the design of the questionnaire.

Mediated interventions had been found more effective than face-to-face or a combination program to increase physical activity levels (Dishman & Buckworth, 1996). Information using internet technology to promote physical activity may be suitable for young people in the modernized society and had been suggested to develop population-based promotion for physical activity in the future (Marcus et al., 2000; Calfas et al., 2000). Using website-based intervention had been found to influence physical activity, self-efficacy and intention efficiently in different age groups (Marshall et al., 2003; Marks et al., 2006).

In this study, the main effect of email treatment showed that the email group had
higher physical activity levels, self-efficacy, enjoyment, and a better perceived home environment compared to the no-email group. Self-efficacy and enjoyment were essential effecting variables to physical activity; and home environments such as home equipment also became more important from recent studies (Trost, 2002). Email-based intervention seems to be offering a more ambitious and direct information to participants. It allowed the participants and researchers to have two way communications during the intervention. A well designed package of email-based approaches to improve people’s physical activity for different generations may be a promising intervention in the near future.

5.4.4 The Simple Main Effects of Teaching and Email Intervention

Within the email groups, the simple main effects revealed that the skill-related teaching groups had a higher intention than the health-related teaching group and the control group. At the age of university students, they may still fancy more skill-related physical activities from a variety of information such as mass media. Basketball, baseball, and soccer are all very popular in the young generation due to the professional games from US, UK, Japan and Taiwan. Their motivation and intention could always be stimulated by the media and strengthen their motivation during different sport seasons. Especially for young men, the competition element in exercise was the most significant perceived benefit (Bourdeaudhuij & Sallis, 2002; Markland & Hardy, 1993). The skill-related courses might enforce their competence and ability for doing certain sport or exercise. In this category, email might play an equally vital role to affect participants’ knowledge in each group but strengthen stronger effects on the skill-related teaching groups due to the information from emails had less overlap with skill-related teaching. Furthermore, the effects of emails might mix up with the effects from teachings especially when the dependent variables were not the strongest determinants.

The simple main effect within the no email groups revealed that both the teaching
groups had higher intention and barrier of efforts than the control group. For the people who did not do exercise they may not experience so many barriers as people who intended to have physical activity. In other words, the extent of self-demanding was different between active people and sedentary people. For example, from precontemplation to contemplation or preparation stage of change, people just need to change their intention for attending some physical activity. However, from preparation stage to action or maintenance stages, they have to put more effort for reaching the regular exercise criterion or keep this effort for at least six months longer. For the active people they might experience the obstacles from bad weather or if it interferes with the university work when they were attending physical activity but sedentary people might not feel any obstacles with no physical activity at all.

Some variables appeared to play different and important roles in different intervention treatments including psychological expectation, health expectation both in email and no-email groups. Research had found that expect benefits had a positive connection to physical activity behaviours (Trost, 2002). The ambiguous results about the expectation of physical activity revealed that university students’ expect benefits from attending physical activity during the intervention had not been well documented in this study. Alternatively, the benefits of physical activity might be just knowledge to the participants. Although, the intervention changed their physical activity behaviour but it did not mean that their body, mind and health had reached the certain level to satisfy or change their thought and knowledge. For example, participants who expected physical activity can help her or him to stay in shape and lose weight at the beginning of the intervention. After the intervention they certainly found it works and they lost weight and stayed in shape. But, their reason for doing physical activity can stay the same or shift to psychological aspect or health aspect.

For the participants who did not engage in physical activity they can still have the
knowledge about the benefits from physical activity. Their aim for attending physical activity can be ambiguous due to no intention to do any physical activity. They might just think the benefits of physical activity more than do physical activity. Their expectation can stay high or even higher than before. The expectation of physical activity reflected people's needs for physical activity at that time but not certainly the level or stage of their physical activity. That knowledge of the health effects of physical activity is not correlated with activity level (Carron, Hausenblas & Estabrooks, 2003). Researchers suggested other factors are more important in the control of physical activity habits and that interventions intended solely to increase knowledge would not be effective (Sallis & Owen, 1999).

Within the email groups, the skill-related teaching group had a better perception of convenient facilities than the health-related teaching group followed by the control group after the sixteen weeks intervention. In the second study, using qualitative research found that most of the students' physical activity took place on campus. The environments variables might be more effective when the participants perceived environments differently at the beginning of the term. After sixteen weeks, students might be more familiar with the campus and exercise facilities whether they were attending the intervention or not.

Firstly, due to the limited range of campus, especially, the design of the university had gathered most of the sport and exercise facilities in a certain area. Their perceived access to physical activity resources can be easily close to the actual access in the university environment. It might be hard to have significant effects from the intervention trying to expand the differences in a university environment. Secondly, when students' main physical activity habit had been established, they might stick to it until they got bored. Their awareness of the physical environment might only be related to the exercise they were attending.
The simple main effects of email within different teaching groups and the control group had different results. Both of the teaching groups had lower barrier of efforts for attending exercise from the email treatment. Email offered a better perceived convenient facility to the health-related teaching group which belong to the environmental category. Emails were more effective on intrapersonal variables including psychological expectation and health expectation for the skill-related teaching group. All the variables had been found to link to people's physical activity level (Sallis & Owen, 1999; Trost, 2002). Even without teaching, participant's perceived convenient facilities had been improved by email but health expectation had a diverse result. The information and knowledge about the benefits of physical activity or exercise might be easy for both groups to gain via a variety of methods but not just from e-mails. The effects of emails could be merged with other information such as education and mass media.

5.4.5 The Follow-up Survey after the Intervention

The follow-up survey took place two months after the intervention due to all participants needing to attend a new PE course after their winter vacation. So, all the follow up results were documented at the second week PE teaching course. Firstly, the interventions maintained effect in promoting long-term physical activity for the two months period. Secondly, there was some mediated variables varied their effects on participants' physical activity over two months when compared to the intervention period.

From the ANCOVA results, both teaching groups still maintained higher physical activity levels than the control group with baseline as covariance. Results also revealed that both teaching groups had higher health expectation, barrier of obstacles and lower barrier of time compared to the control group. The health-related teaching group had higher self-efficacy and enjoyment than the control group. The skill-related teaching perceived a better home environment for physical activities than the other groups.
Different variables exert a different degree of influence on different people (Carron, Hausenblas & Estabrooks, 2003). They can also vary from different periods of time. For example, children and teenagers may need more family support than friend support while attending physical activity. University students may need more friend support than family support due to most of the university students being away from their family. Although, some mediated variables changed their importance over two months, the changes did not influence their physical activity level. Most of the mediated variables might strengthen their physical activity behaviors positively and weaken the effects of barrier of obstacles to the participants.

Also the main effect of the email intervention maintained over two months on participants’ physical activity levels, self-efficacy and perceived home environment. Although the enjoyment variable effect was not significant as intervention period, it might merged to self-efficacy due to their significant correlation.

There were minor changes between intervention period and follow up survey in the simple main effect results. The skill-related teaching group revealed higher intention for physical activity than health-related teaching group within the email intervention. Friend support only emerged at the health-related teaching category that no e-mail group had higher friend support than the email group. It is hard to have a comprehensive explanation for all the mediating variables affected to the participants’ physical activity behaviours due to the interaction between teaching and email intervention treatment. However, the big picture was that participant’s physical activity level had maintained to a certain level and become more active. The deeper explanation of mediating variables’ effect on certain intervention categories needs a further experimental design to test their efficiency.

5.5 Conclusion
The purpose of this study was to increase leisure time physical activity levels among university students via different PE teaching curriculum and mediated intervention with email. The evaluation revealed that both PE teaching curriculum and email had positive impacts on university student's physical activity behaviours and moved them into a better stage to be active via the interventions with long-term effects two months afterwards. Also, some potential mediator variables had changed during the intervention period and the two months follow-up survey from the baseline, and provided some information about the effects of intervention.

The most consistent mediating variables might be mainly attributed from friend support for the intervention and self-efficacy for the follow-up survey among teaching groups and control groups. The email effect might be mainly mediated from self-efficacy, enjoyment, and home environment for the intervention period and self-efficacy and home environment for the follow-up survey according to the ANCOVA results. This study can hardly said that interventions increased university students’ outside of school physical activity level due to more flexible course timetable in university unlike high school or primary school and due to most of the students lived on campus, but the matter of fact was participants' physical activity levels had improved beyond the PE course.

PE courses used to be executed in most of the universities in Taiwan. It is an encouraging message that PE courses can play a vital role for improving university students' physical activity level, since PE classes have been eliminated in many universities in the past decade as a wrong policy. Also, mediated method such as print media and website had been proved to have significant effects on physical activity behaviours and some important mediating variables such as self-efficacy (Marshall et al., 2003; Marks et al., 2006). Using email to promote physical activity can be more applicable to the modern society, especially for young people.
An investigation of university freshmen applied an ecological approach to their physical activity also revealed more university freshmen barriers than other grade groupings in Canada (Gyurcsik et al., 2006). Their barriers for doing physical activity included health issues, lack of sleep, social invitations during workout time, traveling home to visit family/friends, school workload too high to allow for physical activity, job cuts into physical activity time, lack of transportation to facilities and lack of specific sports team to join and so on. All categories of barrier are partly different from previous adult studies (Sallis & Owen, 1998; Trost et al., 2002).

University students' life styles and habit might be very different from general adult's life style. Their behaviours of physical activity might be more predictable and explainable if one focuses on limited classes of behaviours by developing separate models for walking, jogging, gardening, and dance aerobics, and build interventions that encompass the factors in the separate models, tailored to the appropriate variables at the appropriate time according to Baranowski and his colleagues' suggestion (1998). Also, the physical behaviours had been defined in a broad domain. It might cause the difficulties of predicting and explaining various physical activity behaviours with limited variables in different situations.

Investigating or promoting single physical behaviour may be more efficient and predictable for future study such as university students' stair using, transportation, and other specific exercise behaviour. Furthermore, theories or technologies of increasing physical activity may be more or less effective depending on whether they are targeted to people with a history of sedentariness, a history of infrequent activity, or a history of regular activity (Gauvin, et al., 2001).

Physical activity determinants had been defined as the characteristics of adherence to physical activity. It seems more applicable to action and maintenance stage and the people who were active. Once the people who do not exercise or do not have regular
physical activity, it becomes more complicated to explain their behaviour via a variety of determinants. Therefore, if this study only recruited sedentary university as the target population, the relevant variables might be more consistent to previous studies and be more explainable to the results. It could be the limitation of this study.

