Determinants of Physical Activity in Thai Adolescents: Testing the Youth Physical Activity Promotion Model

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ชื่อวิทยานิพนธ์ ปัจจัยทำนายการเคลื่อนไหวร่างกายของวัยรุ่นไทย: การทดสอบรูปแบบการส่งเสริมการเคลื่อนไหวร่างกายของเยาวชน

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บทคัดย่อ

การทำความเข้าใจถึงปัจจัยต่างๆที่เกี่ยวข้องกับการเคลื่อนไหวร่างกายเป็นขั้นตอนแรกที่สำคัญในการส่งเสริมการเคลื่อนไหวร่างกายในวัยรุ่น การศึกษาแบบภาคตัดขวางนี้ศึกษาระดับการเคลื่อนไหวร่างกายของวัยรุ่นไทย และทดสอบรูปแบบการส่งเสริมการเคลื่อนไหวร่างกายที่ดัดแปลงมาจากรูปแบบการส่งเสริมการเคลื่อนไหวร่างกายของเยาวชนเพื่อหาปัจจัยทำนายการเคลื่อนไหวร่างกายของวัยรุ่นไทย ปัจจัยทำนายการเคลื่อนไหวร่างกายประกอบด้วย อิทธิพลของบิดามารดา อิทธิพลของเพื่อน การรับรู้ความสามารถทางกาย และความสนใจในการเคลื่อนไหวร่างกาย กลุ่มตัวอย่างเป็นนักเรียนที่กำลังศึกษาชั้นมัธยมศึกษา 1-6 ของโรงเรียนมัธยมของรัฐบาล 4 แห่ง ในเขตอำเภอหาดใหญ่ จังหวัดสงขลา จำนวน 601 คน กลุ่มตัวอย่างตอบแบบสอบถาม 2 ชุด ห่างกัน 2 สัปดาห์ วิเคราะห์ข้อมูลด้วยวิธีการวิเคราะห์สมการเชิงเส้นโดยใช้โปรแกรมสำเร็จรูปเอมอส 17.0

ผลการวิจัยพบว่ารูปแบบการส่งเสริมการเคลื่อนไหวร่างกายที่ดัดแปลงมาสามารถทำนายการเคลื่อนไหวร่างกายของวัยรุ่นไทยได้สอดคล้องกับข้อมูลเชิงประจักษ์ ชุดของตัวแปรที่ได้กำหนดไว้ประกอบด้วยความสนใจในการเคลื่อนไหวร่างกาย การรับรู้ความสามารถทางกาย อิทธิพลของเพื่อน และอิทธิพลของบิดามารดา ตัวแปรทั้งหมดสามารถร่วมทำนายการเคลื่อนไหวร่างกายได้ร้อยละ 15 ทั้งนี้ ความสนใจในการเคลื่อนไหวร่างกายมีอิทธิพลเชิงบวกโดยตรงต่อการเคลื่อนไหวร่างกาย ($\beta = .39$, $p < .01$) การรับรู้ความสามารถทางกายมีอิทธิพลเชิงบวกโดยอ้อมโดยผ่านความสนใจในการเคลื่อนไหวร่างกาย ($\beta = .26$, $p < .01$) อิทธิพลของเพื่อนมีอิทธิพลเชิงบวกโดยอ้อมต่อการเคลื่อนไหวร่างกายผ่านการรับรู้ความสามารถทางกายและความสนใจในการเคลื่อนไหวร่างกาย ($\beta = .24$, $p < .01$) และอิทธิพลของบิดามารดามีอิทธิพลเชิงบวกโดยอ้อมต่อ

การเคลื่อนไหวร่างกายผ่านการรับรู้ความสามารถทางกายและความสนใจในการเคลื่อนไหวร่างกาย ($\beta = .04$, $p < .01$)

ผลการศึกษาครั้งนี้บ่งชี้ว่ารูปแบบการส่งเสริมการเคลื่อนไหวร่างกายของเยาวชนที่ดัดแปลงมาและได้ทำการทดสอบในการศึกษาครั้งนี้สามารถทำนายการเคลื่อนไหวร่างกายของวัยรุ่นไทยได้บางส่วน การส่งเสริมการเคลื่อนไหวร่างกายของวัยรุ่นจะต้องเน้นให้วัยรุ่นมีความสนใจในการเคลื่อนไหวร่างกาย การรับรู้ความสามารถทางกาย อิทธิพลของเพื่อน และอิทธิพลของบิดามารดา มากขึ้น

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Abstract

Understanding the predictors of physical activity in children and the adolescent population is an important first step in physical activity promotion. The purpose of this observational, cross-sectional study was to examine the level of physical activity, the determinants of physical activity and test the modified Youth Physical Activity Promotion model. The determinants of physical activity included parental influence, peer influence, perceived physical competence, and attraction to physical activity. Participants were 601 secondary school students of four public secondary schools in Had Yai District, Songkhla Province. All participants were asked to complete two questionnaires, two weeks apart. For data analysis, the hypothesized model was tested through a structural equation modeling technique using AMOS 17.0.

The results of this study indicated that the respecified model adequately fit to the sample data. The independent variables of the model were attraction to physical activity, perceived physical competence, peer influence, and parental influence. All variables accounted for 15% of the variance in physical activity. Attraction to

physical activity had a direct effect on the physical activity ($\beta = .39$, $p < .01$). Perceived physical competence had an indirect effect on the physical activity through attraction to physical activity ($\beta = .26$, $p < .01$). Peer influence had an indirect effect on the physical activity through perceived physical competence and attraction to physical activity ($\beta = .24$, $p < .01$). Parental influence had an indirect effect on the physical activity of Thai adolescents through perceived physical competence and attraction to physical activity ($\beta = .04$, $p < .01$).

The results indicated that the modified Youth Physical Activity Promotion model tested in this study could partially explain and predict physical activity in Thai adolescents. The strategies that target attraction to physical activity, perceived physical competence, perception of peer influence, and perception of parental influence should be developed to promote physical activity.

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CHAPTER 1

INTRODUCTION

Background and Significance of the Study

Although the benefits of physical activity on children and adolescents have been reported and recognized by various organizations, recent studies show that many children and adolescents are physically inactive. To prevent chronic disease and to promote health, an effective intervention for increasing physical activity in children and adolescents should be designed. However, understanding the predictors of physical activity in children and the adolescent population is an important first step in designing a population-specific intervention to increase the levels of physical activity.

Physical activity covers virtually all forms of human motion and also includes active play, structured exercise and sports (Caspersen, Powell, & Christenson, 1985; Centers for Disease Control and Prevention, 2006). Physical activity is categorized in various ways, including type/mode and intensity. The common types/mode of physical activity are: occupational physical activities (such as lifting, digging and walking); household physical activities (such as washing and house cleaning); transportation physical activities (such as walking to school or bicycling to the store); and leisure-time physical activities (including free play, games, cycling, football, and basketball). For intensity, physical activity is organized into 3 types based on energy expenditure; light, moderate, and vigorous physical activity (Caspersen et al., 1985; Centers for Disease Control and Prevention, 2006).

Physical activity plays an important role in enhancing health benefits in children and adolescents such as: building healthy bones, muscles, and joints; controlling weight;

reducing fat; and preventing or delaying the development of high blood pressure (U.S. Department of Health and Human Services, 1996). In addition, it also reduces the risk of many chronic diseases in adults (including coronary heart disease, diabetes, hypertension, and colon cancer) (U.S. Department of Health and Human Services, 1996).

The experts recommend that physical activity should be performed regularly for better health. In addition, several organizations have produced guidelines for physical activity in children and adolescents. According to a consensus meeting of the U.S. Department of Health and Human Services, all people older than 2 years should accumulate at least 30 minutes of moderate physical activity on most days of the week (U.S. Department of Health and Human Services, 1996). Recently, the accumulation of at least 60 minutes of moderate-to-vigorous physical activity every day for promoting cardiovascular health and primary prevention of cardiovascular disease was recommended (Department of Health, Ministry of Public Health, 2005; Kavey et al., 2003; Miles, 2007; Williams et al., 2002).

Although many of the recommendations related to physical activity have been published, data related to the physical activity levels and fitness status of children appear to be as alarming as ever. Many studies have reported that in the USA a number of children and adolescents had physical activity levels and physical fitness lower than what is recommended. In addition, the Surgeon General's report on physical activity and health indicated that physical activity levels rapidly decline at the time when children enter adolescence (U.S. Department of Health and Human Services, 1996). With respect to physical activity, a report of the Centers for Disease Control and Prevention (2003) showed that 23% of American children aged 9 to 13

years do not engage in any free-time physical activity. The evidence from a National Health Survey in Spain showed that less than 30% of Spanish youth were physically active (Lasheras, Aznar, Merino, & López, 2001).

In Thailand, little is known about the overall picture of the physical activity levels of children and adolescents. Although some studies have been reported about the number of people who performed exercise or physical activity, the definitions and measures across studies were different. Therefore, it is difficult to summarize trends concerning the physical activity levels of children and adolescents. In terms of exercise, the data from the 2001 Health and Welfare Survey showed that about 75.8% of people aged 15 years or older did not perform any exercise during the three months before the interview (National Statistical Office, 2001). Focusing on the population of children and adolescents, the results from the 2004 Health and Welfare Survey showed 62.5% of children aged 11-14 years and 54.18% of adolescents aged 15-19 years performed exercises 3 days per week (National Statistical Office, 2004). In addition, several studies have been reported that Thai adolescents carried out less exercises than recommended (Charoneying, 2005; Deenan, 2003; Teparatana, 1997).

With respect to physical activity among Thai youths, two studies were involved. A cross-sectional study of a sample of children aged 9-12 years in Bangkok reported that Thai children had an average physical activity level lower than those recommended by the World Health Organization (Nakhanakhup, 1999). The Thailand Population Health Examination Survey III (2003-2004) is only one study that revealed the whole picture of Thais' physical activity behavior. It was found that about 21% of males and 24% of females aged 15 years or older had not carried out sufficient physical activity (Porapakcham & Bunyarattapun, 2006). This evidence

seems to show that the number of people aged 15 years or older who performed exercise and physical activity is increasing. However, nearly half of adolescent did not perform the sufficient exercise.

A number of Thai adolescents are facing low or moderate physical fitness and this may lead to many health problems in the future. With regard to physical fitness of Thai youths, three cross-sectional studies found that most of male and female high school students were at a moderate level of physical fitness (Bureau of Sports Science, 2005a, 2005b; Tummajunta, 2000). In addition, about 17- 35% of students had low or the lowest level of physical fitness for all domains (Bureau of Sports Science, 2005a; 2005b). A European study has supported the relationship between physical activity and physical fitness in children. Ruiz et al. (2006) found that total physical activity, moderate physical activity and vigorous physical activity were positively associated with cardiovascular fitness of children aged 9-10 years.

Nowadays advanced technologies promote sedentary lifestyles and comfort oriented lifestyles for children and adolescents. Automated machines and equipment provide children and adolescents with life-styles that are convenient and require less energy expenditure. In addition, all children have opportunity to access to entertainment media such as television and internet. Along with decreases in the amount of physical activity, children are spending more time in sedentary activities such as watching television, playing computer games, or exploring the internet. Children and youth find that watching television or playing video games are more desirable and easier than physically participating in activities themselves. As a result, the data from Deenan's study (2003) showed that 24.8%, 27%, and 36.7% of Thai adolescents spent 2-3 hours, 4-5 hours, and at least 6 hours per day watching

television or playing computer or video games, respectively. Children and adolescents who maintain sedentary lifestyle may be at risk for becoming obese.

Currently, the situation is that the numbers of children who are overweight and obese have been increasing worldwide and the World Health Organization has declared obesity to be the world epidemic (World Health Organization, 1997). In Thailand, a survey by the Department of Health, Ministry of Public Health in 1995 found that the prevalence of overweight in 10th to 12th grader of ten high schools in Bangkok was 15.9-20.9% (Srinawat & Bunmongkol, 1998). The findings of a National Nutrition Survey showed that the percentage of overweight adolescents was 10.2 in 2002 (Department of Health, Ministry of Public Health, 2006). Recent data from the report of Thailand Population Health Examination Survey III (2003-2004) showed that about 23 % of males and 34% of females aged 15 years or older were overweight (Porapakcham & Bunyarattapun, 2006). Although the criteria used for being overweight across these studies were different, the data has shown that Thai adolescents have a high prevalence of overweight.

In Thailand, most of parents value the academic success as a life success of their children. According to this value, academic excellence and achievement outcome have always been a primary concern for Thai parents (Department of Health, Ministry of Public Health, 2003). Generally, high school students have to achieve the examinations in order to study in a university after completing grade 12. To achieve this goal, parents try to promote their children to study in an extra-class. As a result, most of high school students spend much more time daily for extra-class attendance and doing their homework. Therefore, any activities (including physical activity) that

compromise academic study and negatively affect examination results may be eliminated.

According to the existing data, it seems to support the notion that a lot of children and adolescents generally maintain a sedentary lifestyle, and practice insufficient physical activity. In response, the Thai government instituted the policy to promote active lifestyles among children and adolescents. A committee was assigned by the Ministry of Public Health for formulating the guideline of physical activity and research directions. Based on this policy, some projects were launched to promote physical activity for children in school such as “Thai Kids on the Move” and “Healthy Thai Kids” (Department of Health, Ministry of Public Health, 2003). In addition, the guidelines for appropriate physical activity in children and adolescents were formulated (Department of Health, Ministry of Public Health, 2005; Kijboonchoo, n.d.; Sanguanrunsirikul, n.d.). However, these projects and guidelines were designed based on the knowledge and evidence from other countries.

Taking into account the benefits of physical activity and the negative effects of physical inactivity, many researchers have examined the factors influencing physical activity in children and adolescents. In order to identify the common correlates of physical activity in this population, a number of systematic reviews were conducted in Western countries. The findings from these systematic reviews showed some variables that consistently correlated with physical activity as shown below.

Sallis, Prochaska, and Taylor (2000) found that male gender, white ethnicity, perceived activity competence, intentions, previous physical activity, community sports, sensation seeking, parental support, support from others, sibling physical activity, direct help from parents, and opportunities to exercise were positively

associated with adolescent's physical activity. In addition, age, depression, and sedentary practices after school and on weekends were negatively associated with adolescent's physical activity. Focused on a female population, Biddle, Whitehead, O'Donovan, and Nevill (2005) reported that white ethnicity, age, socio-economic status, enjoyment, perceived competence, self-efficacy, physical self-perceptions, and parental and family support were the correlates of physical activity in girls aged 10-18 years. For social environmental factors, Ferreira et al. (2007) reported that support from significant others, mother's education level, family income, and low crime incidence were the correlates of physical activity in adolescents. Recently, a systematic review study by Van Der Horst, Chin A. Paw, Twisk, and Van Mechelen (2007) was conducted. The findings showed that male gender, parental education, attitude, self-efficacy, goal orientation/motivation, physical education/school sports, family influences, and friend support were positively associated with adolescents' physical activity.

Study of the correlates and determinants of physical activity in children and adolescents has been a popular area in Western countries, but the number of studies in Thailand is limited. This may come from the complexity of this behavior and lack of well-developed instruments to measure physical activity in Thai children and adolescents. Moreover, physical activity is a new field of interest in the area of health science in Thailand. Several years ago a number of studies related to the correlates or predictors of exercise behavior as a subcategory of physical activity among youths were referred to (Charoneying, 2005; Deenan, 2003; Deenan, Thanee, & Sumonwong, 2001 as cited in Deenan, 2003; Teparatana, 1997). However, little is known about the predictors of physical activity among Thai youths.

The findings across the Thai studies related to correlates of exercise behavior of children and adolescents are variable and quite inconsistent. Using the PRECEDE-PROCEED model, Teparatana (1997) found that gender, knowledge, and access to exercise media were the predictors of exercise behavior of 7th to 9th graders. However, these variables explained only a small proportion (7%) of the variance in the exercise behavior. Two studies have shown low to moderate associations between several variables of the Health Promotion Model and exercise behaviors among Thai adolescent (Charoneying, 2005; Deenan et al., 2001 as cited in Deenan, 2003). These variables were health concerns, daily concerns, role model, self-efficacy, social support from friends, social support from classmates, perceived benefits to exercise, interpersonal influences, and situational influences. However, self-efficacy and barriers to exercise emerged as the correlates of exercise behavior in both studies. Using the same theory, Deenan (2003) reported the inconsistent findings in Deenan and colleagues and Charoneying. The results from her study indicated that the constructs of the Health Promotion Model were not significantly correlated with exercise behavior of adolescents. The inconsistency in the results across studies may come from many factors. First are the differences in the definitions, instruments, and sample characteristics across the studies. According to Sallis et al. (2000), measurement errors and differences in sample characteristics could increase the likelihood of inconsistent findings across studies. Second, the theories that guided the studies that were developed to predict or explain general health behaviors in various age groups may not have been appropriate for examining the exercise behavior of Thai children and adolescents.

While an examination of the factors influencing physical activity among adolescents is considered important, few studies have examined the correlates and predictors of exercise behavior among this age-group in Thailand, and none of them cover all types of physical activity. Furthermore, no studies have used the Youth Physical Activity Promotion (YPAP) model as a theoretical framework for examining the relationship of psychosocial factors to participation in physical activity among youths. From this review of literature, it was found that the YPAP model is different for several reasons from other theories that were used to explain physical activity among youths. First, it was specifically developed for predicting or explaining physical activity in populations of children and adolescents (Welk, 1999). Second, the YPAP model integrates a number of constructs from various theories that were the most commonly used determinants of physical activity in children and adolescents from the literature review. Furthermore, the relationships between the YPAP model constructs and physical activity in children and adolescents were supported by several studies (Schaben, Welk, Joens-Matre, & Hensley, 2006; Smith, 2004; Welk & Schaben, 2004; Welk, Wood, & Morss, 2003). Based on this information, the YPAP model may be a useful theoretical framework to guide a study to examine the determinants of physical activity among Thai children and adolescents.

Objectives of the Study

The purposes of this study were to identify the level of physical activity, the determinants of physical activity, and to examine the predictive utility of the modified YPAP model for Thai adolescents.

Research Questions

1. What is the level of physical activity of Thai adolescents?

2. What are the relationships among the modified YPAP model constructs for Thai adolescents?

3. Does perceived physical competence directly influence participation in physical activity among Thai adolescents?

4. Does perceived physical competence indirectly influence participation in physical activity among Thai adolescents through attraction to physical activity?

5. Does attraction to physical activity directly influence participation in physical activity among Thai adolescents?

6. Does parental influence directly influence participation in physical activity among Thai adolescents?

7. Does parental influence indirectly influence participation in physical activity among Thai adolescents through perceived physical competence and attraction to physical activity?

8. Does peer influence directly influence participation in physical activity among Thai adolescents?

9. Does peer influence indirectly influence participation in physical activity among Thai adolescents through perceived physical competence and attraction to physical activity?

Conceptual Framework

The YPAP model was used to guide this study. This model was proposed by Welk (1999) to explain and predict physical activity in youth based on a social

ecological framework and the PRECEDE-PROCEED Model. It was developed by synthesizing research findings that related to the correlates of physical activity in youth. This model used the PRECEDE-PROCEED Model as a roadmap to set a number of commonly used correlates of physical activity in children and adolescents (Schaben et al., 2006). A number of commonly used correlates of youth's physical activity are categorized as factors that predispose, reinforce, or enable physical activity. Furthermore, Welk included demographic characteristics in the model. Based on this synthesis, the YPAP consists of four groups of influencing factors: predisposing factors (such as perception of competence, self-efficacy, enjoyment, beliefs, and attitudes); reinforcing factors (including family influences, peer influence, and coaches influences); enabling factors (including fitness, skills, access, biological factors, and environment); and personal demographics (such as age, gender, ethnicity/ culture, and socio-economic status).

Predisposing factors include variables that increase the probability of individuals being physically active. They reflect the individual's interest in performing physical activity on a regular basis and consist of two constructs based on Fox's conceptualization (Fox, 1991 as cited in Welk, 1999, p. 13); these are *'Is it worth it?*' and *'Am I able?*'. 'Is it worth it?' represents outcome expectancy, and is defined as "enjoyment from and attraction to physical activity" (Welk, 1999, p. 14). 'Am I able?' represents an efficacy expectation, and is defined as "the individual's perception of competence in physical activity" (Welk, 1999, p. 14). These constructs are set in the center of the model and it is proposed that they represent the most direct influences.

Reinforcing factors and enabling factors have direct and indirect influences on youth's physical activity. Reinforcing factors include variables that reinforce a

child's physical activity directly or indirectly through his/her predisposing factors. Parental influence, peer influence, and coaches' influences were reinforcing factors of the YPAP model. Enabling factors include environmental and biological variables that allow children and adolescents to be physically active. According to Welk (1999), without an enabling environment (such as access to equipment, parks, and programs) an individual may lose the opportunity to perform physical activity. Based on this belief, he proposed that environmental attributes have a direct effect on physical activity. In addition, biological factors (including physical skills, fitness, and body fat) can also influence physical activity indirectly through the predisposing factors.

The last component of the YPAP model that indirectly influences physical activity in children and adolescents through predisposing factors, reinforcing factors, and enabling factors is personal demographics. Personal demographics in this model include age, gender, socioeconomic status, and ethnicity. The relationships among variables in the YPAP model are shown in Figure 1.

The researcher conducted research to evaluate the predictive utility of the YPAP model among Thai adolescents. Perceived physical competence, attraction to physical activity, parental influence, and peer influence were selected as predictors of adolescents' physical activity. These variables were chosen for two reasons. First, there is some evidence to support that there is a relationship between each variable and physical activity of children and adolescents. Second, a number of studies have found a relationship among these variables. These findings provide a basis to further investigate this structural relationship in different context, particularly the Thai context. The relationships between the variables in this study are shown in Figure 2.

To use the YPAP model as a framework for this study, the constructs of the model are elaborated.

Perceived physical competence and attraction to physical activity are chosen to represent two predisposing factors, efficacy expectancy and outcome expectancy, respectively. Perceived physical competence represents the adolescents' perceived ability to undertake physical activity. Many studies supported a relationship between perceived physical competence and physical activity of children and adolescents (Davison, Downs, & Birch, 2006; Schaben et al., 2006; Smith, 2004; Welk et al., 2003; Welk & Schaben, 2004). Two studies (Lau, Lee, & Ransdell, 2007; Paxton, Estabrooks, & Dzewaltowski, 2004) found that perceived physical competence directly influenced attraction to physical activity. In addition, three studies have found a relationship among perceived physical competence, parental influence, and attraction to physical activity (Schaben et al., 2006; Smith, 2004; Welk et al., 2003).

Attraction to physical activity is an individual's perceived value of physical activity or various forms of play, game, exercise, and sport (Brustad, 1993). In other words, attraction to physical activity focuses on children's feelings about involvement in their physical activity whether it offers positive feelings. It is based on the concept that children's motivation to participate in physical activity is dependent on their affective reactions to the various dimensions of involvement (Brustad, 1996). The literature review also indicated that there was a relationship between attraction to physical activity and physical activity of children and adolescents (Schaben et al., 2006; Smith, 2004; Welk et al., 2003).

Parental influence and peer influence represent the reinforcing factors in this study. During childhood and adolescence, parents critically influence their children's

health behaviors including physical activity. Parental influence on adolescents' physical activity take a variety of forms such as encouraging children to be active, being active themselves, and facilitating their children's physical activity at home and in the community (Davison et al., 2006). In addition, most children and adolescents perform physical activity in groups rather than individually. Therefore, parents and peers may influence children and adolescents' involvement in physical activity.

For this study, parental influence included three aspects of parental influence on physical activity of adolescents; parental role modeling, parental encouragement, and parental support. A number of studies reported the relationship between one or more aspects of parental influence and the physical activity of children and adolescents (Davison et al., 2006; Schaben et al., 2006; Smith, 2004; Welk et al., 2003). Concerning parental influence on the health behavior of adolescents in the context of Thai culture, the association between parents' behavior and their adolescents' health behavior has been reported by some studies (Jinruang, 2002; Phuphaibul et al., 2005). In addition, a relationship between fathers' and mothers' modeling of health behaviors and health promoting behavior of adolescents were found (Jinruang, 2002; Phuphaibul et al., 2005). Focusing on exercise behavior, the study by Charoneying (2005) found that interpersonal influences (parents, friends, and teachers) were positively related to the exercise behavior of adolescents.

With regards to peer influence on physical activity of children and adolescents, Prochaska, Rodgers, and Sallis (2002) found that peer support correlated with self-report physical activity of students who were studying in 6th-8th grade. In Thailand, Deenan et al. (2001 as cited in Deenan, 2003) found associations between

social support from friends and social support from classmates and the exercise behavior of adolescents.

For the enabling factors, Welk (1999) proposed that they can influence youth's physical activity. However, most of existing studies reported that there was no relationship between physical environmental variables and physical activity in adolescents. According to four systematic review studies (Biddle et al., 2005; Ferreira et al., 2007; Sallis et al., 2000; Van Der Horst et al., 2007), physical (built) environmental variables (availability of facilities and equipment and access to exercise program) did not emerge as correlates of physical activity in adolescents. In addition, some reviews found no relationship between skinfold/body mass index and adolescents' physical activity (Sallis, et al., 2000; Van Der Horst et al., 2007). The fact that a relationship between physical environment and youth's physical activity was not found in most of studies may be because there was no variation of physical environmental variables within these studies. The subjects were in the same context and had the same opportunities to access to the physical environment. This finding may be found in the Thai context that the availability of facilities is less than in Western countries. Thus, the enabling factor of the physical environment was not chosen to investigate in this study. However, this enabling factor was controlled by the study methods. Specifically, the geographical region (school location) and school size were used for stratification of multi-stage random sampling.

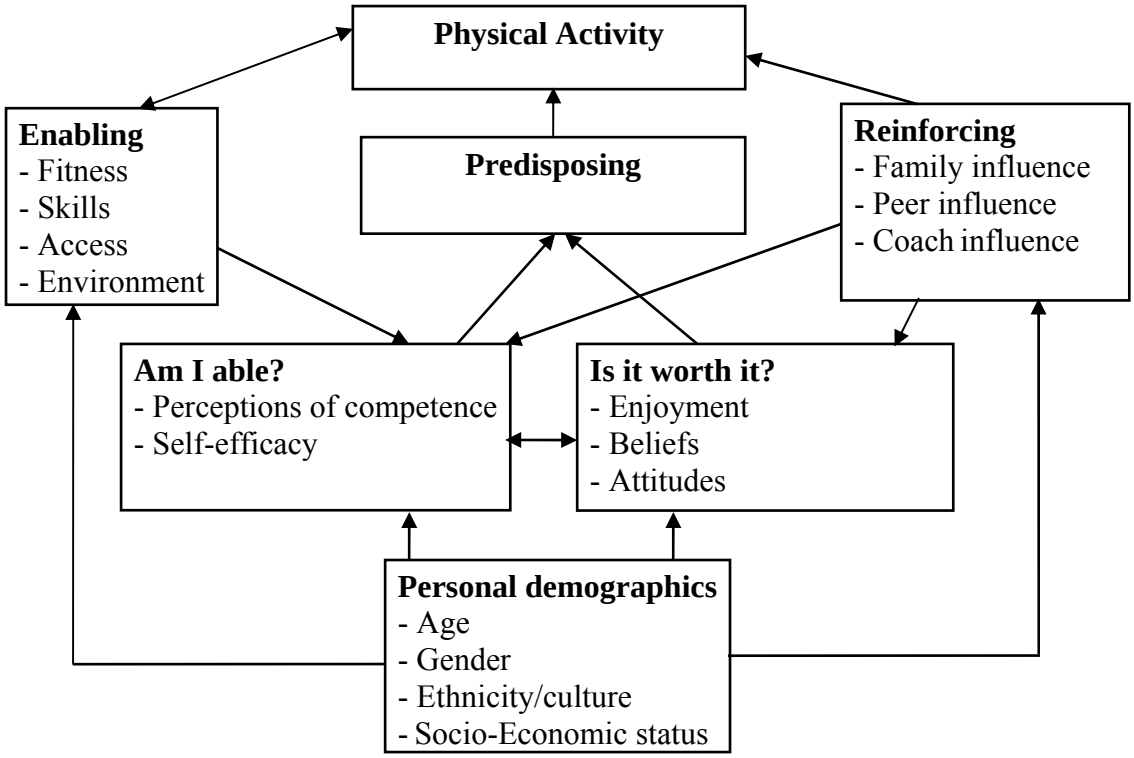

Figure 1. The Youth Physical Activity Promotion model (Welk, 1999)

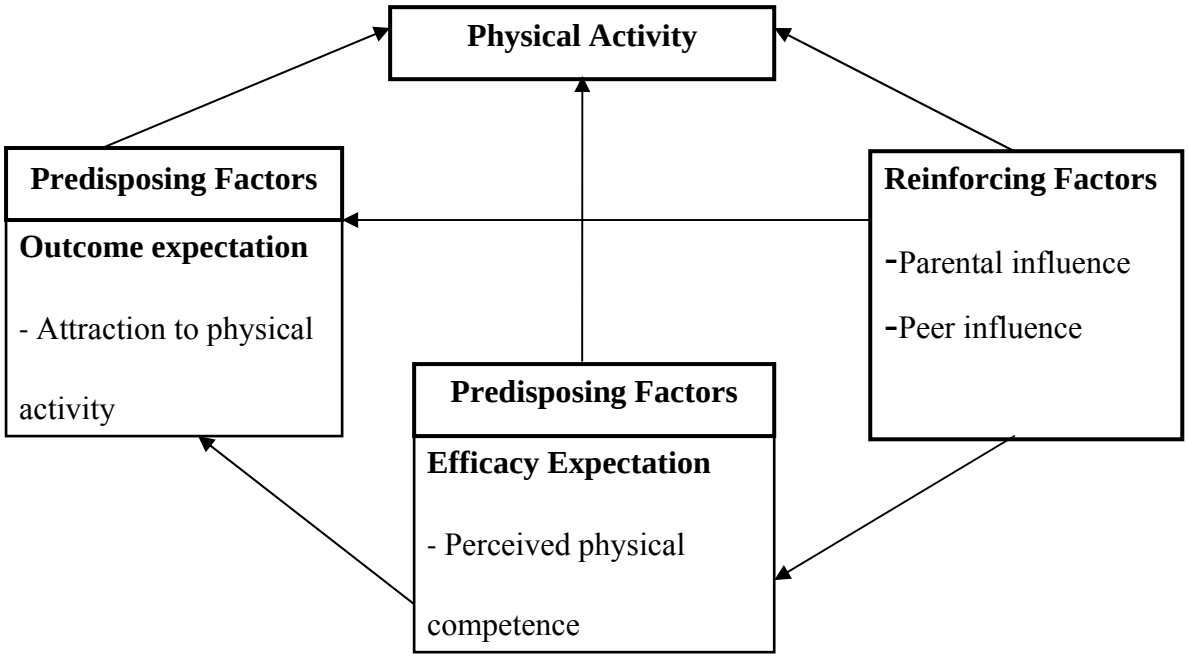

Figure 2. The correlation between study variables guided by the Youth Physical Activity Promotion model

Hypotheses

1. There are relationships among perceived physical competence, attraction to physical activity, parental influence, peer influence, and the physical activity of Thai adolescents.

2. Perceived physical competence has a direct effect on the physical activity of Thai adolescents.

3. Perceived physical competence has an indirect effect on the physical activity of Thai adolescents through attraction to physical activity.

4. Attraction to physical activity has a direct effect on the physical activity of Thai adolescents.

5. Parental influence has a direct effect on the physical activity of Thai adolescents.

6. Parental influence has an indirect effect on the physical activity of Thai adolescents through perceived physical competence and attraction to physical activity.

7. Peer influence has a direct effect on the physical activity of Thai adolescents.

8. Peer influence has an indirect effect on the physical activity of Thai adolescents through perceived physical competence and attraction to physical activity.

