ABSTRACT

Title of Dissertation: EXAMINING THE RELATION BETWEEN STUDENT EXPECTANCY-VALUE MOTIVATION, ACHIEVEMENT IN MIDDLE-SCHOOL PHYSICAL EDUCATION, AND AFTER-SCHOOL PHYSICAL ACTIVITY PARTICIPATION

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The expectancy-value theory (Eccles et al., 1983) explains that student motivation is primarily determined by one's expectancy-beliefs, task values, and perception of the task, and that these factors directly influence student achievements and behavior choices. Based on the expectancy-value theory, the purpose of this study sought to unravel the relation among middle-school students' expectancy-value motivation, achievement in physical education, and after-school physical activity participation. Participants consisted of 854 sixth, seventh, and eighth grade students in 13 schools from a large metropolitan school district. Students' expectancy-value motivation was measured using the expectancy-value questionnaire; achievements in physical education was measuring using pre-posttest on psychomotor skill (including badminton striking and basketball dribbling skills) and fitness knowledge; after-school physical activity participation data were collected using three-day Physical Activity Recall. Data were analyzed both quantitatively using inferential statistics and structural equation modeling, and qualitatively using open coding approach. The results of the study suggested that middle-school students' expectancy beliefs and task values were relatively high (~4 on a 5-point scale) and their psychomotor skill (i.e., badminton striking skill) and fitness knowledge significantly improved in physical education over the academic year. Further analyses using structural equation modeling revealed that students' expectancy beliefs significantly predicted their psychomotor achievement, which in turn predicted their after-school physical activity participation. The model explained about 14.6% of variance in psychomotor achievement and 3.3% in students' after-school physical activity participation. Cost is a critical component in the expectancy-value theory. All three dimensions of cost conceptualized by Eccles et al. (1983) were identified in the data. Students' cost conceptions were found associated with task values, not with expectancy beliefs and achievements. Despite the cost, most of the students expressed high willingness to attend physical education for motivational purposes and health benefits from physical activities. The findings of this study imply that students tend to have high expectancy-value motivation in physical education. The motivation is likely to have small but significant predication of psychomotor skill improvement; which, in turn, related with after-school physical activity participation.

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Dedication

To my parents, who have not had the opportunity for higher education, but value and understand the meaning of it.

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CHAPTER I

INTRODUCTION

Middle school students have drawn plenty of attention from scholars due to their enduring adjustment to changes in school life and their distinctive developmental needs (Anfara, Mertens, & Caskey, 2007). Scholars (Eccles, Lord, Roeser, Barber, & Jozefowicz, 1997) believe that the transition from elementary into middle school has caused maladjustments for young adolescents who are experiencing various developmental changes. Keeping middle school students well-adjusted and motivated for academic achievement has become an important task for educators because of the transition and developmental changes (Eccles et al., 1997). Unfortunately, as students grow older, their achievement motivation for learning in physical education, sport, and other disciplines is likely to decline (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Xiang, McBride, & Bruene, 2006). Specifically for physical education, although students generally are motivated to participate in physical education (Chen, Chen, & Zhu, 2009), research indicates that more than 50% percent of adolescents ranked physical education as the least important subject in their curriculum (Tannehill, Romar, O'Sullivan, England, & Rosenberg, 1994). The fact that students are motivated to but not value physical education have piqued researchers' interest in examining motivation and learning in physical education classes in terms of students' perceptions of values (Chen & Ennis, 2004; Goodlad, 2004).

Student learning in physical education is multidimensional and derived from multiple sources. Physical education classes in schools are considered by some as the most important and meaningful venues to provide sources of knowledge, skills, and motivation for students to participate in physical activities (National Association of Sport and Physical Education [NASPE], 2004). Yet as students progress into their teen-age years most of them are likely to drop physical education as an area of study and stop frequent physical activity (Placek, Griffin, Dodds, Raymond, Tremino, & James, 2001). Adolescents in middle and high schools tend to become disengaged and some of them even display frequent disruptive behavior (Ennis, 2000). The shrinking number of classes and student disengagement undoubtedly result in poor motivation and achievements in physical education. Consequently, adolescents tend to become sharply less physically active (McKenzie, 2001).

In summary, it appears to be a general consensus finding that middle school students tend to become less motivated in physical education, less engaged in learning, and participate less in physical activity than they were in the elementary school. With this trend, they are less likely to meet the competence standards of physical education (NASPE, 2004). Hence it becomes urgent to understand these issues that influence motivation and its relation to achievements so as to develop curricular and instructional strategies to effectively enhance learning and motivation in physical education.

Eccles and Wigfield's (2002) expectancy-value motivation model (Figure 1.1, adapted from Eccles & Wigfield, 2002) incorporates learners' expectancy beliefs, values, achievement, and experiences; therefore it provides a viable framework to understand these important issues. It was theorized in this model that student motivation predicts their learning and after-school behavior, and that student learning over time predicts their achievement-related behavior (Eccles & Wigfield, 2002). It is the general purpose of this dissertation study to advance our understanding of the motivational function of the expectancy-value in physical education with a focus on the relation between the expectancy-value, knowledge and skill achievement, and after-school physical activity participation.

Theoretical Framework

Learning is defined as a multidimensional, interactive process that results in relatively enduring changes in a person, and these changes can occur physically, psychologically, and socially (Alexander, Schallert, & Reynolds, 2008). The constructivist learning theory views learning as an interactive process where the learner constructs his/her knowledge and skill from previous experiences, from interaction with the subject, and from interactions with significant others.

The Constructivist Learning Theory

The constructivist learning perspective views learning primarily as a mental construction process (Bruner, 1960). In this process, learner's prior knowledge is considered as the basis for further knowledge construction (Anderson, 1987). Prior knowledge is conceptualized as a combination of the learner's preexisting total information, beliefs, and experiences of a certain subject (Alexander, Schallert, & Hare, 1991). During learning, contextual factors in the physical, social, cultural, and technological environment interact with prior knowledge to influence the processes of new knowledge construction. With the common acknowledgement of the importance of the prior knowledge, constructivist learning theorists have proposed different theoretical explanations about the way in which knowledge construction takes place. These perspectives include the scheme construction, the zone of proximal development, conceptual change, and, most relevant in the physical skill learning, the psychomotor skill development[a]. I will discuss these perspectives briefly here. More detailed elaborations are included in Chapter II. Although not all the theories are used as a direct guide to the dissertation study, they all have influenced my conceptualization process.