PE course designs and email strategy had been tested with efficacy to improve university students' physical activity levels with long-term effects. Physical education can broadly be a successful group-based intervention in university settings. Future studies may focus on testing its long-term effect to test if PE course attending history can affect physical behaviours during university and after graduation. Applying internet technology, such as email or website, can offer a rapid and mutual reply system between the operator and participants. Internet use has been widely integrated into modern life. It will be promising if internet technology can be broadly applied to promote physical activity in a group-based, community-based, or even a society-based strategy with high efficiency and at low cost. Future study may focus on specific designs, delivery frequency, and information delivery method (email or webpage) for changing specific and general physical activity behaviours, and their mediated variables such as attitude, knowledge, social support and other variables.

The current study found that PE courses and an email strategy influenced university students' physical activity behaviours. It still lacks robust evidence to show a causal effect from PE to university students' physical activity levels, although some mediated variables were also tested to support the possible reasons about how physical activity levels were improved.

The PE courses intended either to build up students' confidence of specific sport skills by skill-related teaching or introduce varieties of activity that are easy to execute in their life by health-related teaching. For the skill-related teaching group, a follow up survey might also include some evaluation of skill improvement. Also, a survey of
current activities and the frequency they are attending might reveal the effects of teaching which can facilitate their involvement in certain sports or activities that have been taught during PE. These actions might help the student to have a better view of the physical activity behaviour changes for the future.

Email treatment had a profound effect on changing students’ physical activity levels in this study. It can be a good way to become a reminder or educator for young generation through mutual communication. Further study shall also test the different effects of information delivery frequency, format, method, and the reply frequency from the participants which may have different influences on participants.
Chapter 6 Overall discussion and conclusion

Physical activity has been identified as an important element to combat the high mortality of coronary heart disease and stroke in the modern society (Biddle & Mutrie, 2001). Studies have also found that physical inactivity has a strong connection to health risks such as cardiovascular disease and premature death (USDHHS et al., 1999). Furthermore, inadequate physical activity has been identified as one of the six priority health risk behaviours for college students' populations (Buckworth, 2001; American College Health Association, 2002).

Researchers must pay as much attention as they can to this population because research has reported that about 40% to 50% of college students are physically inactive (Keating et al, 2005). Research has also highlighted the issue that high percentages of Pacific Asian (42%) and developing country (44%) university students have been identified as physically inactive (Haase et al., 2004). Although participating in inadequate physical activity has become an international issue, specific populations may need particular attention. Studies must pay attention to the possible serious outcome that university students' physical activity further decreases after graduation and with the feeling of being older for male students if basically their physical activity level is comparably lower than non-students today (Leslie et al., 1999; Puska, 1974).

Following the epidemiological procedure and ecological approach, the main purpose of this thesis focused on the university student population to review the previous research results by a systematic review method (first study), to compare the differences between UK and Taiwanese participants' and relevant effective variables by using a quantitative study method (second study), to have a deeper understanding of the Taiwanese university students' physical activity behaviours by using a qualitative study method (third study), then to evaluate the efficiency of designed interventions in
university settings (fourth study). The whole thesis applied the ecological approach to classify the survey variables' effect to university students' physical activity behaviours.

6.1 A Systematic Review of Correlates and Interventions on Physical Activity in University Population

The first study applied the systematic review method trying to have a whole picture of university students' physical activity studies which were published between 1973 and September 2004. Overall, fifty five articles contribute significantly to a general idea and a further understanding of the factors associated with university students' physical activity. Also, few interventions studies were found to apply to this population. Some significant issues were identified from the systematic reviews for further study.

Physical Activity Measurement Issues

Concerning the physical activity measurement issue, estimating the energy expenditure mainly counts on the type (intensity) it assumes that most of the students devoted with fixed duration and frequency. Gender and race differences may be caused from different activity types. For example, if female student preferentially engaged in moderate or light physical activities with low energy requirement such as walking; and male students engaged more in vigorous physical activity with high metabolic cost such as team sports, when estimating their energy expenditure, spending on one hour vigorous physical activities is equal to two hours moderate exercise and three to six hours light exercise. Since seeking available time has become the biggest barrier and excuse for people to participate in adequate physical activity, investing less time in vigorous activity for reaching the criterion of sound physical activity level seems easier for male students and young adults due to their activity type and physical capacity. Besides, the benefit gained from physical activity should not only be based on the total energy expenditure, which is mainly emphasizing physical health, but also the quality
and satisfaction of the activities which may benefit the psychological and social aspects
of well-being.

**Correlates on Physical Activity in University Population**

Although there were no links between attitude and physical activity in adult studies
(Trost et al., 2002), positive attitude did advance university students' physical activity
behaviours. Creating and establishing positive attitude through health and physical
education may be valid for the university students' population.

Barriers of time, motivation and perceived obstacle hindered university students'
participation in physical activity except the barrier of health. According to the physical
development, young adults may not experience the immediate threat of health during
the university life phase. It can cause a lurking risk after their graduation and in later life,
if young adults keep consuming their health and fitness with a sedentary life style.

Enforce commitment to physical activity can enhance physical activity level for
university students, especially for high intensity activities (Deeter, 1988). Using
strategies to strengthen self demand for participating in vigorous activity may have
double effects of positive results.

Social support came from many possible resources with different effect levels.
Female students may emphasize more on health purpose for doing exercise; and, it
maybe more compatible with parents’ or family expectation. While male students
attending physical activities, competitiveness, skills and sport ability may be recognized
more by peers or friends.

It is encouraging that organizing groups with an active atmosphere can raise the
participation in physical activities on campus environments. University decision makers
should be aware of the responsibility to create the opportunities through proper course
design or relevant programs to promote university students' physical activity level and
establish their exercise habits.
Environmental issues still remain on self-reported survey studies. Convenient facilities, proper campus design, home equipments and affordable programs facilitated university students' physical activity behaviours. Policy also played a vital role for offering a active environment through campus design and physical activities promotion campaigns. More objective study designs and measures are needed for campus environments such as applying GIS to physical activity study.

Physical activity history and high school PE courses had certain effects on university students' physical activity behaviours, although research doubted that PE course only initially introduce and expand the variety of activity types but not the total amount of physical activity levels (Eastman et al., 2000). Future studies can focus on alumni's physical activity behaviours via the survey of their physical activity history and PE course attending or more longitudinal studies.

Applying certain variables to predict general or total physical activity levels may be less precise than to specific physical activity behaviours. For example, a person's active transportation behaviour may be affected by a convenient bus stop, available time, and weather but less from the enjoyment, self-efficacy of exercise or social support. And, transportation behaviour may not be the main physical activity in his/her life. It might be why applying variables to predict physical activity behaviour can only explain unsatisfied variation. It may be more useful and precise by using certain effective variables to predict certain or main physical activity behaviour.

Intervention Studies of University Students' Physical Activity

Research needs more effort on intervention studies with university students because few articles have been published in this area. Strategies to strengthen self-efficacy, social support and enjoyment had unequal positive effects on students' physical activity behaviours and their intention to be active. A mediated method with mailed interventions tailored to stages affected university students' physical activity
behaviours. New technologies, such as email and website-based interventions, may substitute the traditional information delivery method and may be more suitable to modern society and a younger generation. Policy, PE courses, designed fitness programs, environmental design, mediators and strategies such as intervention length and frequency are needed along with more longitudinal surveys.

6.2. *A Survey of English and Taiwanese University Students to Assess Intraperonal, Interpersonal and Physical Environmental Influences on Physical Activity*

In the second study, a comparison between UK and Taiwanese university students' physical activity levels had been executed to seek the differences and significant variables to their physical activity behaviours. According to the ecological approach, some relevant variables had been chosen since they all had significant effects in adult studies.

The preferences of physical activities were different based on gender and countries. Intervention or program designs shall fit their needs and consider their differences. Also, the result found that most of the university students still rigidly adhered to so called constructed exercise or sport such as team sport for male students and swimming and aerobic exercise for female students. Some physical activities might be easy to execute in university setting but do not have continuity after their graduation. Active life style such as active transportation, walking and stair climbing should be encouraged to integrate into their life as a custom.

British students had higher physical activity levels and male students had higher physical activity than females. The determinants (variables) in every factor of physical activity levels were more correlated for British participants than Taiwanese participants for both genders. The effects might add up to a certain level from their mutual aids. Although some variables were stronger in Taiwanese students but its single effect might
be not strong enough to stimulate their motivation to be active. According to the ecological model, environmental, interpersonal and intrapersonal supports must be all provided. Creating an active environment and more opportunities; seeking for groups, peers, family and other possible social support; and intensifying their inner thinking for engaging in all kinds of physical activities are all encouraged for university populations.

Intention and friend support were the most consistent correlating variables to physical activity levels for all gender and nationality groups. Also, multiple regression analyses revealed the varied significance of variables to different sample groups when applying all variables to predict physical activity levels. Intention still became the most consistent predictor for most investigating groups except for the British female students. Strategies for strengthening their intention to prevent a sedentary lifestyle and maintain sound physical activity level in their lives of social environment, especially, from friends is noticeable for this target population.

According to the planned behaviour theory, intention is the antecedent variable to physical activity behaviours. And, Leslie et al. (2003) mentioned that young adults do not think as clearly about intention to engage in moderate-intensity activity as they do for vigorous activity. In order to have a better view for applying the theories to physical activity studies, the survey of physical activity may need to be specified its characteristics such as jogging, active transportation, designed exercise programs or sports.

Self-efficacy, friend support and intention had an uptrend of their intensity followed the stage of changes in the second study. These significant variables can be applied to the future study as survey variables which can facilitate university students to step up their pace and strength their adherence to the active stage.

The explanation of variation of physical activity for the British sample was more than 52% by the chosen variable in this study but less than 29% for the Taiwanese
sample. Survey variables might not be suitable for Taiwanese participants to explain their physical activity behaviours. Seeking out more effective determinants for Taiwanese students is essential for future study.

Barriers were supposed to have negative effects on physical activity behaviours if they were real obstructers. If barriers were just an excuse, then, they could be prevalent in every physical activity level such as barrier of time. The major problem is if they considered that physical activity is meaningful to them and put them to the high priority in their daily life.

6.3. A Qualitative Study of University Students' Physical Activity Participation in Taiwan using an Ecological Model Approach

In order to have a deeper understanding of university students' physical activity behaviours, a qualitative study with an in-depth interview had been made according to an ecological framework. The Thematic analysis method identified the thematic codes mainly through ecological model for seeking the theme categories. Some significant issues are noticeable from the study:

Studies must define clearly the meaning of physical activity for the participants if they are not so clear of its meaning. For example, participants in this study initially did not recognize the term when answering the questions. The term of “physical activity” might be perceived and interpreted differently to different people. Most of the Taiwanese participants considered physical activity is equal to exercise and sports.