Definition of Terms

Physical activity refers to self-assessment of an adolescent on any bodily movement that increases energy expenditure that he/she performed before, during,

and after school. It was measured by the Modified Thai Adolescent's Physical Activity Questionnaire. This questionnaire was modified from the Thai Adolescent's Physical Activity Questionnaire that developed by Kijboonchoo et al. (2007). Each activity was measured as the frequency and the duration or time-period that the adolescent took for each activity. To calculate the volume of total physical activity, each activity was converted to metabolic equivalent time or MET-mins using compendium of physical activities (Ridley, Ainsworth, & Olds, 2008; Ainsworth et al., 2000) as shown in Appendix F. The higher scores reflect high level of physical activity.

Perceived physical competence refers to the perception of an adolescent on his/her ability to perform physical activity. It was measured by the Perceived Physical Competence subscale. The higher scores reflect high level of perceived physical competence.

Attraction to physical activity refers to the perception of an adolescent on his/her attitudes to physical activity. It reflects both an individual's feeling about physical activity and individual's perceived value of physical activity. This variable was measured by the Children's Attraction to Physical Activity subscale. The higher scores reflect high level of attraction to physical activity.

Parental influence refers to the perception of adolescent on the impact of parental or guardian support, role modeling, and encouragement on his/her physical activity. It was measured by the Parental Influence subscale. The higher scores reflect high level of perceived parental influence.

Peer influence refers to the perception of adolescents on the impact of friends' support, role modeling, and encouragement on his/her physical activity. It

was assessed by the Peer Influence subscale. The higher scores reflect high level of perceived peer influence.

Significance of the Study

The outcomes of this study could make significant contributions to nursing and other disciplines, as well as to empirical and theoretical contributions to health research both in Thailand and abroad. Examining physical activity levels, identifying the factors influencing physical activity and the predictive utility of the YPAP model among adolescents in Southern of Thailand is essential for designing effective physical activity promotion programs. Once the physical activity level has been examined, nurses and other professionals will able to know which population practices adequate or inadequate physical activity. In addition, understanding the predictors of physical activity in adolescence populations is fundamental for developing effective physical activity programs.

As a result of this study, a model for promoting physical activity among Thai adolescents could be generated. For research purposes, nurses and other professionals could conduct studies to test the model with different populations (such as male adolescents, female adolescents, obese adolescents or non-obese adolescents) in similar settings. Furthermore, researchers could replicate this study with adolescents in other settings.

Finally, this study evaluated the predictive utility of the YPAP model among Thai adolescents. It was expected that the findings from this study would provide an extension of the model for predicting physical activity in another culture. Furthermore, the results would provide the empirical evidence for theorist to confirm or modify the original model.

CHAPTER 2

LITERATURE REVIEW

This chapter presents a review of documents that are relevant to this study. The literatures were reviewed on: definition and classification of physical activity; assessment of physical activity in children and adolescents; existing questionnaires for physical activity assessment in adolescents; benefits of physical activity in children and adolescents; situation of physical activity promotion among Thai children and adolescents; factors associated with physical activity among adolescents; relationships between parental influence, peer influence, perceived physical competence, attraction to physical activity, and physical activity in children and adolescents.

Definition and Classification of Physical Activity

The conventional definition of physical activity is "bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above the basal level" (Caspersen et al., 1985, p 126). Physical activity is frequently categorized according to the context in which it occurs. Four common categories of physical activity include leisure-time activities, household activities, occupational activities, and transportation (Caspersen et al., 1985; Centers for Disease Control and Prevention, 2006; U.S. Department of Health and Human Services, 1996). Leisure-time physical activity is a broad set of the activities that individuals perform during free time, and are based on personal interests and needs (Howley, 2001). It can be further categorized into subcategories such as competitive sports, recreational activities, and exercise training

(U.S. Department of Health and Human Services, 1996). Examples of leisure-time physical activities are playing football, free-play, and cycling. Household physical activity is a set of activities in which an individual participates through housework. It includes many activities such as sweeping floors, scrubbing, washing, doing the laundry, and mowing the lawn. Occupational physical activity refers to activities that are associated with the performance of a job. It includes a number of activities such as walking, lifting, pushing, carpentry, shoveling, digging, and packing boxes. Transportation physical activity refers to activities that are associated with active transportation to and from places. It includes several activities such as walking or cycling to school, and cycling to the store.

Along with physical activity, the terms "exercise", "physical inactivity", and "physical fitness" are often used in articles and research studies in this area. Physical activity and exercise have been used interchangeable in the past. In fact, physical activity and exercise have a number of similar common elements, such as involvement of any bodily movement produced by skeletal muscles that expends energy and is positively correlated with physical fitness (Caspersen et al., 1985). Exercise refers to planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness (Caspersen et al., 1985). However, exercise is not synonymous with physical activity. More recently, exercise has been used as a subcategory of physical activity. For physical inactivity, it can be described as a state in which bodily movement is minimal and energy expenditure approximates the resting metabolic rate (Miles, 2007). Finally, physical fitness refers to "a set of attributes that people have or achieve that relates to the ability to perform physical activity" (Caspersen et al., 1985, p. 129). Physical fitness

commonly has two components: health-related physical fitness and skill-related physical fitness (athletic ability). However, health-related physical fitness is more important to public health than is skill-related physical fitness which is related to athletic ability. Health-related physical fitness consists of cardiorespiratory endurance, muscular endurance, muscular strength, body composition, and flexibility. Physical fitness levels range from low to high (Caspersen et al., 1985).

For describing patterns of physical activity, the following terms are commonly used; frequency, duration, and intensity. Furthermore, energy expenditure is also used to explain activity patterns (Welk, Corbin, & Dale, 2000). Frequency refers to the number of physical activity actions during a specific period. In other words, the frequency is described as the number of activity sessions per day, week, or month (Vanhees et al., 2005). To measure the frequency of activity participation, the number of bouts per day or week or the percentage of children/adolescents being active on a given day is reported (Welk et al., 2000). Duration refers to the length of participation in a single bout of physical activity (Vanhees et al., 2005). The duration of an activity is generally reported in minutes (the number of minutes of activity in each session) or the percentage of time spent participating in an activity (Welk et al., 2000). Intensity refers to "the physiological effort associated with participating in a special type of physical activity" (Vanhees et al., 2005, p. 104). The three degrees or categories of intensity of the physical activity (light, moderate, or vigorous) are based on the amount of energy that the individual expends in performing the activity.

Energy expenditure is a result of physical activity and is usually measured in kilocalories (kcal) (Kohl, Fulton, & Caspersen, 2000). Estimating physical activity to obtain energy expenditure requires information about the metabolic costs of each

activity that an individual has performed (Welk et al., 2000). Estimates are typically made using multiples of the resting metabolic rate and these are reported as Metabolic Equivalents Time (MET) (Welk et al., 2000). Thus, MET is the ratio of the work metabolic rate to the resting metabolic rate. One MET is defined as 1 kcal/kg/hour and is equivalent to the energy cost of sitting quietly. A MET is also defined as oxygen uptake in ml/kg/min with one MET equal to the oxygen cost of sitting quietly, around 3.5 ml/kg/min (World Health Organization, 2004). For example, the MET value of "sitting quietly and watching television" is "1," whereas the MET value of "walking for pleasure" is 3.5. In other words, watching television burns 1 kcal/kg/hr whereas walking for pleasure burns 3.5 kcal/kg/hr.

The intensity of physical activity is most commonly measured using MET (Miles, 2007). The following describes physical activity intensity (Miles, 2007; Pate et al., 1995). Light (low) intensity physical activity refers to activities requiring between 1 and 3 MET, such as ironing, cleaning and dusting. A moderate intensity physical activity refers to activities requiring between 3 and 6 MET, such as painting/decorating, golf, and badminton. Those activities requiring 6 MET and above (such as aerobic dancing, cycling, and swimming) are classified as vigorous intensity activities. Although the intensity of physical activity is often used to categorize physical activity, it is not commonly used as an outcome measure in research. In general, the amount of activity (duration and frequency) is calculated in conjunction with intensity categories for determining the level physical activity.

The pattern of physical activity of children and adolescents is quite different from that of adults. Children and adolescents usually have intermittent activity rather than continuous activity. Using this idea, recent guidelines for children and adolescents

emphasize the accumulation of intermittent activity throughout the day (Department of Health, Ministry of Public Health, 2005; U.S. Department of Health and Human Services, 1996). For an accurate assessment of physical activity among children and adolescents, an instrument has to be sensitive enough to detect typical, sporadic and intermittent activity. A variety of instruments is available to quantify physical activity levels, including both objective methods and subjective methods. These measures can be used to measure many dimensions of physical activity, such as duration, frequency, and intensity of different types of physical activity. However, the application, strength, and weakness of each of the measures are quite different.

Assessment of Physical Activity in Children and Adolescents

Several measures have been developed to assess physical activity among children and adolescents. Some of them are designed for measuring physical activity in a laboratory while some are designed for field-based studies. Physical activity assessment methods can be categorized into 2 major groups: subjective methods (such as questionnaires and activity diaries) and objective methods (such as direct observation, indirect calorimetry, doubly-labeled water, pedometers, accelerometers, and heart rate monitoring). Vanhees et al. (2005) described another way to categorize physical activity assessments. According to Vanhees and colleagues, physical activity assessments can be categorized as criterion methods (including direct observation, indirect calorimetry, and doubly-labeled water), objective methods (such as pedometers, accelerometers, and heart rate monitors), and subjective methods (for example, questionnaires and activity diaries). Generally, selecting a particular method of physical activity assessment for use with children and adolescents depends largely

on the study design and the population (Kohl et al., 2000). Because each method has specific advantages and disadvantages, so they must be considered when selecting an instrument. The specific detail, advantages, and disadvantages of each method are described below.

Physical activity questionnaires or self-report instruments

Physical activity questionnaires or self-report instruments are the most common types of measures used to provide a convenient way of assessing the physical activity patterns of large populations. Using a questionnaire, participants are asked to recall information about physical activity participation during a specific time period in the recent past (such as 1 day, 3 days, 7 days, or 1 month). This method can provide the frequency, duration, and type of physical activity. One of its limitations is the accuracy of the self-report data. To report accurately, individuals must have cognitive abilities to understand the directions given, be able to recall past events, and report information with little bias (Sallis, 1991). Therefore, the researcher should be cautious when using this method for young children who are under 10 years of age (Kohl et al., 2000; Vanhees et al., 2005; Welk et al., 2000). Generally, self-report data shows over estimation. In addition, most validation studies using children have reported only low to moderate correlation between various self-report forms and other objective criteria (Kohl et al., 2000). It is generally recommended that all physical activity questionnaires should be validated against an objective method such as direct observation, indirect calorimetry, doubly-labeled water, pedometers, accelerometers, or heart rate monitors (Vanhees et al., 2005).

Activity diaries

When keeping activity diaries, data may be reported in different units or categories such as type of activity, time, and/or caloric expenditure (Kohl et al., 2000; Welk et al., 2000). This method requires time and commitment on the part of the subjects who are required to keep to a daily reporting schedule. Moreover, it may cause an alteration in the normal pattern of physical activity. Because of these limitations, activity diaries are not popular methods for measuring physical activity among children and adolescents (Kohl et al., 2000).

Direct observation

Direct observation evaluates the behavioral aspects of physical activity (Welk et al., 2000). Frequency, duration, and type of physical activity can be observed and recorded by this method. The data can provide the typical activities of children and adolescents. For direct observation, the observer may be in the environment where the activity is occurring or can observe a specific person via videotape. This method is useful for samples of young children aged 2-10 years who have not yet developed the cognitive ability to accurately recall detailed information (Kohl et al., 2000). However, direct observation may influence the behavior of the sample under study. In addition, direct observation may not be practical for large samples because it is costly and time-consuming (Kohl et al., 2000; Welk et al., 2000).

Heart rate monitors

Heart rate monitors provide real-time estimates of the frequency and intensity of free-living physical activity (Miles, 2007). Heart rate monitors can record and store

information about heart rate responses to physical activity for several hours and days (Vanhees et al., 2005). Information is obtained about energy expenditure. The estimation of energy expenditure from heart rate monitoring is based on the linear relationship between the heart rate (HR) and oxygen consumption (VO_2). The heart rate has been shown to be linearly related to oxygen consumption and energy expenditure during moderate to vigorous physical activity (Miles, 2007; Vanhees et al., 2005; Welk et al., 2000). To obtain the energy cost of physical activity, the HR-VO_2 relationship must be established for each subject for each activity (Schutz, Weinsier, & Hunter, 2001). However, HR measurement is not a good predictor of energy expenditure at low levels of physical activity (Schutz et al., 2001). There are also some limitations when heart rate monitors are used for monitoring over extended periods. First, numerous factors (such as anxiety, stress, and other factors) that influence the heart rate under resting conditions can cause considerable error. Second, the discomfort from wearing a transmitting device (a chest strap transmitter and a small receiver watch) can also reduce compliance by participants (Kohl et al., 2000; Vanhees et al., 2005; Welk et al., 2000).

Accelerometers

An accelerometer is a physical activity monitor that measures the quantity, duration, and intensity of body movement. It can measure physical activity in one dimension (vertical), two dimensions (vertical and medio-lateral), or three dimensions (vertical, medio-lateral, and anterior-posterior) (Miles, 2007; Vanhees et al., 2005; Welk et al., 2000). Moreover, it can detect intermittent activity patterns and store continuous data over extended periods. The accelerometer is one of the most useful

tools for validation of other assessment methods. However, accelerometers may not be practical for large-scale studies because of the high cost and administrative time (Kohl et al., 2000; Welk et al., 2000). The discomfort experienced from wearing an accelerometer may reduce participant compliance. A further limitation of accelerometers is their inability to detect upper body movement, static work (house cleaning and yard work), or movement on soft or graded terrain (such as when playing golf) (Schutz et al., 2001).

Pedometers

Pedometers can assess physical activity by counting steps over a period of time, such as from waking up until a person goes to sleep (Kohl et al., 2000; Vanhees et al., 2005; Welk et al., 2000). These steps can then be converted to distance or energy expenditure. However, they cannot provide detail on the frequency, intensity, and duration of physical activity (Kohl et al., 2000; Vanhees et al., 2005; Welk et al., 2000). They possess similar benefits and weaknesses as other motion sensors, but are less accurate and precise. However, pedometers may offer the best solution at a low cost.

Indirect calorimetry

Indirect calorimetry estimates energy expenditure by measuring respiratory gases, carbondioxide (CO_2) and oxygen (O_2). Participants are required to wear a mask and remain under controlled conditions (Miles, 2007; Vanhees et al., 2005; Welk et al., 2000). It can be used to identify and separate energy expenditure associated with the resting metabolic rate, the thermic effect of food, and the thermic effect of

exercise. Indirect calorimetry techniques are considered to be 'gold standard' assessments, along with doubly-labeled water, for laboratory and field-based studies on physical activity. The limitations of this method are that it is expensive and it cannot measure energy expenditure under associated with normal activity patterns.

Doubly-labeled water

Doubly-labeled water is a method for measuring energy expenditure during free-living activity for periods of days to several weeks (Miles, 2007; Vanhees et al., 2005; Welk et al., 2000). The principle basis of this method is that subjects are required to ingest amounts of water that contain two stable isotopes (hydrogen and oxygen atoms). The amount of unmetabolized isotope from the urine is then measured over the period of a few days to weeks with a mass spectrometer. The results of the urinary measurements for individual subjects provide an indirect measure of oxygen uptake or the rate of carbon dioxide production. Energy expenditure can be measured through the CO_2 production and O_2 consumption. By comparing this to an estimate of the basal metabolic rate (BMR), the energy expenditure for physical activity can be calculated. Furthermore, the physical activity level can be calculated by expressing the total energy expenditure as a multiple of the BMR. There are several advantages in using the doubly-labeled water method for assessing total energy expenditure in children. For example, it is non-invasive, it can measure activity over 1-2 week periods, and it does not interfere with normal activity patterns. The limitations are the cost and the difficulty in obtaining water containing the stable isotopes (Rice & Howell, 2000; U.S. Department of Health and Human Services, 1996; Vanhees et al., 2005).

In summary, the utility and limitations of the various measures should be considered when selecting instruments to assess physical activity. Objective measures using observation, heart rate monitoring, accelerometers, pedometers, doubly-labeled water, or indirect calorimetry have limitations as they are time- and cost-consuming. The subjective method, such as questionnaires or self-reports, may be prone to memory lapses where irregular activity is forgotten and this leads to low validity. The various factors to be considered in the selection of methods to assess physical activity include study goals, sample size, sample characteristics, budget, cultural and social/environmental factors, physical burdens for the subject, and statistical factors (reliability and validity) (Miles, 2007; Schutz et al., 2001).

Existing Questionnaires for Physical Activity Assessment in Adolescents

A number of questionnaires were developed for measuring physical activity in adolescents in many countries. They are 1 day, 3 days, 7 days, 1 month, or 1 year physical activity recall questionnaires. The time span of the recall is related to the reliability of the questionnaire. Higher reliabilities were found when the delay between recalls was 1-3 days than when the delay was 4-6 days (Sallis et al., 1990 as cited in Sallis et al., 1996). For example, the Previous Day Physical Activity Recall Questionnaire (PDPAR) was developed by Weston, Petosa, and Pate (1997) to measure physical activity in youth. It was validated in adolescents in the 7th to the 12th grades, with correlations of 0.53– 0.88 between relative energy expenditure from the PDPAR and either pedometer counts, Caltrac accelerometer counts, or daily heart rate. The 7-days physical activity recall questionnaire (such as the International Physical Activity Questionnaire) had validity against CSA accelerometer lower than

the PDPAR (concurrent validity ranged from .30 to .33). However, the short time span of the recall (1 to 3 days) may not represent the overall physical activity of adolescents. Therefore, the most promising types of questionnaires for measuring physical activity in adolescents appear to be the 7-day physical activity recall questionnaire.

Although the validity of questionnaires for measuring physical activity in adolescents showed low to moderate validity when compared with the objective measure, this method was selected for many studies was largely due to considerations of expense and convenience. In addition, questionnaires provide all four dimensions of physical activity such as type, frequency, intensity, and duration. Quantitative estimates of physical activity are needed for epidemiologic studies and are preferred for evaluating the effects of intervention. Therefore, a questionnaire is the most promising measure for physical activity assessment in large samples of adolescents.

Some of the existing 7-day physical activity recall questionnaires used for measuring physical activity in adolescents are the International Physical Activity Questionnaires and the Global Physical Activity Questionnaire. They are described as in the following paragraphs.

The International Physical Activity Questionnaire (IPAQ) was developed by the World Health Organization (WHO) as a measure for cross-national monitoring of physical activity and inactivity (Craig et al., 2003). Short and long physical activity questionnaires were developed and were pilot tested. The short version included 9 items and provided information on the time spent in walking, in vigorous- and moderate-intensity activity and in sedentary. The long version included 31 items. It was designed to collect detailed information within the domains of household and

yard work activities, occupational activity, transportation activity, and leisure-time physical activity as well as sedentary activity. These questionnaires were designed to be used by adults aged 18-65 years. They were translated into many languages using standard methods. Currently, these questionnaires have been completed by participants in 12 countries. For reliability evaluation, the short and long versions were completed by the participants on two separate occasions (3 to 7 days period). Test-retest reliability of the long version was around .80. Test-retest reliability of the short version was above .65. For criterion validity, the validity of the long version of IPAQ against CSA accelerometer was .33. The validity of the short version of IPAQ against CSA accelerometer was .30 (Craig et al., 2003).

The Global Physical Activity Questionnaire (GPAQ) was developed by the WHO for physical activity surveillance in developing countries. It collects information on physical activity participation in three domains and sedentary behaviour. These domains are: activity at work (occupational activity); travel to and from places (transportation activity); and recreational activity. Information on frequency and duration of moderate-intensity activity and vigorous-intensity activity is collected (World Health Organization, 2004). To calculate total physical activity, MET values are applied to vigorous and moderate intensity variables in the occupational activity, transportation activity, and recreational activity. Different types of activities have been grouped together and given a MET value based on the intensity of the activity.

Within Thailand, Thai Adolescent's Physical Activity Questionnaire (TAPAQ) was developed by Kijboonchoo et al. (2007) for measuring physical activity among Thai adolescents. It is a 7-day physical activity recall questionnaire. To develop the

instrument, the researchers conducted focus group interviews with 60 elementary and secondary school children aged 10-18 years (30 boys and 30 girls, 30 children from public schools and 30 children from private schools). This was to establish the number of activity items that they performed in their daily lives. A standardized interview schedule was developed guided by the items from the IPAQ and the GPAQ. Then it was used as a guideline to interview the participants. All participants were asked about their transportation to and from school, physical activities at school, physical activities after school (at home and outside), and sedentary behavior (such as watching television and computer or internet using). After that, items were developed in a draft TAPAQ using a closed-choice format corresponding to the most frequent physical activities identified by the participants. Activities were categorized into three groups: general physical activity that involved sitting activity (such as watching television, playing music, working jigsaws, and using a computer or the internet); household activity (such as washing and house cleaning); and free-play, exercise, and sports.

The initial pilot study was conducted by Kijboonchoo et al. (2007) with 30 students to examine their understanding of each item. The results indicated that the fifth- and sixth-grade students had difficulty responding to the duration of the activities. During the initial pilot test changes were made to the original questionnaire by dividing the questionnaire into two questionnaires. One is used to assess physical activity in elementary student population (Thai Children's Physical Activity Questionnaire, TCPAQ), and the other is used to assess physical activity in secondary school student population (Thai Adolescents' Physical Activity Questionnaire, TAPAQ). The TAPAQ included the list of physical activities, the frequency, and the

duration or time-period that the adolescent took for each activity. Lastly, the TAPAQs were distributed to 2,883 students (7 to 12 graders) in secondary schools in five regions of Thailand. Approximately 95% of the sample (2,742 students) returned the questionnaires. Following deletions for incomplete data, about 1,013 questionnaires were included for data analysis (item selection). Based on the item selection, 139 activities were obtained. To examine the reliability of the TAPAQ, Cronbach's alpha coefficient was calculated. In addition, item-to-total correlations were examined. Items with item-to-total correlation greater than .4 were retained for further analysis. Finally, 66 activities were retained and used.

For construct validity, factor analysis was employed to group these dichotomous items into a scale. Items with communalities greater than .5 were placed in the same category. The final version of the TAPAQ was distributed to 300 volunteers to examine the concurrent validity (criterion validity). These volunteers were male and female students in five secondary schools in Bangkok and Nakhon Patom province. All volunteers wore an ActiGraph accelerometer for seven consecutive days during their waking hours except when bathing or during any time spent in water activities. During the monitoring period the participants were contacted by phone to remind them to wear the ActiGraph accelerometer. After the collection period, the stored activity counts were downloaded and saved to a compatible computer for subsequent data storage and analysis. After the recording period (having removed the ActiGraph accelerometer), participants were asked to complete the TAPAQ (TAPAQ1). All participants were asked to recall their physical activities during the previous seven days. In addition, the TAPAQ was distributed to all participants for test-retest reliability from 1 to 3 days later (TAPAQ2).

Following deletions for monitoring failure, monitoring loss, or incomplete monitoring data, the final sample consisted of 175 students. Data from 134 students (who wore the ActiGraph accelerometer for 7 days) and 41 students (who wore it for at least 4 days) were included for further analysis. For concurrent validity, the results showed that there was no correlation between activity counts from the ActiGraph accelerometer and TAPAQ scores, which were calculated as total MET-mins value (frequency x the duration x MET value for each kind of physical activity during the previous seven days summed across all activities). However, if duration was eliminated from the calculation, the correlation between activity counts from the ActiGraph accelerometer and the MET value (the summation of the frequency that sample performed each kind of physical activity during the previous seven days x its MET value) from TAPAQ1 and TAPAQ2 improved, but the correlation coefficient was low (r = .26). For test-retest reliability, the intra-class correlation between TAPAQ1 and TAPAQ2 score was .72.

Another questionnaire for physical activity assessment in Thai adolescents is the translated IPAQ. The long form of IPAQ was translated into Thai language and was tested for reliability and validity in a sample of secondary school students. Unfortunately, the psychometric properties of this questionnaire were not available. Based on this existing data, the TAPAQ was selected to assess adolescent's physical activity in this study; however, it was modified before it was used.

Benefits of Physical Activity in Children and Adolescents

Physical activity plays an important role by providing and enhancing many positive health benefits for children and adolescents. Physical activity is inversely

associated with a number of adverse health outcomes, including elevated blood lipids and obesity. It is positively associated with cardio-respiratory fitness, high density lipoprotein (HDL) cholesterol, bone mass, and psychological well-being (Sothern, 2004; Sothern, Loftin, Suskind, Udall, & Blecker, 1999; U.S. Department of Health and Human Services, 1996). It also provides an opportunity for play activity and pleasure, and allows the child to explore the environment (Batch, 2005; Gillis, Kennedy, & Bar-Or, 2006). Concerning psychological health, the systematic review of trials and interventions suggests that exercise (a subcategory of physical activity) has positive short-term effects on self-esteem in children and young people (Ekeland, Heian, Hagen, Abbott, & Nordheim, 2006).

Adequate participation in physical activity during childhood and adolescence may be important in the prevention of chronic disease in later life. The results of a cross-sectional study indicated that children and adolescents with a higher physical activity index had a lower number of biological risk factors for cardiovascular disease (high blood pressure, percentage of high fat mass, or high total cholesterol) (Ribeiro et al., 2004). Furthermore, physical activity may prevent obesity and type II diabetes mellitus, and enhance physical fitness. To support this hypothesis, Butte, Puyau, Adolph, Vohra, and Zakeri (2007) found that physical activity levels were significantly associated with certain percentages of fat mass, fitness, fasting serum insulin, and waist circumference, although the strength of the associations were generally low. In addition, the percentage of fat mass was significantly and positively associated with sedentary activity and was negatively associated with total activity counts. Fitness (represented by oxygen consumption, VO_{2peak}) was significantly and negatively related to the percentage of sedentary activity and was positively related to

total activity counts. Fasting serum insulin was negatively correlated with total activity counts and was positively correlated with the percentage of sedentary activity.

A relationship between physical activity and obesity was also found by Gillis et al. (2006). They reported a small negative correlation between adiposity (percentage of body fat) and the activity scores and between adiposity and total hours of activity. They also found that the amount of moderate activity was the best predictor of obesity.

In Thailand, a quasi-experimental research project was undertaken to determine the effectiveness of an exercise program (aerobic dancing and playing football 30 minutes per day for 8 weeks) on the physical fitness of 39 overweight students (aged 9-12 years). The results showed that the participants had significantly higher cardiopulmonary endurance (over a 1 mile run) and muscular strength (sit-ups) than before exercises were performed. However, body mass index, muscular endurance (pull-ups), and muscular flexibility (sit and reach) were not significantly different (Oonklang, 2003).

An association between physical inactivity and obesity was also reported in the Third National Health and Nutrition Examination Survey in United States. The findings showed that children who spent 4 hours or more watching television or on a sedentary activity every day had higher body mass index (BMI) than children who watched television less than 2 hours per day (Andersen, Crespo, Bartlett, Cheskin, & Pratt, 1998). A similar result was found by Sekine et al. (2002) who conducted a study in 8,274 children aged 6–7 years living in Toyama prefecture, Japan between June and July 1996. It was found that long hours of TV watching and physical inactivity were associated significantly with childhood obesity. Gable and Lutz (2000) also

found that the average number of hours spent watching television per day is a powerful indicator of children's risk of becoming obese.

The health benefits of regular physical activity are dependent on the type, intensity, and volume of activity. However, moderate intensity activities seem to promote health benefits (Sothern et al., 1999). To enhance the health of children and adolescents, nurses and other health professionals could help them to become more active. To encourage youths to become more active, health professionals need to understand the levels of physical activity of individuals. Furthermore, an understanding of the factors influencing the physical activity of youths is also needed.

Situation of Physical Activity Promotion among Thai Children and Adolescents

After Thailand launched a campaign to promote exercise for better health in 2002, several policies were formulated from many governmental organizations. The Ministry of Public Health has designed a policy to promote exercise behavior and expected that at least 60% of people aged 6 years or older regularly performed exercise at least 30 minutes three times per week. Along with this campaign, the Ministry of Tourism and Sports (2008) designed the Sport Development Plan 4 (2007-2010) to promote exercise behavior of Thais. By the end of this plan, it is expected that about 60% of children and youth will regularly perform exercise. The Thai Health Promotion Foundation is an organization that provides financial support to governmental and non-governmental organizations operating exercise-promotion activities. Several projects for promoting exercise behavior were funded and a variety of exercise activities were launched to promote exercise behavior of Thais.

To achieve the goal “Healthy Thailand”, the Ministry of Public Health commissioned an expert committee to design strategies, research frameworks, and the guidelines for promoting physical activity in Thais. Recently, some documents were released from this committee such as the “Guidelines for Exercise Promotion in School” (Kijboonchoo, n.d.) and the “Recommendations for Exercise in Children Aged 2-12 Years” (Sanguanrunsirikul, n.d.). These documents were based on the knowledge from other countries. In addition, the Department of Health, Ministry of Public Health (2005) also published the “Guidelines for an Appropriate Physical Activity/Exercise for Children and Adolescents in School”. Several types of physical activity for promoting cardio-respiratory endurance, cardio-respiratory fitness, resistance/strength training, and stretching were recommended as well as the frequency and duration for each type of activities.

Focused on physical activity promotion among children and adolescents, the “Thai Kids on the Move Project” was launched by the private corporation, the Ministry of Public Health, and the Nutritional Institute Mahidol University (Department of Health, Ministry of Public Health, 2003). It is a project promoting children’s physical activity for the fifth and sixth grade students. Two main activities of this project are “Step for Fun” and “Aerobic Dancing for Health”. The aim of “Step for Fun” is to encourage the child to achieve 10,000 steps per day. The “Aerobic Dancing for Health” is aimed to promote muscular strength and flexibility. This project has been launched since 2003 in elementary schools (5th to 6th grade) in all parts of Thailand. It is expected that at the end of academic year 2008, there will be more than one million students joined in this project. According to this project, it

seems to support that enjoyment is the most important factor for promoting physical activity in Thai children.

The "Healthy Thai Kids Project" is designed to promote children's physical activity in school. The objectives of this project are promoting active lifestyles and promoting health and physical fitness for all students (Department of Health, Ministry of Public Health, 2003). It was launched under the cooperation of the Ministry of Education, the Nutritional Institute Mahidol University, and the Ministry of Public Health. To participate in this project, schools have to provide facility for promoting physical activity and operate a variety of forms of physical activity for 15 minutes a day for all students. Moreover, physical fitness of all students is evaluated two times a year.

Factors Associated with Physical Activity among Children and Adolescents

A number of studies have examined the relationships between physical environmental factors, psychosocial factors and physical activity in children and adolescents over several decades. In addition, several systematic review studies were conducted for understanding the consistent correlates of youth's physical activity (Biddle et al, 2005; Davison et al, 2006; Sallis et al., 2000; U.S. Department of Health and Human Services, 1996; Van Der Horst et al, 2007). The results of these studies found some consistent correlates of physical activity as shown in the following paragraphs.

In the 1996 Surgeon General's report on physical activity (U.S. Department of Health and Human Services, 1996), the most consistent modifiable correlates of physical activity were self-efficacy, physical or sports competence, perceived

benefits, perceived barriers, intention, enjoyment, physical education attitudes, parental encouragement, direct help from parents, peer and sibling support, access to play spaces and equipment, and time spent outdoors. A systematic review performed by Sallis et al. (2000) indicated that some variables were found as the consistent correlates of adolescents' physical activity. These variables were perceived activity competence, intention, depression, previous physical activity, community sports, sensation seeking, parent support, support from others, sibling physical activity, direct help from parents, and opportunities to exercise. According to the review of Biddle et al. (2005), the correlates of adolescent girls' physical activity were enjoyment, perceived competence, self-efficacy, physical self-perceptions, and parental and family support. Another recent systematic review on the correlates of physical activity in youth was conducted by Van Der Horst et al. (2007). For adolescents, positive associations with physical activity were found for male gender, parental education, attitude, self-efficacy, goal orientation/motivation, physical education/school sports, family influences, and friend support. In addition, the evidence for associations of physical activity with intention, perceived barriers, and sport competence was inconclusive.