The Developmental Growth of Scheme. The theory of scheme presumes that an individual builds scheme from personal interactions with the environment through assimilation and accommodation (Piaget, Inhelder, & Szeminska, 1960). Assimilation refers to the process of incorporating objects or events that are new to the existing schemas or operations. During assimilation, new information is added to the existing schema. Accommodation refers to the process of changing internal mental representation, the schema, to selectively accommodate the new information into the schema so that the schema can become consistent with external reality (Piaget et al., 1960). The processes involve individual cognitive efforts to achieve scheme equilibrium, a process that the individual changes and stabilizes the internal mental presentation of the environment. Piaget's (1960) scheme theory explains how an individual develops his / her scheme through internal cognitive efforts, assimilation, and accommodation. But the theory apparently assumes and explains knowledge construction primarily as an individual endeavor.

The Zone of Proximal Development. Vygotsky's (1986) social constructivist theory presumes that knowledge construction primarily is a social interactive process. He argued that meaningful concepts appear first in social interaction, and then gradually become accessible to individuals. The social interaction process which transforms individuals' prior knowledge into more advanced concepts is achieved through the Zone

[a] The psychomotor learning theory is not one that is distinctive from the previous three perspectives; rather it incorporates all relevant components from these cognitive theories in explaining the process of psychomotor skill learning.

of Proximal Development [ZPD]. The ZPD refers to the distance between the learners' current developmental level as an individual problem solver and the potential level as a problem solver in collaboration with more capable peers and knowledgeable others (Vygotsky, 1978). The ZPD recognizes the importance of the social interactions and explains learning as a process in which the individual internalizes the experiences in the ZPD. The concept of ZPD suggests that through scaffolding, an instructional strategy where a more knowledgeable person provides progressive learning opportunities to the learner; the teacher can manipulate the characteristics of the ZPD by changing the social dynamics of the learning environment to facilitate incremental knowledge internalization. Yet the knowledge internalization process does not appear to be explained clearly in the ZPD. It seems that an explanation more satisfying than ZPD about the internalization process is the theory about conceptual change, which explains how an individual's mental model evolves as a result of the knowledge construction process associated with the learning environment.

Conceptual Change. From the conceptual change perspective, the knowledge construction process is described as an evolving process of mental models. A mental model refers to a special mental representation, generated during cognitive functioning, whose characteristics are structured in a way for the model to preserve the structure of the external phenomenon (Vosniadou, 1994). It is proposed that learners' mental models exist in three forms, initial, synthetic, and scientific, and that they evolve gradually over time and progressively from initial to scientific (Vosniadou, 1994). The initial model represents one's intuitive mental presentation of a subject with presumptions and beliefs. The synthetic model includes a mixed mental presentation of the initial model and scientific knowledge. The scientific model represents the scientifically accepted understanding of a subject. Vosniadou (1994) explained that the learners' initial mental models develop directly through his or her everyday experiences. When children are exposed to scientific concepts that conflict with their initial models, they are likely to distort their interpretation of the scientific concepts in an attempt to accommodate them within their initial models. The accommodation of the new concepts into the initial mental model will result in the development of a synthetic model which consists of a mix of learner's initial concepts coupled with scientifically correct concepts. It is assumed that students' initial and synthetic models evolve to parallel the scientific model as they acquire more domain knowledge and learn to revisit their beliefs (Vosniadou, 1994). Knowledge construction from this perspective involves not only accumulative and incremental changes but also drastic knowledge restructuring and reorganization as the learner's mental model evolves from initial into scientific.

Psychomotor Learning Theory

Along with cognitive knowledge construction, psychomotor learning is an essential element in physical education. Psychomotor learning is defined as a change in the capability of a person to perform a physical skill as a result of practice or experience. Rose and Christina (2006) elaborated that motor learning is "a process by which the capability for producing movement performance and the actual movement performance are reliably changed through instruction, practice, and/or experience" (p. 168).

The development of motor learning theories has been informed by the cognitive learning theories. For example, from the perspective of the schema theory, psychomotor learning process is conceptualized as the development of scheme with practice and experience (Schmidt, 1975). The most critical variable in this process, aside from the actual practice itself, is feedback (i.e., the knowledge of results) to the learner. It represents the augmented extrinsic information about task performance provided to the learner by the coach, teacher, or even peers. This information is presumed as a basis for error correction in the next trial and thus can be used to achieve more effective performance as practice continues. According to Schmidt (1991), knowledge of results was crucial to motor learning and it should be presented to the learner as often, as soon after completing the movement as possible, in order to maximize its effect on updating the memory representation. The correct memory representation of a motor skill will lead to the correct development of a schema for the skill, which in turn leads to proficiency in performing the skill.

Because psychomotor skill learning often takes place in public, for example, in school gymnasia, it can be explained using the constructivist learning theory, especially the social constructivist learning theory. For example, the feedback provider (i.e., a coach or a physical educator) plays a role of the more knowledgeable other that interacts with the learner in the ZPD (Vygotsky, 1978). Similarly when the process is viewed from Piaget's perspective, the feedback causes disequilibrium that leads the learner to assimilate and accommodate new information until a state of new equilibrium is reached.