Physical activity history played a vital role for university students to establish an active life style via attending exercise and sport clubs. Students continue their physical activity mainly based on their competence on this activity (exercise or sport). The habit was established due to their self-confidence and achievement so that they could enjoy this physical activity.
Participants in this study set up the priority reason for doing physical activities. Male students emphasized more on the competence, fitness and enjoyment. Female students concerned more about interest, fitness, weight control and friendship. Intervention design may consider satisfying the different needs of gender differences.

The enjoyment feeling may be the incentive for people continuing their physical activity. Creating enjoyable activities and changing the stereotype of physical activity as a hard work may be encouraging for inactive students.

Self-efficacy had been found as the strongest effective variable to physical activity behaviours. In this study, university students not only were concerned about their confidence for doing physical activities under specific circumstances but also their competence to attend specific physical activity. It might be that most of the students attended skill-related physical activity such as sports but not health-related physical activity such as jogging or running. Education must emphasize sport is not the only option to be active. There are still varied physical activities which can satisfy their needs to be active without or needed less skill such as jogging, weight training, walking and so on. Sports may not be the only option for young people or students.

Most of the students did not intend to participate in physical activities because they consider exercise is not being important to their daily life. How to persuade and educate university students regarding the important benefits of physical activity to their life has become the first step for promoting their intention and physical activity levels.

This study found that barriers were prevalent not only to sedentary students but also to active students. Obviously, active students had stronger commitment to their physical activity behaviours when against the barriers.

Friend support is more significant than family support during the university life phase for participating in physical activity. It might be hard for sedentary students to get involved in active student groups. Organizing activities and encouraging some
individual physical activities can improve this situation.

School or university facilities were the first option and safe setting for university students participating in physical activities. Convenient facilities, flexible opening times, nice weather, and space become the most significant environmental issues on campus.

Students' sedentary/active behaviours might be inherited from parents or established from their family history or habits. Education should break the stereotype of obesity and over weight students that physical activity is not a competition or sport. People have the right and responsibility to maintain their health and pursue a better life through an active life style.

6.4 An Intervention to Increase University Students' Physical Activity Using Health-related versus Skill-related PE Curricula and Email Delivery Strategies

The purpose of the fourth study to test the difference of a health-related PE course and a skill-related PE course compared to control groups; and examine the efficacy of a new mediated method (email) to promote university students' physical activity levels. A longitudinal design with a sixteen weeks intervention period and a two months follow up survey were executed in a university setting.

Survey to baseline, after the intervention and follow up phases, the most consistent correlated variables to physical activity levels were self-efficacy, barrier of time, friend support and convenient facility. They may represent the most critical variables which affected university students' physical activity behaviours.

Results indicated the sound and long-term effects of interventions according to the promotion of stage of changes and physical activity levels. It proved both PE course designs and mediated strategy (email) could improve university students' physical activity levels.

Previous study focused on university students' intention to be active and found that
short-range about 2 to 3 days intention was a better predictor of physical activity than
the longer-range intention /4 weeks (Courneya & McAuley, 1993); and, this study used
fortnight as the range. Intention range can be a new issue, especially, when a study
applies the relevant theory such as theory of planned behaviour as a central subject.

Information using internet technology to promote physical activity may be suitable
for young people in the modernized society and had been suggested to develop
population-based promotion. (Marcus et al., 2000; Calfas et al., 2000). Using a
website-based intervention has been found to influence physical activity, self-efficacy
and intention efficiently in different age groups (Marshall et al., 2003; Marks et al.,
2006). In this study, an email strategy has been proven to be an effective method to
increase university students’ physical activity levels. Further research should test, if the
frequency of information sending can have different effect levels to physical activity
behaviour change.

It is encouraging that a PE course design could improve physical activity levels in
the university setting. Policy should not ignore the value of the PE course teachings
since most of the university students need more education and help to establish their
active and healthy life style.

Some survey variables in the intervention study did not have the mutual changes
with physical activity levels from the main effects results. It meant mediators had
inconsistent power to affect physical activity behaviours that was influenced by the
interventions. It may because that intervention did not highlight to change any single
mediator to improve physical activity but physical activity itself and all potential
mediators averagely. Future intervention studies may focus on certain mediator effects
to physical activity changes upon applying theories or models.

6.5 Conclusion

Due to the wide range of definitions of “physical activity”, it may give participants
an ambiguous direction or huge picture to think about their physical activity behaviours if they did not have main or regular physical activities. It may decrease predictor's powers, especially, for sedentary participants by investigated variables because some predictor variables may only effect to specific activity and specific person under a specific situation. Studies may also classify different intensities of physical activities to see the different significance or effective levels of predictor variables.

According to university students' and adults' studies, variables might have different effect to general physical activity behaviour (Sallis & Owen, 1998; Trost et al., 2002; Keating et al., 2005). The significance of their effects might vary from time to time. Environmental variables can be the basic support and unchangeable variables for people to be active in their present living area; and interpersonal variables come to the second supporter. Then, intrapersonal variables strengthen their commitment to maintain active or become their excuses to be sedentary. Stage of changes may be applicable to see the shift but it needs a long term survey and a longitudinal study design.

University students have distinguishing characteristics that may be affected by their physical development. Maturity of physical condition during the university phase may decrease their awareness of the risk from a sedentary lifestyle. The priority of life arrangement also lets them ignore the need to be active. They also do not feel the immediate threat from health problems and aging. This phenomenon decreased their need and their value of physical activities. Promoting university students' physical activity level must emphasize both the benefits of active lifestyle and potential and serious risk of sedentary behaviour for their later life. Health can not be postponed until problems emerge. It can be a multiple of the social cost and personal time with lots of efforts to redeem.

Universities must take the responsibility for providing an active environment and opportunities for university students to be active. Policy must create a safe environment
and offer a convenient access by active campus design, affordable facilities, flexible opening times, various activities and organized programs to support their physical activity levels. Physical education, exercise or sport clubs and any other physical activity opportunities are all encouraged to facilitate university students to establish active habits to maintain their health.

New information technologies such as internet and GIS (Geographic Information System) need more attention for future study. Mediated methods had been applied to promote peoples’ physical activity level in many studies such as a newsletter, the telephone, and the mass media. Using designed home page and email can offer a new chance for delivering messages and receiving responses. New technologies can have immediate and wide ranging effects with a very low cost compared to other mediated methods. It may be suitable to promote the physical activity for young generations like university students.

Most of the studies used self-report design to measure environmental variables. Study revealed there were no differences of awareness and unawareness of campus facilities between active and inactive students both for females and males (Leslie et al., 1999). People who lived in the same area might have different awareness and judgments of their physical environments. An objective measurement such as GIS can have a better view of people’s environmental issues like estimating and considering the number and distance of schools, parks, pavements, cycling lines and any other important area for doing physical activities. It can facilitate the self-report studies. And, with these objective surveys, self-perceived (self-report) environment can also be used to identify its validation to relevant physical environmental studies.

Although this study attempted a wide ranging understanding of university students’ physical activity behaviours, there are still some suggestions that may benefit future research in this area. Firstly, more studies are needed on the environment, policy, and
intervention designs focusing on this population.

Secondly, the term “physical activity” sometimes is confusing and restricted to “exercise” and “sport” for younger generations. Researchers need to have a clear definition for the participants and make sure they fully understand the definition of “physical activity”.

Thirdly, measurement issues are always important for explaining results and making appropriate conclusions. Varieties of physical activity measuring methods were designed with different considerations in mind. Choosing or developing a valid and reliable physical activity measurement which can satisfy the study purpose and design has become more critical for future studies. Also, chosen variables may be more powerful to predict specific physical activity behaviours but not general physical activity level.

Fourthly, in order to generalize the results of the study, more participants, especially for English students, are needed to come to a stronger conclusion and to satisfy the cultural comparison purpose sought.

Fifthly, for the study purpose for expanding the difference in the qualitative study, the participants at the preparation stage were excluded. This population may have larger potential to cross the line to maintain regular physical activity and therefore need to be considered as a focus group in the future.

Sixthly, polices and environmental strategies are easier to execute in university settings when compared to some community settings. The successful strategies and experiences from university settings for young adults may be more applicable to translate to wider modern society, such as car use policy on university campuses.
References


Chief Medical Officer. (2004). At least five a week -- Evidence on the impact of physical activity and its relationship to health.  
http://www.creationsports.co.uk/articles/at-least-5-a-week.pdf


At least five a week: Evidence on the impact of physical activity and its relationship
to health. Chief Medical Officer.

determinates of self-reported physical activity to a motion sensor. Medicine and
Science in Sports and Exercise, 24 (8), 904-910.


Champaign, IL: Human Kinetics.

Douglas, K. A. et al. (1997). Results from the 1995 National College Health Risk

Drummond, J. L. (1996). Type of physical activity, variables describing participation in
physical activity, and self-perceived fitness. Perceptual and Motor Skill, 83 (2),
472-474.

Active, a randomized trial. Medicine and Science in Sports and
Exercise, 1076-1083.

interventions- History, short- and long-term effects, and recommendation.


Social cognitive theory versus the theories of reasoned action and planned behavior.
Journal of Sport and Exercise Psychology. 12 (4), 388-405.


the transtheoretical model need an attitude adjustment?: Integrating attitude with decisional balance as predictors of stage of change of exercise. *Psychology of Sport and Exercise*, 3 (1), 65-83.


Kathryn, H. S. et al. (2002). Psychosocial correlates of physical activity and sedentary leisure habits in young adolescents: The teens eating for energy and nutrition at school study, *Preventive Medicine*, 34 (2), 266-278.