In addition to the systematic review studies on psychosocial correlates of physical activity, three studies that focused on physical environment were conducted. Sallis et al. (2000) reviewed studies that were published between 1970 and 1998. They found no association between the physical environment (equipment/supplies available) and adolescents' physical activity. Ferreira et al. (2007) published a comprehensive review of environmental correlates of physical activity in youths. One hundred and fifty studies published between January 1980 and December 2004 were

included in the review. The findings showed that sixteen out of twenty studies found no association between access/availability of physical activity equipment at home and adolescents' physical activity. For the neighborhood, thirty-two out of forty-five studies found no association between access/availability to physical activity equipment/facilities/programs and adolescents' physical activity. In addition, three out of five studies found no association between exposure to/interest in sport media and adolescents' physical activity. Recently, Davison and Lawson (2006) conducted a systematic review of 33 studies on physical environmental correlates of youths' physical activity published between 1990 and 2006. The findings indicated that four out of six studies found no association between home equipment and children's physical activity. However, a significant positive association between the proximity of parks and playgrounds to the home and children's physical activity was identified in three out of five studies. In eight out of ten studies a significant positive association was also identified between the availability of recreation areas, or presence of such areas in the vicinity of the home, and children's physical activity. In summary, most of studies found no relationships between the physical environment and adolescents' physical activity.

Studies related to the correlates of physical activity among Thai children and adolescents are very limited. However, some researchers have conducted studies to examine the factors influencing exercise behavior in children and adolescents during the past decade. Although a number of studies in this area have been conducted, it is not clear whether physical environment and psychosocial variables are associated with Thai adolescents' physical activity. An overview of relevant studies dealing with correlates and determinants of exercise behavior in children and adolescents is offered below.

Guided by the PRECEDE-PROCEED Planning model, two cross-sectional studies were conducted with the sample of grade 1-6 students (Chotimanothum, 2003) and grade 7-9 students (Teparatana, 1997). For elementary school students, the predictors of exercise behavior were family influences, the community's environment and facilities, psychological factors, and school influences. Family influences included parental support, parental provision, parental involvement, and parental encouragement. Psychological factors included child's attitude (toward exercise, sport, and physical education), perceived ability to perform exercise, and the consequences of exercise. However, the measure used to assess exercise behavior in elementary students did not reflect only exercise behavior itself. It included items that captured both exercise behavior and behavior to prevent injuries from exercise. For adolescents, the predictors of exercise behavior were male gender, knowledge about exercising, and access to exercise media.

Guided by Pender's Health Promotion Model (HPM), Deenan et al. (2001 as cited in Deenan, 2003) reported that some individual characteristics and experiences variables and behavior-specific cognition and affect variables were associated with adolescents' exercise behavior. The samples in this study included 1,086 secondary school students who lived in urban and rural areas of the eastern seaboard of Thailand. The findings showed that health concerns and daily concerns (individual characteristics and experiences variables) and role models, self-efficacy, social support from friends, and social support from classmates (behavior-specific cognition and affect variables) were positively associated with exercise behavior. Barriers to exercise were negatively related to exercise behavior. Guided by the HPM, Deenan (2003) examined the predictors of exercise behavior in 311 bilingual secondary

school students in Bangkok and Chonburi Province. The findings did not show relationships between individual characteristics and experiences variables, behavior-specific cognition and affect variables, and exercise behavior. Using the same theory, Charoneying (2005) conducted a cross-sectional study to examine the correlates of exercise behavior in 394 secondary school students (grade 10 to 12) in Prachinburi Province. The findings showed that perceived benefits to exercise, perceived self-efficacy to exercise, interpersonal influences, and situational influences were positively related with exercise behavior. Perceived barriers to exercise were negatively related to exercise behavior.

From three studies guided by HPM, self-efficacy and barriers to exercise emerged as the correlates of exercise behavior in two of three studies. However, two studies by Deenan and her colleagues that used the same measures to assess behavior-specific cognition and affect variables (such as perceived benefit, perceived barriers, and self-efficacy) showed different results. The differences in the measures used to assess exercise behavior and sample characteristics might be the cause of the inconsistency.

Recently, a study that focused on the relationship between the friendship variable and participation in physical activity by high school students was conducted by Page, Taylor, Suwanteerangkul, and Novilla (2005). This study investigated the association between the ability to make friends, level of involvement with friends, perceived friends' involvement in exercise/physical activity, and participation in physical activity in a sample of 2,519 secondary level students in Chiang Mai Province. The results showed that overall participation in physical activity was lowest among adolescents who had difficulty in making new friends, who were less involved

with friends, and who reported that no or only some of their friends participated in exercise/physical activity.

From the literature review a number of variables emerged as the correlates of exercise behavior in Thai children and adolescents. These variables were male gender, knowledge about exercising, access to exercise media, family influences, the community's environment and facilities, psychological factors, school influences, self-efficacy, barriers to exercise, role models, social support from friends, social support from classmates, perceived benefits to exercise, perceived self-efficacy to exercise, interpersonal influences, and situational influences. The correlates of physical activity were ability to make friends, level of involvement with friends, and perceived friends' involvement in exercise/physical activity. However, the relationships of these variables with exercise behavior or physical activity was supported by one or two studies. It is, therefore, difficult to make firm conclusions concerning the correlates of exercise behavior or physical activity in Thai children and adolescents.

According to the literature review, most of the systematic review studies (Biddle et al., 2005; Sallis et al., 2000; U.S. Department of Health and Human Services, 1996; Van Der Horst et al., 2007) reported that self-efficacy and perceived competence emerged as the consistent correlates of adolescents' physical activity. In addition, parents, family, and friends seem to be the social influencing factors of adolescents' physical activity. For outcome expectancy variables, attitude/enjoyment emerged as a correlate of youth's physical activity in two systematic review studies (Biddle et al., 2005; Van Der Horst et al., 2007). However, one psychological variable that reflects children's attitudes to physical activity was not included in any

systematic reviews. This variable was named “attraction to physical activity”. The relationship between attraction to physical activity and physical activity in children and adolescents has been examined by many researchers during the past decade. The findings indicate that there is an association between attraction to physical activity and physical activity among children and the adolescents.

Relationships between Parental Influence, Peer Influence, Perceived Physical Competence, Attraction to Physical Activity, and Physical Activity in Children and Adolescents.

Relationships between parental influence and physical activity in children and adolescents

During childhood and adolescence families critically influence their children's health behaviors including physical activity. According to Baranowski (1997 as cited in Trost et al., 2003), parents can influence their children’s health behaviors through a variety of mechanisms. These include direct modeling, rewarding desirable behaviors and punishing or ignoring undesirable behaviors, establishing or eliminating barriers, providing resources to perform the behavior, and employing authoritative parenting procedures to help the child develop self-control skills. In Thai societies parents are always influential in determining a child’s lifestyle during his or her growth and development. The relationships between parental role models and health behavior of Thai adolescents have been reported (Jinruang, 2002; Phuphaibul et al., 2005). For exercise and physical activity behavior, direct and indirect parental influence has been empirically identified by various studies from Thailand and other countries. According to literature review, parental influence on children’s and

adolescents' physical activity takes a variety of forms such as encouragement, role modeling, support, provision of transportation, and facilitation (Hoefer, McKenzie, Sallis, Marshall, & Conway, 2001; Schaben et al., 2006; Welk et al., 2003;).

For parental support, the following factors were significantly related to adolescent self-reported physical activity: parent does physical activity with adolescents; provide transportation to physical activity setting; watches adolescent do physical activity; tells she/he is doing well in physical activity (Prochaska et al., 2002). However, the result of this study showed that there was no relationship between parental encouragement and adolescents' physical activity. The relationships between parental support and adolescents' physical activity were also found by Trost, et al. (2003). Parental support in this study included: encourage their child to do physical activities; do a physical activity with their child; provide transportation to physical activity; watch their child participate in physical activity; and told their child that physical activity is good for his or her health.

Welk et al. (2003) proposed a model to explain the direct and indirect effects of parental influence on physical activity in a sample of 994 children (mean age 9.95 years). In this study, parental influence had four domains: parental role modeling, parental encouragement, parental involvement, and parental facilitation. Parental role modeling reflected the parent's interest in activity and their effort to be physically active. The parental encouragement reflected the overt efforts of parent to encourage their child to be active. Parental involvement was defined as a more overt form of support, such as playing with a child. Parental facilitation was considered to reflect the parent's passive efforts to provide access or opportunities for the child to be active. The findings from this study indicated that parental influence explained 19.7%, of the

variance in physical activity. Similar results were found by Schaben et al. (2006) in a sample of 996 middle and 999 high school students. The findings showed that parental influence accounted for 9% and 14% of the variance in physical activity in middle school students and in high school students, respectively. In addition, the results of this study also suggested that the effect of parental influence on physical activity may be partially mediated by perceived competence and attraction to physical activity.

The influence of parents' physical activity involvement upon children's time spent in physical activity was examined in a longitudinal study over a 12-month period in a sample of 152 French children (mean aged 9.5 $\pm$ .8 years) and their parents (Bois, Sarrazin, Brustad, Trouilloud, & Cury, 2005). Two forms of parental socialization influence were assessed: parental role modeling and parents' beliefs about their children's physical activity competence. The results from Structural Equation Modeling analysis showed that mothers' role modeling had a direct effect on children's time spent in physical activity.

Davidson et al. (2006) examined the effect of parental support of physical activity and girls' perceived athletic competence across the age of 9 to 11 years on girls' physical activity at age 11 years. Participants were 174 girls and their parents who completed questionnaires when the girls were 9 and 11 years old. In this study, parental support consisted of two forms of support: logistic support (such as enrolling children in sports and taking them to and from sport events); and modeling (such as being active with their child). The results of this study showed that parental support of physical activity for girls 11 years of age was significantly associated with girls' physical activity at age 11 years.

Focused on the provision of transportation, Hoefer et al. (2001) found that parent transportation for physical activity significantly contributed to girls' total physical activity and their participation in sports/activity lessons. In addition, parent transportation for physical activity significantly contributed to boys' participation in sports/activity lessons.

Based on the existing studies, many aspects of parental influence were associated with children and adolescents' physical activity. A number of studies supported the direct effect of parental influence on children and adolescents' physical activity. In addition to direct effect on children and adolescents' physical activity, some studies suggested the indirect effect of parental influence on children and adolescents' physical activity.

Relationships between parental influence and perceived physical competence in children and adolescents

Brustad (1993) examined the relationship between parental socialization and perceived physical competence in fourth-grade children. Socialization was defined as "the process whereby individuals learn skills, traits, values, attitudes, norms, and knowledge associated with the performance of present or anticipated social roles" (Brustad, 1993, p. 211). The relationships between two dimensions of parental socialization (parental encouragement and parental enjoyment of physical activity) and perceived physical competence were examined. The results of path analysis indicated that 32.2% of the variance in parental encouragement for children to be physically active was explained by gender and parental enjoyment. The combination of parental encouragement and gender explained 17.3% of the variance in children's perceived physical competence. Brustad (1996) conducted a study to extend

comprehensive understanding about the relationships between parental physical activity socialization processes and children's perceived competence. The sample consisted of 107 children in fourth to sixth grade from a large school district in the Los Angeles metropolitan area. In this study, the parental socialization consisted of three dimensions: parental encouragement of the child's physical activity; perceived parental enjoyment of physical activity; and parental role-modeling behavior. The results of this study showed that there were significant relationships between children's perceptions of their parents' physical activity socialization processes and their own physical activity. For boys, parental encouragement of children's physical activity and parental enjoyment of physical activity were significant predictors of perceived physical competence. For girls, the significant predictors of perceived physical competence were perceived parental enjoyment of physical activity and perceived parental encouragement respectively.

The link between parental influence and perceived physical competence was examined by Welk et al. (2003) in a sample of 994 elementary school children (mean age 9.95 years). The findings showed that parental influence explained 28% of the variance in perceived physical competence. The relationships between parental influence and perceived physical competence in adolescents were also found in a cross-sectional study by Schaben et al. (2006). The results of this study showed that parental influence was associated with perceived physical competence of middle school students and high school students ($r = .42$ and .42, respectively).

For a longitudinal study, the relationships between parental role modeling, parental beliefs about their children's physical activity competence, and children's perceptions of competence were found (Bois et al., 2005). The results of Structural

Equation Modeling analysis indicated that the mother's perception of a child's competence in physical activity had an indirect effect on children's physical activity by influencing children's perceived competence. Another longitudinal study in a sample of 174 non-Hispanic white girls also found a link between parental influence and children's perceived competence (Davidson et al., 2006). The findings from this study supported a positive association between parent's perceived support of their children physical activity (parental support) and children's perceived athletic competence. In this study, girls with higher perceived athletic competence had parents who provided higher levels of support. In addition, parental support for girls 9 years of age was significantly associated with girls' perceived athletic competence at aged 11 years.

In conclusion, the relationships between many aspects of parental influence and perceived physical competence in children and adolescents were supported by a number of cross-sectional and longitudinal studies.

Relationships between parental influence and attraction to physical activity in children and adolescents

The relationship between parental socialization and children's attraction to physical activity in fourth-grade children was examined by Brustad (1993). The results of this study indicated that parental encouragement had an indirect influence on children's attraction to physical activity through perceived physical competence. To gain more understanding about the relationships between parental physical activity socialization processes and attraction to physical activity, a cross-sectional study was conducted by Brustad (1996). Parental encouragement of children's physical activity and parental

enjoyment of physical activity emerged as the significant predictors of boys' attraction to physical activity (liking of games and sports and the fun of physical exertion). For girls, the significant predictors of attraction to physical activity (liking of games and sports and peer acceptance in games and sport) were perceived parental enjoyment of physical activity and perceived parental encouragement, respectively.

The association between parental influence and attraction to physical activity was examined by Welk et al. (2003) in a sample of elementary school children. The findings showed that parental influence explained 26% of the variance in attraction to physical activity. The relationships between parental influence and adolescent's attraction to physical activity were also found by Schaben et al. (2006). The results of their study indicated that parental influence was associated with attraction to physical activity of middle school students and high school students ($r = .45$ and .50, respectively).

Within Asian countries, the results from a cross-sectional study supported the relationships between parental influence and attraction to physical activity. Lau et al. (2007) found that the overall parental influence (parental role modeling, encouragement, and enjoyment) were significantly and positively related to children's attraction to physical activity.

In conclusion, parental influence was associated with children's and adolescents' attraction to physical activity. Furthermore, the direct effect of parental influence on children and adolescents' attraction to physical activity was suggested from the existing researches.

Relationships between perceived physical competence and physical activity in children and adolescents

Perceived physical competence reflects an individual's self-perceived ability to perform physical activity (Harter, 1985 as cited in Raustorp, Stahle, Gudasic, Kinnunen, & Mattsson, 2005). It appears to contribute to higher levels of involvement in physical activity (Ommundsen, Klasson-Heggeb, & Anderssen, 2006; Schaben et al., 2006; Welk et al., 2003). The relationships between perceived physical competence and physical activity in children and adolescents were supported by cross-sectional and longitudinal study as shown in the following paragraphs.

In a cross-sectional study, Welk et al. (2003) found that perceived physical competence was associated with children's physical activity ($r = .43$). This finding is consistent with those of Paxton et al. (2004), who examined the relationships between perceived physical competence, attraction to physical activity, and physical activity in 63 children aged 9 to 14 years. In that study, the results showed that perceived physical competence was associated with youth's physical activity. However, this relationship disappeared when attraction to physical activity was added into the regression model. The final model suggested that perceived physical competence had an indirect effect on physical activity through attraction to physical activity. The influences of perceived physical competence on adolescents' physical activity were also reported by Schaben et al. (2006). According to Schaben and colleagues, the combination of perceived physical competence and attraction to physical activity explained 21% and 17% of the variance in physical activity of middle school students and high school students.

In a longitudinal study, Bois et al. (2005) found that children's perceived physical competence predicted their physical activity involvement. In addition, Davidson et al. (2006) also found a link between girls' perceived athletic competence across the age of 9 to 11 years on their physical activity at age 11 years. The results of this study indicated that girls' perceived athletic competence at 9 years of age was correlated with girls' perceived athletic competence at 11 years of age. Furthermore, girls' perceived athletic competence at the age of 11 years was correlated with girls' physical activity at the age of 11 years.

Based on the existing studies, perceived physical competence had direct and indirect effects on physical activity of children and adolescents.

Relationships between attraction to physical activity and physical activity in children and adolescents

Attraction to physical activity was proposed to represent children's attitudes to physical activity (Brustad, 1993). It reflects children's feelings about what they do and do not like about their physical activity experiences. To assess children's attitudes about physical activity, the Children's Attraction to Physical Activity (CAPA) scale was developed by Brustad. This scale is based on the concept that children's motivation to participate in physical activity is dependent on their affective reaction to various dimensions of involvement. This initial scale was completed by 231 fourth grade students. The results of factor analysis showed that the CAPA scale consisted of 5 factors. Factor 1 related to children's feeling about engaging in vigorous exercise that was labeled 'liking of vigorous exercise'. Factor 2 pertained to fun experienced through playing games and sports and was labeled 'liking of games and sports'.

Factor 3 related to children's cognitions about the importance of exercise to physical health and was labeled ‘importance of exercise’. Factor 4 involved children's popularity with their peers during participation in games and sports and was labeled ‘peer acceptance in games and sports’. The last factor related to children’s like or dislike of certain strenuous aspects of physical activity and was labeled ‘fun of physical exertion’. A number of studies suggested the relationships between attraction to physical activity and children’s and adolescents’ physical activity as the following paragraph.

Welk et al. (2003) found that attraction to physical activity influenced physical activity in elementary children. For adolescents, Paxton et al. (2007) found the direct effect of attraction to physical activity on physical activity in children aged 9 to 14 years. Similar findings were reported in a cross-sectional study by Schaben et al. (2006). The results of that study showed that the combination of perceived physical competence and attraction to physical activity accounted for the variance in adolescents’ physical activity.

In conclusion, attraction to physical activity had a direct effect on physical activity in children and adolescents.

Relationships between perceived physical competence and attraction to physical activity in children and adolescents

The current knowledge indicates that higher levels of perceived physical competence have been linked to children’s and adolescents’ interest in and desire to engage in physical activity (Brustad, 1993, 1996). In other words, children who perceived themselves as more physically competent were more attracted to physical

activity. According to Brustad (1993), perceived competence had direct effect on five dimensions of attraction to physical activity in elementary school children. Perceived competence explained 18.5%, 16.8%, 13.7%, 46.2%, and 41% of the variance in liking vigorous exercise, liking of game/sport, important of physical activity to health, peer acceptance in games and sports, and fun of physical exertion, respectively. Welk et al. (2003) also found the relationship between perceived physical competence and children's attraction to physical activity.

Paxton et al. (2004) conducted a cross-sectional study to examine the relationships between perceived physical competence, attraction to physical activity, and physical activity in 63 children aged 9 to 14 years. The researchers hypothesized that attraction to physical activity would mediate the relationship between perceived physical competence and youths' physical activity. The results showed that perceived physical competence had an indirect effect on physical activity through attraction to physical activity. In other word, attraction to physical activity was a mediator of the relationship between perceived physical competence and youths' physical activity.

Within Asia, Lau et al (2007) found that perceived competence was related to overweight children's attraction to physical activity. Moreover, the results of hierarchal multiple regressions showed that father's role modeling and perceived competence accounted for the variance in attraction to physical activity of overweight boys. For overweight boys and girls, perceived competence explained 39% and 43% of the variance in attraction to physical activity, respectively.

Relationship between peer influence and physical activity in children and adolescents

When considering social influences, parents and peers seem to be fundamental contributors in shaping the physical activity behavior of children and adolescents. Parental influence might be even greater on such physical activity in younger children because parents are likely to be the ones who provide and structure initial physical activity opportunities for their children. Furthermore, they are frequently engaged more actively in their children's physical activity and sport experiences. However, older children and adolescents spend the majority of their day away from direct parental contact. It is also possible that peers exert a greater role modeling influence on children's and adolescents' activity than parents do. The role of peer influence on adolescents' health behaviors is believed to increase with age (Prochaska et al., 2002). Peers exert their influence on adolescent behavior through imitation and social reinforcement (Wold & Hendry, 1998 as cited in Prochaska et al., 2002). From the literature review, peer support for children's and adolescent's physical activity was was examined for many dimensions such as encouragement, participation, and praise.

Prochaska et al. (2002) conducted a cross-sectional study to examine the relationships between peer support and physical activity in 138 children (mean age 12.1 $\pm$ .9 years). To assess peer support, four items were used to assess peer praise, peer encouragement, peer participation, and the adolescents' encouragement of peers to be physically active. The result from a hierarchical regression model showed that peer support was the predictor of self-reported physical activity. Similar results were found in a study by Ommundsen et al. (2006) with a sample of 760 Norwegian boys and girls aged 9-15 years. The findings of this study showed that peer support was a

positive correlate of informal games play at school and organized sport, structured exercise and playing games in leisure time.

DeBourdeaudhuij et al. (2005) conducted a cross-sectional study to examine the relationships between psychosocial variables and physical activity in 5,393 normal weight and 500 overweight adolescents in Belgium. Physical activity was assessed in diverse domains, such as school activity, transportation, and leisure time activity. Social support from friends was assessed by asking respondents how frequently their friends encouraged them to be physically active. The results indicated that social support from friends was related to total physical activity of both normal weight and overweight adolescents.

Springer, Kelder, and Hoelscher (2006) conducted a study to examine the relationships between friends' participation in physical activity, friends' encouragement of physical activity, and physical activity. The sample consisted of 718 sixth-grade girls between the ages of 10 to 14 years. The results showed that friends' participation in physical activity and friends' encouragement of physical activity were positively related to moderate-to-vigorous physical activity.

The research findings from Western countries provide evidence that friends are one of the key social influencers of physical activity during adolescence. In line with research findings from other countries, social influences on Thai children and adolescents' exercise behavior have been investigated and reported on. Deenan et al. (2001 as cited in Deenan, 2003) found that social support from friends and social support from classmates were associated with the exercise behavior of adolescents. Furthermore, Charoneying (2005) reported that interpersonal influences were associated with the exercise behavior of secondary school students. Interpersonal

influences were assessed by asking respondents how much their parents, siblings, cousins, friends, and teachers encouraged, praised, involved, and supported them to perform exercise.

From the literature review, it can be seen that the relationships between parental influence, peer influences, perceived physical competence, attraction to physical activity, and physical activity were supported. Parental influence and peer influence had a direct effect on children's and adolescents' physical activity. Parental influence also had an indirect effect on children's and adolescents' physical activity through perceived physical competence and attraction to physical activity. In addition, perceived physical competence had both direct and indirect effects on children's and adolescents' physical activity through attraction to physical activity. Lastly, attraction to physical activity had a direct effect on children's and adolescents' physical activity.

CHAPTER 3

METHODOLOGY

The aims of this study were to examine the level of physical activity, identify determinants of physical activity, and test the Youth Physical Activity Promotion model in Thai adolescents. This chapter presents the details of methodology including research design, population and sample of the study, type and context of the study, research instruments, data collection, data analysis, and protection of human subject's rights.

Research Design

An observational, cross-sectional study was used to examine the physical activity level, identify the determinants of physical activity, and evaluate the utility of the YPAP model in Thai adolescents. Participants were selected using multi-stage stratified random sampling. The variables that were used for stratification in this study were geographical region (school location), school size (total number of students), and grade level. Seven public secondary schools in Had Yai District were categorized into two groups depending on the school location. They were located either in Had Yai Municipality or outside. Then, each school was categorized into four groups depending on size and were classed as small school (total students 1-120), medium school (total students 121-600), large school (total students 601-1,500), or very large school (total students $\geq$ 1,500) (Office of National Primary Education, 1995).

There are 7 public secondary schools in Had Yai District. They are 2 very large schools located in Had Yai Municipality and 1 medium school, 1 large school, and 3 very large schools located outside. School size may have had influence on student's physical activity, therefore, the researcher planned to get an equal number of participants from the medium school, large school, and very large school. In addition, the proportion of female and male students in each class were not equal, the researcher planned to use proportionate sampling (Burns & Grove, 2001; Polit & Beck, 2004) to obtain 50% female and 50% male students from randomly selected classrooms.

However, the researcher did not achieve these goals due to some limitations. Firstly, the number of students per class in each school was not equal. The medium and large schools had a few students (6-30 students) per class, whereas the very large school had a large number of students (35-55 students) per class. Secondly, there was a large difference in the number of students per grade level in each school. The number of students per grade level ranged from six students to several hundred students depending on school size. Thirdly, it was very difficult for the researcher to separate participants from non-participants. The researcher had to include all students of the selected class in the same room. Because of these limitations, the researcher decided to distribute the questionnaires to all students in that class who were willing to participate in this study.

To obtain a representative sample for this study a random selection was made of one very large school located in Had Yai Municipality, and one medium school, one large school, and one very large school located outside. Then, simple random sampling was used to select one or two classrooms per grade level from the randomly

selected school. Lastly, all students in the selected classes were invited to participate in this study. The multi-stage stratified random sampling used in this study is shown in Figure 3.

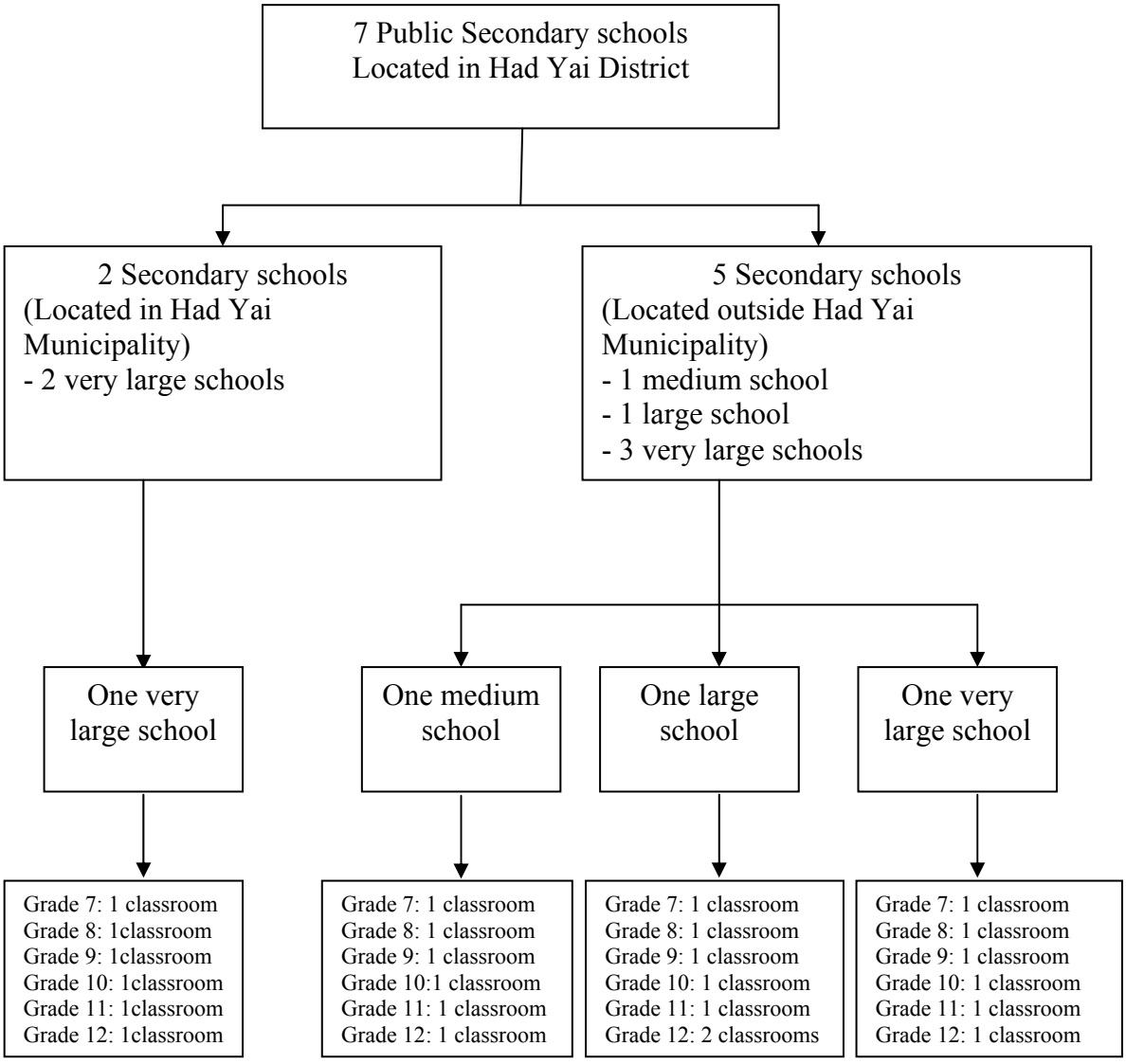

Figure 3. Multi-stage stratified random sampling used in this study

Population and Sample of the Study

The target population of this study was adolescents who were studying from grades 7 to 12 in seven public secondary schools in Had Yai District, Songkhla Province, Thailand. The sample consisted of adolescents who were studying in grades 7 to 12 in the 2008 academic year. A multi-stage stratified random sample of 801 seventh to twelfth graders completed the Thai Children's Physical Activity Correlates scale and 712 seven to twelve graders completed the Modified Thai Adolescent's Physical Activity Questionnaire.

For the sample size determination, some guidelines about absolute sample size in structural equation modeling analysis were offered. For descriptive study, sample sizes less than 100 subjects could be considered to be a small sample size. A sample size of between 100 and 200 subjects could be considered to be a medium sample size. Lastly, sample size that exceeded 200 subjects could be considered to be a large sample size (Kline, 1998, 2005). Another consideration was model complexity. A sample size of $\geq$ 200 may be necessary for a very complicated model. In addition, the ratios of the number of cases to the number of free parameters were offered. The recommended ratios of cases to free parameters were 20:1 and 10:1. In addition, the statistical precision of the results may be doubtful if the ratio was less than 5:1(Kline, 2005).

However, the sample size of this study was taken from Fan and Wang's work (1998 as cited in Norris, 2001). According to Fan and Wang, a sample size of 500 did not produce inappropriate solutions for a three-factor model. Because the sample of the present study was selected from six grade levels, the researcher increased the number in the sample to 600 (100 participants per grade level). Students who were

receiving any treatment or medication for reducing weight, or were diagnosed with delayed development, or had a serious or chronic illness were excluded from this study because these conditions could confound the interpretation of findings.

Type and Context of the Study

Data was collected at four public secondary schools through the General Education Department in Had Yai District. Had Yai District, Songkhla Province which has seven public secondary schools is located in the southern part of Thailand. All schools are opened Monday to Friday from 7.30 a.m. to 4.30 p.m. The academic year is divided into 2 semesters: the first semester lasts from June to October, and the second semester goes from November to March. The curriculum of each school is organized under the guidelines of the Ministry of Education. Approximately one hour of physical education per week is scheduled for classes in all schools. All public secondary schools in Thailand receive a budget from the government. The large schools receive more than the small schools (the budget depends on the total number of students). In addition, the large schools usually receive some donations from the Alumni or Parental Foundation to support teaching-learning activity and other activities. Therefore, a large school may have more facilities than small schools. As for the private secondary schools, they receive some budget from the government but less than the public secondary school. Most private schools are self-supporting. Accordingly, because of this policy, the physical environment of the public school and the private school may be different. Therefore, the private secondary schools were not included in this study.

Research Instruments

The data was collected by the researcher using: 1) a Demographic Data Questionnaire, 2) a Thai Children's Physical Activity Correlates scale, 3) a Modified Thai Adolescent's Physical Activity Questionnaire, and 4) Instrument for measuring body weight and height.

1) *The Demographic Data Questionnaire*: It was developed by the researcher to collect data on adolescents' demographic characteristics. Age, gender, grade level, religion, body weight, height, athletic representative, history of injury or illness during the previous week, mother's occupation, father's occupation, and family income are included in this questionnaire (Appendix C).