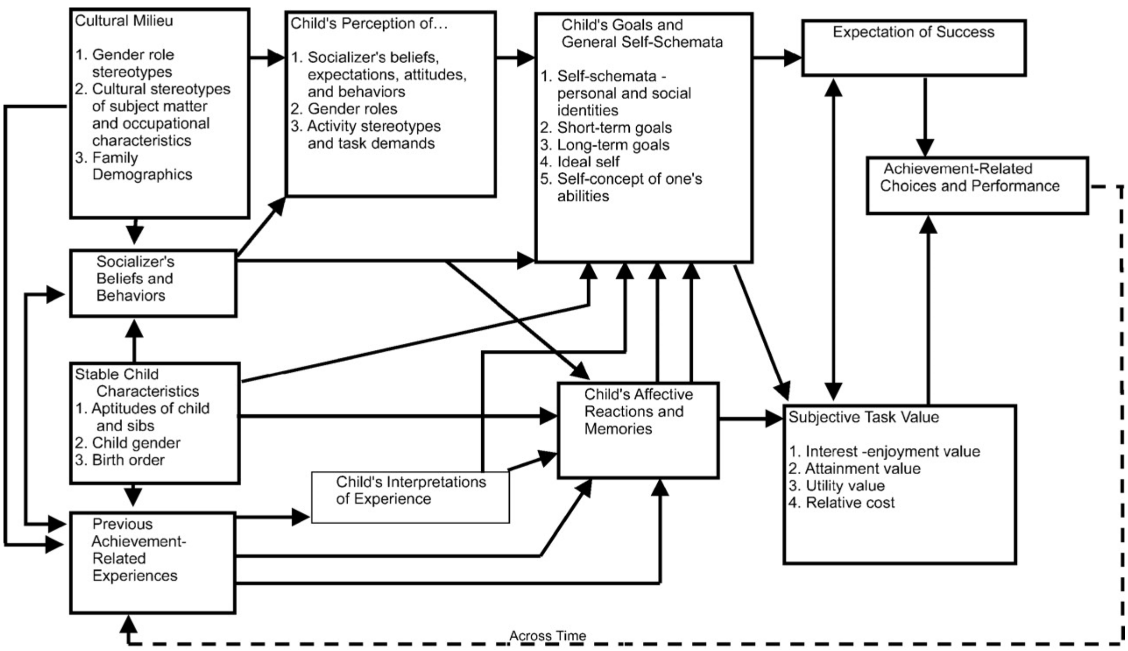
Learning in Physical Education

Learning in physical education involves construction of both cognitive knowledge and psychomotor skills. Physically educated students are expected to be able to not only demonstrate in the classroom but also apply in their real lives the cognitive knowledge and psychomotor skills (NASPE, 2004). This expectation is consistent with the constructivist learning theory in that students learn by constructing knowledge and skill based on authentic experiences involving prior cognitive and physical experiences. In addition, students learn to apply the knowledge and skills learned in school to their lives outside the school. Hence, knowledge acquisition, skill performance, and after-school physical activity behavior constitute important indicators of achievement in physical education (NASPE, 2004). In this study, achievement in physical education is assumed to contain these indicators.

Expectancy-Value Motivation Theory

Given the fact that complex knowledge and skill acquisition requires extended effort and persistence, educators need to foster a positive motivation experience for the learner (Alexander, 2006). The expectancy-value motivation theory (Eccles et al., 1983; Eccles & Wigfield, 2002; Wigfield & Eccles, 2000) posits that student motivation is determined by expectancy beliefs, task values, and perceptions of cost in a task. Expectancy beliefs are defined as students' beliefs about how well they will perform on upcoming tasks/activities. The expectancy-beliefs are conceived of as broad beliefs about one's competence to meet the standard of success in a specific domain. The value of a task is determined not only by the characteristics of the task itself, but also by the needs, goals, and subjective valuation of the person. Eccles and colleagues (1983) elaborated that there are three major values in a specific task: (a) the attainment value, (b) the intrinsic/interest value, and (c) the utility value. Attainment value refers to the personal perceived importance of being successful on a task (Eccles et al., 1983). Intrinsic value, measured as intrinsic interest of the task, refers to the inherit enjoyment through the engagement in the activity. Utility value refers to the perceived usefulness of the task for the individual's current and future goals and agenda (Eccles et al., 1983). Eccles and colleagues (Eccles et al., 1983; Eccles & Wigfield, 2002) conceptualized cost as negative outcomes of engaging in a task. It includes perceptions of effort exerted on a task, loss of time that could be spent on pursuing other activities, and potential consequence of failure (Eccles et al., 1983).

Figure 1.1 The Eccles et al. expectancy-value model of achievement.



The expectancy-value theory posits that one's expectancy beliefs and task values impact the individual's achievement-related behaviors, such as the choice of the task, persistence on the task, as well as the performance of the task. Eccles and her colleagues have tested and elaborated the expectancy-value model of achievement in schools (Eccles et al., 1983, 1984; Eccles & Wigfield, 2002; Wigfield & Eccles, 2000). As depicted in Figure 1.1 (adapted from Eccles & Wigfield, 2002), students' expectancy beliefs and subjective values directly influence their achievement-related choices and performances which over time will constitute their achievement-related experiences. Expectancies and values are impacted by individual goal, self-schema, perceptions of task difficulty, and perceptions of competence. These socio-cognitive variables are influenced by socializer's (e.g., peers) belief and behaviors, student perception of others' expectations and interpretations, and student affective reactions and memories. In the end, these variables are presumed to be determined by the cultural milieu, individuals' stable genetic traits, and previous experiences.

The expectancy-value model of achievement motivation creates an opportunity to systematically examine student motivation and achievement in physical education. For example, Xiang, McBride, and Bruene (2004) found that elementary students' expectancy-beliefs were the major contributor to their performance on the one-mile-run test explaining 22 percent of variance. Among all the other motivation sources, students' interest value was found to be the major contributor to their intention for future running participation, explaining 43 percent of its variance. The results suggest that students' expectancy beliefs predict their achievement, and that their interest value is likely to predict their behavioral choice.

An Overview of the Existing Studies

The dissertation study is a continuation of my research on the impact of expectancy-value motivation on achievement in physical education learners. I had exerted my efforts in understanding student expectancy-value motivation and achievements during the course of the research. I led (as a researcher and lead author) the effort to examine the psychometric properties of the Expectancy-Value Questionnaire for physical education among middle school students (Zhu, Chen, Sun, & Ennis, 2009a), and conducted a cross-sectional analysis on students' expectancy-value motivation and learning performances across the 6th, 7th, and 8th grade students (Zhu, Chen, & Sun, 2008). I have also attempted to investigate the role of expectancy-value motivation in relation to psychomotor skill performance and after-school physical activity participation (Zhu, Chen, Sun, & Ennis, 2009c).