### Appendix 1

#### Systematic review of physical activity and university (college) student

<table>
<thead>
<tr>
<th>Ref No.</th>
<th>STUDY</th>
<th>COUNTRY</th>
<th>MEASUREMENTS (VARIABLES)</th>
<th>PARTICIPANTS (University or college students)</th>
<th>AGE</th>
<th>METHOD OF ANALYSIS</th>
<th>SUMMARY OF RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sonstroem &amp; Walker (1973)</td>
<td>US</td>
<td>Rotter's I-E scale&lt;br&gt;Attitudes Toward Physical Activity (ATPA)&lt;br&gt;Voluntary PA Questionnaire</td>
<td>102</td>
<td></td>
<td>One way analysis of covariance</td>
<td>Attitude effect was significant on voluntary exercise reports. More favourable attitudes toward PA obtained significantly better fitness scores and reported significantly greater amount of voluntary physical exercise than others.</td>
</tr>
<tr>
<td>2</td>
<td>Puska (1974)</td>
<td>Finland</td>
<td>Health behaviour investigation</td>
<td>231 student&lt;br&gt;189 non-student</td>
<td></td>
<td>Descriptive analysis</td>
<td>Non-student seemed to have more physical activity because of their work. On the other hand there was no difference in taking part in special sports activities.</td>
</tr>
<tr>
<td>3</td>
<td>Hendry (1975)</td>
<td>Scotland</td>
<td>Greater amounts of movement behaviour&lt;br&gt;(Active-competitively, Active-recreatively, and Non-Participant)&lt;br&gt;Eysenck Personality Inventory&lt;br&gt;Attitude to Physical Activity Scale&lt;br&gt;Social class&lt;br&gt;Academic performance</td>
<td>96 men&lt;br&gt;134 women</td>
<td></td>
<td>Regression analysis</td>
<td>Active student were more stable and extraverted, and had more favourable attitudes to PA. Active involvement in movement behaviour was positively related to previous school involvement, social class and extraversion for men; year of study, multiple choice scores and previous school involvement for women.</td>
</tr>
<tr>
<td></td>
<td>Study (Year)</td>
<td>Country</td>
<td>Test/Scale</td>
<td>Sample Size</td>
<td>Method</td>
<td>Findings</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-------------------</td>
<td>-----------</td>
<td>----------------------------------------------------------------------------</td>
<td>-------------</td>
<td>-------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Joesting (1981)</td>
<td>US</td>
<td>Body-cathexis scale</td>
<td>66</td>
<td>t-test</td>
<td>People who participate in regular physical activity do have a better view of their bodies as well as a higher self-concept.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Self-cathexis scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hours per week PA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Type of PA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Onifade (1985)</td>
<td>Nigerian in US</td>
<td>Attitude Toward Physical Activity (ATPA)</td>
<td>Male 217</td>
<td>Multiple regression</td>
<td>There was no relationship among attitude, physical activity behaviour and physical activity belief of Nigerian university students in USA.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Physical activity behaviour scale</td>
<td>Female 133</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Physical activity believe scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Mathes &amp; Battista (1985)</td>
<td>US</td>
<td>Kenyon Attitude Toward Physical Activity Scale</td>
<td>50 male athletes</td>
<td>Factor analysis</td>
<td>Health and fitness are more important than competition and social experience factors as a motive for involvement in PA. Women rated competition lower and social experience higher than men. Athletes had higher scores to competition.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50 female athletes</td>
<td>t-test</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50 male nonathletes</td>
<td>MANOVA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50 female nonathletes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Richert &amp; Hummers (1986)</td>
<td>US</td>
<td>Self-report eating and exercise habit(11 common physical activities)</td>
<td>183 males</td>
<td>correlation</td>
<td>Total EAT scale scores showed significant, positive correlations with reported hours of jogging per week and with exercising alone. A larger percentage of persons potentially at risk for eating disorders (70.6%) than of normals (45.1%) reported engaging in jogging.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>145 females</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 males (at risk group)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>26 females (at risk group)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Page</td>
<td>Study</td>
<td>Country</td>
<td>Measure</td>
<td>Sample Size</td>
<td>Method</td>
<td>Findings</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-------</td>
<td>---------</td>
<td>---------</td>
<td>-------------</td>
<td>--------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Page (1987)</td>
<td>US</td>
<td>Self-report physical activity</td>
<td>274</td>
<td>Descriptive analysis t-test</td>
<td>40.4% male and 32.3% female maintained a regular schedule of physical activity. 76.9% of those who did not maintain a regular schedule of physical activity intended to have a regular schedule soon. Females were significantly more likely to agree with the statements 'I need to get enough exercise' and 'It's hard for me to stick to a regular schedule of physical activity'. Males were more likely to believe that 'the amount of physical activity I now get is enough to keep me healthy'.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Seggar, McAmmon &amp; Cannon (1988)</td>
<td>US</td>
<td>Hours of athletic activity weekly, Jourard Body-cathexis Scale, Personal Ideal Discrepancy, Shared Ideal Discrepancy, Psychological well-being</td>
<td>323 women</td>
<td>Zero-order partial correlation</td>
<td>PA was not directly related to psychological well-being, however, PA did reduce weight discrepancies and improved body-cathexis.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Deeter (1988)</td>
<td>US</td>
<td>Commitment to Physical Activity Scale, Two week physical activity recall</td>
<td>Sample 1: 155 female and 160 male, Sample 2: 80 female and 66 male</td>
<td>Bivariate correlation Regression</td>
<td>High commitment was only related to greater frequency and duration of high intensity activities but not moderate and low intensity activities.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Carlson &amp; Petti (1989)</td>
<td>US</td>
<td>Health Locus of Control Physical activity section (in Wellness Activity Profile Questionnaire)</td>
<td>579 females 454 males</td>
<td>ANOVA Discriminant analysis</td>
<td>Significant differences between males and females were noted in 28 of the 35 physical activities. Participation in high caloric expenditure activities was more frequent among internal subject, while low caloric expenditure activities were associated with and external orientation.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Haynes &amp; McNamara (1989)</td>
<td>US</td>
<td>Physical activity recall questionnaire Comparative physical activity questionnaire Derogatis stress profile Physical self-efficacy scale Health beliefs questionnaire Personal health behavior questionnaire</td>
<td>Phase 1: 88 men, 82 women Phase 2: 31 men, 34 women</td>
<td>Correlation Discriminant analysis Canonical correlation</td>
<td>For men, comparative activity and health beliefs and health behaviour were positively correlated. Physical self-efficacy was positively correlated with both energy expenditure and comparative activity. Comparative activity was negatively correlated with both objective and subjective stress scores. Physical self-efficacy, health behaviours, and subjective stress best predicted group membership. For women, positive correlations were found between health beliefs and comparative activity and energy expenditures. Physical self-efficacy was positively correlated with comparative activity. Stress profile positively correlated with energy expenditures. Health beliefs was the only variable which predicted group membership. Stress feedback manipulation was not effective in promoting interest in PA information or encouraging initiation of activity.</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Country</td>
<td>Design</td>
<td>Outcome</td>
<td>Sample Size</td>
<td>Statistical Test</td>
<td>Summary</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>--------</td>
<td>---------</td>
<td>-------------</td>
<td>------------------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Dzewaltowski, Noble, &amp; Shaw (1990)</td>
<td>US</td>
<td>Physical Activity, Participation (7-days recall), Intention, Attitude toward physical activity, Subjective norm, Perceived behavioural control, Self-efficacy, Outcome expectations, Satisfaction</td>
<td>121 males, 133 females</td>
<td>Regression</td>
<td>The social cognitive theory variables significantly predicted physical activity participation, with self-efficacy, and self-evaluation of the behaviour significantly contributing to the prediction. The greater the confidence in participating in PA and greater the satisfaction with present PA, the more PA performed. Social cognitive theory constructs were better predictors of PA than those from the theories of reasoned action and planned behaviour.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Davis et al. (1991)</td>
<td>Canada</td>
<td>Physical activity (1 month), Body satisfaction</td>
<td>103 male, 18-34 M=26, 61</td>
<td>Stepwise multiple regression</td>
<td>Physical activity was negatively related to body dissatisfaction.</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>White et al. (1991)</td>
<td>US</td>
<td>Physical Activity Survey</td>
<td>33</td>
<td>t-test, Multiple regression</td>
<td>Individuals who exercised twice weekly were more likely to exercise in their leisure time after termination of the exercise program than individuals who exercised four times a week. Frequency and duration may need to be considered when structuring an exercise program to increase leisure activities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>US</td>
<td>PA outcome-expectancy (OE)</td>
<td>13 men</td>
<td>M=25.</td>
<td>Canonical correlation</td>
<td>Canonical correlation yielded one significant linear combination of the set of psychological variables and physical self-efficacy and the of physical activity estimates. Multiple correlations indicated that OE values and barriers and physical self-efficacy explained 26% variation in 7-day diary but unrelated to Caltrac counts.</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td></td>
<td>31 women</td>
<td>9 and 23.2</td>
<td></td>
<td>Multiple correlation</td>
<td>ANOVA t-test</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Physical competence (self-efficacy)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Caltrac accelerometer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7-days daily diary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Dishman, Darracott, &amp; Lambert (1992)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>UK</td>
<td>Liverpool Questionnaire (PA 14 days)</td>
<td>20 male</td>
<td>18-22</td>
<td>Spearman's correlation</td>
<td>Perceived fitness was influenced by the amount and types of leisure-time physical activity (correlated to total activity and very hard activity) undertaken.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Physiology assessment</td>
<td>20 female</td>
<td>M=20. 6</td>
<td>Linear regression</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Lamb (1993)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Canada</td>
<td>Behavioural intention (short-range 2-3 days and long-range 4 weeks)</td>
<td>42</td>
<td>M=20. 3</td>
<td>Correlations</td>
<td>Short-range intention is a better predictor of physical activity than the longer-range intention. However, even the short-range intention-physical activity correlations were only of modest magnitude.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Physical activity (1 item)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19 Calfas, Sallis, Lovato, Campbell (1994)</td>
<td>US</td>
<td>7 days recall PA</td>
<td>194 college students</td>
<td>Chi-square</td>
<td>Factor analysis</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Stage of change</td>
<td>204 alumni</td>
<td>ANOVA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Benefit/Motivators</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Barriers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Enjoyment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Others</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Half of the alumni reported that they are less active now than they were in college, and subjects in both groups perceived that they are becoming less active over time. Contemplators and relapers reported more barriers and fewer benefits than beginners or maintainers. The most preferred type of activity intervention was a one-semester course led by a professional. The most highly rated incentives to participate in an intervention included paid participation, free physical activity instruction, and reduced membership fees for health clubs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 Shifflet, Cator &amp; Megginson (1994)</td>
<td>US</td>
<td>Adherence (1-10)</td>
<td>56 male</td>
<td>Correlations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Active lifestyle scale</td>
<td>22.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(perceived competence, social support, benefits, barriers of facilities, and barriers of health)</td>
<td>24.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Open questionnaire</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exercise adherence was positively correlated to perceived competence and benefits for nondisabled students. 67% reported that a lack of time most affected their adherence. Lack of motivation (18%), having active friends (17%), health benefits (15%), and lack of nearby facilities were all affected their adherence using the opened questionnaire.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>21 Kelley &amp; Kelley (1994)</td>
<td>US</td>
<td>Lipid Research Clinic's Physical Activity Questionnaire</td>
<td>253</td>
<td>Chi-square analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Physical Activity Questionnaire</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Physical Activity History Questionnaire</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Approximately 42% of male and 65% of female African-American college students were classified as low or very low active. Males were found to be more active than females. Descriptive statistics showed a trend for groups categorized as more active to participate more frequently in selected physical activities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Country</td>
<td>Description</td>
<td>Sample</td>
<td>Method</td>
<td>Findings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>---------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------</td>
<td>----------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Kelley (1995)</strong></td>
<td>US</td>
<td>Lipid Research Clinic's Physical Activity Questionnaire</td>
<td>57 males</td>
<td>t-test, chi-square test, ANOVA</td>
<td>Few African-American females being categorized as high active. More females (71%) than male (49%) were classified as very low or low active.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **Leighton & Swerissen (1995)** | Australia | 7 days recall of vigorous physical activity  
Perceived obstacles to physical activity  
Perceived benefits scale  
Self-efficacy for exercise behaviours scale  
Friend and family support for exercise Physical environmental factors | 149 females, 46 males | Correlation Regression analyses | A variance in current levels of vigorous physical activity was explained by cognitive, social, and environmental factors. Hierarchical regression analysis indicated that both proximal (current) and distal (historical) variables contributed to the explanation of variation in physical activity levels. Perceived self-efficacy for vigorous activity and perceived obstacles had the highest association with activity levels. |
| **Pinto & Marcus (1995)**      | US      | Stage of change  
Health needs  
Questionnaires | 217 (49% males, 51% female) | Chi-square | 46% of the Ss were inactive or were exercising irregularly. Gender and year in school were unrelated to stage of exercise adoption |