2) *The Thai Children's Physical Activity Correlates (TCPAC) scale*: This scale consisted of four subscales (52 items) which make up psychosocial factors: Perceived Physical Competence subscale (5 items); Children's Attraction to Physical Activity subscale (15 items); Parental Influence subscale (18 items); and Peer Influence subscale (14 items). Perceived Physical Competence subscale, Children's Attraction to Physical Activity subscale and Parental Influence subscale were obtained from a back-translation process of the original English version, the Children's Physical Activity Correlates (CPAC) scale. The Peer Influence subscale was developed by the researcher.

The CPAC scale was developed by Welk to assess the constructs of the YPAP model by combining items from a number of other validated scales (Schaben et al., 2006; Welk, 2006). This scale includes 44 items with 4 subscales that assess various psychosocial correlates of physical activity in children. It includes 15 items from Brustad's Children's Attraction to Physical Activity scale, 5 items from Harter's

Perceived Physical Competence scale, 6 items from Rosenberg's Self-Esteem scale, and 18 items from Welk's Parent Socialization scale. All items of the CPAC scale use Harter's structured alternative approach (Harter, 1982) to reduce socially desirable responses. All items are responded by presenting adolescents with two opposing choices and then asking adolescents to choose which one best represents how they describe themselves. Once they choose which statement best describes them, they are then asked if the statement is sort of true for them or really true for them. The Perceived Physical Competence subscale, the Children's Attraction to Physical Activity subscale, and the Parental Influence subscale were selected for translation into Thai language in this study. The detail of each subscale was described as in the following paragraphs.

Perceived Physical Competence subscale: It was used to assess children's perception of their ability to perform physical activity. This scale was modified from Harter's Perceived Competence scale (Brustad, 1996; Welk, 2006). The Cronbach's alpha of this scale when used with a sample of 107 fourth to sixth graders was .71 (Brustad, 1996). In addition, the Cronbach's alpha of this scale when used with a sample of 996 middle and 999 high school students aged 12 to 19 years was .84 and .85, respectively (Schaben et al., 2006). For this study, Perceived Physical Competence subscale included 4 positive statements and 1 negative statement. Items were scored on a 4-point response format using Harter's structured alternative approach (Welk, 2006). A score of 1 reflected a low level of perceived physical competence and 4 reflected a high level of perceived physical competence. The score for negative items were reversed for summing up the total score. Total score of this subscale ranged from 5 to 20.

Children's Attraction to Physical Activity subscale: It was used to assess children's general attraction to physical activity and sport participation. This scale was developed by Brustad (1993) with a sample of third- and fourth grade children. It has five factors (15 items): liking of vigorous exercise (3 items); liking of games and sports (3 items); importance of exercise (3 items); peer acceptance in games and sports (3 items); and fun of physical exertion (3 items). The Cronbach's alpha of each factor of the Children's Attraction to Physical Activity scale in a sample of 231 elementary school children ranged from .62 to .78. In addition, the Cronbach's alpha of this scale was .86 when used with a sample of 996 middle school students and .87 with a sample of 999 high school students (Schaben et al., 2006). For this study, Children's Attraction to Physical Activity subscale included 6 positive statements and 9 negative statements. Items were scored on a 4-point response format same as the Perceived Physical Competence subscale. A score of 1 reflected a low level of attraction to physical activity and 4 reflected a high level of attraction to physical activity. The score for negative items were reversed for summing up the total score. Total score of the Children's Attraction to Physical Activity subscale ranged from 15 to 60.

Parental Influence subscale: It was used to capture the reinforcing factor construct of the YPAP model. This scale was developed by Welk et al. (2003) to assess the parental influence on physical activity in a sample of 994 children (grade 3 to 6). It has three components (18 items); perception of parental role modeling (6 items), perception of parental encouragement (6 items), and perception of parental support (6 items). The items to capture parental role modeling and parental encouragement were taken from Brustad's (1993) work. The items to assess the

perception of parental support were developed by Welk and colleagues to capture parental facilitation and parental involvement. The perception of parental role modeling component designed for capturing the children's perception of their parents' interest and involvement in physical activity. The perception of parental encouragement component designed to assess the overt efforts of the parents to encourage the child to be active. The perception of parental support component intended to assess the overt and passive forms of social support. The Cronbach's alpha of this scale when used with a sample of 994 third to sixth graders was .81. In addition, the Cronbach's alpha of this scale when used with a sample of 996 middle and 999 high school students aged 12 to 19 years was .86 and .85, respectively (Schaben et al., 2006). For this study, Parental Influence subscale included 14 positive statements and 4 negative statements. Items were scored on a 4-point response format same as the Perceived Physical Competence subscale. A score of 1 reflected a low level of perceived parental influence on adolescent's physical activity and 4 reflected a high level of perceived parental influence on adolescent's physical activity. The score for negative items were reversed for summing up the total score. Total score of the Parental Influence subscale ranged from 18 to 72.

Peer Influence subscale: It was developed to parallel a Thai Parental Influence subscale. However, four items (PAREN4: *Some kids have parents that tell them not to watch too much TV;* PARSUP1: *Some kids have parents who let them play on community or school sport teams;* PARSUP4: *Some kids have parents who buy them a lot of sports equipment; and* PARSUP5: *Some kids have parents who don't take them to parks or playgrounds*) were deleted because they were not related to peer influence. As a result, the Peer Influence subscale included 14 items with three

components (5 items of peer encouragement, 3 items of peer support, and 6 items of peer role modeling). This subscale included 11 positive statements and 3 negative statements. Items were scored on the same 4-point response format as the Parental Influence subscale. A score of 1 reflected a low level of perceived peer influence on adolescent's physical activity and 4 reflected a high level of perceived peer influence on adolescent's physical activity. The score for negative items were reversed for summing up the total score. Total score of the Peer Influence subscale ranged from 14 to 56.

Translation Process

Three subscales of the CPAC scale, originally developed in English language, are translated into Thai using the back-translation method with decentering approach after receiving the permission from the originator. Decentering is a translation concept that refers to "a process by which one set of materials is not translated with as little change as possible into another language" (Brislin, 1980, p. 433). According to decentering approach, when the material in an original language (English) is translated, changing is allowed so that there will be a smooth, natural-sounding version in another language (Thai).

A panel of three experts, fluent in both Thai and English languages, were asked for translation and back-translation. Two experts were asked to translate the English version of the instrument into Thai. One of them was an instructor in mental health and another was an instructor in health promotion. They are experts in scale development. In addition to translation, they also examined the content validity of this scale. The researcher and advisors reviewed the translated Thai version for discrepancies and resolved them with agreement of the experts. One other expert was

asked to back translate the Thai version into English. Then the researcher and advisors reviewed the new English scales and the original scale for discrepancies and resolved them with agreement of the expert. Lastly, a Thai scale to assess perceived physical competence, attraction to physical activity, and parental influence was obtained and 38 items were included.

Once a Thai scale to assess parental influence was obtained, a Thai scale (14 items) to assess peer influence was developed to parallel this scale. The final, 52-item, Thai Children's Physical Activity Correlates (TCPAC) scale was used to assess all psychosocial variables in this study. It consists of 4 subscales: Perceived Physical Competence subscale (5 items); Children's Attraction to Physical Activity subscale (15 items); Parental Influence subscale (18 items); and Peer Influence subscale (14 items). Example items of the TCPAC are shown in Appendix D.

The TCPAC scale was evaluated by secondary school students using a random probe technique for their understanding of the item (Waltz, Strickland, & Lenz, 2005). For the random probe technique, the researcher selected a random sample of items from a scale and a random sample of subjects from target population. Ten Thai students (6 girls and 4 boys) who were studying in grade 9 were selected using convenience sampling. Individual from this group was asked to read and answer each item. The researcher then asked him/her, "What does it mean?", to clarify whether he/she had understood. If they could not justify their response or their justification is unexpected, the item was analyzed for misunderstanding. For this study, no item was revised during this process.

The TCPAC scale was distributed to 31 eleventh graders for examining for internal consistency reliability in a classroom setting during a school period.

Cronbach's alpha coefficient was computed. The acceptable range for the new instrument is .70 to 1.00 (Burns & Grove, 2001; Polit & Beck, 2004). In addition, an item analysis was conducted. According to Polit and Beck, an item analysis is an examination of the correlations between individual items and the overall scale score. An item-to-total correlation below .3 is considered unacceptable and should lead to item deletion. For this study, Cronbach's alpha of Perceived Physical Competence subscale; Children's Attraction to Physical Activity subscale; Parental Influence subscale; and Peer Influence subscale was .84, .80, .81, and .63, respectively. However after pilot study for an internal consistency reliability, most of participants suggested to change the term "เด็กบางคน" (some kids) to "เด็กกลุ่ม A" (sample A) and "เด็กคนอื่นๆ" (other kids) to "เด็กกลุ่ม B" (sample B). This scale was revised in accordance with the comments of the participants in pilot study. After that, all subscales were re-examined for its internal consistency reliability by 25 students who were studying in grade 11 of a public high school in Had Yai Municipality. Cronbach's alpha of Perceived Physical Competence subscale; Children's Attraction to Physical Activity subscale; Parental Influence subscale; and Peer Influence subscale was .81, .86, .84, and .82, respectively. Focused on each item, some items had corrected item to total correlation less than .30. However, they were retained and examined further using confirmatory factor analysis.

3) *The Modified Thai Adolescent's Physical Activity Questionnaire (MTAPAQ):* For this study, the Thai Adolescent's Physical Activity Questionnaire (TAPAQ) that was developed by Kijboonchoo et al. (2007) was modified and used to assess the physical activity of adolescents. To modify the TAPAQ, walking and transportation physical activity were added. Furthermore, exercises that involved standing (such as

standing on one leg, standing on one leg and stretching two arms to two sides, and standing with kicking) were separated from exercises that involved jumping (such as high jump and long jump) because they did not have the same MET value. Lastly, sedentary behaviors such as watching television and using computer or internet were separated from other general physical activities that involved sitting activity (such as playing music and jigsaw puzzles). In addition, some activities that involved sitting quietly such as listening to music, watching a movie in a theater, and reading/doing homework were added in this domain. These modifications were intended to increase validity. Sample items of the MTAPAQ are shown in Appendix E.

To complete the MTAPAQ, all subjects were presented with a list of seven groups of physical activity and a group of sedentary activities. Seven groups of physical activity are: (1) activities that involved sitting; (2) games and free-play that involved movement; (3) exercises; (4) walking; (5) sports; (6) household activity; and (7) transportation activity. All participants were asked to recall the number of days they performed each activity in the previous seven days (frequency) and the duration per day of each activity (duration). Frequency of activity is reported in days and duration in hours and minutes. In addition, participants were also instructed to report the time they were "actually" active and not to include time they were resting or waiting to play.

To calculate the volume of total physical activity, the energy cost of the physical activity (energy expenditure expressed as Metabolic Equivalents, MET-mins) was calculated using a standardized method proposed by Ainsworth et al. (2000). Activities listed in the questionnaire were based on MET values in the compendia of physical activities developed by Ridley, Ainsworth, and Olds (2008)

and Ainsworth et al. (2000). All types of physical activity were converted to MET-mins by multiplying using 3 values: MET value of activity, frequency, and duration (minutes). Finally, these numbers were summed to represent the volume of total physical activity of each subject. Higher values of MET-mins indicated higher volumes of physical activity. Because this study aimed to examine the determinants of physical activity, the sedentary behavior was eliminated from the calculation.

An example of calculating a MET-mins was based on a subject who played badminton (moderate effort) for 45 minutes only once during the week of assessment. The standard value of 4.5 MET by Ridley et al. (2008) was assigned to playing badminton. The final MET-mins was computed by using the 4.5 MET multiplied by 1 day by 45 minutes which was 202.5 MET-mins.

For concurrent validity evaluation, 56 secondary school students (20 males and 36 females) were invited to wear accelerometer (CSA model 7164, FL) for seven consecutive days. Prior to data collection, parental consent and participant assent were obtained. All subjects wore an accelerometer during their waking hours except when bathing or during any time spent in water activities. For this study, the accelerometer was placed into a pouch. All subjects wore an accelerometer on their waist (over the right hip) at least 10 hours a day. Subjects and parents were given a written instruction sheet. Consistent and correct placement was emphasized in the instruction. Furthermore, subjects were asked to call the researcher if an internal flashing light-emitting diode (LED) was not visible through the accelerometer translucent case. During the monitoring period the participants were contacted by cell phone message to remind them to wear the accelerometer every morning. To prevent monitoring failure or monitoring loss, the researcher downloaded accelerometer data everyday

(except the weekend or holiday). If any participants forgot to wear the accelerometer at any day or if the monitor failured, they were asked to start wearing accelerometer again and recommenced the process. For participants who refused to follow the instruction, they continued the old schedule or terminated use of the accelerometer. Of 56 participants, 14 (25%) encountered this problem and were excluded from further analysis. The stored activity counts were downloaded and saved to a compatible computer for subsequent data analysis.

After the recording period (having removed the accelerometer), the MTAPAQ was distributed to participants. They were asked to complete the questionnaire and return to the researcher within 2 days. Participants were instructed to recall the number of days they performed each activity in the period that they wore accelerometer and the duration per day of each activity. Only data from 40 participants (17 males and 23 females aged 12-18 years) who wore accelerometer for seven consecutive days and completed the questionnaire as described were analyzed. Accelerometer failure, incomplete monitoring data, or incomplete questionnaires were reasons of excluding the data of participants.

To explore the relationships between physical activity self-report from the MTAPAQ (MET-mins) and activity counts from accelerometer, a Pearson correlation coefficient was calculated. The activity counts were determined to be highly positively skewed (skewness = 1.42, SE = .37; kurtosis = 2.22, SE = .73) and were log (10) transformed for subsequent analysis. The correlation between MET-mins and activity counts was significant ($r = .59$, $p = .01$).

For reliability evaluation, the initial instruction of the MTAPAQ had minor revision and the details of walking were added. This revised questionnaire was later

distributed to 33 students (13 males and 20 females) who studied in eleventh grade on two separated occasions. Parental consent and participant assent were obtained prior to data collection. They were asked to complete the same questionnaire twice, three days apart (MTAPAQ1 and MTAPAQ2). They completed the questionnaire during a classroom session by recalling their physical activities during the previous seven days. The researcher verbally explained how to complete the questionnaire and read the standardized introduction of the questionnaire to them. Thirty completed questionnaires were used in final analysis (12 males and 18 females).

Test-retest reliability of the MTAPAQ was evaluated by correlating scores from two administrations separated by 3 days. The total volume of physical activity (MET-mins) from MTAPAQ1 was not normally distributed (skewness = 1.08, SE = .43; kurtosis = 1.91, SE = .83) and was log (10) transformed for analysis. The correlation between MET-mins from MTAPAQ1 and MTAPAQ2 was significant, with Pearson's correlation coefficient of .76 ($p = .01$). However, if the sedentary behavior was eliminated from the calculation, the total volume of physical activity (MET-mins) from MTAPAQ1 was determined to be positive skewed (skewness = 1.18, SE = .43; kurtosis = 2.09, SE = .83) and was log (10) transformed for subsequent analysis. The correlation coefficient between MET-mins from MTAPAQ1 without sedentary behavior and MTAPAQ2 was .84 ($p = .01$).

4) Instrument for measuring body weight and height: There were two anthropometric measures in this study. Body weight was measured by a digital scale with an accuracy of $\pm$ 100 grams. The digital scale was calibrated according to manufacturer's guidelines and tested for stability before using. Standing height was measured with the use of a commercial stadiometer.

Data Collection

A letter from the Dean of the Faculty of Nursing, Prince of Songkla University asking for permission to collect data was submitted to the principal of the selected schools.

The steps and methods for collecting data were described as follows:

1. The researcher contacted the principal and coordinator teachers of the selected schools to describe the objectives of the study and the research procedure. The schedule of data collection was arranged by the researcher and coordinator teachers of each school.

2. The researcher selected students using stratified random sampling as described previously. The researcher then contacted the students to introduce herself, describe the objectives of the study, the research procedure, and the procedure for the protection of human rights. A consent form was sent to parents or guardians to explain the purposes of this study and to obtain agreement for allowing their children to participate. An assent form was also distributed to students to obtain their agreement to participate. Participants were asked to return these forms to the coordinator teachers before the collection date. Unfortunately, approximately 10% of participants forgot to return the consent form to the researcher as scheduled. However, all students were informed about their right to participate or not participate in this study again in the classroom before data collection. If they did not agree to participate in the study, they were allowed to decline. In this study 10 students refused to participate. In case that he/she did not return the consent form as scheduled but he/she agreed to answer the questionnaire, they were asked to bring it to their teacher later.

3. After receiving permission from the parents or guardians and agreement of participants, the TCPAC scale was distributed to the sample in the classroom during a school period. The researcher explained how to complete the scale and a standardized introduction to the scale was read. The researcher walked around the classroom to answer any questions posed by the adolescents.

4. Anthropometric data (body weight and height) of all participants were collected by the researcher and well trained research assistants on the same day or approximately 2 weeks later. Anthropometric data were kept confidential. All subjects were weighed without shoes, in their uniform. Standing height was measured without shoes to the nearest 0.5 centimeters with the use of a commercial stadiometer with the shoulders in relaxed position and arms hanging freely. Body weight and height was measured twice and the average was used for body mass index calculation. Body mass index (BMI) was calculated (kg/m^2), and was interpreted using the International Obesity Task Force (IOTF) reference, sex- age-specific body mass index (BMI) cut-offs that correspond to BMIs of 25 for overweight and 30 for obesity at age 18 (Cole, Bellizzi, Flegal, and Dietz, 2000).

5. To prevent a carry-over effect of the questionnaire on physical activity (the items of the TCPAC scale may influence physical activity behaviour of an individual) and to explain the cause and effect in this study, the MTAPAQ was completed by the participants approximately 2 weeks later.

Data Analysis

The SPSS 17.0 program was used for data management and preliminary data analysis to examine the accuracy of the data, testing underlying assumptions for

multivariate analysis, and examining validity and reliability of the questionnaires. Mean, standard deviation, skewness, and kurtosis, were analyzed for all subscales of the TCPAC scale and the MTAPAQ. Frequency and percentage were used to describe demographic characteristics of participants. Cronbach's alpha coefficients were calculated to assess the internal consistency reliability of the TCPAC scale. To assess the test-retest reliability and concurrent validity of the MTAPAQ, Pearson's correlation was used. Associations between the constructs based on the YPAP model were also examined using Pearson's correlation coefficients. Finally, Structural Equation Modeling (SEM) was carried out to evaluate the predictive utility of the modified YPAP model with Thai adolescents using the Amos 17.0 program. Data management and data analysis was performed as follows.

Data management and preliminary data analysis

For accuracy of data entry, the researcher entered data into two independent data sets. A screening of raw data was performed before they were analyzed through an examination using basic descriptive statistics such as the minimum and maximum values, means, and standard deviations (Tabachnick & Fidell, 2001). The descriptive statistics of two data sets were examined and compared for accuracy.

For preliminary data analysis, missing data was examined. Attention was focused on the percentage of missing data and the pattern of missing data. According to Cohen and Cohen (1983 as cited in Kline, 1998), 5% to 10% missing data on a particular variable is not large. To establish the pattern of missing data, random and non-random missing data was evaluated (Mertler & Vannatta, 2002). Non-random missing data pose more serious problems than missing data scattered at random

through a data matrix (Tabachnick & Fidell, 2001). For the physical activity variable, it was assumed that all participants walked every day and reported the frequency and duration in the MTAPAQ. However, small numbers (1%) of missing data at random from human error were observed in walking. According to Tabachnick and Fidell, the problem are less serious and almost any procedure for handling missing values yields similar results if the missing data was $\leq$ 5% and in a random pattern from a large data set. Therefore, 7 of 712 participants with missing data of walking were excluded from further analysis. Percentage and pattern of missing data of other variables were further examined with a sample of 705 secondary students. Overall missing data at random from human error of the TCPAC scale was 1.42%. Again, 10 cases with missing data of TCPAC scale were excluded.

Testing the assumptions of structural equation modeling

General statistical assumptions of the multivariate analyses are also applied for SEM. The assumptions included normality, absence of outliers, homoscedasticity, linear relationships, and absence of multicollineality. To test these assumptions, normality, multivariate outliers, homoscedasticity, linearity, and multicollinearity were examined as follow.

Normality: Normality of variables can be detected by either statistical or graphical methods. For this study, univariate normality was detected by examining skewness and kurtosis. A skewed variable means a variable whose mean is not in the center of the distribution. Kurtosis reveals the 'peakedness' of a distribution; a distribution is either too peaked or too flat (Tabachnick & Fidell, 2001). The values of skewness and kurtosis are zero when a distribution is normal. According to Kline

(1998, 2005), variables with an absolute value of skewness index greater than 3 is skewed. For kurtosis, an absolute value of kurtosis index greater than 10 may indicate a problem. In addition, the Monte Carlo computer simulations in CFA using maximum likelihood method by Curran, West, and Finch (1996) indicated that significant problems of overestimation arising with univariate skewness of 2.0 and kurtosis of 7.0. For this study, most item scores and parcel indicator scores were univariate normally distributed, with only 3 of 35 indicators (LIKEEX2, FUNEX2, and PEERSUP1) had skewness or kurtosis values above |1.0|. It was found that these items had negative skewness (skewness = -1.03, kurtosis = .69, skewness = -.19, kurtosis = -1.03, and skewness = -1.2, kurtosis = 1.47, respectively). Thus, the researcher used transformation of variables to improve their normality.

According to Tabachnick & Fidell (2001), the best strategy for transformation the data with negative skewness is to reflect the variable and then apply the appropriate transformation for positive skewness. To reflect a variable, find the largest score in the distribution and add one to it to form a constant that is larger than any score in the distribution. Then create a new variable by subtracting each score from the constant. Finally, a variable with negative skewness was converted to one with positive skewness prior to transformation. After that, square root transformation was performed for both items. As the result of transformation, the skewness and kurtosis of LIKEEX2 were .69 and -.43 and the skewness and kurtosis of PEERSUP1 were .80 and -.07, respectively.

The results of CFA and SEM analysis using the raw data set and transformed data set showed very close findings (factor loadings and fit indices). Therefore, the raw

data set was used for CFA and SEM analysis in this study to decrease the difficulty of interpretation.

Outliers: An outlier is a case with unusual or an extreme value on one variable (univariate outlier) or a combination of scores on two or more variables (multivariate outlier) at the end of a sample distribution (Mertler & Vannatta, 2002; Tabachnick & Fidell, 2001). There are three causes of outliers: data entry errors; the subject is not a member of the target population; and the subject is simply different from the remainder of the sample (Mertler & Vannatta, 2002). For this study, Mahalanobis distance was analyzed to identify multivariate outliers. Mahalanobis distance is the distance of a case from the centroid of the remaining cases where the centroid is the point created at the intersection of the means of all variables. Mahalanobis distance can be evaluated for each case using the χ^2 distribution with degrees of freedom equal to the number of variables in the analysis. The accepted criterion for multivariate outliers is Mahalanobis distance at $p \leq .001$ (Tabachnick & Fidell, 2001).

It was found that there were 26 cases with p value of Mahalanobis $\leq .001$ and considered multivariate outliers. However, these outliers still were retained in the further analysis because the result of multiple regression analysis of two data sets (with the outliers included and with the outliers excluded) showed quite similar results (Duffy & Jacobsen, 2001). The proportion of variance explained by the regression analysis was 13.5% and 14.6%, respectively. In addition, the results of CFA and SEM analysis using two data sets (with the outliers included and with the outliers excluded) showed very close findings (factor loadings and fit indices).

Homoscedasticity: It refers to homogeneity of variance. The assumption underlying homoscedasticity is that the dependent variable exhibits similar amounts

of variance across the range of values for an independent variable (Mertler & Vannatta, 2002; Tabachnick & Fidell, 2001). To check this assumption, a scatter plot of the Studentized Deleted Residuals (Y axis) and the Standardized Predicted scores (X axis) was plotted. If the linearity and the homoscedasticity assumptions are met, the plot of points will appear as a rectangular band in a scatter plot (Tabachnick & Fidell, 2001). For this study, the scatter plot showed a rectangular band and indicated homoscedasticity.

Linearity: Linearity is the assumption that there is a straight-line relationship between two variables. The most commonly recommended strategy for evaluating linearity is visual examination of a scatter plot. Scatter plots were used to determine whether or not the relationship between each independent variable (predictor) and dependent variable (criterion) was linear. If the scatter plot is represented by a straight line, it will be concluded that the relationship is linear. It was found that relationship between each independent variable and dependent variable was represented by a straight line. Furthermore, the scatter plot of the Studentized Deleted Residuals and the Standardized Predicted scores were used to check the assumption of linearity same as the homoscedasticity assumption. If there is a strong relationship between the variables, the rectangular band will be narrow. If the relationship is weaker, the rectangular band becomes broader (Tabachnick & Fidell, 2001). For this study, the scatter plot showed a rectangular band and indicated linearity.

Multicollinearity: Multicollinearity occurs when one independent variable is strongly correlated with one or more of the other independent variables ($r \geq .90$) (Tabachnick & Fidell, 2001). For assessing multicollinearity, the correlation coefficients (r) were evaluated. The correlations between independent variables ranged from .31 to

.63. Furthermore, multicollinearity was detected by examining the tolerance value for each independent variable. Tolerance is the amount of variability in one independent variable that is not explained by the other independent variables. Tolerance values less than 0.10 indicate collinearity (Stevens, 2002; Tabachnick & Fidell, 2001). In this study tolerance was between .54 and .77.

Conducting structural equation modeling

SEM is a technique that is used to test causal relationships of a theoretical model with multilevel analysis. SEM tests two models simultaneously; a measurement model and a structural (theoretical) model. SEM has several advantages over other techniques. First, it allows for a more precise estimation of the indirect effects of the exogenous variables (independent variables) on all endogenous variables (dependent variables). This study tested hypotheses of direct and indirect effects of one variable on another. To test these hypotheses, all paths within the model that represent the direct and indirect effects of one variable on another can be obtained from SEM. Second, measurement errors can be determined and taken into account in the analysis process of SEM. SEM also takes unexplained variances of all latent variables into consideration. Therefore, the researcher can identify whether or not the measures are reliable, and whether or not the model is misspecified (Byrne, 2001). For this study, an initial measurement model was estimated to evaluate each latent construct separately before examining the structural model. Then, SEM analysis was performed to test the proposed structural model.

Measurement model

A measurement model is a model of how theoretical constructs are measured. For this study, three latent constructs in the proposed model (attraction to physical activity, perceived parental influence, and perceived peer influence) that are multi-factorial constructs, were estimated in the measurement model. In addition, perceived physical competence that is a unifactorial construct was also estimated. Confirmatory factor analysis (CFA) was performed to evaluate the measurement model.

For parameter estimation, the maximum likelihood method was used. Maximum likelihood method is a full-information technique which estimates the entire system of equations simultaneously (Diamantopoulos & Siguaw, 2000). An advantage of this method is that the estimation of each parameter utilizes the information provided by the entire system (Long, 1983 as cited in Diamantopoulos & Siguaw, 2000). Maximum likelihood method provides consistently efficient estimation under the assumption of multivariate normality and is relatively robust against moderate departures from the latter. Model-fit statistics of each measurement model were examined for goodness of fit of the model to the sample data. In case that the model-fit statistics of the measurement model did not meet the criteria, model modification was carried out.

A number of model-fit statistics (goodness-of fit measures) are available to assess the overall fit of the hypothesized model. They can be classified into three types: absolute fit indexes, incremental fit indexes, and parsimonious fit indexes (Ho, 2006). Absolute fit indexes determine the degree to which the proposed model fits the observed covariance matrix. Some commonly used indexes of absolute fit include chi-square statistic, the goodness-of-fit statistics, and the root mean square error of approximation. Incremental fit

indexes compare the proposed model to some baseline model (independence model or the null model). In the independence model, the observed variables are assumed to be uncorrelated with each other. A number of incremental fit indexes include Tucker-Lewis index, Relative Fit Index, Incremental Fit Index, and Comparative fit index. Parsimonious fit indexes are used to compare models on the basis of criteria such that less complex models have better fit than those that are more complex. In scientific research, theories should be as parsimonious as possible. A model with fewer unknown parameters may be considered as a better model for replication or explanation. Parsimonious fit indexes include Parsimonious Normed Fit Index, Akaike Information Criterion, and Bayes information criterion.

To determine a good fit for the measurement model of this study, a number of model-fit statistics were evaluated. Focusing on the first set of fit statistics in Amos results, CMIN (most commonly expressed as a chi-square, χ^2), DF (degree of freedom), and p (probability value) were evaluated. A chi-square test of non-significance and a relative chi-square of less than 3 are required (Ho, 2006; Norris, 2001). Chi-square (χ^2) assesses the difference between observed data and a restricted structure resulting from the measurement model. In the SEM analysis of this study, the researcher expected the chi-square to be non-significant to confirm the null hypothesis. According to the null hypothesis, there is no difference between the data and the model. However, the chi-square statistic is more likely to suggest rejection of the null hypothesis when the sample size is $\geq$ 500 (Wang et al., 1996 as cited in Norris, 2001). Therefore, the chi-square statistic should not be the sole method used for drawing conclusions about model fit. A relative chi-square is a ratio of chi-square to degrees of freedom (χ^2/df). The degrees of freedom are calculated as ½ k (k + 1) – t, where k is a

number of observed variables and t is a number of parameters to be estimated (Diamantopoulos & Siguaw, 2000).

Turning to the next group of statistics, goodness of fit index (GFI) was examined. The GFI is a measure of the relative amount of variance and covariance in the sample covariance matrix that is jointly explained by the estimated population covariance matrix (Byrne, 2001). Generally, a model with GFI greater than .90 is considered to be a good-fitting model (Norris, 2001). Currently, a value close to .95 has been advised for GFI (Hu & Bentler, 1999).

The next set of goodness of fit statistics, comparative fit index (CFI) and Tucker-Lewis index (TLI) were evaluated. These indices are used to compare the proposed model to the null or independence model. The independence model is the model in which all correlation among variables are zero (Byrne, 2001). A value of CFI and TLI greater than .90 was considered representative of a well-fitting model. However, a value close to .95 is suggested (Hu & Bentler, 1999).

The root mean square error of approximation (RMSEA) was for the focus of the next set of fit statistics. RMSEA represents the average residual value derived from the fitting of the variance–covariance matrix for the hypothesized model to variance–covariance matrix of the sample data. The value of RMSEA ranges from 0 to 1.00. Values less than .05 indicate good fit, values between .05 and under .08 represent reasonable error of approximation, values between .08 and .10 indicate mediocre fit, and those greater than .10 indicate poor fit (MacCallum et al., 1996 as cited in Byrne, 2001). MacCallum and his colleagues recommended the use of confidence intervals to assess the precision of RMSEA estimates. Amos reports a 90% interval around the RMSEA value. A small RMSEA with a wide confidence

interval would indicate the imprecision of the RMSEA value in reflecting model fit in the population. The upper bound of the 90% interval $\leq$ .06 was recommended by Hu and Bentler (1999).

Finally, Akaike Information Criterion (AIC) and Bayes information criterion (BIC) were addressed. AIC and BIC are used for a parsimony adjustment in this study. The AIC and BIC are used in the comparison of two or more models. A small value indicates a good-fitting and parsimonious model. Therefore, a model with the smallest AIC and BIC compared to other competing models represents a better fit of the hypothesized model (Byrne, 2001; Tabachnick & Fidell, 2001).

Structural model

The structural model is a model of the hypothesized relationships between the theoretical constructs. The initial structural model was proposed to test the hypothesized relationships among theoretical constructs as shown in Figure 4. According to an initial structural model, ten paths between study variables were allowed. The path coefficients (parameters) were calculated using SEM analysis and the statistical significance of parameter estimates was examined. Nonsignificant parameters were considered unimportant to the model and were deleted from the model (Byrne, 2001). To determine whether there is a good fit with the structural model, model fit statistics were estimated and interpreted the same as for the measurement model. Finally, the direct, indirect, and total effects of the independent variables on physical activity were determined.