In one of the studies (Zhu et al., 2008), findings suggested that middle school students' expectancy-value explain little to their basketball dribbling performance (7% of the variance) and badminton striking performance (4% of the variance), and did not predict fitness knowledge gain. These findings are not consistent with those from Xiang et al. (2008) on the relation between student expectancy-value motivation and student achievements in physical education. Despite that the inconsistent findings from the two studies can result from various factors, the inconsistence suggests a need for additional research on this important topic in physical education.

Although studies (Wigfield & Guthrie,1997) in other domains found that expectancy-value motivation relates with student achievement-related choices after school, the existing studies conducted within physical education contexts observed no direct significant relation between student expectancy-value motivation and their after-school physical activity participation (Zhu et al., 2009c). Even though students reported that they had very high expectancy-value motivation in physical education (Zhu et al., 2008), yet the motivation may not translate into their actual behavior choices for after-school physical activity. It remains unclear as to whether or not their relation is mediated by other variables such as their achievement. In addition, although cost was recognized as an important component of expectancy-value motivation theory, it was absent from

Xiang et al. (2004) and Zhu et al. (2008)'s studies. Its role in students' motivation process seems still ambiguous (Chen, Martin, Ennis, & Sun, 2008).

Statement of the Problem

An in-depth review of the research findings on the expectancy-value motivation and achievement in physical education points to three urgent issues that need to be addressed in order for us to advance our understanding of the relation between student expectancy-value motivation and achievements in physical education. First, it is clear that components in the expectancy-value model are related to physical performance (e.g., running, Xiang et al., 2004) and knowledge gain (e.g., fitness knowledge, Zhu et al., 2008). It is not clear that this relation is predictive and can be considered trustworthy or ecologically valid; especially when psychomotor learning is conceptualized as change-in-performance over time (Magill, 2001). Second, it is apparent that the expectancy-value motivation may have an impact on achievement in classroom-based tasks. It is not clear what role it plays in contributing to or mediating the relation between psychomotor skill achievement and after-school physical activity. Third, it is obvious that cost is an integral component in the expectancy-value model and is theorized to play an important prohibiting role for achievement motivation. It is not clear what effects it has on learner motivation and achievement in physical education because it has been excluded from empirical studies in physical education as an integral component in the theoretical framework.

The Purpose of the Study

The general purpose of the study was to address these issues by examining the relation among student expectancy-value motivation and achievements. Specifically, the first purpose was to verify the direct effects of the expectancy-value motivation on student achievements as manifested in changes in knowledge and physical skill performance. The second purpose was to identify the trilateral relation among students' expectancy-value motivation, achievement in knowledge and motor skill, and after-school physical activity participation. The third purpose was to determine the role of cost, as an integral component of the expectancy-value model, in relation to achievement and after-school physical activity participation.

Research Questions

I intended to fulfill the purposes of the study by answering the following three sets of research questions: (a) To what extent does expectancy-value motivation directly predict student achievement in physical education? Does expectancy-value motivation and achievement in physical education vary across the middle school years? (b) Does student motivation in physical education predict their after-school physical activity participation? Does student achievement mediate the relation between expectancy-value motivation and after-school activity participation? (c) What constitutes the cost dimension of the expectancy-value model in physical education? What are the characteristics of the cost? Whether or not they relate to students' expectancy beliefs, task values, and achievement in physical education?

As part of a series of research, this dissertation study relied on continuing to analyze the existing data from a larger study. The approaches used to answer the research questions included statistical analysis on quantitative data (e.g., knowledge and skill test data, responses to the expectancy-value questionnaire) and qualitative analysis on students' conception of cost data. I had been an active participant of the larger study during my entire graduate education program and participated in every aspect of the study, including data collection, training data collectors, conducting preliminary data analysis, performing in-depth data analysis, formulating independent studies, and writing research reports for presentations and publications. These experiences have given me the capability and confidence to conduct the dissertation to address the above questions.

Research Assumptions

The dissertation study was based on two major assumptions. First, it was assumed that the new physical education curriculum having been tested in the larger study provided an achievement-related context in which students were expected to master the knowledge and skills. A subsequent assumption was that the fitness knowledge and the fundamental skills that were taught in the curriculum were developmentally appropriate for the students. The second major assumption was that student learning in physical education *should* be explained from a broad constructivist learning perspective. Subsequently, it can be assumed that students' learning involves different ways of construction, individually and/or collectively.

Significance and Limitations of the Study

Significance

The investigation of relation among middle school student expectancy-value motivation, learning in physical education, and after-school physical activity participation could deepen our understanding about student motivation in physical education and their involvement in physical activities. By using Eccles and Wigfield's (2002) expectancy-value model, this study represents an effort to further understand the complicated relation between motivation and achievement defined in conceptual knowledge, psychomotor skill, and after-school physical activity participation. Examining this relation will provide useful evidence conducive to designing and revising middle school physical education programs. The evidence will contribute to the theory of learning through identifying specific path ways of contribution of the expectancy-value model to specific achievement.

One unique contribution of the study to the expectancy-value research in physical education lies incorporating the cost component in the study. Through exploring the (de)motivational function of perceived cost, the study will be the first to test the expectancy-value theory (Eccles et al., 1983) and its function in its entirety in physical education. Practically, systematically studying the cost component will help physical educators identify unnecessary practices that might be perceived as cost to motivation by the students, which may help prevent unproductive curriculum and instructional decisions. Examining cost in relation to the specified achievement will further allow us to unravel its role in determining knowledge and skill learning and physical activity behavior change; both are important goals for students to achieve (NASPE, 2004).