<p>| <strong>Steptoe et al. (1996)</strong>      | UK      | Number and duration of hard, moderate, light physical activity and cycling for transportation | 180 | ANOVA (repeat Measures) | A decrease in the amount of physical activity in the exam-stress group between baseline and exam session. The stress of forthcoming examinations was associated with a decrease in the duration but not the number of sessions of vigorous physical activity. |</p>
<table>
<thead>
<tr>
<th>#</th>
<th>Author(s) (Year)</th>
<th>Country</th>
<th>Study Title</th>
<th>Sample Size</th>
<th>Gender Distribution</th>
<th>Average Age</th>
<th>Analysis</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>Tam et al. (1996)</td>
<td>US</td>
<td>Specific physical activity (SPA one day)</td>
<td>89</td>
<td>36 males, 53 females</td>
<td>M=24</td>
<td>Descriptive statistic t-test</td>
<td>Most students participated in SPA at light or moderate level. Few students spent time at severe activity or very severe activity. Males had higher all physical activity and total energy expenditure than females.</td>
</tr>
<tr>
<td>27</td>
<td>Douglas et al. (1997)</td>
<td>US</td>
<td>National College Health Risk Behaviour Survey (NCHRBS)</td>
<td>4607</td>
<td>18 or older</td>
<td>Descriptive analysis</td>
<td>37.6% students had participated in vigorous physical activity for at least 20 minutes on 3 or more of the 7 days preceding the survey. Male students and aged 18-24 had higher vigorous physical activity than female student and older students. 19.5% reported moderate physical activity for at least 30 minutes at a time on 5 or more of the 7 days preceding the survey. Participation in vigorous physical activity did not vary by race and ethnicity. Black students, however, engaged in moderate physical activity significantly more often than did White students.</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Eastman, Hostetter, Targett &amp; Carroll (1998)</td>
<td>Canada</td>
<td>Leisure time physical activity</td>
<td>34 males and 51 females (longitudinal design) 32 males and 63 female to 138 males and 216 females (time-lag study)</td>
<td>Repeated-measure t-test  Stepwise multiple regression</td>
<td>Part 1: The single best predictor for LTPA of young adults as university students, 5 year out of high school, is the amount of LTPA engaged in during the high school years. Enrolment in High school PE courses is related to number of different activities participated in but not to the amount of time devoted to LTPA. Part 2: For the 1991 adult sample sex, high school PE enrolment, and last year in high school predicted TOTALTIMEANDNUMBERACT. For the 1996 sample none of these variables predicted either LTPA measure.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Johnson et al. (1998)</td>
<td>US</td>
<td>College version of Youth Risk Behaviour survey (CYRBS) Seven-Day physical activity recall (PAR)</td>
<td>576 (56% female, 54% male)</td>
<td>Hierarchical regression</td>
<td>Vigorous, Moderate leisure activities and flexibility activity corrected to eating health foods for men. Vigorous physical activity was related to eating healthy food, and strengthening activities were related to eating fewer fatty foods for women.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Author(s)</td>
<td>Country</td>
<td>Language</td>
<td>Sample Size</td>
<td>Statistical Tests</td>
<td>Results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>--------------------</td>
<td>---------</td>
<td>----------</td>
<td>-------------</td>
<td>------------------</td>
<td>---------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Chen (1998)</td>
<td>China</td>
<td>English</td>
<td>289 Chinese</td>
<td>ANOVA</td>
<td>American subjects spent significantly more time participating in physical activity and exercise than did Chinese subjects; men were significantly more likely than women to engage in physical activity and exercise. Significant difference on Weight/Body Management, Mental Health, and Social Interaction among the Chinese and American subjects. Social interaction was the primary motive for American men and Chinese women. In contrast, management of body weight was the primary motive for American women.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>US</td>
<td></td>
<td>180 American</td>
<td>MANOVA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Multiple regression</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Kelly, Lowing, and</td>
<td>US</td>
<td>English</td>
<td>79 men</td>
<td>Chi-square test</td>
<td>More men (57%) than women (32%) were classified as being in the action stage. Approximately 37% of the men compared to women 63% were in the contemplation stage. And 6% of the men and 5% of the women were classified as precontemplators.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kelly (1998)</td>
<td></td>
<td></td>
<td>133 women</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Welsh, Robinson &amp;</td>
<td>US</td>
<td>English</td>
<td>82 men</td>
<td></td>
<td>Men scored significantly higher on the Physical Self-efficacy scale an attitude toward physical activity. Men also engaged in team sports, weight training, and other sports significantly more often than women. The healthy behaviours men report are greater physical activity, while women focus on dietary changes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lindman (1998)</td>
<td></td>
<td></td>
<td>166 women</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Country</td>
<td>Methodology</td>
<td>Sample Characteristics</td>
<td>Analysis</td>
<td>Findings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------------------------</td>
<td>----------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leslie et al. (1999)</td>
<td>Australia</td>
<td>Leisure-time physical activity report (two weeks)</td>
<td>2729 (42.8% male, 57.2% female)</td>
<td>M=20</td>
<td>Logistic regression. Lower social support from family and friends, lower enjoyment of activity, and not working can significantly predict being insufficiently active for female and lower support from family and friends, lower enjoyment of activity, and being older for male. Awareness of facilities available on campus was not associated with insufficient activity for either males or females.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hayes, Crocker, &amp; Kowalski (1999)</td>
<td>Canada</td>
<td>Physical Self-perceptions Leisure Time Exercise Questionnaire (LTEQ)</td>
<td>94 female 89 male</td>
<td>Correlation</td>
<td>Only the conditioning scale was related to physical activity for women, whereas all self-perception scales (sport competence, body attractiveness, physical conditioning, physical strength, and general physical self-worth) were related to physical activity for men.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Study</td>
<td>Country</td>
<td>Study Variables</td>
<td>Sample Size</td>
<td>Methodology</td>
<td>Project Findings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>----------------</td>
<td>---------</td>
<td>---------------------------------------------------------------------------------</td>
<td>-------------</td>
<td>-------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Sallis et al. (1999)</td>
<td>US</td>
<td><strong>Physical activity recall</strong>&lt;br&gt;Self-efficacy&lt;br&gt;Social support&lt;br&gt;Benefits of PA&lt;br&gt;Barriers to PA&lt;br&gt;Processes of change&lt;br&gt;Enjoyment</td>
<td>M=24&lt;br&gt;184 female&lt;br&gt;154 male</td>
<td>Repeated measures&lt;br&gt;ANCOVA&lt;br&gt;Regression</td>
<td>Project GRAD had significant effects on self-efficacy for making time, self-efficacy for resisting relapse, social support from friends, and experiential and behavioural processes of change for women after 16-weeks course. The intervention improved use of behavioural processes but also increased perceived barrier of men. Significant contributors to regressions explaining physical activity change were social support from friends (for total activity) and change in self-efficacy for resisting relapse (for vigorous exercise) for women and change in enjoyment (for total activity), change in self-efficacy for resisting relapse (for strength exercise) and change in benefits (for moderate intensity activity) for men.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Calfas et al. (2000)</td>
<td>US</td>
<td><strong>7-days physical activity readiness</strong>&lt;br&gt;Questionnaire&lt;br&gt;Self-efficacy&lt;br&gt;Social support&lt;br&gt;Benefits&lt;br&gt;Barrier&lt;br&gt;Enjoyment&lt;br&gt;Processes of change</td>
<td>18-29&lt;br&gt;185 male&lt;br&gt;153 female</td>
<td>Repeated measures&lt;br&gt;ANCOVA&lt;br&gt;Regression&lt;br&gt;Bonferroni adjustment</td>
<td>Project GRAD had no significant effects on physical activity outcomes at 2 years for either men or women. Experiential and behavioural processes of change were significantly improved for intervention women over 2 years.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Authors (Year)</td>
<td>Country</td>
<td>Methods</td>
<td>Sample Size</td>
<td>Measure</td>
<td>Method</td>
<td>Results</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>----------------</td>
<td>---------</td>
<td>---------</td>
<td>-------------</td>
<td>---------</td>
<td>--------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Lowry et al. (2000)</td>
<td>US</td>
<td>Seven days recall (PA) Consumption behaviour BMI</td>
<td>4609 undergraduate college students</td>
<td>Descriptive statistic Logistic regression</td>
<td>35% of students were overweight or obese. Trying to lose weight was associated with participation in vigorous physical activity and strengthening exercises.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Sarkin et al. (2000)</td>
<td>US</td>
<td>7days Physical Activity Recall (PAR) Youth Risk Behaviour Survey (YRBS) National Health Interview Survey (NHIS) Cardiovascular test (3mins step test)</td>
<td>575 university students (56% women)</td>
<td>Percentage Logistic regression</td>
<td>The NHIS, YRBS and PAR result in significantly different proportions of those meeting the health-related guideline. The type of measurement as well as the scoring protocol affected prevalence estimates of meeting the physical activity guidelines. This study indicates the difficulty of comparing prevalence rates across studies using different measures.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Wallace et al. (2000)</td>
<td>US</td>
<td>Stage of change Exercise self-efficacy Nonexercise VO2max estimation Enrollment in PE and participation in sport PA history Sedentary behaviour Social support for exercise behaviour</td>
<td>937</td>
<td>Descriptive statistic Multiple discriminant analysis</td>
<td>Exercise self-efficacy, physical activity history, and nonexercise estimation of aerobic capacity were significant predictors of the stage of exercise behaviour change for both males and females. Among females, exercise self-efficacy and family social support for physical activity were the best predictors of stage of exercise behaviour change. Friend social support, physical activity history, and exercise self-efficacy were significant predictors of stage of exercise behaviour change among males.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study ID</td>
<td>Authors/Region</td>
<td>Sample Information</td>
<td>Measure</td>
<td>Effect Size</td>
<td>Methodology</td>
<td>Summary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
<td>--------------------</td>
<td>---------</td>
<td>-------------</td>
<td>-------------</td>
<td>---------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Allgower, Wardle, Steptoe (2001)</td>
<td>16 countries</td>
<td>Beck Depression Inventory</td>
<td>3438 women, 2091 men</td>
<td>M=21.</td>
<td>Multiple logistic regression</td>
<td>Depressive symptoms were significantly associated with lack of physical activity and other health behaviours. Also, low social support was independently associated with lack of physical activity and other health behaviours.</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Stock, Wille &amp; Kramer (2001)</td>
<td>Germany</td>
<td>The number of self-reported hours of exercise per week</td>
<td>288 male, 362 female</td>
<td>M=19-33</td>
<td>Descriptive analysis</td>
<td>Students reported being highly physical active. Only 21.8% of respondents did not exercise at all, with no substantial difference between males and females. Multiple regressions showed only self-perceptions of conditioning significantly predicted PAR and LTEQ. SPA did not add any unique variance in predicting activity, and no moderator effects were found for either for PAR or LTEQ.</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Brown &amp; Blanton (2002)</td>
<td>US</td>
<td>National College Health Risk Behaviour Survey (NCHRBS): 7days recall of vigorous activity and moderate activity</td>
<td>4728 college students</td>
<td></td>
<td>Multiple logistic regression</td>
<td>Men in the &quot;low activity&quot; group were at almost half the odds of reporting suicidal behaviour than men in the &quot;not active&quot; group. Women who engaged in moderate or frequent vigorous activity were at greater odds of reporting suicidal behaviour compared with inactive women.</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Hall, Kuga, &amp; Jones (2002)</td>
<td>US</td>
<td>Lipid Research Clinics Physical Activity Questionnaire (LRC)</td>
<td>347</td>
<td>Multiple regression ANOVA Chi-square</td>
<td>African-American respondents reported more regular physical activity habits than Asians or Hispanics. Males reporting more vigorous and regular physical activity than females. The strongest individual relationships included gender, benefits, participation in high school varsity sports, participation in youth sports, and barriers to PA.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Rovniak et al. (2002)</td>
<td>US</td>
<td>Social support Self-efficacy Outcome expectations Self-regulation Physical activity (Stages of changes and Aerobics Center Longitudinal Study PA Questionnaire)</td>
<td>277</td>
<td>SEM</td>
<td>Self-efficacy had the greatest total effect on physical activity, mediated largely by self-regulation, which directly predicted physical activity. Social support indirectly predicted physical activity through its effect on self-efficacy. Outcome expectations had a small total effect on physical activity, which did not reach significance. The social cognitive model explained 55% of the variance observed in physical activity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Authors</td>
<td>Country</td>
<td>Design</td>
<td>Sample Size</td>
<td>Age Range</td>
<td>Method</td>
<td>Findings</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------</td>
<td>---------</td>
<td>---------------------------------</td>
<td>-------------</td>
<td>-----------</td>
<td>--------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Suminski, Petosa, Utter, Zhang (2002)</td>
<td>US</td>
<td>Self-Report of Physical Activity (SRPA)</td>
<td>2836</td>
<td>18-25</td>
<td>MANOVA</td>
<td>$53%$ of the women and $40.3%$ of the men had not engaged in vigorous physical activity. $22%$ of the women and $11.3%$ of the men did not engage in any physical activity. Ethnic and gender-specific rates of no physical activity (SRPA = 0 or 1) were $28.1%$, $23.5%$, $17.4%$ and $20.3%$ for Asian, African American, White and Hispanic women, respectively. For men, the rate were $11.7%$, $7.7%$, $12.0%$, and $13.8%$ for Asians, African Americans, Whites and Hispanics, respectively. Weight training activity, youthful physical activity, and TV viewing accounted for a significant portion of the variance in physical activity levels.</td>
<td></td>
</tr>
<tr>
<td>Stone Strikwerda-Brown, &amp; Gregg (2002)</td>
<td>Australia</td>
<td><strong>Quantitative physical activity questionnaire</strong></td>
<td>462 (9% staff)</td>
<td><strong>Descriptive statistics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-----------</td>
<td>-----------------------------------------------</td>
<td>----------------</td>
<td>--------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transtheoretical model of behaviour change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Qualitative items</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Quantitative result: 59% of participants were in stage 3 (intention to be active) and stage 4 (early action stages of physical activity). 91% had not participated in any sporting, recreational, social or cultural activity on campus. No suitable activities were offered, lack of time and that respondents did not what facilities or programs were available are the three greatest barriers. Improve facility, affordable facilities/programs, organised programs being available, having time and having an organised group with which to be active would enable participation in physical activity on campus.