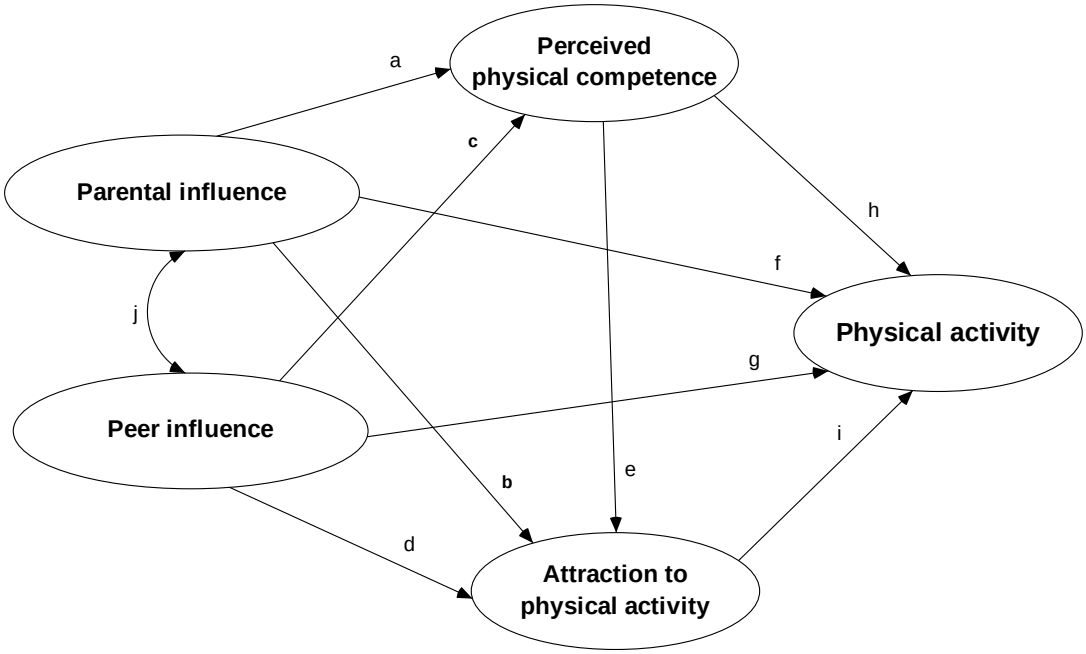

Figure4. An initial structural model of this study

Note. a, b, c, d, e, f, g, h, i, and j were path coefficients.

Protection of Human Subject's Rights

Prior to commencing the study, this research proposal was submitted for approval by the Dissertation Committee of the Faculty of Nursing, Prince of Songkla University. It then was reviewed and approved by the Research Ethics Committee of the Faculty of Nursing. Written informed consent from the subjects' parents was obtained for permission of their children to participate in this study. The assent form was also obtained from the adolescents for their agreement to participate in this study. All subjects were informed that the information they provided during the study would be kept confidential and used only for the purpose of statistical analysis. They were informed that they might ask questions regarding the study at any time and that they

could withdraw from the study at any time. In addition, they were informed that withdrawal from this study would not have any effect on their grades.

Summary

A cross-sectional study was conducted for examining the level of physical activity in Thai adolescents, identifying the determinants of physical activity, and evaluating the utility of the YPAP model in Thai adolescents. Inferential statistics were used for data analysis to examine the predictors of physical activity in adolescents and test the YPAP model in the context of Thai culture.

CHAPTER 4

RESULTS AND DISCUSSION

The results and discussion of the results are presented in this chapter as follows:

1. Demographic characteristics of the sample are described.

2. Description of perceived physical competence, attraction to physical activity, parental influence, peer influence, and physical activity are presented.

3. The results of comparison of means of the study variables are presented.

4. The relationships among the study variables are reported: perceived physical competence, attraction to physical activity, parental influence, peer influence, and physical activity.

5. The results of confirmatory factor analysis of four measurement models (latent constructs) are reported; perceived physical competence, attraction to physical activity, parental influence, and peer influence.

6. The initial structural model estimation is presented followed by the estimation of the respecified model.

7. *The discussion of the results is presented. The demographic characteristics of the sample are discussed first followed by the level of physical activity, the measurement model, and respective research questions and hypotheses.*

Demographic Characteristics of the Sample

Initially, eight hundred and one students (339 males, 42.32% and 462 females, 57.68%) from four public secondary schools completed the TCPAC Scale. Seven hundred and twelve students completed the MTAPAQ two weeks later. Response rate was 88.89%. Of the 712 participants, the following participants (n = 111) were excluded: 42 participants reported the duration of physical activity more than 10 hours a day, 52 participants reported accident or illness during the previous week, 10 participants provided incomplete data of TCPAC scale, and 7 participants did not report walking. The final sample size was 601 (84.41% of those that completed the MTAPAQ). There was no significant gender difference between those that completed the study and those that did not (Pearson Chi-Square = .31, df = 1, p = .58). Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to describe the demographic characteristics of the participants.

The majority of participants were from schools located outside the municipality (75.21%). The highest numbers of participants were studying in grade 10 (20.63%). The mean age was 15.54 (S.D. = 1.68) ranging from 11.77 to 18.99 years. For gender, the highest numbers of participants were females. Demographic variables describing the participants are presented in Table 1.

Table 1

Demographic Characteristics of the Sample (N =601)

Variable	n	%
1. School size and location	601	100.00
Medium high school (located outside the municipality)	98	16.31
Large high school (located outside the municipality)	156	25.96
Very large school (located outside the municipality)	198	32.94
Very large school (located in the municipality)	149	24.79
2. Gender	601	100.00
Male	251	41.76
Female	350	58.24
3. Religion	601	100.00
Buddhism	559	93.01
Islam	35	5.83
Christianity	5	.83
Missing	2	.33
4. Grade level	601	100.00
7	95	15.81
8	86	14.31
9	101	16.81
10	124	20.63
11	102	16.97
12	93	15.47

Table 1 (continued)

Variable	n	%
5. Age* (Mean = 15.54 years, SD =1.68)	601	100.00
11.77 - 12.99	44	7.32
13.00 - 13.99	95	15.81
14.00 - 14.99	91	15.14
15.00 - 15.99	105	17.47
16.00 -16.99	123	20.47
17.00 - 17.99	99	16.47
18.00 - 18.99	38	6.32
Missing	6	1.00
6. Body mass index**		
Male (total 251 cases, missing 28 cases)	223	100.00
$\leq$ 25kg/m^2	169	75.78
> 25kg/m^2	39	17.49
> 30 kg/m^2	15	6.73
Female (total 350 cases, missing 31 cases)	319	100.00
$\leq$ 25kg/m^2	262	82.13
> 25kg/m^2	42	13.17
> 30 kg/m^2	15	4.70

Note. *Age was computed based on days and converted to years

** using the International Obesity Task Force (IOTF) reference (Cole et al., 2000) (Appendix G)

Table 1 (continued)

Variable	n	%
7. To be an athlete in school or community's team	601	100.00
Yes	56	9.32
No	545	90.68
8. Have a computer at home	601	100.00
Yes	406	67.55
No	191	31.78
Missing	4	.67
9. Extra class (hours/week)(Mean = 3.49, SD = 4.47)	601	100.00
0	274	45.59
1- 5.5	149	24.79
6-10.5	134	22.30
11-15.5	27	4.49
16-20.5	9	1.50
21-25	5	0.83
Missing	3	0.50
10. Play time	601	100.00
School time	228	37.94
Before or after school	364	60.56
Both	2	.33
Missing	7	1.17

Table 1 (continued)

Variable	n	%
11. Available number of sport equipment at home	601	100.00
None	62	10.32
1	204	33.94
2	164	27.29
3	102	16.97
≥ 4	67	11.15
Missing	2	0.33
12. Availability of place for exercise nearby their house	601	100.00
None	173	28.79
Yes (public place)	214	35.61
Yes (private place)	205	34.11
Missing	9	1.49
13. Play ground	601	100.00
House area	293	48.75
School area	229	38.10
Fitness/gymnasium	72	11.98
Missing	7	1.17
14. Watching television (hours /day) (Mean = 2.23, SD = 1.44)	601	100.00
None	22	3.66
≤ 2 hours	306	50.92
> 2-5 hours	252	41.93
> 5 hours	21	3.49

Table 1 (continued)

Variable	n	%
15. Using computer or internet (hours/day) (Mean = .88, SD = 1.00)	601	100
None	101	16.80
≤ 2 hours	440	73.21
> 2-5 hours	56	9.32
> 5 hours	4	0.67
16. People who plays or exercise with you (most often)	601	100.00
Alone	29	4.83
Friend	336	55.91
Sibling	127	21.13
Father/ mother	28	4.66
Others (guardian, relative, neighborhood, or teacher)	74	12.31
Missing	7	1.16
17. Mother's occupation	601	100.00
Housework	107	17.80
Employee of a company/business	67	11.15
Government officer	71	11.81
Farmer	149	24.79
Business owner	176	29.29
Others	17	2.83
Missing	14	2.33

Table 1 (continued)

Variable	n	%
18. Father's occupation	601	100.00
Housework	11	1.83
Employee of a company/business	90	14.98
Government officer	117	19.47
Farmer	137	22.79
Business owner	186	30.95
Others	24	3.99
Missing	36	5.99
19. Family income (Thai baht/month)	601	100.00
(Mean = 24,569, SD = 20,441.1)		
$\leq$ 10,000	189	31.45
10,001 - 20,000	136	22.63
20,001- 30,000	89	14.81
30,001- 40,000	41	6.82
40,001- 50,000	55	9.15
> 50,000	43	7.15
Missing	48	7.99

Description of Perceived Physical Competence, Attraction to Physical Activity, Parental Influence, Peer Influence, and Physical Activity

The proposed structural model is comprised of four independent variables: perceived physical competence, attraction to physical activity, parental influence, and peer influence; and one dependent variable: physical activity (MET-mins). Minimum, maximum, mean, standard deviation, skewness, and kurtosis of these variables are listed in Table 2.

Comparison of Means of the Study Variables

The mean of each independent variable was identified and compared between subgroups of the sample. The results of independent t-tests indicated that there were significant differences between the male and female sample in the perceived physical competence, attraction to physical activity, and peer influence. The mean values indicated that males had the perceived physical competence, attraction to physical activity, and peer influence significantly higher than females. Description of independent variables in male and female groups and the results of independent t-test are shown in Table 3.

For parental influence, middle school students (7th to 9th graders) perceived parental influence significant higher than high school students (10th to 12th graders) ($t = 2.09$, $df = 599$, $p = .04$). However, perceived peer influence of middle school students and high school students did not reach the statistical differences ($t = 1.76$, $df = 599$, $p = .08$).

To identify the physical activity level of the participants, total volume of physical activity (MET-mins) was reported. It was found that males had physical

activity level (n = 251, Mean = 9,312.77, SD = 4259.64) higher than females (n = 350, Mean = 7,740, and SD = 3,634.14). However, the assumption of homogeneity of variance was not met. Thus, the total volume of physical activity (MET-mins) was square root transformed before subsequent analysis. The assumption of homogeneity of variance was re-examined using Levene's test for equality of variances. The result showed homogeneity of variance (F= 3.67, p = .06). The result from the independent t-test analysis indicated that there was a significant difference between the male and female sample in the level of physical activity, t = 4.86 (df =599, p < .001). The mean values indicated that males had physical activity level (mean = 93.91, SD = 22.26) higher than females (mean = 85.64, SD = 20.18).

Physical activity level of participants was also identified in seventh to ninth graders (n = 282) and tenth to twelfth graders (n = 319). Mean of the total volume of physical activity (MET-mins) was 9,591.96 (SD = 4,224.21) in seventh to ninth graders and 7,340.87 (SD = 3,426.71) in tenth to twelfth graders. The independent t-test was used for testing the differences between the means of these groups. Levene's test for equality of variances showed homogeneity of variance (F= 2.89, p = .09). The result from the independent t-test analysis indicated that there was a significant difference between the seventh to ninth graders and tenth to twelfth graders in the level of physical activity, t = 7.21 (df =599, p < .001). The mean values indicated that the seventh to ninth graders had physical activity level higher than tenth to twelfth graders.

Table 2

Minimum, Maximum, Mean, Standard Deviation, Skewness, and Kurtosis of the Study Variables (N = 601)

Variables	Possible range	Minimum	Maximum	Mean	SD	Percentage of mean	Skewness	Kurtosis
Perceived physical competence	5-20	5	20	11.72	2.85	58.60	0.28	-0.07
Attraction to physical activity	15-60	25	59	43.89	6.75	73.15	-0.09	-0.46
Parental influence	18-72	25	68	49.70	7.18	69.03	-0.01	-0.10
Peer influence	14-56	21	56	40.66	5.67	72.61	0.004	-0.21
Physical activity (MET-mins)		1,493	21,501	8,397.1	3,980.52		0.79	0.22

Note. Percentage of mean = (mean x 100)/maximum possible score

Table 3

Independent T-Test Results (N = 601; Male = 251, Female = 350)

Variable	Gender	Mean	SD	Levene's test		Independent t-test		
				F	p value	t	df	p value
Parental influence	Male	49.63	6.96	1.26	.26	-.20	599	.84
	Female	49.75	7.34					
Peer influence	Male	42.68	5.41	.06	.81	7.77	599	.000
	Female	39.21	5.42					
Perceived physical competence	Male	12.63	2.72	.20	.65	6.92	599	.000
	Female	11.06	2.76					
Attraction to physical activity	Male	46.21	6.65	.77	.38	7.47	599	.000
	Female	42.22	6.32					

The Relationships among the Study Variables; Perceived Physical Competence, Attraction to Physical Activity, Parental influence, Peer influence, and Physical Activity

Bivariate correlational analysis among measured variables in the proposed model was performed in the preliminary analysis to test the Hypothesis 1. This hypothesis was that there are relationships among perceived physical competence, attraction to physical activity, parental influence, peer influence, and the physical activity of Thai adolescents. Bivariate correlations indicated a significant positive correlation between each independent variable (perceived physical competence, attraction to physical activity, parental influence, and peer influence) and the dependent variable (physical activity) (r ranged from .18 to .30, $p < .01$). Relationships among the study variables are described in Table 4.

Table 4

Correlation Matrix of the Study Variables

Variables	Physical activity	PPC	APA	Peer influence	Parental influence
Physical activity	1.00				
PPC	.30**	1.00			
APA	.29**	.63**	1.00		
Peer influence	.26**	.39**	.52**	1.00	
Parental influence	.18**	.31**	.34**	.45**	1.00

** $p < .01$

PPC = perceived physical competence; APA = attraction to physical activity

Measurement Models

Before the structural model among latent variables was tested, an initial measurement model was examined to evaluate the construct validity of each latent variable separately. Four latent variables in the proposed structural model of this study, perceived physical competence, attraction to physical activity, parental influence, and peer influence, were examined in the measurement model by performing confirmatory factor analysis (CFA). Perceived Physical Competence subscale, Attraction to Physical Activity subscale, and Parental Influence subscale had its associated indicators and/or its associated factors originally proposed by the originators. In addition, the Peer Influence subscale had the same associated indicators and associated factors as the Parental Influence subscale. Lastly, the overall measurement model was tested using CFA.

The first factor loading for each latent variable was constrained to 1.0 for the purpose of model identification and latent variable scaling (Byrne, 2001). Errors of measurement associated with each observed variable are uncorrelated. In the first-order CFA, each observed variable (item) was allowed to load on its respective latent variable (factor). In the other words, it was not allowed to load on other latent variables. For the latent variables with multidimensional constructs (attraction to physical activity, parental influence, and peer influence), all factors are intercorrelated in the first-order CFA. For second-order CFA, covariation among all first-order factors are explained fully by their regression on the second-order factor (Byrne, 2001). The variance of second-order factor was also constrained to 1.00 for the purpose of model identification. The relationships between the observed variables and the underlying latent constructs were estimated. The factor loading of variable on the

associated factor indicates the reliability of the empirical indicator used to measure the underlying factor. Values of factor loadings $\geq$ .33 are considered acceptable values (Tabanick & Fidell, 2001). In addition, nonsignificant parameters were deleted from the model because they were considered as unimportant parameters (Byrne, 2001).

Perceived Physical Competence subscale

A first-order CFA of the Perceived Physical Competence subscale was performed. This first-order CFA tested the hypothesis that perceived physical competence is a unidimensional construct composed of 5 items. The findings from the first-order CFA confirmed that all five items of the subscale had good factor loadings and the percentage of variance in each item was adequately accounted for by its latent construct. Standardized factor loadings ranged from .41 to .72 with a minimum variance explained by its respective factor of 16% (Figure 5, Table 5). Overall, the model demonstrated a satisfactory fit; χ^2 (5, N = 601) = 6.45, p = .26; GFI = .99; CFI = .99; and RMSEA = .02 (90% confidence interval ranging from .00 to .06).

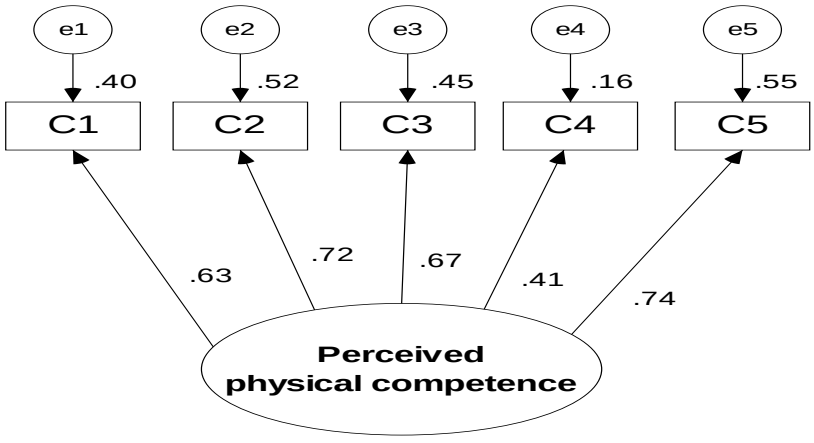

Figure 5. Measurement model of Perceived Physical Competence subscale

Table 5

Standardized Factor Loadings and R^2 of Items from the Perceived Physical Competence Subscale

Indicator	Factor loading	R^2
C1: *Some kids are good at most games and sports.*	.63	.40
C2: *Some kids feel they are better than other kids their age at games and sports.*	.72	.52
C3: *Some kids are pretty sure that they are a good athlete.*	.67	.45
C4: *Some kids don't do well at new games and sports.*	.41	.16
C5: *Some kids do very well at all kinds of games and sports.*	.74	.55

Attraction to Physical Activity subscale

A first-order CFA of the Attraction to Physical Activity subscale was performed (Model 1). This first-order CFA tested the hypothesis that attraction to physical activity is a multidimensional construct composed of five factors: liking of vigorous exercise (3 items), liking of games and sports (3 items), importance of exercise (3 items), peer acceptance in games and sports (3 items), and fun of physical exertion (3 items). There were 15 observed variables in this first-order CFA. The observed variables were loaded on the factors in the following pattern: LIKEEX1-LIKEEX3 were loaded on liking of vigorous exercise factor; LIKEG1-LIKEG3 were loaded on liking of games and sports factor; IMEX1-IMEX3 were loaded on importance of exercise factor; PEERAC1-PEERAC3 were loaded on peer acceptance

in games and sports factor; and FUNEX1-FUNEX3 were loaded on fun of physical exertion factor. The findings from the first-order CFA indicated that most of items of the subscale had fair to good factor loadings and the percentage of variance in each item was adequately accounted for by its latent construct. Standardized factor loadings ranged from .19 to .83 with a minimum variance explained by its respecting factor of 4% (Table 6). One item (PEERAC2) showed a low factor loading (.19), which was less than the lowest acceptable value ($\geq$ .33) (Tabanick & Fidell, 2001). Overall, the model demonstrated an acceptable fit; χ^2 (80, N = 601) = 207.16, p < .001; GFI = .96; CFI = .94; TLI = .92; AIC = 287.16; BIC = 463.11; and RMSEA = .05 (90% confidence interval ranging from .04 to .06).

In an effort to improve the fit indices, the model was re-specified in which one item (PEERAC2) was dropped out (Model 2). The results of the respecified model indicated an improvement of fit with respect to χ^2, AIC, and BIC; all other selected indices remained intact; χ^2 (67, N = 601) = 184.59, p < .001; GFI = .96; CFI = .94; TLI = .92; AIC = 260.59; BIC = 427.74; and RMSEA = .05 (90% confidence interval ranging from .04 to .06).

A second-order CFA of the model with 14 items was conducted and then factor analyzed to examine the construct validity of the higher latent variable, attraction to physical activity (Model 3). Results suggested that the five-factor model had a marginally acceptable fit; χ2 (72, N = 601) = 229.60, p < .001; GFI = .95; CFI = .93; TLI = .91; AIC = 295.60; BIC = 440.75; and RMSEA = .06 (90% confidence interval ranging from .05 to .07). Although goodness of fit for this model was found to be acceptable, the solution for the liking of vigorous exercise was somewhat problematic. More specifically, an error message in the output warned that the

variance was negative; as a consequence, the solution was considered to be inadmissible. In an effort to solve this problem, the variance is constrained to .05 (Loehlin, 2004) and the model was re-estimated (Model 4). Results related to this re-specified model demonstrated acceptable fit indices; $\chi 2$ (73, N = 601) = 235.22, $p < .001$; GFI = .95; CFI = .92; TLI = .90; AIC = 299.22; BIC = 439.98; and RMSEA = .06 (90% confidence interval ranging from .05 to .07). However, the results showed that only 19% of the variance in the importance of exercise factor was explained by attraction to physical activity (factor loading = .43, $R^2 = .19$). The variance explained in other factors by attraction to physical activity was more than 50% (Table 8).

A second-order CFA of the attraction to physical activity was re-specified in which the factor of importance of exercise was eliminated (Model 5). Results suggested that the four-factor model had good fit indices; $\chi 2$ (40, N = 601) = 122.97, $p < .001$; GFI = .97; CFI = .95; TLI = .93; AIC = 174.97; BIC = 289.33; and RMSEA = .06 (90% confidence interval ranging from .05 to .07). The final model of the Attraction to Physical Activity subscale consisted of 4 factors with 11 items; 1) liking of vigorous exercise (3 items), 2) liking of games and sports (3 items), 3) peer acceptance in games and sports (2 items), and 4) fun of physical exertion (3 items). Standardized factor loadings ranged from .50 to .78 with a minimum variance explained by its respective factor of 25% (Figure 6, Table 7 and Table 8)

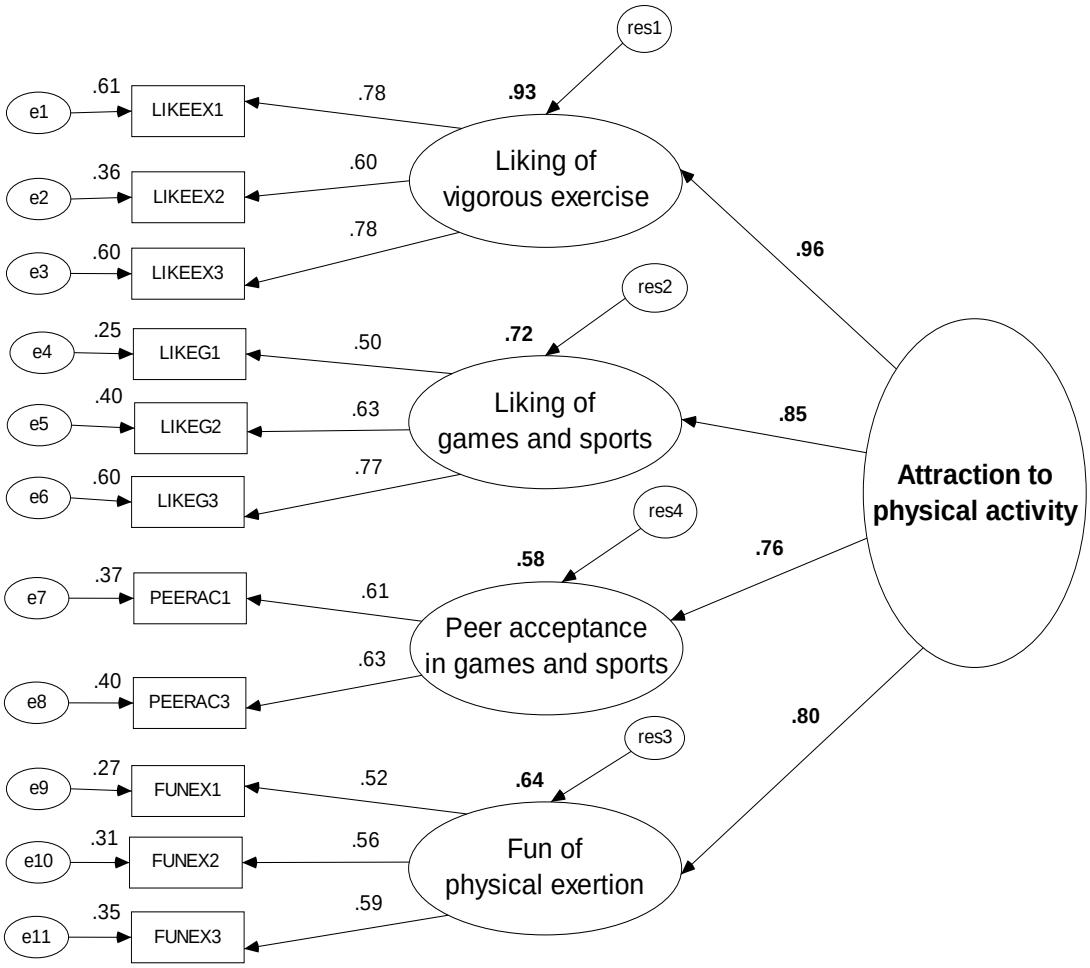

Figure 6. Measurement model of Attraction to Physical Activity subscale

Table 6

Standardized Factor Loadings and R^2 of Items from the Children's Attraction to Physical Activity Subscale (First-Order CFA)

Factor	Indicator	Model 1 (15 items)		Model 2 (14 items)	
		Factor loading	R^2	Factor loading	R^2
Liking of vigorous exercise	LIKEEX1: *Some kids don't like to exercise very much.*	.77	.59	.76	.58
	LIKEEX2: *Some kids don't enjoy exercise very much.*	.61	.38	.62	.38
	LIKEEX3: *Some kids really don't like to exercise.*	.79	.63	.79	.62
Liking of games and sports	LIKEG1: *Some kids like playing outdoor games and sports.*	.59	.34	.50	.25
	LIKEG2: *Some kids have more fun playing games and sports than anything*	.61	.37	.63	.40
	LIKEG3: *For some kids, games and sports is their favorite thing.*	.83	.69	.78	.60
Importance of exercise	IMEX1: *Some kids try hard to stay in good shape.*	.45	.20	.45	.20
	IMEX2: *Some kids think it is very important to be in good shape.*	.59	.35	.69	.47
	IMEX3: *Some kids don't think that exercise is important for their health.*	.81	.65	.67	.45

Table 6 (continued)

Factor	Indicator	Model 1 (15 items)		Model 2 (14 items)	
		Factor loading	R^2	Factor loading	R^2
Peer acceptance in games and sports	PEERAC1: *Some kids get told by other kids that they are not very good at games and sports.*	.60	.38	.60	.36
	PEERAC2: *Some kids get teased by other kids when they play games and sports.*	.19	.04	-	-
	PEERAC3: *Some kids are popular with other kids when they play games and sports.*	.64	.42	.64	.41
Fun of physical exertion	FUNEX1: *Some kids don't like getting sweaty when they exercise or play hard.*	.60	.36	.51	.26
	FUNEX2: *Some kids don't like getting out of breath when they play hard.*	.55	.31	.57	.32
	FUNEX3: *Some kids feel bad when they run hard.*	.67	.45	.59	.35

Table 7

Standardized Factor Loadings and R^2 of Items from the Children's Attraction to Physical Activity Subscale (Second-Order CFA)

Factor	Indicator	Model 4 (5 factors; 14 items)		Model 5 (4 factors; 11 items)	
		Factor loading	R^2	Factor loading	R^2
Liking of vigorous exercise	LIKEEX1	.79	.62	.78	.61
	LIKEEX2	.61	.37	.60	.36
	LIKEEX3	.79	.62	.78	.60
Liking of games and sports	LIKEG1	.50	.25	.50	.25
	LIKEG2	.63	.40	.63	.40
	LIKEG3	.77	.60	.77	.60
Importance of exercise	IMEX1	.45	.20	-	-
	IMEX2	.69	.48	-	-
	IMEX3	.67	.44	-	-
Peer acceptance in games and sports	PEERAC1	.61	.37	.61	.37
	PEERAC3	.63	.40	.63	.40
Fun of physical exertion	FUNEX1	.52	.27	.52	.27
	FUNEX2	.56	.31	.56	.31
	FUNEX3	.59	.34	.59	.35

Table 8

Standardized Factor Loadings and R^2 of Factors from the Children's Attraction to Physical Activity Subscale (Second-Order CFA)

Factor	Model 4 (5 factors; 14 items)		Model 5 (4 factors; ; 11 items)	
	Factor loading	R^2	Factor loading	R^2
Liking of vigorous exercise	.95	.90	.96	.93
Liking of games and sports	.85	.72	.85	.72
Importance of exercise	.43	.19	-	-
Peer acceptance in games and sports	.75	.57	.76	.58
Fun of physical exertion	.79	.63	.80	.64

Parental Influence subscale

A first-order CFA of the Parental influence subscale was performed (Model 1). This first-order CFA tested the hypothesis that parental influence is a multidimensional construct composed of three factors: perception of parental role modeling (6 items), perception of parental encouragement (6 items), and perception of parental support (6 items). There were 18 observed variables in this first-order CFA. The observed variables were loaded on the factors in the following pattern: PARRO1-PARRO6 were loaded on perception of parental role modeling factor; PAREN1-PAREN6 were loaded on perception of parental encouragement; and PARSUP1-PARSUP6 were loaded on perception of parental support factor. The findings from the first-order CFA indicated that most of items of the subscale had fair to good standardized factor

loadings and the percentage of variance in each item was adequately accounted for by its latent construct. Three items (PAREN4, PARSUP1, and PARRO6) had standardized factor loadings lower than an acceptable value (.19, .29, and .30, respectively) (Table 9). Fit indices were indicative of a poor fit of the model to the sample data; $\chi 2$ (132, N = 601) = 415.08, $p < .001$; GFI = .93; CFI = .83; TLI = .80; AIC = 493.08; BIC = 664.63; and RMSEA = .06 (90% confidence interval ranging from .05 to .07). A model was respecified in which three items (PAREN4, PARSUP1, and PARRO6) were omitted one at a time with subsequent reanalysis and evaluation of the effect on model fit and remaining item loadings. The result of the respecified model still demonstrated poor fit of the model to the sample data; $\chi 2$ (87, N = 601) = 290.81, $p < .001$; GFI = .94; CFI = .86; TLI = .83; AIC = 356.81; BIC = 501.97; and RMSEA = .06 (90% confidence interval ranging from .05 to .07).

To improve the fit indices, the model was re-specified using parceling technique. Parcels were used as indicators of latent constructs (parental role modeling, parental encouragement, and parental support) based on internal-consistency approach (Kishton & Widaman, 1994 as cited in Little, Cunningham, Shahar, & Widaman, 2002). Two conditions were considered before creating parcels of each latent variable in this study. First, Peer Influence subscale was developed to parallel the Parental Influence subscale. Therefore, each pair of items of both subscales had redundant item content. If the parceling technique was used for Parental Influence subscale it also should be used for Peer Influence subscale. Because the number of items of both subscales is not equal (parental encouragement = 6 items and peer encouragement = 5 items; parental support = 6 items and peer support = 3 items), the content of each item must be considered before parceling. These factors of both subscales must be parceled

in the same way. Second, each factor should have at least three observed variables (indicators) for an over identified model in CFA (Aroian & Norris, 2001; Kline, 2005). This condition was applied for this study. Therefore, each factor of Parental Influence subscale and Peer Influence subscale was comprised of three indicators.