Limitations

A major analytical approach I used to analyze the data is structural equation modeling which allows establishing a tentative cause-effect relation under the condition of a strong theoretical articulation of the relation (a priori). In other words, using the structural equation modeling analysis, part of the findings should be relevant for inferring a causal relation between expectancy-value motivation and achievements. Yet data to be analyzed are correlational in nature. No experimental design was used in the larger study to manipulate the motivation variables to induce achievement. No control condition was used in the larger study to rule out potential confounds, although a random sampling procedure helped control the possible impact from the lack of a control condition on the measures of the variables. Therefore, precautions must be taken when the findings are to be used as exclusive evidence for the cause-effect relation between the expectancy-value motivation and achievement. Further, because this is a field-based study, its findings may only be applicable to similar contexts.

In the larger study, student achievement was operationalized primarily by the gains observed in psychomotor skill and conceptual knowledge performance tests. Besides that, the fact that only two fundamental psychomotor skills were measured and included as the indicators of psychomotor performance reflects a simplified psychomotor skill achievement that should not be considered to be representative of achievement in all psychomotor skills to be learned in the entire curriculum. Although student after-school physical activity participation was measured and included as an important achievement variable, it is not conceptualized and measured as a disposition (or affective) variable. Precautions are advised that changes observed in after-school physical activity behavior do not represent changes in students' value system (affective achievement).

Definition of Key Terminologies

Learning is a multidimensional process that results in a relatively enduring change in a person or persons, and consequently how that person or persons perceive the world and reciprocally respond to its affordances physically, psychologically, and socially (Alexander et al., 2008). According to Alexander et al. (2008), four types of activities are not learning based on their definition. First, all innate capacities, those inborn, genetically and biologically programmed aspects of humanness are not learning. Second, the biological / neurological maturation of the human organism in and of itself does not constitute learning. Third, just recalling that which was previously learned that does not constitute learning per se. Finally, sensorial experiences do not count as learning unless these experiences leave some relatively enduring footprint.

Domains refer to the formalized bodies of knowledge that constitute a subject area (Alexander, 2006). Within a particular domain, the declarative, procedural, and conditional knowledge are interconnected for the person to be functional in the domain (Alexander & Judy, 1988).

Conceptual knowledge includes the sum of all translated experiences, and it exists in three states: *declarative*, *procedural*, and *conditional* (Alexander et al., 1991).

Declarative knowledge consists of the factual descriptions, definitions, and explanations of the subject.

Procedural knowledge reflects to how learners use their declarative knowledge to carry out procedures and routines (Alexander et al., 1991).

Conditional knowledge refers to the understanding of when, where, and why a learner should use declarative knowledge.

Scaffolding is an instructional strategy where a more knowledgeable other provides scaffolds or supports to facilitate the learner's development so that the learner can accomplish (with assistance) the tasks that he or she could otherwise not complete (Bransford, Brown, & Cooking, 2000).

Psychomotor learning is defined as "a process by which the capability for producing movement performance and the actual movement performance are reliably changed through instruction, practice, and / or experience." (Rose & Christina, 2006; p. 168).

Motivation signals the individual's energization and the direction of behavior (Pintrich, 2003). In education, motivation theories attempt to uncover what gets students moving (energization) and toward what activities or tasks (direction; Pintrich & Schunk, 2002).

Expectancy beliefs are defined as students' beliefs about how well they will perform on upcoming tasks / activities either in short or longer term future. According to Eccles et al. (1983), the expectancy-beliefs are conceived of as broad beliefs about one's competence in a given domain.

Task values are conceptualized with four motivational components, *attainment value, intrinsic value, utility value*, and *cost* (Eccles et al., 1983).

Attainment value refers to the personal perceived importance of the doing well on the task (Eccles et al., 1983).

Intrinsic value refers to the inherit enjoyment that the individual perceives while being engaged in the activity. It is determined by the perceived interest that the individual may derive in the activity.

Utility value refers to the perceive usefulness of the task for the individual's current and future goals and agenda. Utility value itself might not be related to the nature of the task at hand (Eccles et al., 1983).

Cost is conceptualized as the negative aspects of engaging in a task (Eccles et al., 1983). Typically, it is conceptualized as perceptions of effort exerted on a task, loss of time that could be spent on alternative activities, and potential consequence of failure (Eccles et al., 1983).

After-school physical activity refers to physical activities such as sports and fitness that students participate in during the day after-school from 3:00p.m. to 10:00p.m. Although some entertainment and socialization activities may also involve physical activity, they may not be reported or coded as so in this study.

CHAPTER II

REVIEW OF LITERATURE

In this chapter, I intended to review the literatures relevant to my dissertation study in areas of learning theory, achievement motivation theory, and their applications to the context of physical education. The primary focus was to summarize (a) how learning has been conceptualized particularly in physical education, (b) what motivation is conceptualized and operationalized in the context of learning, and (c) how motivation, specifically, expectancy-value motivation influences student learning in physical education. The review also served as a basis on which I conceptualized my dissertation study.

Perspectives on Learning

As Dewey (1916) elaborated, student learning is a central mission that school education has to fulfill. Student learning, however, has been viewed from multiple perspectives based on different epistemology beliefs. For example, in an early review by Melton (1950), learning was predominantly studied and viewed from the paradigms of "stimulus-response experiment" and "field" theories. In these paradigms, as manifested in Pavlov (1928), Watson (1913), Hull (1943), and Skinner's (1938) studies, learning was defined as observable changes in behavior, the observable end product of some processes. Learning theories from these paradigms, since mostly looking at relatively permanent behavioral change, are often denoted as the behaviorist learning theories. The behaviorist learning theory, however, fails to address what takes place in people's mind which often determines the observable changes in behavior.

Contemporary learning theories are established on the pioneering work by scholars such as Piaget (1955), Bruner (1960) who, through their research, reconceptualize learning as changes in internal cognitive structure of the learner. Based on this reconceptualization, a plethora of learning theories have been developed to explain the mental processes of learning as associated with constructing and changing the cognitive structure. According to Alexander (2006), these contemporary theories may be understood as siblings of a constructivist learning theory family. They can be arranged on a continuum based on their epistemological presumptions about where knowledge is located and how knowing occurs as the consequence of constructing the cognitive structure. Conceptualizing learning using the constructivist perspective is important in that it can help interpret the learning process within and across different knowledge domains, such as learning in psychology or in physical activity (Alexander, 2006). Of particular interest of my dissertation research, I will base my study on the constructivist learning theory and the motor learning theory to understand their integrated implication in learning in physical education.