Qualitative result: Three themes emerged about the campus in terms of sporting, recreational, social and cultural opportunities were the natural environment, the small size and the friendly nature of the campus. Organised team sports is the most preference.
Male and female students were distributed differently across the stages of changes. More men than women were in the maintenance stage, and more women than men were in the contemplation stage. Among women, Asian students represented the highest percentage of precontemplators, and White women were the lowest proportion in the contemplation stage and the highest percentage in the maintenance stage. Among men, Asian students were least likely to be in the action stage. The highest percentage of maintainers and the lowest percentage of contemplation were African Americans students. Asian women and men, and Hispanic women were more likely to be in the nonexercise stages. Half of the sedentary students and 15.6% of the active students were misclassified by the stage of change procedure, especially for minority women and Asian students.
| 24hrs Physical Activity Recall Instrument | 24hrs Physical Activity Recall Instrument | 142 male | 156 female | 19.8 | 18.8 | Descriptive statistics MANOVA Stepwise discriminate analysis |

There were significant differences between males and females in each stage of exercise change. The main effect for gender suggests that females were more likely to participate in physical activity based on parental support, attitudes towards physical activity and enjoyment, while males were more likely to exercise based on perceived competence. Interpretation of the main effect for stages exercise change indicate that as individuals progress from becoming inactive to active their scores for physical activity, determinants, and values increase while scores for barriers decrease. Result indicate participates in stage one were classified by parental support and physical/social barriers, stage two was perceived competence, stage three was values physical activity and self motivation, and stage four was parental support and perceived competence.
<table>
<thead>
<tr>
<th>Study ID</th>
<th>Authors/References</th>
<th>Country</th>
<th>Measure Details</th>
<th>Study Sample Size</th>
<th>Statistical Test</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>Youngstedt et al. (2003)</td>
<td>US</td>
<td>Sleep diary Total daily exercise duration (minutes per day)</td>
<td>31 university students</td>
<td>M=22. Spearman rank-order correlation t-test</td>
<td>No significant correlation of exercise duration and sleep.</td>
</tr>
<tr>
<td>51</td>
<td>Rivis &amp; Sheeran (2003)</td>
<td>UK</td>
<td>Theory of planned behaviour variables Prototype Exercise behaviour (last month and last two weeks)</td>
<td>333</td>
<td>Hierarchical regression</td>
<td>Findings supported the utility of the TPB, descriptive norms, Prototype similarity, and past behaviour in predicting intentions and behaviour. Prototype similarity was directly associated with behaviour, both on its own and through its relationship with descriptive norms, even after controlling for the TPB and past behaviour.</td>
</tr>
<tr>
<td>52</td>
<td>Kennedy, DeVoe, Shockley, Pacchione, LeSage (2003)</td>
<td>?</td>
<td>Stage of Change Questionnaire Self-efficacy for physical activity assessment</td>
<td>833</td>
<td>Chi-square analysis</td>
<td>Mailed a weekly newsletter for 6 weeks that contained information tailored to the stage that the subjects were in during pretest exhibited the most positive stage movement, with 24% advancing one stage and 36% advancing two or more stages. Mailed a traditional action-oriented brochure participants, 24% advanced one stage, whereas 3% general health promotion newsletter group (control group) advanced one stage.</td>
</tr>
<tr>
<td>ID</td>
<td>Authors</td>
<td>Country</td>
<td>Year</td>
<td>Method</td>
<td>n</td>
<td>Results</td>
</tr>
<tr>
<td>----</td>
<td>---------------------------------</td>
<td>---------</td>
<td>------</td>
<td>--------</td>
<td>-----</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>53</td>
<td>Reed &amp; Phillips (2003)</td>
<td>US</td>
<td></td>
<td></td>
<td></td>
<td>Correlations: Intensity and duration of physical activity were significantly related to proximity of exercise facilities for women. Frequency was found correlated with the proximity of exercise facilities for men. All of the independent variable significant correlated with quantity of home exercise equipment, but were not related to the satisfaction of home exercise equipment.</td>
</tr>
<tr>
<td>54</td>
<td>Staten, Miller, Noland &amp; Rayens (2003)</td>
<td>US</td>
<td></td>
<td></td>
<td></td>
<td>Descriptive statistic: Approximately 60% of college students ages 18-24 year are not participating in vigorous or moderate physical activity. Barriers to physical activity included lack of facilities, campus design that does not support cycling or walking, and lack of convenient shopping. Institutional policies that did not support physical activity were the absence of a physical activity requirement and inadequate intramural opportunities.</td>
</tr>
<tr>
<td>Study</td>
<td>Countries</td>
<td>Survey</td>
<td>N</td>
<td>Method</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>-----------</td>
<td>--------</td>
<td>---</td>
<td>--------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>Haase et al. (2004)</td>
<td>23</td>
<td>International Health and Behaviour Survey (IHBS) (2 items to assess PA)</td>
<td>19298</td>
<td>Descriptive analysis</td>
<td>The likelihood of leisure-time physical activity was positively associated with cultural and economic developmental factors, averaging 23% (North-Western Europe and the United States), 30% (Central and Eastern Europe), 39% (Mediterranean), 42% (Pacific Asia), and 44% (developing countries). Leisure time physical activity was positively associated with the strength of beliefs in the health benefits of activity and with national economic development. Knowledge about activity and health that was only 40-60% being aware that physical activity was relevant to risk of heart disease.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 2
R03/P7

LOUGHBOROUGH UNIVERSITY

ETHICAL ADVISORY COMMITTEE

RESEARCH PROPOSAL
INvolving HUMAN PARTICIPANTS

Title: Determinants of University Students' Physical Activity: Intrapersonal, Interpersonal and Physical Environments Influences.