To create parcels of the Parental Influence subscale, three pairs of items of the parental role modeling factor were randomly selected then their score was computed. For the parental encouragement, 5 items (PAREN1, PAREN2, PAREN3 and PAREN5, PAREN6) that had the redundant item content with peer encouragement were randomly selected to create three parcels. Two pairs of items were randomly selected first. This resulted in two parcels and one item. Then, one item which did not have pair item in the previous step was matched with PAREN4. To create three parcels of the perception of parental support, 3 items (PARSUP2, PARSUP3, and PARSUP6) which had the redundant item content with peer support were selected to be the starting three parcels. Then, the remaining three items (PARSUP1, PARSUP4, and PARSUP5) were randomly selected to match with PARSUP2, PARSUP3, or PARSUP6. Based on these steps, the observed variables of the parental influence were parceled in the following pattern: PARRO1 and PARRO5, PARRO2 and PARRO3, PARRO4 and PARRO6; PAREN1 and PAREN5, PAREN2 and PAREN3, PAREN4 and PAREN6; PARSUP1 and PARSUP6, PARSUP2 and PARSUP4, PARSUP3 and PARSUP5. Finally, the Parental Influence subscale had 9 parcels (3 factors).

A first-order CFA of the Parental Influence subscale was performed again based on the results of parceling. The findings from the first-order CFA indicated that most of the items had moderate to good factor loadings. Standardized factor loadings

ranged from .45 to .71 with a minimum variance explained by its respecting factor of 20% (Figure 7). The results indicated good fit of the model to the sample data; $\chi 2$ (24, N = 601) = 68.16, $p < .001$; GFI = .97; CFI = .96; TLI = .94; AIC = 110.16; BIC = 202.53; and RMSEA = .05 (90% confidence interval ranging from .04 to .07).

Second-order CFA was conducted and then factor analyzed to examine the construct validity of the higher latent variable, Parental influence. The findings indicated that most of items had moderate to good factor loadings and item loadings were similar to those obtained in the first-order CFA (Figure 8, Table 10)**.** The variance explained by its respective factor ranged from 56 to 85% (Table 11). Results suggested that the three-factor model had an acceptable fit; $\chi 2$ (24, N = 601) = 68.16, $p < .001$; GFI = .97; CFI = .96; TLI = .94; AIC = 110.16; BIC = 202.53; and RMSEA = .05 (90% confidence interval ranging from .04 to .07). The final model of the Parental Influence subscale consisted of 3 factors with 9 indicators; 1) perception of parental role modeling (3 indicators), 2) perception of parental encouragement (3 indicators), and 3) perception of parental support (3 indicators).

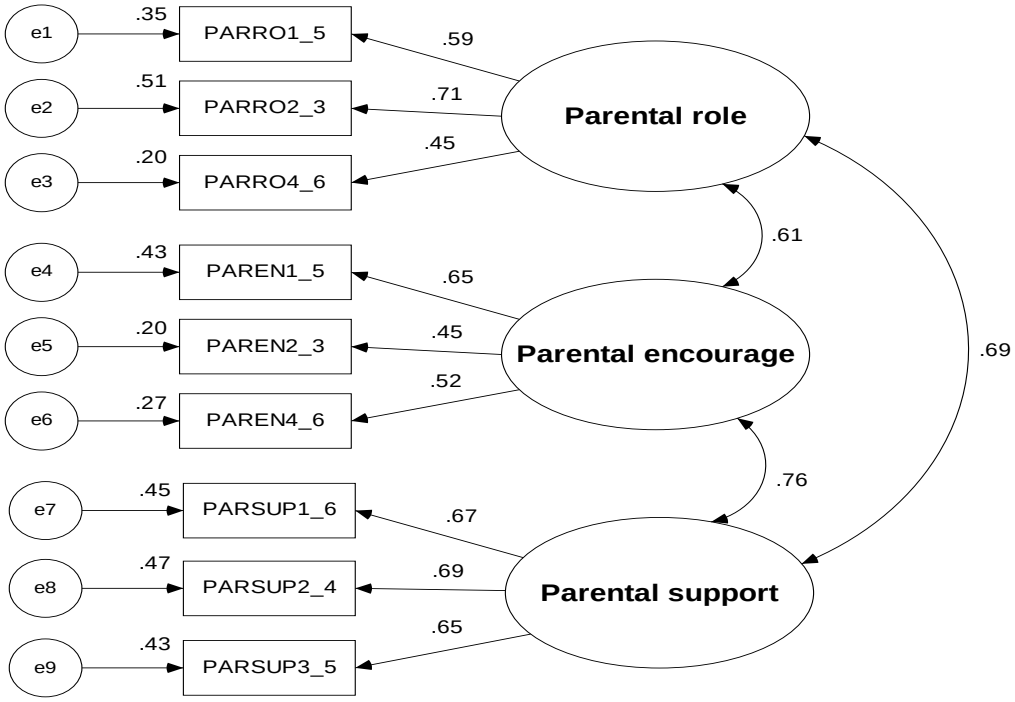

Figure 7. Measurement model of Parental Influence subscale (first-order CFA)

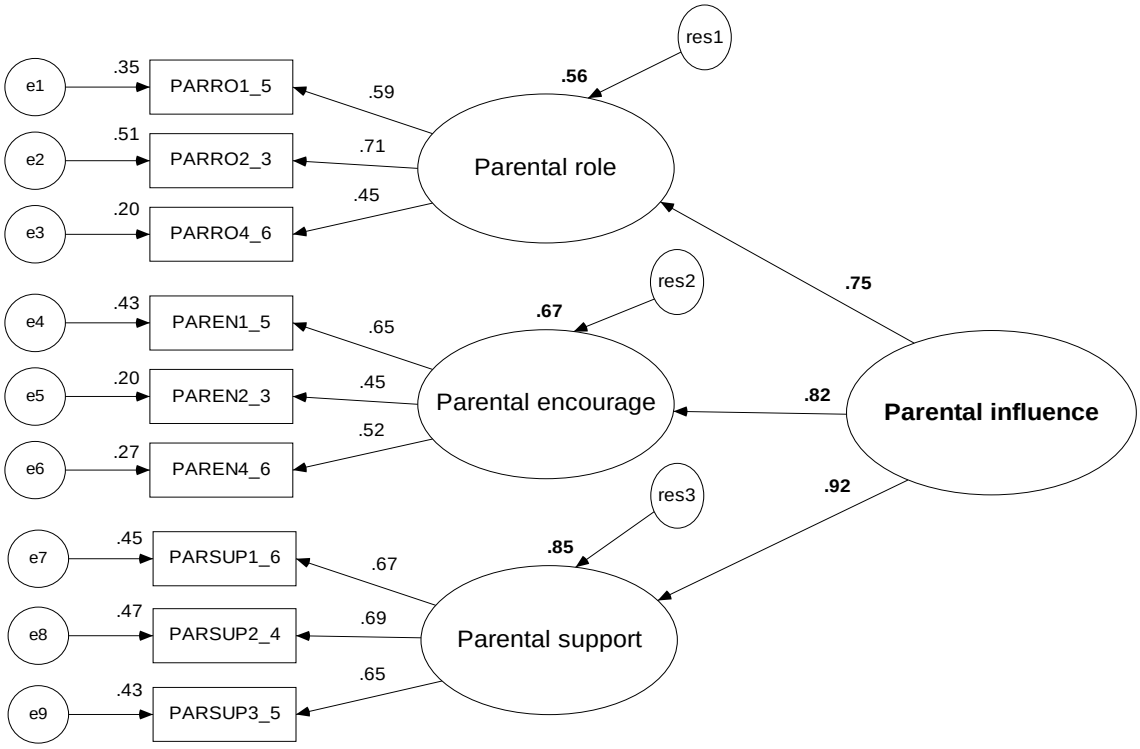

Figure 8. Measurement model of Parental Influence subscale (second-order CFA)

Table 9

Standardized Factor Loadings and R^2 of 18 Items from the Original Parental Influence Subscale (First-Order CFA)

Factor	Indicator	Factor loading	R^2
Perception of parental role modeling	PARRO1: *Some kids have parents who get a lot of exercise.*	.57	.32
	PARRO2: *Some kids have parents who are in really good shape.*	.37	.14
	PARRO3: *Some kids have parents that like to walk for exercise.*	.63	.40
	PARRO4: *Some kids have parents who don't like to do much physical activity*.	.41	.16
	PARRO5: *Some kids have parents that usually walk or bike a lot.*	.48	.23
	PARRO6: *Some kids have parents that would rather walk to the store if possible.*	.30	.09
Perception of parental encouragement	PAREN1: *Some kids have parents who tell them that they are good at games and sports.*	.40	.16
	PAREN2: *Some kids have parents that don't encourage them to play outside.*	.50	.25
	PAREN3: *Some kids have parents who want them to play outside.*	.40	.16
	PAREN4: *Some kids have parents that tell them not to watch too much TV*.	.19	.04
	PAREN5: *Some kids have parents who remind them to do some physical activity.*	.53	.28
	PAREN6: *Some kids have parents who encourage them to try hard at games and sports.*	.66	.44

Table 9 (continued)

Factor	Indicator	Model 1 (18 items)	
		Factor loading	R^2
Perception of parental support	PARSUP1: *Some kids have parents who let them play on community or school sport teams.*	.29	.08
	PARSUP2: *Some kids have parents who play games and sports with them.*	.67	.44
	PARSUP3: *Some kids have parents that don't help them much with sports.*	.49	.24
	PARSUP4: *Some kids have parents who buy them a lot of sports equipment.*	.47	.22
	PARSUP5: *Some kids have parents who don't take them to parks or playgrounds.*	.45	.20
	PARSUP6: *Some kids have parents that practice games and sports skills with them a lot.*	.69	.48

Table 10

Standardized Factor Loadings and R^2 of 9 Parceling Indicators from the Parental Influence Subscale (Second-Order CFA)

Factor	Indicator	Factor loading	R^2
Perception of parental role modeling	PARRO1 and PARRO5 (PARRO1_5)	.59	.35
	PARRO2 and PARRO3 (PARRO2_3)	.71	.51
	PARRO4 and PARRO6 (PARRO4_6)	.45	.20
Perception of parental encouragement	PAREN1 and PAREN 5 (PAREN1_5)	.65	.43
	PAREN2 and PAREN3 (PAREN2_3)	.45	.20
	PAREN4 and PAREN6 (PAREN4_6)	.52	.27
Perception of parental support	PARSUP1 and PARSUP6 (PARSUP1_6)	.67	.45
	PARSUP2 and PARSUP4 (PARSUP2_4)	.69	.47
	PARSUP3 and PARSUP5 (PARSUP3_5)	.65	.43

Table 11

Standardized Factor Loadings and R^2 of Factors from the Parental Influence Subscale with Parceling Indicators (Second-Order CFA)

Factor	Factor loading	R^2
Perception of parental role modeling	.75	.56
Perception of parental encouragement	.82	.67
Perception of parental support	.92	.85

Peer Influence subscale

A first-order CFA of the Peer influence was performed (Model 1). This first-order CFA tests the hypothesis that peer influence is a multidimensional construct composed of three factors: perception of peer role modeling (6 items), perception of peer encouragement (5 items), and perception of peer support (3 items). There were 14 observed variables in this first-order CFA. The observed variables load on the factors in the following pattern: PEERRO1-PEERRO6 load on perception of peer role modeling factor; PEEREN1-PEEREN5 load on perception of peer encouragement; and PEERSUP1-PEERSUP3 load on perception of peer support factor. The findings from the first-order CFA indicated that most of items of the subscale had low to moderate standardized factor loadings and the percentage of variance in each item was adequately accounted for by the variance in its latent construct (Table 12), with two items (PEERRO6 and PEEREN1) showing low factor loadings (.29 and .32). Fit indices are indicative of a poor fit of the model to the data; $\chi 2$ (74, N = 601) = 241.25, $p < .001$; GFI = .94; CFI = .87; TLI = .84; AIC = 303.25; BIC = 439.60; and RMSEA = .06 (90% confidence interval ranging from .05 to .07). As expected, this finding was similar to the first-order CFA results of the Parental Influence subscale. Therefore, the model was re-specified using the parceling technique to improve the fit indices.

The observed variables were parceled in the following pattern: PEERRO1 and PEERRO5, PEERRO2 and PEERRO3, PEERRO4 and PEERRO6; PEEREN1 and PEEREN4, PEEREN2 and PEEREN3, PEEREN5. For the perception of peer support, the original observed variables were used because it had three observed variables. The findings from the first-order CFA indicated that most of items had acceptable factor loadings. Standardized factor loadings ranged from .48 to .68 with a minimum

variance explained by its respective factor of 23% (Figure 9). Results related to this re-specified model demonstrated acceptable fit indices; $\chi 2$ (24, N = 601) = 35.44, p = .06; GFI = .99; CFI = .99; TLI = .98; AIC = 77.44; BIC = 169.81; and RMSEA = .03 (90% confidence interval ranging from .00 to .05).

The second-order CFA was conducted and then factor analyzed to examine the construct validity of the higher latent variable, Peer influence. The findings from the second-order CFA indicated that most of items had acceptable factor loadings and item loadings were similar to those obtained in the first-order CFA (Figure 10, Table 13). The variance explained by its respective factor ranged from 63 to 94% (Table 14). Results suggested that the three-factor model had a satisfactory fit; $\chi 2$ (24, N = 601) = 35.44, p = .06; GFI = .99; CFI = .99; TLI = .98; AIC = 77.44; BIC = 169.81; and RMSEA = .03 (90% confidence interval ranging from .00 to .05). The final measurement model of the Peer influence subscale consisted of 3 factors with 9 indicators: perception of peer role modeling (3 indicators), perception of peer encouragement (3 indicators), and perception of peer support (3 indicators).

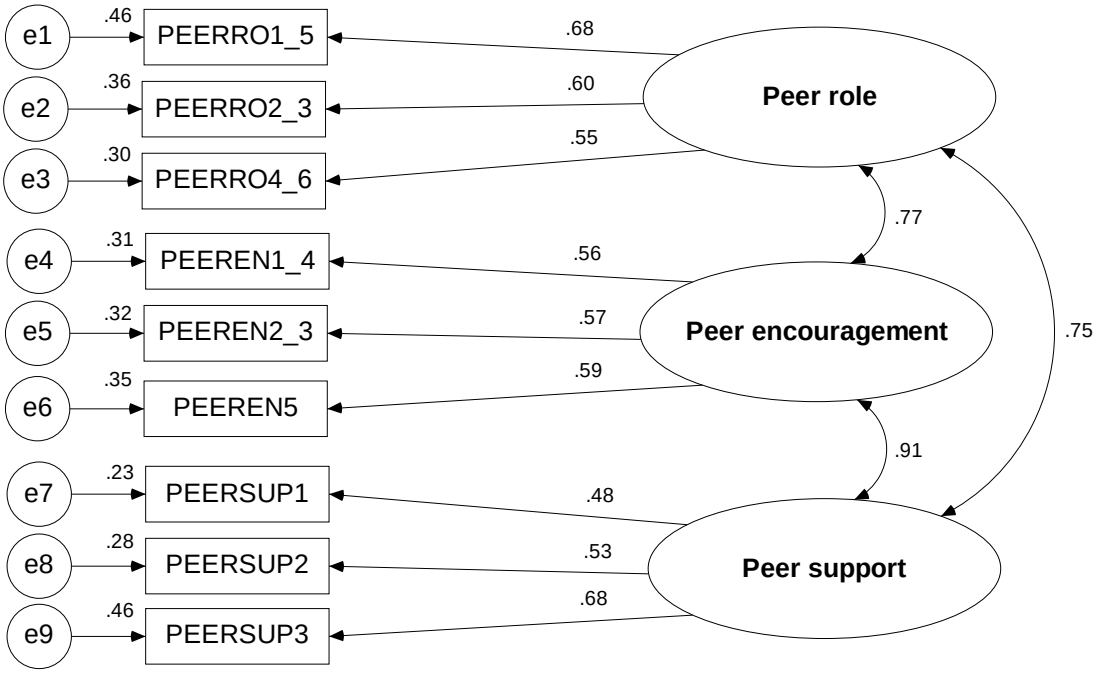

Figure 9. Measurement model of Peer Influence subscale (first-order CFA)

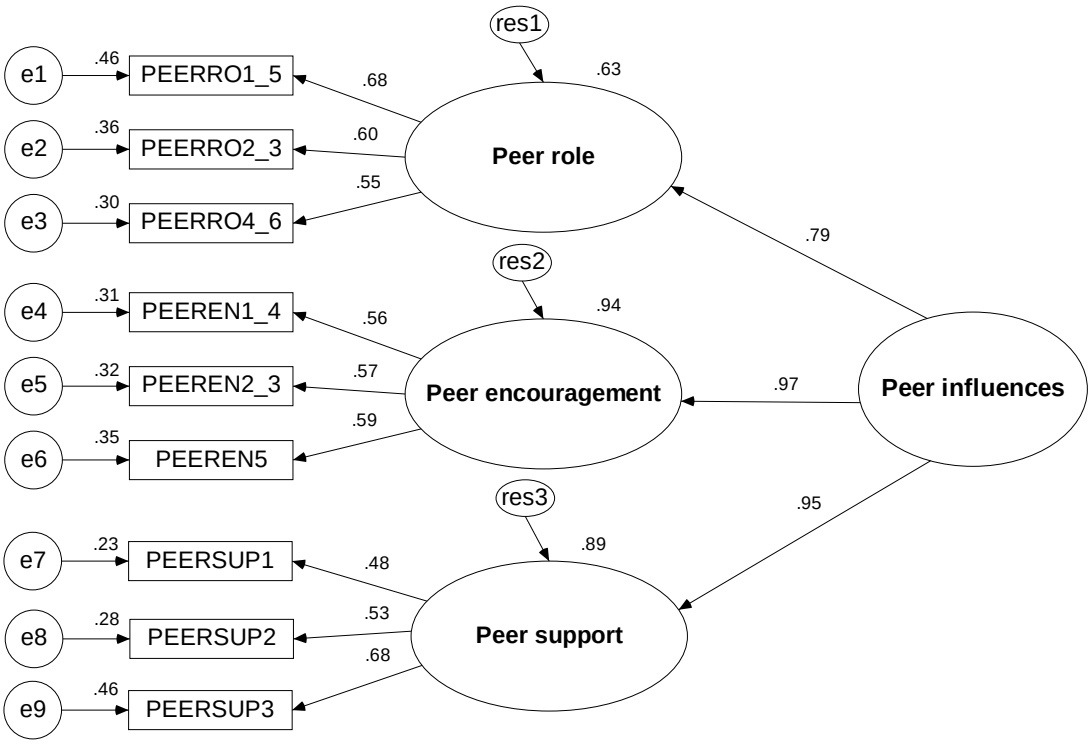

Figure 10. Measurement model of Peer Influence subscale (second-order CFA)

Table 12

Standardized Factor Loadings and R^2 of 14 Items from the Peer Influence Subscale (First-Order CFA of Original Subscale)

Factor	Indicator	Factor loading	R^2
Perception of peer role modeling	PEERRO1: *Some kids have friends who get a lot of exercise.*	.59	.35
	PEERRO2: *Some kids have friends who are in really good shape.*	.43	.19
	PEERRO3: *Some kids have friends that like to walk for exercise.*	.44	.19
	PEERRO4: *Some kids have friends who don't like to do much physical activity*.	.53	.28
	PEERRO5: *Some kids have friends that usually walk or bike a lot.*	.36	.13
	PEERRO6: *Some kids have friends that would rather walk to the store if possible.*	.29	.09
Perception of peer encouragement	PEEREN1: *Some kids have friends who tell them that they are good at games and sports.*	.32	.10
	PEEREN2: *Some kids have friends that don't encourage them to play outside.*	.53	.28
	PEEEREN3: *Some kids have friends who want them to play outside.*	.49	.24
	PEEREN4: *Some kids have friends who remind them to do some physical activity.*	.43	.18
	PEEREN5: *Some kids have friends who encourage them to try hard at games and sports.*	.58	.34

Table 12 (continued)

Factor	Indicator	Factor loading	R^2
Perception of peer support	PEERSUP1: *Some kids have friends who play games and sports with them.*	.49	.24
	PEERSUP2: *Some kids have friends that don't help them much with sports.*	.53	.28
	PEERSUP3: *Some kids have friends that practice games and sports skills with them a lot.*	.67	.45

Table 13

Standardized Factor Loadings and R^2 of the Parceling Indicators from the Peer Influence Subscale (Second-Order CFA)

Factor	Indicator	Factor loading	R^2
Perception of peer role modeling	PEERRO1 and PEERRO5 (PEERRO1_5)	.68	.46
	PEERRO2 and PEERRO3 (PEERRO2_3)	.60	.36
	PEERRO4 and PEERRO6 (PEERRO4_6)	.55	.30
Perception of peer encouragement	PEEREN1 and PEEREN4 (PEEREN1_4)	.56	.31
	PEEREN2 and PEEREN3 (PEEREN2_3)	.57	.32
	PEEREN5	.59	.35
Perception of peer support	PEERSUP1	.48	.23
	PEERSUP2	.53	.28
	PEERSUP3	.68	.46

Table 14

Standardized Factor Loadings and R^2 of Factors from the Peer Influence Subscale with Parceling Indicators (Second-Order CFA)

Factor	Factor loading	R^2
Perception of peer role modeling	.79	.63
Perception of peer encouragement	.97	.94
Perception of peer support	.95	.89

Overall measurement model

The overall measurement model that included four latent variables (parental influence, peer influence, perceived physical competence, and attraction to physical activity) and one observed variable (physical activity) was examined using CFA. The results indicated poor fit of the model to the sample data, $\chi 2$ (541, N = 601) = 1282.92, $p < .001$; GFI = .89; CFI = .87; TLI = .86; AIC = 1460.92; BIC = 1852.39 and RMSEA = .05 (90% confidence interval ranging from .04 to .05). As mentioned in Chapter 3, the Peer Influence subscale was developed to parallel the Parental Influence subscale; all items of the Peer Influence subscale had item content similar with the item pair of the Parental Influence subscale. According to Byrne (2001), error correlations between item pairs are often an indication of perceived redundancy in item content. Thus, error covariance between the parallel items should be allowed to estimate the measurement model. A review of the modification indexes also suggested allowance of error covariances between these observed variables pairs; PARRO1_5 and PEERRO1_5, PARRO2_3 and PEERRO2_3, PARRO4_6 and PEERRO4_6, PARSUP3_5 and PEERSUP2, PAREN1_5 and PEEREN1_4, PAREN2_3 and PEEREN2_3, PAREN4_6 and PEEREN5, C1 and PEERAC1, LIKEG1 and LIKEG3, FUNEX1 and FUNEX3. Guided by theoretical and statistical points of view, the error covariance of these observed variables were allowed to be estimated: PARRO1_5 and PEERRO1_5, PARRO2_3 and PEERRO2_3, PARRO4_6 and PEERRO4_6, PARSUP3_5 and PEERSUP2, PAREN1_5 and PEEREN1_4, PAREN2_3 and PEEREN2_3, PAREN4_6 and PEEREN5, C1 and PEERAC1, LIKEG1 and LIKEG3, FUNEX1 and FUNEX3. The model was respecified in which these error covariances were estimated (Figure 11) because the item content of each

pair was quite similar. The results showed acceptable fit indices; $\chi 2$ (531, N = 601) = 1027.54, $p < .001$; GFI = .91; CFI = .92; TLI = .91; AIC = 1227.54; BIC = 1661.54; and RMSEA = .04 (90% confidence interval ranging from .039 to .043).

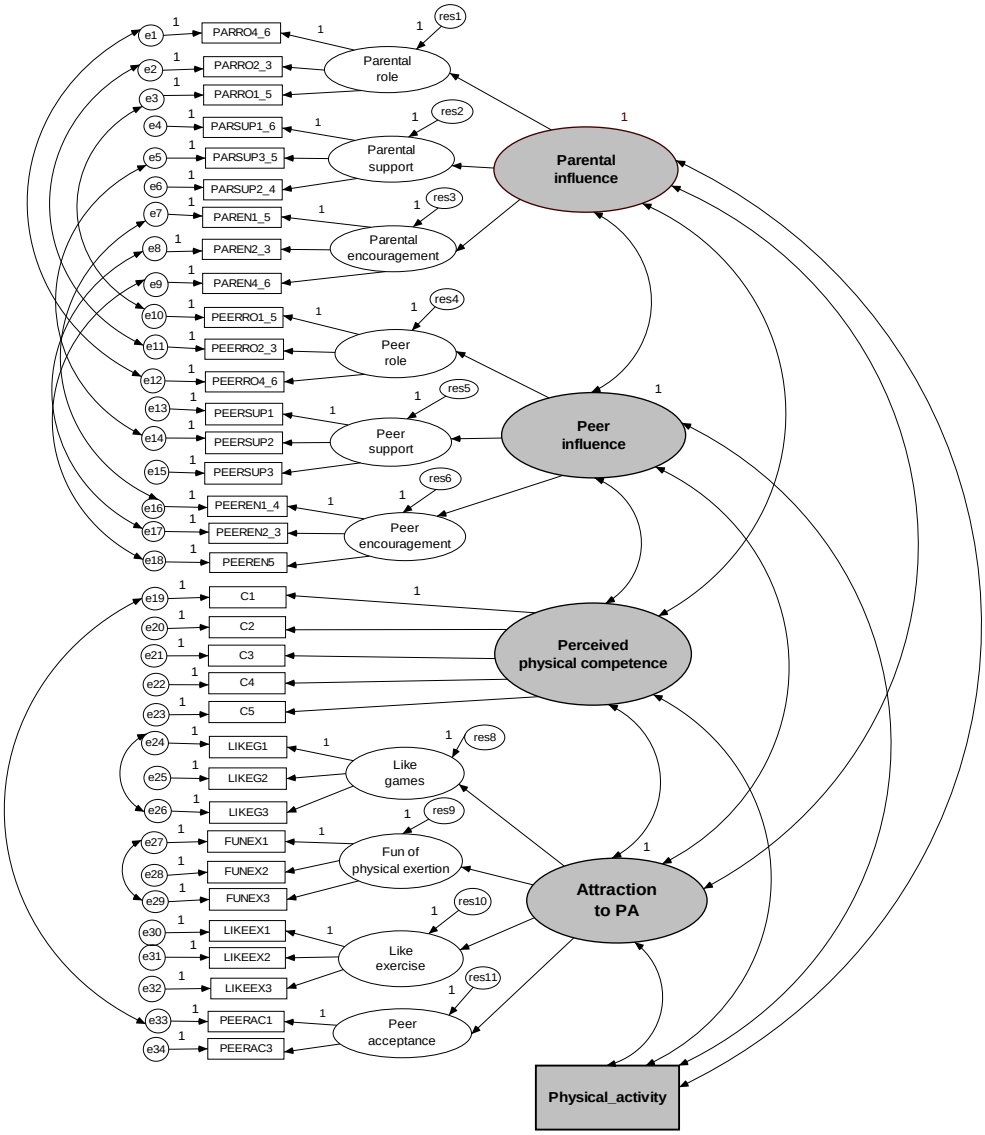

Figure 11. Overall measurement model

Note. Like games = liking of games and sports; Like exercise = liking of vigorous exercise; Peer acceptance = peer acceptance in games and sports; Attraction to PA = attraction to physical activity; Physical_activity = physical activity

Structural Model

The initial structural model of this study was specified to test the hypothesized relationships (hypotheses 2-8). All variables in models A and B were composed as they were specified in the proposed model. Perceived physical competence, attraction to physical activity, parental influence, and peer influence were independent latent variables. The total volume of physical activity (MET-mins) from the MTAPAQ, a measured variable, was used as the dependent variable of the structural model. To estimate the structural model, the variance of two independent variables (parental influence and peer influence) was constrained to 1.00. Furthermore, the first factor loading of each latent variable was constrained to 1.00. For this study, physical activity had only one indicator (MET_mins). Therefore, the variance was constrained to zero (Loehlin, 2004). In the other words, MET_mins (the observed variable) was used as dependent variable. Model estimates and fit indices were assessed to specify improper solutions, hypothesized relationships, and model fit using the same criteria as the measurement model.

The initial structural model: Models A and B

Model A (Figure 12) was specified based on the translation of the proposed measurement model. Although the results of the initial measurement model of parental influence, peer influence, and attraction to physical activity revealed poor fit of the model to the data, they were used to evaluate the initial structural model. As expected, the results of Model A estimations indicated poor fit of the model to sample data; $\chi 2$ (1307, N = 601) = 3289.64, $p < .001$; GFI = .81; CFI = .75; TLI = .73; AIC = 3537.64;

BIC = 4083.07; and RMSEA = .05 (90% confidence interval ranging from .04 to .052).

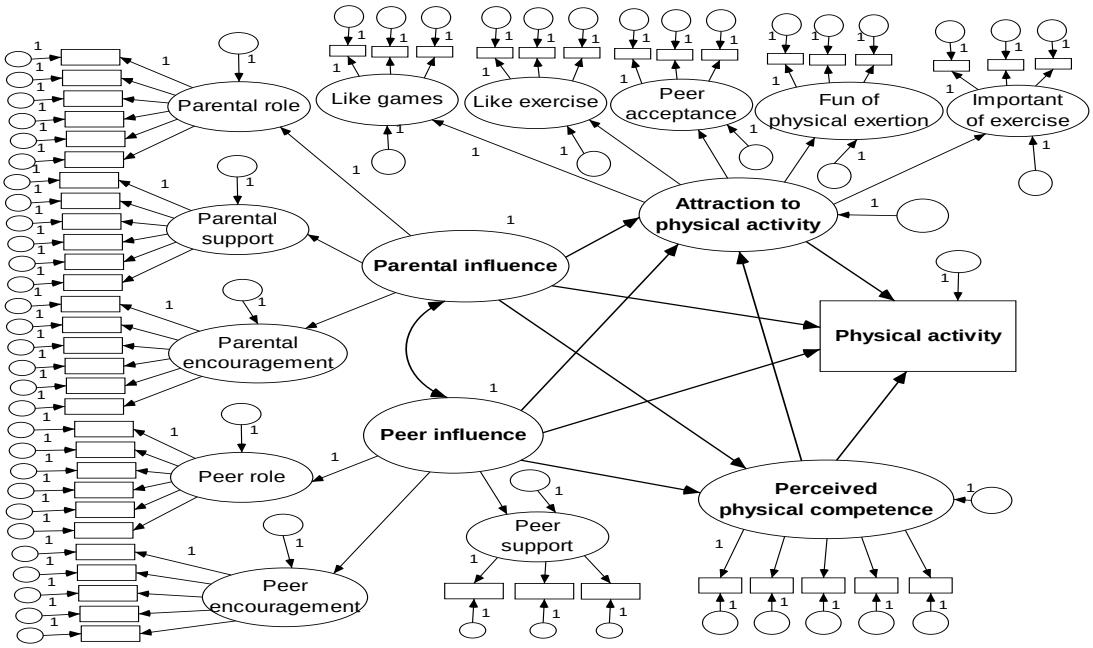

Figure 12. Structural Equation Modeling of Model A

Note. Like games = liking of games and sports; Like exercise = liking of vigorous exercise; Peer acceptance = peer acceptance in games and sports

Model B1 was proposed as a theoretical model of this study. It was constructed based on results from the overall measurement model. The results indicated good fit of the model to the sample data; $\chi 2$ (531, N = 601) = 1027.54, $p < .001$; GFI = .91; CFI = .92; TLI = .91; AIC = 1225.54; BIC = 1661.60 and RMSEA = .04 (90% confidence interval ranging from .036 to .043). However, a review of the estimates revealed that there were five nonsignificant parameters. These parameters were factor loading of parental influence onto attraction to physical activity; factor loading of parental influence onto physical activity; factor loading of perceived physical competence onto physical activity; factor loading of peer influence onto physical

activity; and factor loading of attraction to physical activity onto physical activity (p = .96, .57, .34, .32, and .12 respectively).