The Constructivist Learning Theory

Alexander (2006) used the locus of knowledge continuum to describe the constructivist theories ranging from individual to social-oriented knowledge construction. On the one end of the continuum, the radical constructivist learning theory (Glasersfeld, 1991) was identified as very individually oriented in that it assumes knowledge does not exist without individual's construction. On the other end, the socio-cultural constructivist theory (Vygotsky, 1978) was deemed as social-oriented because it views knowledge as entities embedded in the social cultural environments shared by members of a particular social or cultural group. Knowledge then is collectively constructed, rather than by any individual. In between of these two poles, there are social-cognitive constructivist learning theories that acknowledge the importance of both social and individual constructions (Cobb, 1994).

Despite the variations, a common ground for the constructivist theory is that learning is conceptualized as a process in which the learner, or a group of learners, actively constructs and builds the knowledge based upon what they already know or have experienced: prior knowledge. Prior knowledge is often explained as a combination of a learner's preexisting total information, beliefs, and experiences of a certain subject (Bransford et al., 2000). Although the importance of prior knowledge is acknowledged by the constructivist learning theories, the learning process of how the new knowledge develops from the prior knowledge is viewed differently from different theoretical perspectives. For example, Piaget viewed the process as developing scheme (Piaget et al., 1960); Vygotsky (1978) viewed it as satisfying a gap in the Zone of Proximal Development [ZPD]; and recently it is viewed as a process of changing one's mental models about a phenomenon (conceptual change) (Vosniadou, 1994).

The Developmental Growth of Scheme. Learning from this Piagetian perspective is viewed as a developmental process of cognitive adaption. Within this process, the simplest unit of adaption is the schema, a mental representation of necessary physical or mental actions that the learner follows in order to perform on an object, event, or phenomenon (Piaget et al., 1960). A schema can be discrete and specific, or sequential and elaborate. In the process of cognitive adaptation, the schema experiences changes through assimilation and accommodation. Assimilation refers to the process of learner perceiving objects or events that are new to the existing schemas or operations. During assimilation, new information is added to the existing schema. Accommodation refers to the process of learner changing internal mental representation, the schema, to incorporate the new information so that the schema can become consistent with external reality (Piaget et al., 1960). In other words, accommodation takes place when existing schemas are being modified or new schemas are being created to account for a new experience.

Assimilation and accommodation influence each other. According to Dancan (1995), the purpose of the assimilation and accommodation processes is for the learner to keep dynamitic equilibrium in his / her cognitive structure. When a learner perceives that the external environment is different from the existing schemas, an internal cognitive conflict occurs, which is referred to as dis-equilibration. It is assumed then that a natural biological drive would immediately guide the learner to achieve a state of equilibrium between the external world and his / her internal mental structures. This natural biological drive, being referred to as equilibration, helps the learner reach a state of equilibrium between cognitive structures and the environment (Duncan, 1995).

Piaget et al. (1960) believed that human beings continually attempt to make sense of the world around them by assimilating new information into pre-existing schemas and accommodating thought processes as necessary. As Piaget using his learning theory to study children's conception of movement and speed, he found that children's notions of space and time qualitatively differ from adults (Piaget, 1970). He then identified four major stages of cognitive development: sensorimotor, preoperational, concrete operational, and formal operational. Each stage becomes increasingly more complicated than the prior one. The sensorimotor stage lasts from birth to about two years old. At this stage, the infant primarily uses senses and motor abilities to understand the world, beginning with reflexes and ending with complex combinations of sensorimotor skills. The preoperational stage lasts from about two to about seven years old. During this stage children begin to use language and symbols with very limited ability of manipulation. The concrete operations stage lasts from about seven to about 11. During this stage children are able to not only use symbols representationally, but also manipulate those symbols logically to solve problems within the context of concrete situations. From around the age of 12 on, children enter the formal operations stage. During this stage, they become increasingly competent at adult-style thinking that involves using logical operations, and using them in the abstract, and hypothetical contexts. It is assumed that all children pass through these stages to advance to the next level of cognitive development. Although an average biological age for a stage is provided, the development can vary individually due to the differences in environment and background of individual children. It is quite possible that at a given time a child may exhibit characteristics of more than one stage (Piaget, 1970).

The theory of scheme presents one possibility about how learning takes place with the interaction of mental representations and new experiences in the external environment. The theory presumes that students build scheme from personal interactions with the environment through assimilation and accommodation. It involves individual cognitive efforts to achieve equilibrium. During the process of achieving equilibrium, learners change their internal mental presentation of the environment (i.e., the scheme). It seems clear that the theory explains how an individual develops his / her scheme through internal cognitive efforts, assimilation, and accommodation. But the theory apparently explains learning solely to be an individual endeavor as it overlooks social interaction in the learning process. Yet social interaction, particularly which is based on verbal communication, is found to be one of the most important factors influencing children learning even at very young ages (Hart & Risley, 1994).

The Zone of Proximal Development. In contrast to Piaget's work (1960, 1970), Vygotsky (1930 [translated into English in 1978], 1986) focused on the role of social interaction in the learning process. He argued that advanced concepts appear first in social interaction, and then gradually become accessible to individuals (Vygotsky, 1986). The social interaction process which transforms individuals' prior knowledge into more advanced concepts is achieved through the Zone of Proximal Development [ZPD]. The ZPD signifies the distance between the learners' *current* developmental level as an individual problem solver and the *potential* level as a problem solver in collaboration with more capable peers and adults (Vygotsky, 1978). In developing this ZPD, the learner is expected to be involved in social-cultural interactive practices that require capabilities above his / her individual ability. During the process, learners form a learning community to share, negotiate, and create meanings in the social and cultural experiences that help actualize their potential. Then recursively, the successful participations in the social interactions will help the learner to achieve knowledge internalization.