Applicants: Professor Stuart Biddle and Chung-Ming Chen

Departments: School of Sport and Exercise Sciences

Date of clearance: 18 February 2003

Comments of the Sub-Committee:
The Sub-Committee agreed to issue clearance to proceed.
Appendix 3

The Survey of Student’s Physical Activity

What is “Physical Activity”? 

Physical activity is defined as at least 15 minutes of physical movement that may make you slightly sweaty, leave you warm, raise your heart rate, or slightly out of breath. e.g. brisk walking, cycling, football, swimming, tennis, social dancing, exercises, heavy DIY, heavy housework but excludes light housework, caring activity, and activities less than 15 minutes continuous, such as stair climbing.

PLEASE REFER TO THIS THROUGHOUT THE SURVEY.

Chen, Chun-Ming (Jimmy) 
School of Sport & Exercise Sciences 
Loughborough University
SECTION A: (Details about you)

1. Department: ________________________________

2. Your current year of study:
   - [ ] Undergraduate Year 1
   - [ ] Undergraduate Year 2
   - [ ] Undergraduate Year 3
   - [ ] Undergraduate Year 4
   - [ ] Postgraduate (taught)
   - [ ] Postgraduate (research) (please tick one)

3. Age: ______ years ______ months

4. Gender: [ ] male [ ] female

5. Where do you live in university term-time?
   A. On campus (please write one building)
      The name of the building you live: (e.g. David Collett) ________________________________
   B. Off campus (e.g. John Phillips or the private house location)
      School's building ________________________________
      or The name of the street: ________________________________ Postcode: ______
      (No need for exact house number)

6. Compared to secondary school, how much exercise do you do?
   - [ ] Much less
   - [ ] Less
   - [ ] Same
   - [ ] More
   - [ ] Much more

7. During this academic year, do you attend an exercise or sport club or class at least once per week?
   - [ ] Yes
   - [ ] No

8. The average monthly budget for recreation (all types)? (please tick one box)
   - [ ] £0-£10
   - [ ] £11-£20
   - [ ] £21-£30
   - [ ] £31-£40
   - [ ] £41-£50
   - [ ] £50+

9. Do you work for money during the university term? (please tick one box)
   a. [ ] Part time work:
      - [ ] 0-5hrs (per week)
      - [ ] 6-10hrs
      - [ ] 10hrs+
   b. [ ] Occasional work
   c. [ ] Not working

10. What is your preferred activity? (please tick one box)
    - [ ] Aerobics
    - [ ] Cycling
    - [ ] Gym/weights
    - [ ] Jogging
    - [ ] Racquet sport
    - [ ] Swimming
    - [ ] Team sport
    - [ ] Walking
    - [ ] Other (specify): ________________________________

11. Your height: ______ cm
    Weight: ______ kg

12. Today’s date: ______ / ______ /2003
13. Your email address: 
   (If you allow us to have further contact with you by email)
SECTION B. (Here we are interested in your views. There are no right or wrong answers.)

1. YOUR REASONS FOR PHYSICAL ACTIVITY (Please use this scale):

<table>
<thead>
<tr>
<th></th>
<th>strongly</th>
<th>somewhat</th>
<th>Neutral</th>
<th>somewhat</th>
<th>strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>disagree</td>
<td>disagree</td>
<td>disagree</td>
<td>agree</td>
<td>agree</td>
</tr>
</tbody>
</table>

1.23

A major benefit of physical activity for me is:

a. Stay in shape
b. Make me feel better in general
c. Good health
d. Maintain proper body weight
e. Improve appearance
f. Enhancing self-image and confidence
g. Positive psychological effect
h. Reduce stress and relax
i. Fun and enjoyment
j. Help cope with life’s pressures
k. Lose weight
l. Companionship

2. YOUR BARRIERS TO PHYSICAL ACTIVITY

A major reason why or when I do not have physical activity is:

a. Lack of motivation
b. Too lazy
c. Too busy
d. Not enough time
e. Interferes with university work
f. Too tired
g. Interferes with ‘money’ work
h. Too inconvenient
i. Bad weather
j. Lack of facilities
k. Physical activity is boring
l. Too fatigued by physical activity
m. Family obligations
n. Limiting health reason

3. YOUR PHYSICAL ACTIVITY CONFIDENCE

Circle a number to indicate how confident you are that you could have your physical activity in each of the following situations:

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>Very confident</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Confident</td>
<td></td>
</tr>
</tbody>
</table>

a. When I am tired
b. When I am in bad mood
c. When I feel I don’t have time
d. When I am on vacation
e. When it is raining or snowing

1 2 3 4 5 6 7 8 9 10 11

211
4. YOUR SOCIAL SUPPORT for PHYSICAL ACTIVITY AND EXERCISE

<table>
<thead>
<tr>
<th>none</th>
<th>rarely</th>
<th>a few times</th>
<th>often</th>
<th>very often</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

During the past three months, my family (or members of my household) or friends:

- a. Exercised with me
- b. Offered to exercise with me
- c. Gave helpful reminders to exercise (e.g., "Are you going to exercise tonight?")
- d. Gave me encouragement to stick with my exercise programme
- e. Change their schedule so we could exercise together
- f. Discussed exercise with me
- g. Complained about the time I spend exercising
- h. Criticised me or made fun of me for exercising
- i. Gave me rewards for exercising (e.g., Bought me something or gave me something I like)
- j. Planned for exercise on recreational outings
- k. Helped plan activities around my exercise
- l. Asked me for ideas on how they can get more exercise
- m. Talked about how much they like to exercise
5. THE PHYSICAL ACTIVITY QUESTIONNAIRE

This next part of the survey is about your activities over the past 7 days. Think about your physical activities during the past week, including those done before and after university classes, at university, at home and away from home, and on weekends. For sport, please report both practices and matches. There are no right or wrong answers. No one does all these activities. Please be as accurate and honest as possible.

For each activity listed, answer three questions:
1. Did you do this activity in the past 7 days? Circle yes or no.
2. If yes, on how many days did you do the activity in the past 7 days?
3. On average, how many minutes did you do this activity on the days that you did?

### A. Did you do these activities during the last 7 days?

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>Yes</th>
<th>No</th>
<th>Number of times in past week</th>
<th>Minutes per session</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sport &amp; Dance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Basketball</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Cricket</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Dance (ballet, jazz, modern, tap)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Dance (social, recreational)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Golf</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Gymnastics, tumbling, trampoline</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Hockey (field, ice, or roller)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Martial arts: karate, judo, boxing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Netball</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Racquet sports: badminton, tennis, squash, table tennis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Roller-blading</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Rugby</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Water sport: canoeing, sailing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Water sport: windsurfing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Soccer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Volleyball</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Other (specify):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Other (specify):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Exercise</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Aerobics/aerobic dancing/bench/step aerobics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Calisthenics: push-ups, sit-ups, jumping jacks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Running, jogging, jumping rope</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Swimming laps</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Walking for exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Weight lifting/weight training</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. Exercise machine: cycle, treadmill, rower, climber</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26. Other (specify):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

213
### General Physical Activities

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>27.</td>
<td>Bicycling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.</td>
<td>Hiking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29.</td>
<td>Walking for transportation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30.</td>
<td>Water play: in pool, lake, or sea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31.</td>
<td>Outdoor chores: mowing, raking, gardening</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32.</td>
<td>Indoor chores: mopping, vacuuming, sweeping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33.</td>
<td>Other (specify):</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Education & Entertainment

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>34.</td>
<td>Computer/Internet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35.</td>
<td>Video games</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36.</td>
<td>Homework, Studying (inc. 'study reading')</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37.</td>
<td>(Leisure) Reading (not for university)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38.</td>
<td>Sitting and talking with friends (not on phone); listening to music</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39.</td>
<td>Talking on the phone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40.</td>
<td>Television or video watching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41.</td>
<td>Other (specify):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42.</td>
<td>Other (specify):</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

214
B. Circle the number on the LADDER that best shows where you are NOW. Each rung on this ladder shows where various people are in their thinking about physical activity.

* Regular physical activity = 3 times or more times per week, for 15 minutes or longer.
(See front page for full definition)
6. YOUR PHYSICAL ACTIVITY ENVIRONMENT

A. Please indicate which items you have in your term-time home, garden/yard, or university hall complex (yes=1; no=0)

1. stationary aerobic equipment
2. bicycle
3. dog
4. trampoline for jogging in place
5. running shoes
6. swimming pool
7. weight lifting equipment (e.g., free weights, machines)
8. skis (snow or water)
9. aerobic workout videotapes or audiotapes
10. step aerobics, slide aerobics
11. skates (roller, in line, or ice)
12. sports equipment (ball, racquets, golf clubs etc)
13. surf board, boogie board, windsurf board
14. canoe, row boat, kayak
15. toning devices (e.g., heavy hands, ankle weights, etc)

B. Please indicate which of the following apply to your immediate neighbourhood. (yes=1, no=0)

1. pavements
2. heavy traffic.
3. hills.
4. street lights
5. dogs that are unattended
6. enjoyable scenery
7. frequently see people walking or exercise
8. high crime

C. How safe do you feel walking in your neighbourhood during the day? (Please circle a number)

Very unsafe 1 2 3 4 5 very safe

D. For each of these places where you can exercise, please indicate if it is on a frequently travelled route (e.g., to and from university) or within a 5-min drive from your term-time home. (yes=1, no=0) ??

1. aerobic dance studio
2. basketball court
3. beach or lake
4. bike lane or trails
5. golf course
6. health spa/gym
7. running track
8. martial arts studio
9. playing field
10. public park.
11. public recreation/leisure centre
12. racquetball/squash court
13. skating rink
14. sporting goods shop
15. swimming pool
16. walking/hiking trails
17. tennis courts
18. dance studio
7. FEELINGS OF DOING PHYSICAL ACTIVITY

When I was doing physical activity I felt:

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Neutral</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. It's fun.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>b. It's interesting.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>c. It makes me happy</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>d. I like to do this activity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>e. I find this activity is stimulating.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>f. I enjoy this activity</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

8. YOUR INTENTION

a. I intend to participate in physical activities for 15 minutes at a time at least three times per week in the next fortnight. (please tick one box)

b. I plan to participate in physical activities for 15 minutes at a time at least three times per week in the next fortnight. (Please tick one box)

c. I want to participate in physical activities for 15 minutes at a time at least three times per week in the next fortnight. (Please tick one box)
Appendix 4

The procedure of interview

1. Introduction and explanation of the interview (5 minutes)
   Dialog:
   The study is trying to explore the reasons why university students may differ in levels of physical activity. Before the interview, I would like to ask you to fill out one questionnaire about your background without your name on it. Your data and the content of interview will only apply on research purpose safely.