The model was re-specified (Model B2, Figure 13) in which four paths (path between parental influence and attraction to physical activity, path between parental influence and physical activity, path between perceived physical competence and physical activity, and path between peer influence and physical activity) were eliminated one at a time with subsequent reanalysis and evaluation of the effect on model fit. The results showed acceptable fit indices; $\chi 2$ (535, N = 601) = 1030.30, p < .001; GFI = .91; CFI = .92; TLI = .91; AIC = 1220.30; BIC = 1638.16; and RMSEA = .04 (90% confidence interval ranging from .036 to .043).

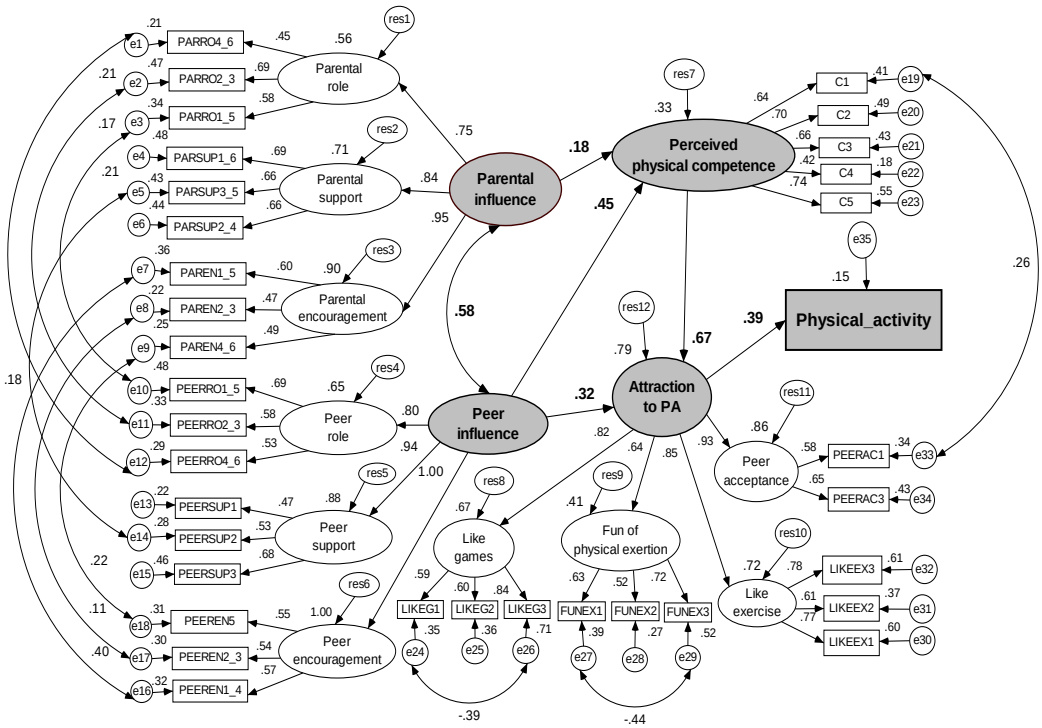

Figure 13. Structural Equation Modeling of Model B2

Note. Like games = liking of games and sports; Like exercise = liking of vigorous exercise; Peer acceptance = peer acceptance in games and sports; Attraction to PA = attraction to physical activity; Physical_activity = physical activity

Finally, Model B2 was selected as the final model based on both theoretical and statistical support. For theoretical support, the results indicated that all the significant paths were in the expected direction. Parental influence had an indirect effect on the physical activity through perceived physical competence and attraction to physical activity. Peer influence had an indirect effect on the physical activity through perceived physical competence and attraction to physical activity. Perceived physical competence had an indirect effect on the physical activity through attraction to physical activity. Attraction to physical activity had a direct effect on the physical activity. Overall, the variables in the model (parental influence, peer influence, perceived physical activity, and attraction to physical activity) accounted for 15% of the variance in physical activity. The direct, indirect, and total effects of parental influence, peer influence, perceived physical competence, and attraction to physical activity on physical activity are shown in Table 15. Standardized coefficients between study variables are shown in Figure 14. For the statistical support, the results indicated good fit of the model to the sample data. All fit indices were acceptable. Compared with another nested model (Model B1), Model B2 showed better fit indices and was more parsimonious. Fit indices of indicators in Models B1and B2 are displayed in Table 16.

Table 15

Standardized Direct, Indirect, and Total Effects of Parental Influence, Peer Influence, Perceived Physical Competence, and Attraction to Physical Activity on Physical Activity

Paths			Effects (standardized)		
			Direct	Indirect	Total
Parental influence	→	Physical activity	.05^{ns}	.04**	.04**
	→	Perceived physical	.18**		.18**
Peer influence	→	Physical activity	.07^{ns}	.24**	.24**
	→	Perceived physical	.45**	.00	.45**
	→	Attraction to physical	.32**	.21**	.53**
Perceived physical	→	Physical activity	.07^{ns}	.26**	.26**
	→	Attraction to physical	.67**	.00	.67**
Attraction to	→	Physical activity	.39**	.00	.39**

^{ns} = non-significant, ** $p < .01$

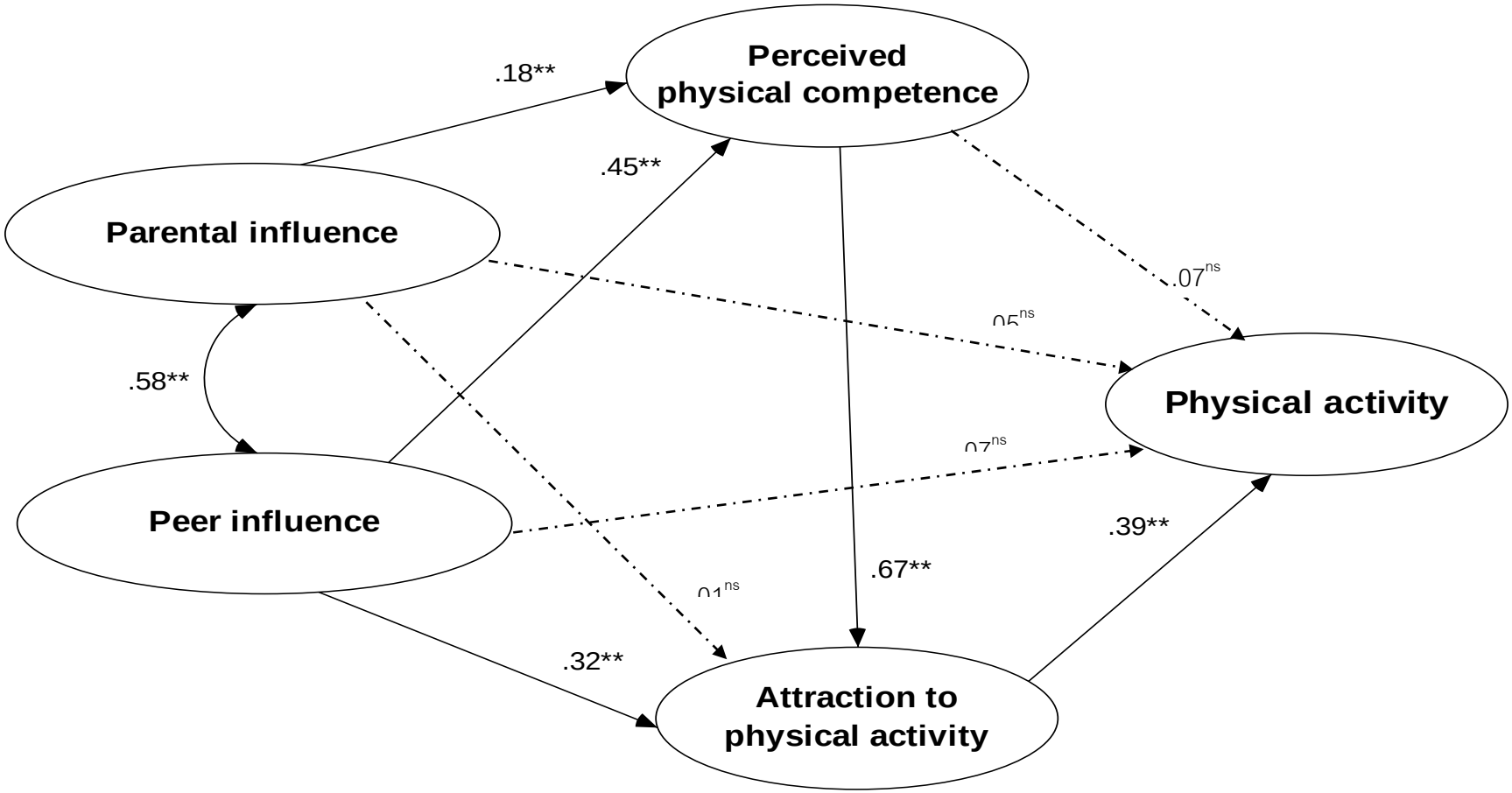

Figure 14. Structural Equation Modeling with standardized coefficients for physical activity in Thai adolescents

ns = non-significant, ** p < .01

Table 16

Fit Indices of Models B1and B2

Fit Index	Model B1	Model B2
Chi-square ($\chi 2$)	1027.54	1030.30
df	531	535
p value	< .001	< .001
GFI	.91	.91
CFI	.92	.92
TLI	.91	.91
RMSEA	.04	.04
AIC	1225.54	1220.30
BIC	1661.00	1638.16

Summary of Hypotheses Testing

Hypothesis 1: There are relationships between perceived physical competence, attraction to physical activity, parental influence, peer influence, and the physical activity of Thai adolescents.

Pearson's correlation coefficients demonstrated the relationships among pairs of variables in the proposed model. Therefore, this hypothesis was supported.

Hypothesis 2: Perceived physical competence has a direct effect on the physical activity of Thai adolescents.

This hypothesis addressed the direct effect of perceived physical competence on physical activity. It was found from the Model B2 that perceived physical competence did not have a direct effect on physical activity. Thus, this hypothesis was not supported.

Hypothesis 3: Perceived physical competence has an indirect effect on the physical activity of Thai adolescents through attraction to physical activity.

Hypothesis 3 addressed an indirect effect of perceived physical competence on physical activity of Thai adolescents through attraction to physical activity. The estimation results of Model B2 demonstrated an acceptable fit of the model to the sample data. The results showed that perceived physical competence had an indirect effect on the physical activity through attraction to physical activity ($\beta = .26$, $p < .01$). Therefore, this hypothesis was supported.

Hypothesis 4: Attraction to physical activity has a direct effect on the physical activity of Thai adolescents.

Hypothesis 4 was that attraction to physical activity has a direct effect on the physical activity of Thai adolescents. This hypothesis was supported. The parameter estimates of Models B2 indicated that attraction to physical activity has a direct effect on the physical activity ($\beta = .39$, $p < .01$). Participants who had high attraction to physical activity reported higher MET-mins of physical activity.

Hypothesis 5: Parental influence has a direct effect on the physical activity of Thai adolescents.

Hypothesis 5 addressed a direct effect of parental influence on the physical activity. The estimation results of Model B2 did not support this hypothesis. Parental influence did not have a direct effect on the physical activity of Thai adolescents.

Hypothesis 6: Parental influence has an indirect effect on the physical activity of Thai adolescents through perceived physical competence and attraction to physical activity.

Hypothesis 6 was that parental influence has an indirect effect on the physical activity through perceived physical competence and attraction to physical activity. The estimation results of Model B2 demonstrated acceptable fit indices. All path coefficients (path between parental influence and perceived physical competence, path between perceived physical competence and attraction to physical activity, and path between attraction to physical activity and physical activity) were significant. Therefore, this hypothesis was supported. Parental influence had an indirect effect on physical activity through perceived physical competence and attraction to physical activity ($\beta = .04$, $p < .01$).

Hypothesis 7: Peer influence has a direct effect on the physical activity of Thai adolescents.

Hypothesis 7 addressed a direct effect of peer influence on the physical activity of Thai adolescents. The estimation results of Model B2 showed that peer influence did not have a direct effect on the physical activity. Thus, this hypothesis was not supported.

Hypothesis 8: Peer influence has an indirect effect on the physical activity of Thai adolescents through perceived physical competence and attraction to physical activity.

This hypothesis addressed an indirect effect of peer influence on the physical activity of Thai adolescents through perceived physical competence and attraction to physical activity. The estimation results of Model B2 showed that all path coefficients (path between perceived physical competence and attraction to physical activity and path between attraction to physical activity and physical activity) were significant. Peer influence has an indirect effect on the physical activity through perceived physical competence and attraction to physical activity ($\beta = .24$, $p < .01$). Thus, this hypothesis was supported.

Discussion of the Results

Demographic characteristics of the sample

Eight hundred and one secondary school students of four public secondary schools located in Had Yai District participated in this study. The data from 200 participants were discarded because of missing data of the MTAPAQ or TCPAC scale, over report of the number of hours in physical activity participation, and having accident or illness during the previous week. The final sample size was 601. The religion of the majority sample of this study was Buddhism (93%), which is similar to other studies (Deenan, 2003; Deenan et al., 2001; Wannasuntad et al., 2007). Gender was not substantially different, though more female participants (58.2%) participated in this study. This finding is consistent with studies in the central part of Thailand

(Deenan, 2003; Deenan et al., 2001). Most of participants played or exercised with their friends (55.9%) which is consistent with the literature that peers may play a more important role for physical activity or exercise of adolescents than parents (Prochaska et al., 2002).

Focused on body mass index, Cole et al. (2000) established the standard definition for child overweight and obesity for international studies. They provided the specific cut off points of body mass index from aged 2 to 18 years to define overweight and obesity. According to their guideline, the prevalence of overweight and obesity of males of this study was 17.49% and 6.73% (total prevalence = 24.22%) whereas the prevalence of overweight and obesity of females was 13.17% and 4.70% (total prevalence = 17.87%). Using the same criteria, this prevalence is lower than the prevalence of overweight and obesity during the past decade in American adolescents but higher than Chinese and Russian adolescents (Wang & Wang, 2002). The prevalence of overweight and obesity in American adolescents between 1988 and 1994 was 26.8% in male and 27.5% in female, whereas the prevalence of overweight and obesity in male and female Chinese adolescents in 1991 was 4.5% and 4.5%, respectively. For Russian adolescents, the prevalence of overweight and obesity of males and females in 1992 was 11.5% and 11.7%, respectively. In addition, the prevalence of overweight and obesity of Thai adolescents in the present study was higher than the prevalence of overweight/obesity in Taiwanese adolescents. The results from the 2001 National Health Interview Survey in Taiwan indicated that the prevalence of overweight and obesity in Taiwanese adolescents using the International Obesity Task Force criteria was 14.04% (Chen, Haase, & Fox, 2007). However, BMI of Taiwanese adolescents was calculated using self-reported body

weight and height. The prevalence of overweight/obesity in Thai adolescents was also higher than the prevalence of overweight/obesity in Vietnamese adolescents in 2004 (20.48% vs. 15.64%, respectively) (Trang, Hong, Dibley, & Sibbrit, 2009).

As reported in Chapter 1, most of Thai parents and adolescents value academic success as a life success. Thus, the large numbers of secondary school students spent many hours for extra-class attendance. As a result, above half of participants (53.91%) had extra classes after school or weekends. It was found from this study that Thai adolescents spent an average 3.49 hours/week (approximately half hour a day) for extra class attendance. Trang and colleagues (2009) also found that Vietnamese students spent approximately 135 minutes/day for attending courses after class.

Focused on two common sedentary behaviors among children and adolescents, 45% of the participants spent more than 2 hours per day for watching television and 10% used a computer or internet more than 2 hours per day. Compared with the previous study in central Thailand, Deenan (2003) found that 63% of the adolescents spent $\geq$ 4 hours for watching television. The result of the present study was very close to the report of Thai Health Promotion Foundation (2006). According to that report, Thai children spent 16.4 hours per week or 2.34 hours per day watching television. Compared with other countries, one national study indicating that U.S. children spent an average of 3.32 hours per day watching television and video and .55 hours per day playing video games (Woodard & Gridina, 2000 as cited by Springer et al., 2006). In Canada, children age 2-11 years spent an average of 14.1 hours per week watching television (Canada's National Statistical Agency, 2006). According to the recommendation of the American Academy of Pediatrics (2001), children and adolescents should not

spend more than 2 hours per day watching television. These data show that children in many countries spent more time watching television than what is recommended.

Level of physical activity

As expected, males participated in physical activities more than females did. This findings is similar to the previous studies in Thailand (Deenan, 2003; Pipatkasira, 2008; Teparatana, 1997) and in others countries (Ekelund et al., 2005; Gillis et al., 2006; Trost et al., 2003; Wu, Pender, & Noureddine, 2003; Wu, Pender, & Young, 2002; Van Der Horst et al., 2007). It is generally accepted that there are gender differences in physical activity levels, with males more active than females. One possible explanation for this could be the different roles the society assigns to boys and girls in general and particularly in relation to physical activity. In Thai society, it appears that males are given more permission than females to explore their physical environment. In addition, boys are more likely to be encouraged to practice physical activity earlier than girls, and girls are less likely than boys to be rewarded for their physical activity.

The results of this study indicated that middle school students (grade 7-9) had a physical activity level higher than high school students (grade 10-12). This finding is similar to the previous study in American adolescents (Schaben et al., 2006). Gillis et al. (2006) also reported a decline in physical activity in adolescence at 12 to 16 years old. Furthermore, Sallis et al. (2000) found that age was negatively associated with adolescent's physical activity. There is a possible explanation for this finding. Thai high school students have to prepare themselves for examinations to apply to a university. Perhaps a greater emphasis placed on academic success by high school

students and parents may have accounted for the lower levels of physical activity. As a result, they spent much of their time on academic study and extra classes in the tutor institute. The results from additional analysis of this study indicated that high school student spent their time for extra class more than middle school students (mean = 4.59 hours/week, SD = 4.47 and mean = 2.25 hours/week, SD = 3.75, respectively).

Analyses of physical activity during different segments of the day showed that adolescents were most active before or after school (60.56%). This finding was very close to the finding of the American study by Going et al. (1999). However, in that study the segments of the day were categorized as before school, during school, and after school. Results indicated that American Indian adolescents had the highest total volume of physical activity for after school time compared with before school and during school. In the context of the secondary schools in Thailand, the students have about 8 to 10 periods per day for academic study (50 minutes per period). They also have 10 minutes between periods for changing their classroom and about 50 minute a day for lunch. Therefore, it was quite difficult for them to play or exercise during school time.

Validity and reliability of the Modified Thai Adolescents Physical Activity Questionnaire

The results from this study provided evidence of moderate validity for the MTAPAQ in assessing physical activity in Thai adolescents. The concurrent validity of MTAPAQ against accelerometer is higher than the previous study conducted by Kijboonchoo et al. (2007). Several explanations could support these findings. Firstly, the TAPAQ developed by Kijboonchoo and her colleagues missed information

relating to walking and transportation physical activity. All participants of the validity study reported walking every day during their monitoring period. However, the frequency and duration they walked varied from one individual to another. For transportation physical activity, 15 (37.5%) participants of the validity study performed this activity and yielded a large number of activity counts. Adding both activities into the questionnaire increased the accuracy of self-report physical activity. Secondly, standing and jumping were categorized into the same dimension in the TAPAQ. Because they did not have the same MET value, they were categorized separately in the MTAPAQ. Thirdly, the questionnaires were checked for discrepancies and validated information with each participant when needed, without intimidating the participants.

The strength of the association between self-report physical activity and objectively assessed physical activity in the present study was similar or even stronger than the previous studies in other populations. It was similar to the study by Ekelund et al. (2005) that assessed the criterion-related validity of a newly developed self-reported 7-day physical activity questionnaire for use in Swedish adolescents with a wide variation in body fatness. That study showed moderate criterion-related validity ($r = 0.49$, $P< 0.001$) of the questionnaire using accelerometer (MTI ActiGraph, Fort Walton Beach, FL) as the criterion. Furthermore, the concurrent validity of MTAPAQ was quite similar to a study of American adolescents by Janz, Lutuchy, Wenthe, and Levy (2008). They reported the association between the total physical activity from Physical Activity Questionnaire for Adolescents and activity counts from ActiGraph activity monitor (model 7164, Fort Walton Beach, FL) was rho = 0.56. Compared with the results of a study by Wong, Leatherdale, and Manske (2006) which

examined the concurrent validity of the School Health Action, Planning and Evaluation System (SHAPES) physical activity questionnaire against the ActiGraph (MTI, model AM7164) in Canadian students (grade 6-12), the present study showed higher concurrent validity ($r = .59$, $p = .01$ vs. Spearman $r = 0.44$, $p < .01$). However, Wong and colleagues examined the correlation between self-reported and accelerometer-measured average daily time spent performing moderate to vigorous physical activity.

Compared to another questionnaire that was modified from the International Physical Activity Questionnaire (IPAQ) and was used in Vietnamese adolescents (Lachat et al., 2008), the results of the present study provided a higher validity value. According to the IPAQ, the participants had to judge the category of the activity that they performed as light, moderate, and vigorous physical activity by themselves. The IPAQ may have been asked general questions and quite difficult to answer, resulting in low concurrent validity of the questionnaire.

The MTAPAQ had an acceptable level of reliability for a newly developed instrument. The test-retest reliability in this study is very close to the previous study by Kijboonchoo and colleagues (2007). By comparison, participants in the current study completed the MTAPAQ on two separate occasions, 3 days apart whereas all participants of Kijboonchoo and her colleagues' study completed the questionnaire within 1 to 3 days apart. The results of the current study suggested that the test-retest reliability of the questionnaire was higher than other questionnaires for adolescents (Lachat et al., 2008; Wong et al., 2006). Wong and colleagues reported moderate agreement (Weighted kappa = .58) for 1-wk test–retest reliability of physical activity level (inactive, moderately active, active) from the SHAPES physical activity

questionnaire in Canadian students (grades 9–12 aged 16 $\pm$ 1.6 years. Compared with another questionnaire for Asian adolescents, the MTAPQ has a higher reliability coefficient than the IPAQ that was translated and used in Vietnamese adolescents. However, Lachat and colleagues examined the test-retest reliability of the questionnaire for a two-week period that may have contributed to the lower correlation coefficient (Spearman coefficient, $\rho = 0.45$).

Measurement model

This study investigated the measurement properties of a questionnaire associated with the Youth Physical Activity Promotion model. The results indicated that the initial model of each subscale had poor to very good fit with the sample data. One subscale which had very good fit was the Perceived Physical Competence subscale. This findings was similar to the previous study in a sample of 296 children in grade 5 to 8 (Rowe, Raedeke, Wiersma, & Mahar, 2007). Other subscales (Attraction to Physical Activity subscale, Parental Influences subscale, and Peer Influence subscale) demonstrated good fit after item removal or item parceling.

For the Attraction to Physical Activity subscale, one item (PEERAC2: *Some kids get teased by other kids when they play games and sports*) was deleted because of a low factor loading. Focused on internal consistency reliability, PEERAC2 had a corrected item-total correlation less than .3. This item was not deleted in the previous study (Rowe et al., 2007). However, the sample of that study was younger than the present study. There was no evidence to show the factor loading of this item in an adolescent population. More information is needed before reaching a conclusion. One

factor (importance of exercise) was dropped from the model of the present study because only 19% of its variance was explained by attraction to physical activity. Importance of exercise was not selected to represent attraction to physical activity in the previous study by Rowe and colleagues because the originator found extremely low internal consistency and subsequently deleted this subscale in his research (Brustad, 1993 as cited by Rowe et al., 2007). A possible explanation for these results was mentioned. Adolescent may not value the health benefit of physical activity because most of them were healthy.

Although the results of CFA of each measurement model showed good fit of the model to the sample data, the results of CFA of the overall measurement model revealed poor fit of the model to the sample data. Some possible explanations are elaborated. First, because the Peer Influence subscale was developed to parallel the Parental Influence subscale, therefore all pair item had similar content. Second, examining the content of each item indicated that the content of LIKEG1 *(Some kids like playing outdoor games and sports)* and LIKEG3 *(For some kids, games and sports is their favorite thing)* was very close. The similar content was also found between FUNEX1 *(Some kids don't like getting sweaty when they exercise or play hard) and* FUNEX3 *(Some kids feel bad when they run hard)*. Perceived redundancy or similarity in item content is one cause of poor fit of the model to the sample data. However, the results of CFA indicated good fit of the model after ten error covariances were allowed to be estimated.

Predictive utility of the determinants of physical activity

This section is organized by discussing the influence of the determinants of physical activity in the proposed structural model that emerged throughout the analytical processes both preliminary analysis and structural equation modeling. It is presented sequentially according to the strengths of each predictor to physical activity from the strongest to the least strong.

Attraction to physical activity.

Attraction to Physical Activity was proposed to have a direct effect on physical activity in Thai adolescents. The results of the present study indicated a positive relationship between attraction to physical activity and physical activity ($r = .29$, $p = .01$). This finding was consistent with those of other researchers (Dollman & Lewis, 2009; Paxton et al., 2004; Schaben et al., 2006; Smith, 2004; Welk et al., 2003). Moreover, the results from the present study confirmed a direct effect of attraction to physical activity on physical activity ($\beta = .39$, $p < .01$). The finding from this study was consistent with the study by Paxton et al. (2004). They found that attraction to physical activity had a direct effect on physical activity of children aged 9 to 14 years. These findings suggested that attraction to physical activity is the most important influence upon physical activity.

Perceived physical competence.

Perceived physical competence was hypothesized to have both direct and indirect effect on physical activity in Thai adolescents. Previous research findings from cross-sectional and longitudinal study suggested the positive relationship

between perceived physical competence and physical activity (Bois et al., 2005; Paxton et al., 2004; Schaben et al., 2006; Welk et al., 2003). The present study also found that perceived physical competence was positively associated with physical activity ($r = .30$, $p = .01$). Although the positive correlation between perceived physical competence and physical activity was found, the path estimate of the final model did not show a significant direct effect of perceived physical competence on physical activity. In other words, hypothesis 2 was not supported. The findings from the present study were consistent with a previous study done by Paxton et al. (2004). They found that the relationship between perceived physical competence and physical activity disappeared when attraction to physical activity was added into the regression model.

The positive correlation between perceived physical competence and attraction to physical activity was also found in the present study ($r = .63$, $p < .01$). This finding was consistent with other researchers (Brustad, 1993; Lau et al., 2007; Paxton et al., 2004; Schaben et al., 2006) that found a link between perceived physical competence and attraction to physical activity. Furthermore, an indirect effect of the perceived physical competence on physical activity were found in this study ($\beta = .26$, $p < .01$).

Focused on predisposing factors in this study, only attraction to physical activity had a direct effect on physical activity, whereas the perceived physical competence had an indirect effect on physical activity. This study lends some support to the results of an American study conducted by Paxton and colleagues (2004), who found the effects of perceived physical competence on physical activity was mediated through attraction to physical activity. According to Welk (1999), children and adolescents who feel capable of competently performing the activity and value

physical activity will be predisposed to an active lifestyle. A possible explanation for these findings is that youths usually value what they are good at doing and pursue things that they value (Welk, 1999). In addition, Paxton and colleagues hypothesized that when adolescents perceived themselves as being good at an activity, they increase their attraction and will do it more often. As a result, children who had higher levels of perceived competence will demonstrate greater attraction to physical activity (Brustad, 1993).

Peer influence.

Peer influence was one of reinforcing factors that was proposed to have an influencing, both direct and indirect effects on physical activity in Thai adolescents. Correlational analysis revealed a positive relationship between peer influence and physical activity ($r = .26$, $p = .01$). These findings are consistent with those of other researchers (De Bourdeaudhuij et al., 2005; Deenan et al., 2001 as cited in Deenan, 2003; Ommundsen et al., 2006; Prochaska et al., 2002; Springer et al., 2006). A direct effect of peer influence on physical activity in Taiwanese adolescent was reported (Wu & Pender, 2002; Wu et al., 2003). However, the present study found that peer influence did not have a direct effect on physical activity in adolescents. A possible explanation for this finding may be that two mediating variables (perceived physical competence and attraction to physical activity) were included in the model. Therefore, the direct effect of peer influence may decrease when more mediating variables were added.

An indirect effect of peer influence on physical activity was confirmed in this study. Peer influence had an indirect effect on physical activity through perceived

physical competence and attraction to physical activity ($\beta = .24$, $p < .01$). The results of this study supported an indirect effect of peer influence on physical activity that was proposed by Welk (1999). The indirect effect of peer influence on physical activity was also found in Taiwanese studies (Wu & Pender, 2002; Wu et al., 2003). They found that peer influence had an indirect effect on physical activity in both male and female adolescents through perceived self-efficacy. The results of this suggested that peers may well provide role model, encouragement, and support for physical activity as well as increase adolescents' beliefs in the competency to perform physical activity. In addition, peers may also increase their attraction through acceptance that they are good at games and sports.

Parental influence.

Parental influence was proposed as the determinant of physical activity in Thai adolescents. According to Welk (1999), parental influence has both direct and indirect effect on physical activity. The relationship between parental influence and health behavior in children and adolescents was reported by previous researches (Baranowski, 1997 as cited in Trost et al., 2003; Jinruang, 2002; Phuphaibul et al., 2005). Focused on physical activity, many aspects of parental influence were associated with children and adolescents' physical activity (Bois et al., 2005; Davidson et al., 2006; Hoefer et al., 2001; Prochaska et al., 2002; Schaben et al., 2006; Trost, et al., 2003;Welk et al., 2003). The relationship between parental influence and physical activity was also found in this study ($r = .18$, $p = .01$).

The results of structural equation modeling showed that parental influence did not have a direct effect on physical activity in adolescents. This finding was quite

similar to the previous study in Taiwanese adolescents (Wu, Pender, & Noureddine, 2003). According to Wu and colleagues, parental influence did not have both direct and indirect effect on adolescents' physical activity. However, this finding was not consistent with the longitudinal study in French children (Bois et al., 2005) and cross-sectional study in American adolescents (Trost et al., 2003). According to Bois and colleagues, the direct effect of mothers' role modeling on French children's time spent in physical activity was demonstrated from structural equation modeling analysis. However, Bois and colleagues conducted a study in a sample of children that younger than the present study (mean aged 9.5 $\pm$ .8 years vs. 15.54 $\pm$ 1.68 years). In addition, they measured only one aspect of parental influences (mothers' role modeling as reflected by mothers' physical activity during the previous 7 days). According to Trost and colleagues, parental support for physical activity had a direct effect on physical activity of 380 students in grades 7 through 12 (mean age = 14.0 $\pm$ 1.6 years). It is interesting that parental support for physical activity in their study was reported by parents.

The findings from the present study indicated that parental influence had an indirect effect on physical activity through perceived physical competence and attraction to physical activity. In other words, parental influence had a direct effect on perceived physical competence and also had an indirect effect on attraction to physical activity. An indirect effect of parental encouragement on attraction to physical activity through perceived physical competence was also found in the previous cross-sectional study (Brustad, 1993). In addition, Schaben et al. (2006) also reported that the effect of parental influence on physical activity may be partially mediated by perceived competence and attraction to physical activity. The result of

the present study revealed that parents may increase adolescents' beliefs in their physical competence with providing a role model, encouragement, and support for physical activity.

Although the correlation between parental influence and physical activity was significant, it was found that the total effect of parental influence on physical activity was lower than peer influence. In addition, it was found that the relationship between parental influence and physical activity was lower than the relationship between peer influence and physical activity. This finding was similar to the previous study by Duncan, Duncan, & Strycker (2005). The results of their study showed that friend social support was found to have the strongest influence on physical activity among youth between the ages of 10 and 14 in a model that included parental and sibling sources of support. According to the findings of Prochaska et al. (2002), although parental and peer support were positively correlated with adolescent physical activity, peer support was a stronger predictor. Most recently, Springer et al. (2006) found that the relationship between peer influence (peer participation and peer encouragement) and moderate to vigorous physical activity was higher than the relationship between family influence (family participation and family encouragement) and moderate to vigorous physical activity in girls aged 10 to 14 years.