The social interaction which dominates the ZPD is mediated by complex symbol systems, such as language, writing, and drawing (Vygotsky, 1986). Student knowledge construction process in the ZPD, therefore, can be examined by investigating their language, writing as well as drawing during the process. To the learners, however, the social interactions in the ZPD occur externally through social discourses. A teaching strategy that educators are encouraged to use to facilitate the knowledge construction is scaffolding. Using scaffolding instruction, a more knowledgeable other provides scaffolds or supports to facilitate the learner's development so that the learner can accomplish (with assistance) the tasks that he or she could otherwise not complete (Bransford et al, 2000). Using this strategy, educators can structure social interactive experiences for the learner to participate in learning discourses more complex than they are able to process on their own (Brown & Ferrara, 1985). By using the scaffolding strategy in the ZPD, the teachers can adjust the complexity of tasks in terms of the collective abilities in the group of learners, encourage intensive use of various symbol systems as the learners interact, and facilitate knowledge construction at both individual and collective levels.

Besides individual cognitive efforts, the ZPD recognizes the importance of the social interactions and scaffolding during the learning process. It explains why children's interaction with capable peers and adults is important for their learning. ZPD leaves no doubt that learning takes place as an interactive process, and that an important component in the process is for individual learners to be able to internalize what they are experiencing within the ZPD. The ZPD explains that through scaffolding, the teacher can manipulate the characteristics of the ZPD so as to facilitate knowledge internalization. But the internalization process appears not clearly explained in the ZPD. It seems an explanation more satisfying than ZPD about the internalization process is the theory about conceptual change, which explains how an individual's mental model evolves because of the knowledge construction process.

Conceptual Change. Scientific knowledge does not always accumulate and progress smoothly; instead it often involves drastic changes in important concepts (Kuhn, 1996, Vosniadou, 1994). It is assumed from this perspective, that learners' prior knowledge mostly reflects types of naïve conceptions or alternative conceptions that are inconsistent with scientific conceptions (Vosniadou, 1994). Scientific conceptions, on the other hand, represent the scientifically accepted knowledge, concepts, and beliefs that are developed and accepted by scientific communities. Learning, therefore, should be a process involving not only accumulative and progressive knowledge development but also drastic knowledge restructuring and reorganization from naïve conceptions to scientific conceptions.

One way to describe student learning process from the conceptual change perspective is to investigate students' mental models. Mental model refers to a special mental representation, generated during cognitive functioning, whose characteristics are structured in a way for the model to preserve the structure of the external phenomenon (Vosniadou, 1994). Vosniadou (1994) proposed that learners' mental models exist in three forms, initial, synthetic, and scientific, and that they evolve progressively and gradually over time from initial to scientific. The initial model represents one's intuitive mental presentation of a subject with presumptions and beliefs. It is often not scientifically correct, but appears coherent to the learner. The synthetic model includes a mixed mental presentation of the initial model and scientific knowledge. The scientific model represents the scientifically correct understanding of a subject. Vosniadou (1994) explained that the learner' initial mental models develop directly through his or her everyday experiences. When children learn new scientific knowledge which conflicts with their initial models, they then distort their interpretation of the scientific knowledge in attempt to reconcile them within their initial models. The distortion of the initial mental model will result in the development of a synthetic model which consists of a mix of learner's initial models and scientifically correct models. It is assumed that students' initial and synthetic models evolve to parallel the scientific model as they acquire more domain knowledge and learn to revisit their beliefs (Vosniadou, 1994).

Using Vosniadou's (1994) mental model framework to study learning in physical education is in an early stage of infancy. Bonello (2008) described six grader's (n = 18) metal models about the fitness concept of physical activity intensity. She collected data through observation, written questionnaires, and interviews from the students and their physical education teachers. Bonello (2008) found that despite experiencing the same lessons, students constructed different conceptual understandings and organized their academic beliefs, knowledge, and perceptions about intensity within their mental model in different ways. For example, five students were identified as having constructed Mental Model One [MM1]. Students having MM1 believed that intensity comprised one generic form that they applied irrespective of activity type. For these students, fitness development required moderate to vigorous intensity levels, and they perceived a relation between intensity and time. While these five students' mental model about intensity appears to be initial, the rest of the students' (n = 14) mental models were found to be synthetic with more scientifically correct information and relations expressed. Even though none of the students was found being able to construct a scientific mental model about intensity, Bonello's (2008) study points out the possibility of describing student learning as an internalization process using the theory of conceptual change.

Context Factors Influencing Student Learning. The constructivist learning theory accentuates that the learners' knowledge construction is influenced by contextual factors including physical, social, cultural, and technological environment in which the knowledge construction takes place. Inside the schools, the degree to which teachers and the curriculum nurture a coherent and powerful environment influences the knowledge construction process. From the constructivist learning perspective, teachers play a role of facilitators who help student knowledge construction through manipulating learning tasks (Shuell, 1986). Research evidence also suggests that the curriculum can create an environment where knowledge construction can be accomplished through using constructivist learning principles. For instance, using an experiment-control design, Chen, Ennis, Martin, and Sun (2006) examined a constructivist physical education curriculum centered on facilitating elementary school learners learning using a 5-E scientific knowledge construction approach. Compared with results from the control group (n = 2015), learners from the experimental group (n = 2144) mastered approximately 18% more knowledge measured as percentage knowledge gain (experimental 20% vs. control 2%, p = .001).

The constructivist learning theory also acknowledges that the environmental factors, peers, and cultural norms can influence many educationally relevant variables such as students' motivation, achievement, and extracurricular activity participation (Vygotsky, 1978). Environmental factors such as the amount of time spent in schools have been found with a profound effect on students' cognitive learning (e.g., language) particularly at their adolescent ages (Huttenlocher, Levine, & Vevea, 1998). According to Vygotsky's (1978) social constructivist learning theory, learning occurs while students interact with their peers in social-cultural activities. Students' peers, parents, and their cultural norms form a social support out of the schools that influences students' motivation to learn and their achievements within the schools (Wentzel, 1998; Wentzel, McNamara, & Caldwell, 2004). Mahoney, Lord, & Carryl (2005) conducted a longitudinal study evaluating children's (n = 599) after-school program participation, the development of academic performance and teacher-rated motivational attributes in a disadvantaged urban context. Four types of after school care were identified: after-school program participation care, parent care, combined parent / sibling care, and combined other-adult / self-sibling care. They found that academic performance and motivational attributes in school were significantly higher ($p < .05$) at the end of the school year for children in after-school program participation care compared with those in the other three types of care. Mahoney et al. (2005) pointed out that the students in after-school program participation were more motivated and learned better because it provided a structured, adult-supervised context; a curriculum aimed at promoting academic skill development; and resources to support the learning objectives. Using these approaches, the after-school program care showcases the utilization of constructivist learning principles by using adults and other resources as scaffolds to support student learning.