2. Fill out the questionnaire of background and physical activity level (5 minutes)
   Dialog:
   The term of “physical activity” is defined as “at least 15 minutes of physical movement that may make you slightly sweaty, leave you warm, and raise your heart rate or slightly out of breath. e.g. brisk walking, cycling, football, swimming, tennis, social dancing, exercises, heavy DIY, heavy housework that could happen in your daily life but excludes light housework, caring activity, and activity less than 15 minutes continuous, such as stair climbing".
   There is no right or wrong answers. All your opinions will be essential to the study. You can answer my questions either based on your experiences or your feelings. If there anything you cannot understand, you can ask me to explain to you anytime. I would like to tape the interview for data collecting. Is that O.K. to you?

3. interviewing (30 minutes)

Semi-structured Questions (main questions)

1. When comparing to your friends (or classmates), your physical activity level is high or low? How or why your physical activity is higher (or lower) than the other people? (Physical activity)
2. Except the PE class, what are the most frequent physical activities you attended during the academic terms for the time being? Why you prefer that kind of physical activities? (Type and Preference)
3. Do you like physical activity? (Enjoyment) Yes—how do you feel? No—why not? What do you feel?
4. How confident are you that you could have your physical activity in raining day, or when you don’t have time, or when you are tired? (Self-efficacy)
5. Do you ever intend to have some more physical activity during the academic years? Why? (Intention and Reason)
6. In what situations that stopped or postponed your daily or frequent physical activities? (Barriers)
7. What motivates you to be physical active? [e.g. Weight control? Being with friend? (Motive)
8. Can you tell me why you or some of your friends maintain higher level of physical activity? (Benefit and Expectation)
9. Normally, where was your main physical activity taking place? (Physical environment)
10. What changes to the environment including your home, neighborhood, and campus can encourage you and university students to be active? (Physical environment)
11. Can you tell me who ever affect or encourage you to have physical activities in your life? Who affect you the most? (Social environment and social support)
12. At present, who affect you or encourage you the most about your physical activity? (Social environment and Social support)
13. What affects the university students’ physical activity levels the most? (Determinants in general)
Appendix 5

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling? 

   ___ days per week

   □ No vigorous physical activities → Skip to question 3

2. How much time did you usually spend doing vigorous physical activities on one of those days?

3. ___ hours per day

   ___ minutes per day

   □ Don't know/Not sure

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

4. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

   ___ days per week

   □ No moderate physical activities → Skip to question 5

220
5. How much time did you usually spend doing moderate physical activities on one of those days?
   
   ________ hours per day
   ________ minutes per day

   [ ] Don't know/Not sure

Think about the time you spent walking in the last 7 days. This includes walking at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?
   ________ days per week

   [ ] No walking ➔ Skip to question 7

6. How much time did you usually spend walking on one of those days?
   
   ________ hours per day
   ________ minutes per day

   [ ] Don't know/Not sure

The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the last 7 days, how much time did you spend sitting on a week day?
   
   ________ hours per day
   ________ minutes per day

   [ ] Don't know/Not sure

This is the end of the questionnaire, thank you for participating.
Appendix 6
A. Content of Skill-related PE Course

Course title: Physical Education
Instructor: Chun-Ming Chen
Phone: 51201 (campus ext)
Semester: Fall 2004
Office: CCU PE centre
Email: zwfrpu2001@yahoo.com.tw

Course Description: This course is designed to provide basic and advance skills and techniques of many sports which emphasis on skills development, rules, and strategy.

Calendar

<table>
<thead>
<tr>
<th>Week</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction: Course design and evaluation (PA baseline test)</td>
</tr>
<tr>
<td>2</td>
<td>Physical activity and health (indoor course)</td>
</tr>
<tr>
<td>3</td>
<td>Basketball: dribbling and footwork</td>
</tr>
<tr>
<td>4</td>
<td>Basketball: passing and shooting</td>
</tr>
<tr>
<td>5</td>
<td>Basketball: defensive skills and rebounding</td>
</tr>
<tr>
<td>6</td>
<td>Basketball: mechanics and teamwork</td>
</tr>
<tr>
<td>7</td>
<td>Soccer: individual ball control</td>
</tr>
<tr>
<td>8</td>
<td>Soccer: passing and heading</td>
</tr>
<tr>
<td>9</td>
<td>Soccer: shooting and goal keeping</td>
</tr>
<tr>
<td>10</td>
<td>Soccer: attacking and defensive mechanics</td>
</tr>
<tr>
<td>11</td>
<td>Softball: pitching and catching</td>
</tr>
<tr>
<td>12</td>
<td>Softball: hitting and running</td>
</tr>
<tr>
<td>13</td>
<td>Softball: team defense</td>
</tr>
<tr>
<td>14</td>
<td>Softball: fielding and scoring</td>
</tr>
<tr>
<td>15</td>
<td>Volleyball: underhand pass and overhand serve</td>
</tr>
<tr>
<td>16</td>
<td>Volleyball: overhand pass and set</td>
</tr>
<tr>
<td>17</td>
<td>Volleyball: spike and block</td>
</tr>
<tr>
<td>18</td>
<td>Volleyball: team defense and offense strategies</td>
</tr>
<tr>
<td>19</td>
<td>Course review an evaluation</td>
</tr>
<tr>
<td>20</td>
<td>Paper test and course evaluation (intervention test)</td>
</tr>
</tbody>
</table>

Assessment:
Students are required to attend PE class regularly and encouraged to participate in class discussion. Grade distribution: 2 skills performance test 60%, attendance 30% and paper test 10%.
B. Content of Health-related PE Course Design

Course title: Physical Education
Instructor: Chun-Ming Chen
Phone: 51201 (campus ext)
Office: CCU PE centre
Email: zwfrpu2001@yahoo.com.tw

Course Description: This course is designed to provide opportunities for physical activities through basic physical skills and exercise training to develop knowledge of active and healthy lifestyle.

Calendar

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Introduction of the course design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 2</td>
<td>Physical activity and health (indoor course and baseline test)</td>
</tr>
<tr>
<td>Week 3</td>
<td>Swimming: water safety and self-protection</td>
</tr>
<tr>
<td>Week 4</td>
<td>Swimming: basic skills and group activities</td>
</tr>
<tr>
<td>Week 5</td>
<td>Swimming: water board activities and physical training</td>
</tr>
<tr>
<td>Week 6</td>
<td>Swimming: water aerobic</td>
</tr>
<tr>
<td>Week 7</td>
<td>Badminton: gripping and group activities</td>
</tr>
<tr>
<td>Week 8</td>
<td>Badminton: feeding a partner and net shots</td>
</tr>
<tr>
<td>Week 9</td>
<td>Badminton: underhand and overhand returns</td>
</tr>
<tr>
<td>Week 10</td>
<td>Badminton: single and double games</td>
</tr>
<tr>
<td>Week 11</td>
<td>Weight training and body building</td>
</tr>
<tr>
<td>Week 12</td>
<td>Basic pilates</td>
</tr>
<tr>
<td>Week 13</td>
<td>Cycling and fast walking on campus</td>
</tr>
<tr>
<td>Week 14</td>
<td>Aerobic dancing</td>
</tr>
<tr>
<td>Week 15</td>
<td>Golf: swing with 7 iron</td>
</tr>
<tr>
<td>Week 16</td>
<td>Golf: putting and field walking</td>
</tr>
<tr>
<td>Week 17</td>
<td>Bowling: ball holding and footwork</td>
</tr>
<tr>
<td>Week 18</td>
<td>Bowling: games</td>
</tr>
<tr>
<td>Week 19</td>
<td>Course review and evaluation</td>
</tr>
<tr>
<td>Week 20</td>
<td>Paper test and course evaluation (intervention test)</td>
</tr>
</tbody>
</table>

Assessment:
Students are required to attend PE class regularly and encouraged to participate in class discussion. Grade distribution: 5-page report 60%, attendance 30% and paper test 10%.
Appendix 7
Intervention Slogans and themes used in email’s group

Week 1: “Commit to your plan, commit to your health!” (Stage 3, 4, 5)
   “Sofa so good?” – Keep away from sedentary lifestyle and be active!
   (Stage 1,2)
Week 2: “Are you consuming your health from not being active?” – Time and
   health wait nobody. (All stages)
Week 3: “Finding some events you are planning to participate and setting up the
   plan you are going to train for them!” (Stage 3, 4, 5)
   “I am not a sporty type, can I still be active?” – What are the
   differences among physical activity, exercise and sport? Seeking any
   possibility to be active! (Stage 1, 2)
Week 4: “Where to go and how to be active?” – Rechecking your home,
   community, and campus environments and there is always
   opportunities for physical activities and is always someone who can
   help you. (All stages)
Week 5: “Everybody moves your body!” – You are sitting enough but are you
   active enough? (All stages)
Week 6: “Setting your personal goal and pace, pursing you personal
   health”—Physical activity is nothing about competing to others but
   your self management. (Stage 1, 2)
   “No pain, no gain?” – Training versus physical activity, how much is
   too much? How little is too little? (Stage 3, 4, 5)
Week 7: “New lesson for young people, be responsible to your healthy
   lifestyle”—Do not give up your right to be active and fit. (All stages)
Week 8: “Nowhere to go and nothing to do? You can be active anytime and
   anywhere.” (All stages)
Week 9: “Saving health equal to saving money – the best investment!” (Stage 3, 4,
   5)
   “Be active can not be succeed by thinking but acting.” (Stage 1, 2)
Week 10: “You are young enough but are you strong enough?” Do not rely on
   your youth but your efforts. (All stages)
Week 11: “Everyone can be active in many ways, and you are included!” (All
   stages)
Week 12: “Climbing and walking for your health” – Easy to be active from stairs
   climbing and active transportation. (All stages)
Week 13: “Many stages in your life and career to reach but maintaining on one
   stage in your good health – be active” (All stages)
Week 14: “Do you workout today?” One of the best regards to your friends and
   from your friends everyday. (All stages)
Week 15: “A man/woman can not have successful career without health” (Stage 3,
   4, 5)
   “Write down your barriers. Differentiate your true barriers and
   excuses then conquer and solve them – you can do it!” (Stage 1, 2)
Week 16: “Pursuing the quality of life – the important role and benefits of
   physical activity,” (All stages)

224
"Sofa so Good?"
Keep away from sedentary lifestyle and be active!

©Study found that more than 50% of university students are inactive. If you are included in the sedentary group, you are also in the risk of developing major chronic disease - such as coronary heart disease, stroke and type 2 diabetes – by up to 50%, and the risk of premature death by about 20-30%.

Now, get out of your sofa. Active your body and gain your health!

Physical Education Centre

(Newsletter sample sent to the inactive students for the first week intervention.)