The results of the present study indicated that middle school students perceived parental influence higher than high school students did. This result is similar to the findings of Duncan and colleagues (2005) who found that younger adolescents perceived greater social support from parents than did older adolescents. As reported in the Chapter 2, adolescents spend the majority of their time away from direct parental contact. Focused on parental occupation, most of parents (both father

and mother) were holding jobs outside the home. The contact hours between adolescents and their parents in this study may be decreased due to the parents' occupation. It is also possible that parents play a lesser role modeling influence on adolescents' activity than peers do. The role of parental influence on adolescents' health behaviors is believed to decrease with children's age. Also, with advancing age, children usually transition from relying on parents to using peers as major sources of support (McGuire, Hannan, Neumark-Sztainer, Cossrow, & Story, 2002). For the present study, a review of mean scores indicated that the percentage mean score of parental influence was lower than the percentage mean score of peer influence (69.03% and 72.60%, respectively). In addition, the highest number of participants (55%) reported that friends were the most often the persons with whom they played or exercised. These results indicated that adolescents not only perceived more peer influence but also participated in the same physical activities with them.

In conclusion, the results of this study indicated that reinforcing factors (peer influence and parental influence) had only indirect effects on physical activity. This result is similar to the findings of Taymoori, Rhodes, and Berry (2008) who showed indirect effect of social support from mother, social support from father, and social support from friends on physical activity of 558 female Iranian adolescents. However, the results of this study are also contrary to the findings of others who showed both direct and indirect influences of social support on physical activity in adolescents (Motl, Dishman, Saunders, Dowda, & Pate, 2007; Trost et al., 2003). According to Motl and colleagues, the participants were adolescent girls. Further research is clearly needed to determine how reinforcing factors (parental influence and peer influence) influence adolescents' physical activity.

Summary

In sum, the results from structural equation modeling showed an overall good fit between the respecified model (Model B2) and the sample data and indicated that all the significant paths were in the expected direction. Among Thai adolescents, all variables in the proposed model emerged as significant predictors of physical activity. However, the paths in the proposed model (Model B1) were partially supported. Only one variable (attraction to physical activity) had a direct effect on physical activity, whereas the other variables (parental influence, peer influence, and perceived physical competence) had indirect effects on physical activity. The findings indicated that predisposing factors (attraction to physical activity and perceived physical competence) are more important predictors than reinforcing factors (peer influence and parental influence). This finding was relevant to the YPAP model. According to Welk (1999), the predisposing factors are set in the center of the model and it is proposed that they represent the most direct influences on physical activity. Among all the variables in this study, attraction to physical activity was the strongest predictor of physical activity in Thai adolescents ($\beta = .39$, $p < .01$).

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the summary of the research findings, implications, strengths and limitations of this study, and recommendations for future knowledge development.

Summary of the Research Findings

This study aimed to examine the determinants of physical activity in Thai adolescents. An observational, cross-sectional study was conducted with 801 secondary school students. The proposed measurement models were tested and respecified through confirmatory factor analysis with a sample of 601 secondary school students. After that, the proposed structural models were tested and respecified using structural equation modeling analysis.

Four subscales, Perceived Physical Competence subscale, Children's Attraction to Physical Activity subscale, Parental Influence subscale, and Peer Influence subscale, were used to assess the predisposing factors and reinforcing factors according to the Youth Physical Activity Promotion Model. The back-translation technique was conducted with three subscales, the Perceived Physical Competence subscale, Children's Attraction to Physical Activity subscale, and Parental Influence subscale. The Peer Influence subscale was developed to parallel the Parental Influence subscale by the researcher. Reliability of all subscales in a sample of 25 secondary school students was in acceptable range (Cronbach's alpha was range from .81 to .86). Confirmatory factor analysis was

performed to examine the structural validity of these subscales.

Confirmatory factor analysis of an initial measurement model of perceived physical competence demonstrated a good fit. For the initial measurement model of attraction to physical activity, the results of first-order CFA showed the model fit the sample data. Although the results indicated acceptable fit indices, the model was respecified in which one item that had factor loading less than .33 was eliminated from the model. Furthermore, the results of second-order CFA showed that 19% of the variance in the importance of exercise factor was explained by attraction to physical activity whereas more than 50% of the variance in other factors was explained. Thus, the model was respecified in which the importance of exercise factor was eliminated. The four-factor model (11 items) of attraction to physical activity demonstrated good fit and was used in further analysis. A first-order CFA was performed to examine the construct validity of the Parental Influence subscale. The results of CFA indicated poor fit of the model to the sample data. A parceling technique was used to create parcels, then, they were used as indicators of each latent variable. First-order and second-order CFA was performed to examine the structural validity of the Parental Influence subscale. The results indicated good fit of the model to the sample data. Lastly, the results of a first-order CFA of the Peer Influence subscale indicated a poor fit of the model to the sample data. Therefore, parcels were created that were similar to the Parental Influence subscale. The model was examined again and the findings indicated a good model fit.

The overall measurement model that included four latent variables (parental influence, peer influence, perceived physical competence, and attraction to physical activity) and one observed variable (physical activity) was examined using CFA. The

results indicated poor fit of the model to the sample data. Thus, the model was respecified guided by theoretical and statistical points of view, ten error covariances were allowed to be estimated. The results showed acceptable fit indices.

The MTAPAQ was modified from the Thai Adolescent's Physical Activity Questionnaire and used to measure physical activity of Thai adolescents. The concurrent validity of this questionnaire against an objective technique was acceptable. Test-retest reliability in a sample of 30 eleven graders was in the acceptable range. The total volume of physical activity (MET-mins) was used as a single indicator in structural models.

The initial structural model guided by the Youth Physical Activity Promotion Model was specified based on the results from the measurement models of the Parental Influence subscale, Peer Influence subscale, Perceived Physical Competence subscale, and Children's Attraction to Physical Activity subscale to test the hypothesized relationships. The results indicated good fit of the model to the sample data. However, a review of the estimates showed that there were five nonsignificant parameters (factor loading of parental influence onto attraction to physical activity; factor loading of parental influence onto physical activity; factor loading of perceived physical competence onto physical activity; factor loading of peer influence onto physical activity; and factor loading of attraction to physical activity onto physical activity). Therefore, the models were respecified in which four paths were eliminated (path between parental influence and attraction to physical activity; path between parental influence and physical activity; path between perceived physical competence and physical activity; and path between peer influence and physical activity). Finally, the results of the respecified model indicated good fit of the model to the sample data.

Among all psychosocial variables, only attraction to physical activity had a direct effect on physical activity whereas other factors (perceived physical competence provided, peer influence, and parental influence) had indirect effects on physical activity. Overall, the final model accounted for 15% of the variance in physical activity.

Implications

The findings of this study provide several implications for the nursing profession, other professions (such as public health, medicine, and education), and Thai government. Interventions to promote physical activity in Thai adolescents can occur in schools and communities. Nurses (school nurses and community nurses) and physical education teachers may take an important role in promoting physical activity in Thai adolescents. To promote physical activity in this population, four determinants should be the focus. Nurses and physical education teacher should start by assessing the adolescent's physical activity level and the determinants of physical activity. For example, the nurse and teacher should assess pattern of physical activity; preferred activities; attraction to physical activity; perceived physical competence; perception of peer influence; and perception of parental influence. Physical activity interventions can then be developed for the individual that focuses on the most relevant sources of motivation as well as their personal concerns.

The roles of attraction to physical activity, perceived physical competence, perception of peer influence, and perception of parental influence are substantial in influencing physical activity and must be considered in the promotion of physical activity. Physical activity promotion strategies that target attraction to physical

activity, perceived physical competence, perception of peer influence, and perception of parental influence should be developed.

Because the attraction to physical activity was only one of the variables that had a direct effect and explained a relatively large proportion of the variance in physical activity, in order to design intervention programs to enhance participation in physical activity, a strong emphasis could be placed on enhancing adolescents' attraction to physical activity. Such an intervention may use a focus group interview or participatory action research process to determine an individual's feeling about physical activity and the type of physical activity adolescents find most attractive.

A strong indirect effect between perceived physical competence and physical activity also was suggested. Therefore, an intervention to enhance perceived physical competence should be emphasized. To enhance confidence and perceived physical competence in Thai adolescent, intervention strategies may include providing enjoyable, rewarding, and preferred activities in which they can experience personal success in performing physical activity. In addition, the fact that these Thai adolescent girls rated themselves as lower on the perceived physical competence than their male peers suggests the need to identify specific areas in which these girls do not feel confident and to design interventions to develop their mastery and confidence to perform regular physical activity.

Focusing on reinforcing factors, peers had the strongest direct effect on perceived physical competence and attraction to physical activity for Thai adolescents. Interventions to promote physical activity in this group may best be promoted through peers. That is, greater emphasis might be placed on developing physical activity or recreational clubs and "peer groups" to assist less active

adolescents in increasing their attraction to physical activity and perceived physical competence. An indirect effect of parental influence on physical activity was also found in this study. When promoting physical activity in these adolescents, health-promotion efforts should rely not only on attraction to physical activity, perceived physical competence, and peer influence, but also on parental influence. To create the perception of parental influence, three aspects of parental support should be targeted; support, role modeling, and encouragement.

To sustain physical activity in adolescence, the policy to support these behaviors are needed. For example, school should provide safe recreational facilities and increase the opportunity for students to spend time outdoors. In addition, sport day or sport competitions should be arranged to enhance physical activity in adolescents.

Strengths and Limitations

Strengths of this study are related to theoretical and methodological issues. The theoretical model proposed in the present study was derived from theoretical framework used in explaining the correlates of physical activity in youth. This study provides additional support for the empirical adequacy of the Youth Physical Activity Promotion Model. For methodological aspects, this study used a large sample size that resulted in power sufficient to detect effects. In addition, an effort was made to draw representative samples from different regions of the city through stratified random sampling to be able to more broadly generalize the findings to Thai adolescents across the district. Furthermore, statistical analysis using the SEM technique gave the best and most precise estimations of all hypothesized relationships. Another strength of the present study was an examination of the concurrent validity of the MTAPAQ against

objective technique. This effort provided an acceptable level of validity and reliability for the newly developed instrument used to assess physical activity, and contributed to the validity of the study.

Although, these findings partially supported the proposed model, four limitations in the study should be mentioned. First, there was a wider age range of adolescents completing the questionnaires than has been used in previous studies (Schaben, 2006; Welk, 2002). This range may impact on the validity of measures, as there is evidence that factor structure may fluctuate across age groups (Paxton et al., 2004). Further this could alter potential relationships. Second, because the present study did not perform a cluster analysis to examine the cluster effect of personal demographic characteristics and physical environment variables on psychosocial variables and physical activity, caution should be used when drawing conclusions. Third, majority of the participants in this study were Buddhist and most of them were studying in secondary school located outside the municipality. To generalize across the population these demographic characteristics of the sample should be considered. Fourth, the study design was cross-sectional; it does not allow for interpreting the results to suggest that perceptions of physical competence lead to attraction to physical activity, which, in turn, leads to physical activity. However, the theoretical structure was based on literature review and the data was collected on two occasions (two weeks apart). Further research should examine this relationship in an experimental design to determine the causal nature of these relationships. Fifth, the moderate concurrent validity of the MATPAQ (r =. 59) may have influenced the relationships between the study variables.

Future Research and Recommendations

Several areas of future research are recommended. First, the finding that the MTAPAQ had moderate concurrent validity suggests future studies to modify this questionnaire. To begin such a study, this questionnaire should be further revised and tested for validity against an objective technique again with a larger sample size. Second, both genders and a wide range of age groups of participants were included in this study. Several studies can be conducted to see whether or not the model fit to the sample data in each group of males and females. Also, the age group of participants can be separated between middle school students (grade 7-9) and high school students (grade 10-12). Third, an intervention research study is also recommended. Parental influence, peer influence, perceived physical competence, and attraction to physical activity demonstrated the effects on physical activity. Therefore, an intervention program that includes strategies to enhance parental influence, peer influence, perceived physical competences, and attraction to physical activity should be developed and tested. Fourth, the variables in the proposed model of this study explained only 15% of the variance in physical activity, additional variables from the Youth Physical Activity Promotion model such as enabling factors (access to sport equipment, fitness, and body fat) and personal demographic (age, gender, and socioeconomic status) need to be considered and incorporated in future research.

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APPENDICES

APPENDIX A

INFORMED CONSENT FORM

เรียน ผู้ปกครองของ ด.ญ./ด.ช./นางสาว/นาย.....

ดิฉัน นางพิสมัย วัฒนสิทธิ์ อาจารย์ประจำภาควิชาการพยาบาลกุมารเวชศาสตร์ คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์ อ.หาดใหญ่ จ. สงขลา กำลังศึกษาปัจจัยทำนายการเคลื่อนไหวร่างกายของวัยรุ่นไทย โดยใช้แบบสอบถามในการเก็บรวบรวมข้อมูลจากนักเรียนชั้นมัธยมศึกษาปีที่ 1-6 การศึกษานี้เป็นส่วนหนึ่งของการศึกษาในหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาการพยาบาล คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์

ในการนี้ดิฉันขอความร่วมมือจากบุตรของท่านในการตอบแบบสอบถามเกี่ยวกับกิจกรรมการเคลื่อนไหวร่างกายและแบบสอบถามปัจจัยที่สัมพันธ์กับการเคลื่อนไหวร่างกาย ซึ่งข้อมูลที่ได้จากการศึกษาครั้งนี้จะถูกเก็บเป็นความลับและนำเสนอโดยภาพรวมเท่านั้น ถ้าบุตรของท่านไม่ยินดีที่จะเข้าร่วมในการศึกษาครั้งนี้บุตรของท่านสามารถปฏิเสธหรือถอนตัวออกจากการศึกษาได้ตลอดเวลาที่ต้องการ ซึ่งการปฏิเสธหรือถอนตัวจากการศึกษาดังกล่าวจะไม่มีผลกระทบใดๆต่อบุตรของท่าน

ดิฉันยินดีที่จะตอบข้อสงสัยเกี่ยวกับการศึกษาครั้งนี้ตลอดเวลา ท่านสามารถติดต่อดิฉันได้ที่ โทร. 086-9624427

ขอขอบคุณที่ให้ความร่วมมือ

(นางพิสมัย วัฒนสิทธิ์)

สำหรับผู้ปกครอง

ข้าพเจ้าและบุตรได้รับทราบรายละเอียดของการศึกษาครั้งนี้ และยินดีให้บุตรเข้าร่วมในการศึกษาครั้งนี้

ลงชื่อ..... (ผู้ปกครอง) วันที่.....

APPENDIX B

INFORMED ASSENT FORM

เรียน ด.ญ./ด.ช./นางสาว/นาย.....

ดิฉัน นางพิสมัย วัฒนสิทธิ์ อาจารย์ประจำภาควิชาการพยาบาลกุมารเวชศาสตร์ คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์ อ.หาดใหญ่ จ. สงขลา กำลังศึกษาปัจจัยทำนายการเคลื่อนไหวร่างกายของวัยรุ่นไทย โดยใช้แบบสอบถามในการเก็บรวบรวมข้อมูลจากนักเรียนชั้นมัธยมศึกษาปีที่ 1-6 การศึกษานี้เป็นส่วนหนึ่งของการศึกษาในหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาการพยาบาล คณะพยาบาลศาสตร์ มหาวิทยาลัยสงขลานครินทร์

ในการนี้ดิฉันขอความร่วมมือจากท่านในการตอบแบบสอบถามเกี่ยวกับกิจกรรมการเคลื่อนไหวร่างกายและแบบสอบถามปัจจัยที่สัมพันธ์กับการเคลื่อนไหวร่างกาย ข้อมูลที่ได้จากการศึกษาครั้งนี้จะถูกเก็บเป็นความลับและนำเสนอโดยภาพรวมเท่านั้น ถ้าท่านไม่ยินดีที่จะเข้าร่วมในการศึกษาครั้งนี้ท่านสามารถปฏิเสธหรือถอนตัวออกจากการศึกษาได้ตลอดเวลาที่ต้องการ ซึ่งการปฏิเสธหรือถอนตัวจากการศึกษาดังกล่าวจะไม่มีผลกระทบใดๆต่อท่านและเกรดของท่าน

ดิฉันยินดีที่จะตอบข้อสงสัยเกี่ยวกับการศึกษาครั้งนี้ตลอดเวลา ท่านสามารถติดต่อดิฉันได้ที่ โทร. 086-9624427 หรือ 074-284847

ขอขอบคุณที่ให้ความร่วมมือ

(นางพิสมัย วัฒนสิทธิ์)

สำหรับผู้เข้าร่วมวิจัย

ข้าพเจ้าได้รับทราบรายละเอียดของการศึกษาครั้งนี้ และยินดีเข้าร่วมในการศึกษาครั้งนี้

ลงชื่อ..... (ผู้เข้าร่วมวิจัย) วันที่.....

APPENDIX C

DEMOGRAPHIC DATA QUESTIONNAIRE

ส่วนที่ 1 ข้อมูลทั่วไป

1. ชื่อ.....เพศ……เกิดวันที่.....เดือน.....พ. ศ. .....
2. เรียนอยู่ชั้น.....โรงเรียน.....
3. น้ำหนัก...../.....กิโลกรัม ส่วนสูง...../.....เซนติเมตร
4. นับถือศาสนา

   ☐ พุทธ ☐ อิสลาม ☐ คริสต์ ☐ อื่นๆ ระบุ.....

5. นักเรียนเป็นนักกีฬาของโรงเรียน หรือหน่วยงานอื่นๆ หรือไม่

   ☐ ไม่เป็น ☐ เป็น ระบุชนิดกีฬา .....

6. เมื่ออาทิตย์ที่แล้ว นักเรียนไม่สบาย หรือ เกิดอุบัติเหตุ จนต้องขาดเรียน หรือไม่

   ☐ ไม่ใช่ ☐ ใช่ หยุดเรียน.....วัน

7. อาชีพมารดา

   ☐ แม่บ้าน ☐ เอกชน/ บริษัท ☐ รับราชการ/ รัฐวิสาหกิจ ☐ เกษตรกรรม ☐ ค้าขาย/ธุรกิจส่วนตัว ☐ อื่นๆ ระบุ.....

8. อาชีพบิดา

   ☐ พ่อบ้าน ☐ เอกชน/ บริษัท ☐ รับราชการ/ รัฐวิสาหกิจ ☐ เกษตรกรรม ☐ ค้าขาย / ธุรกิจส่วนตัว ☐ อื่นๆ ระบุ.....

9. รายได้ของบิดาและมารดารวมกัน .....บาท/เดือน

ส่วนที่ 2 ข้อมูลเกี่ยวกับปัจจัยด้านสิ่งแวดล้อม

1. นักเรียนมีอุปกรณ์ที่ใช้ในการเล่น ออกกำลังกาย หรืออุปกรณ์กีฬาอะไรบ้างที่เป็นของตนเอง .....

.....

2. บ้านของนักเรียนมีคอมพิวเตอร์หรือไม่

   ☐ มี ☐ ไม่มี

3. นักเรียนใช้เวลาในการเรียนพิเศษ .....ชั่วโมง/สัปดาห์

4. นักเรียนมีสถานที่สำหรับเล่น ออกกำลังกาย หรือเล่นกีฬาที่อยู่ใกล้บ้านของท่านหรือไม่

   ☐ ไม่มี ☐ มี (เป็นสถานที่ของราชการ) ☐ มี (เป็นสถานที่ของเอกชน)

5. นักเรียนเล่น ออกกำลังกาย หรือเล่นกีฬากับใครบ่อยที่สุด

   ☐ คนเดียว ☐ เพื่อน ☐ พี่/น้อง ☐ บิดา ☐ มารดา

   ☐ ผู้ปกครอง ☐ ญาติ ☐ เพื่อนบ้าน ☐ ครู ☐ อื่นๆ ระบุ.....

6. นักเรียนเล่น ออกกำลังกาย หรือเล่นกีฬาช่วงเวลาใดมากที่สุด

   ☐ ช่วงระหว่างอยู่ในโรงเรียน ☐ ก่อนไปหรือหลังกลับจากโรงเรียน

7. นักเรียนเล่น ออกกำลังกาย หรือเล่นกีฬาที่ใดบ่อยที่สุด

   ☐ บริเวณบ้าน ☐ โรงเรียน ☐ สถานที่ออกกำลังกาย

APPENDIX D

EXAMPLE ITEMS OF THE THAI CHILDREN'S PHYSICAL ACTIVITY CORRELATES (TCPAC) SCALE

แบบวัดปัจจัยที่มีความสัมพันธ์กับการเคลื่อนไหวร่างกายของเด็กและวัยรุ่น

.....

คำชี้แจง : ข้อความต่อไปนี้ถามความสนใจของคุณเกี่ยวกับการทำกิจกรรมการเคลื่อนไหวร่างกาย

: กรุณาอ่านตัวอย่างคำถามในแต่ละข้อ ตัดสินใจว่าเด็กกลุ่ม A หรือ B ตรงกับตัวคุณมากที่สุด เมื่อเลือกกลุ่มได้แล้ว พิจารณาว่าข้อความนั้นเป็นจริงทั้งหมดหรือเป็นจริงเพียงบางส่วน

: โปรดเลือกเพียงคำตอบเดียวแล้วทำเครื่องหมาย **X** ในช่องที่เลือก จำไว้ว่าไม่มีคำตอบที่ถูกหรือผิด เพียงแค่เลือกคำตอบที่ตรงกับตัวคุณมากที่สุด

	เป็นความจริงสำหรับฉันมาก	เป็นความจริงสำหรับฉันอยู่บ้าง	กลุ่มตัวอย่าง A	แต่	กลุ่มตัวอย่าง B	เป็นความจริงสำหรับฉันอยู่บ้าง	เป็นความจริงสำหรับฉันมาก
1.			เด็กบางคนชอบเล่นเกมการละเล่นหรือเล่นกีฬากลางแจ้ง	**แต่**	เด็กคนอื่นๆอยากเล่นอยู่ภายในอาคารมากกว่า		
2.			เด็กบางคนไม่ชอบการมีเหงื่อออกมากเมื่อเขาเหล่านั้นออกกำลังกายหรือเล่นอย่างหนัก	**แต่**	เด็กคนอื่นๆไม่สนใจว่าจะมีเหงื่อออกมากหรือไม่เมื่อเขาเหล่านั้นออกกำลังกายหรือเล่นอย่างหนัก		
51.			เด็กบางคนมีพ่อแม่ที่กระตุ้นให้เขาใช้ความพยายามอย่างเต็มที่ในการเล่นเกมการละเล่น	**แต่**	เด็กคนอื่นๆมีพ่อแม่ที่ไม่ค่อยกระตุ้นเขามากนักในการเล่นเกมการละเล่นและกีฬา		
52.			เด็กบางคนมีเพื่อนที่กระตุ้นให้เขาใช้ความพยายามอย่างเต็มที่ในการเล่นเกมการละเล่นและกีฬา	**แต่**	เด็กคนอื่นๆมีเพื่อนที่ไม่ค่อยกระตุ้นเขามากนักในการเล่นเกมการละเล่นและกีฬา		

APPENDIX E

EXAMPLE ITEMS OF THE MODIFIED THAI ADOLESCENT'S PHYSICAL ACTIVITY QUESTIONNAIRE (MTAPAQ)

กิจกรรม	จำนวนวันที่ทำกิจกรรมในช่วง 7 วัน ที่ผ่านมา	ใช้เวลาวันละเท่าไร	
1. กิจกรรมที่นั่งนิ่งๆ เป็นส่วนใหญ่ ● นั่งดูโทรทัศน์ …… ●	.....วัน	.....ชั่วโมง	..... นาที
2. เกมหรือกิจกรรมการเล่นที่มักจะนั่งทำเป็นส่วนใหญ่ (เช่น นั่งประดิษฐ์ของเล่น นั่งปั้นดินน้ำมัน เล่นหมากกระดาน ต่อจิ๊กซอว์ นั่งเล่นดนตรี)	..... วัน	..... ชั่วโมง	..... นาที
3. เกมหรือกิจกรรมการเล่นที่มีการเคลื่อนไหวเป็นส่วนใหญ่ (เช่น เล่นกระต่ายขาเดียว วิ่งเปี้ยว ตี่จับ เล่นเตย กระโดดกบ เก้าอี้ดนตรี ชักเย่อ งูกินหาง อีกาฟักไข่ ซ่อนแอบ เล่นว่าว	..... วัน	..... ชั่วโมง	..... นาที
4. กิจกรรมกายบริหารและการออกกำลังกาย ● กายบริหารที่มักกระโดดเป็นส่วนใหญ่ เช่น กระโดดเชือก กระโดดตบ สกอตจั้ม ● กายบริหารที่มีการวิ่งเป็นส่วนใหญ่ เช่น วิ่งเล่น วิ่งออกกำลังกาย วิ่งซิกแซก วิ่งเตะขา วิ่งก้มแตะ วิ่งข้ามสิ่งกีดขวาง ● กายบริหารที่มีการยืนเป็นส่วนใหญ่ เช่น ยืนขาเดียว ยืนเตะขา ยืนกางแขน ● ● ปั่นจักรยาน (ไม่รวมการเดินทางไปหรือกลับจากโรงเรียน)	..... วัน ..... วัน ..... วัน ..... วัน	..... ชั่วโมง ..... ชั่วโมง ..... ชั่วโมง ..... ชั่วโมง	..... นาที ..... นาที ..... นาที ..... นาที

กิจกรรม	จำนวนวันที่ทำกิจกรรมในช่วง 7 วัน ที่ผ่านมา	ใช้เวลาวันละเท่าไร	
5. กิจกรรมการเดิน	..... วัน	..... ชั่วโมง	..... นาที
6. กีฬา			
● ฟุตบอล	..... วัน	..... ชั่วโมง	..... นาที
● วอลเลย์บอล	..... วัน	..... ชั่วโมง	..... นาที
●			
● ยิมนาสติก	..... วัน	..... ชั่วโมง	..... นาที
7. กิจกรรมเกี่ยวกับงานบ้านและการดูแลบ้าน			
● ซักรีดเสื้อผ้า (เช่น ซักผ้า ตากผ้า พับผ้า รีดผ้า)	..... วัน	..... ชั่วโมง	..... นาที
● ช่วยทำอาหาร ล้างจาน	..... วัน	..... ชั่วโมง	..... นาที
●			
8. กิจกรรมการเคลื่อนไหวร่างกายที่เกี่ยวกับการเดินทาง			
● เดินไปหรือกลับจากโรงเรียน	..... วัน	..... ชั่วโมง	..... นาที
● ปั่นจักรยานไปหรือกลับจากโรงเรียน	..... วัน	..... ชั่วโมง	..... นาที

APPENDIX F

EXAMPLE OF THE COMPENDIUM OF ENERGY EXPENDITURES FOR YOUTH

Code	Activity	MET
122160	listening to music/radio – sitting	1.3
121130	sitting at the movies/cinema/theatre	1.2
121050	watching TV – sitting	1.2
240052	walking - moderate effort	3.6
341752	aerobics/health hustle - moderate effort	6.2
341652	athletics (track and field): jumping - moderate effort	6.0
341672	athletics (track and field): throwing - moderate effort	4.0
342012	badminton - moderate effort	4.5
342031	basketball - light effort	7.2
342032	basketball - moderate effort	8.2
341082	calisthenics - moderate effort	5.8
341132	dancing (general) - moderate effort	5.5
342252	European handball (team) - moderate effort	8.0
321870	fishing	3.0
341212	golf - moderate effort	4.3
341222	gymnastics - moderate effort	4.0
331330	juggling	4.0
341322	karate/martial arts/judo /kick boxing - moderate effort	10.0
341992	unstructured outdoor play - moderate effort	5.0
332040	pool/billiards/snooker	2.5
341242	riding a bicycle/bike - moderate effort	6.2
341482	running/jogging - moderate effort	8.5
341472	skipping/jump rope - moderate effort	8.3

Code	Activity	MET
342182	soccer (field/indoor) - moderate effort	8.8
331590	stretching exercises	2.5
341932	swimming (playing in pool) - moderate effort	4.0
341612	swimming laps - moderate effort	9.9
342622	table tennis - moderate effort	4.0
331630	tai chi/yoga	2.5
342642	tennis (court) - moderate effort	7.0
342692	volleyball (court) - moderate effort	4.0
420000	arts and crafts - sitting	1.6
420050	computer work (e.g. typing/internet)	1.8
420030	studying/homework	1.4
622030	child care (e.g. feeding)	2.5
632050	doing the laundry	2.6
641120	mopping	3.6
642260	washing car or windows	3.0
630270	washing or clearing dishes	1.9
643280	watering plants	2.5

Note. From “Development of a compendium of energy expenditures for youth” by K., Ridley, B. E., Ainsworth, and T. S., Olds, 2008, *International Journal of Behavioral Nutrition and Physical Activity*, 5, 8 pages. [Electronic Version].

APPENDIX G

INTERNATIONAL CUT OFF POINTS FOR BODY MASS INDEX FOR OVERWEIGHT AND OBESITY

Age (years)	Body mass index 25 kg/m^2		Body mass index 30 kg/m^2	
	Males	Females	Males	Females
11	20.55	20.74	25.10	25.42
11.5	20.89	21.20	25.58	26.05
12	21.22	21.68	26.02	26.67
12.5	21.56	22.14	26.43	27.24
13	21.91	22.58	26.84	27.76
13.5	22.27	22.98	27.25	28.20
14	22.62	23.34	27.63	28.57
14.5	22.96	23.66	27.98	28.87
15	23.29	23.94	28.30	29.11
15.5	23.60	24.17	28.60	29.29
16	23.90	24.37	28.88	29.43
16.5	24.19	24.54	29.14	29.56
17	24.46	24.70	29.41	29.69
17.5	24.73	24.85	29.70	29.84
18	25	25	30	30

Note. International cut off points for body mass index for overweight and obesity by sex between 11 and 18 years, defined to pass through body mass index of 25 and 30 kg/m^2 at age 18, obtained by averaging data from Brazil, Great Britain, Hong Kong, Netherlands, Singapore, and United States. From “Establishing a standard definition for child overweight and obesity worldwide: International survey” by T. J., Cole, M. C., Bellizzi, K. M.,Flegal, and W. H., Dietz, 2000, *BMJ, 320*, 1-6.

APPENDIX H

LIST OF EXPERTS

LIST OF EXPERTS

The translation and back-translation process of the Children's Physical Activity Correlates scale was performed by three experts:

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Wandee Suttharangsee, RN, Ph.D.

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Assistant Professor

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VITAE

Name Mrs. Pissamai Wattanasit

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Educational Attainment

Degree	Name of Institution	Year of Graduation
Predoctoral Visiting Fellow	University of Texas Health Science Center at Houston, School of Nursing, TX, USA	2009
M.N.S. (Pediatric Nursing)	Mahidol University, Ramathibodi School of Nursing, Bangkok, Thailand	2000
B.Sc. (Nursing)	Faculty of Nursing, Khon Kaen University, Khon Kaen, Thailand	1987

Scholarship Awards during Enrolment

2006-2008	Doctoral scholarship, Prince of Songkla University and Faculty of Nursing, Prince of Songkla University
2007-2008	The Dissertation grant, the Faculty of Graduate Studies, Prince of Songkla University
2008	Predoctoral scholarship, Prince of Songkla University and Faculty of Nursing, Prince of Songkla University
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List of Publication and Proceedings

Publication

Sripotchanart, W., Wattanasit, P., Impat, A., Nakdam, P., & Changplary, C. (2008). A follow-up study of graduate nurses of Faculty of Nursing, Prince of Songkla University, academic year 2003. *Songklanagarind Journal of Nursing*, *28*(2), 53-70.

Punthmatharith, B., Buddharat, U., & Wattanasit, P. (2008). Quality of life and factors influencing quality of life of cancer children in southern Thailand. *Songklanagarind Medical Journal*, *26*(5), 501-511.

Presentation (International)

Wattanasit, P., Prateepchaikul, L., Petpichetchian, W., Meininger, J. C., & Kijboonchoo, k. (2009, April). *Validity and Reliability of the Modified Thai Adolescent's Physical Activity Questionnaire (MTAPAQ)*. Poster session presented at the Texas Obesity Research Center, University of Houston Inaugural Conference, Texas, United States of America.