In summary, the constructivist learning theory recognizes the importance of students' prior knowledge and their active role in the knowledge construction process. The constructivist learning theory also acknowledges that the context factors both within and outside of the schools influences students learning process. In this dissertation research, it is assumed that learning in physical education is an endeavor that combines individual and collective knowledge/skill construction. Based on the above literature review I believe that the knowledge construction process in physical education is primarily a cognitive process associated with physical experiences. The characteristics of the process can be identified with the theories of scheme (Piaget, 1960), or the ZPD (Vygotsky, 1978), or conceptual change (Kuhn, 1996; Vosniadou, 1994). Learning in physical education apparently relies on a comprehensive psychomotor involvement. Explanation of learning in physical education requires a coupling of the theories of cognitive learning with the theories that explains the function of psychomotor involvement. Psychomotor learning theory not only defines what the end product of the motor learning is, but also explains how the learning takes place.

The Psychomotor Learning Theory

While the constructivist learning theory emphasizes the cognitive construction process of knowledge, the motor learning theories appear to emphasize on using relatively permanent performance changes as the indicator of learning. Magill (2001) stated that performance, as “observable behavior” (p. 168), refers to the execution of a skill at a specific time and in a relevant situation. Rose and Christina (2006) define motor learning as “a process by which the capability for producing movement performance and the actual movement performance are reliably changed through instruction, practice, and/or experience.” (p. 168). Therefore, motor learning is defined as a change in the capability of a person to perform a skill that must be inferred from a relatively permanent improvement in performance as a result of practice or experience.

According to Magill (2001), when motor skill learning takes place there are four observable performance characteristics, improvement, consistency, persistence, and adaptability. First, when skill learning takes place, the performance of the skill shows improvement over a period of time (Ericsson & Charness, 1994; Melnick, 1971). Second, as skill learning progresses, performance of the skill becomes increasingly more consistent (Sherwood, 1988). Third, the persistence characteristic relates to the emphasis in Magill's (2001) definition of learning on a relatively permanent improvement in performance. That is, when a person progresses in learning a skill, the person who has learned the skill should be able to demonstrate the skill performance in a relatively long period of time. Lastly, adaptability refers to the improved performance of a skill that is adaptable to a variety of performance contexts. As a person progresses in skill learning, she or he will be able to demonstrate the capability of performing the skill in a progressively improved manner.

Knowledge of Results in Schema Theory. From the perspective of the schema theory, psychomotor learning process is conceptualized as the development of scheme with practice and experience (Schmidt, 1975, 2003). According to the schema theory, psychomotor skills were represented by two structures (i.e., scheme). The first structure, called the generalized motor program, supported a class of movements (e.g., overhand throwing) by storing invariant features, such as the order by which the individual parts of the movement unfolded during action, as well as their relative timing and relative force. A separate structure, called the recall schema, was responsible for supplying the parameters that were needed to scale the generalized motor program's output to the specific environmental demands and conditions. According to the theory, each practice attempt produces information that is abstracted and used to update the accuracy and reliability of the schema. The schema comes to represent the relation between (a) components of the generalized motor program that were used on each practice attempt and (b) the outcome (e.g., distance thrown) that was produced in the environment on that practice attempt. The difference of the components of the generalized motor program and the outcome will result in conflicts that require the learner to adjust their schema. Knowledge of results ([KR], or augmented feedback) plays a central role in the process of recognizing the conflict and adjusting learner's schema, according to Schmidt (1975):

> Learning is possible by feeding back the essential error information to the scheme. The response specifications and initial conditions are stored when the movement is selected, and the actual proprioceptive and exteroceptive feedback are stored as the movement progressing and as these sources of information is generated. Finally, the actual outcome is stored, based on KR when it is present, but based on subjective reinforcement if KR is not present. These sources of information can then be used to update the schema rules and provide revised estimates of the expected sensory consequences and response specifications on the next trial (Schmidt, 1975; p. 240).

Increasing the number of practice trials with KR will help renew the learners' generalized motor program and recall schema thus reinforces the learners' performances (Schmidt, 1975). According to Schmidt (1991), knowledge of results was a crucial to motor learning and it should be presented to the learner as often, as soon after completing the movement as possible, so as to enhance its use in evaluating the movement performance and updating the memory representation. Sherwood and Lee (2003) argued that in addition to emphasizing KR and variability and order of practice, motor learning theory should pay more attention to role of learners' cognitive effort.

The schema theory has some characteristics of Piaget's notion of schema development. For example, both theories consider schema as the basic unit of learning, and both require the learner to adapt. The psychomotor learning process involving KR can be understood from all the theoretical perspectives that I reviewed earlier. For example, when the process is viewed from Piaget's perspective, the KR results in disequilibrium which lead the learner to assimilate new information and accommodate until reach a new state of equilibrium. The KR provider, however, normally involves a coach, teacher, or a peer. Viewing from a social constructivist process of learning, the KR provider can play a role of the more capable others who interact with the learner in the ZPD. From the conceptual change perspective, the KR triggers the learners' initial mental model to evolve, and then helps to stabilize the new mental model. In this sense, the motor learning process can be one of schema building, social construction, and conceptual change with the need of the learners' neuro-mechanic adaptation.

As in other subject areas, KR in learning motor skills takes place mostly in the form of language communication that provokes a cognitive process in the learner (Lee, Swinnen, & Serrien, 1994). Along with the constructivist learning principle, many physical education teachers also use students' prior experiences as the basis to teach new skills. For example, Magill (1994) suggested that it is important for the instructor to evaluate student skill level and the characteristics of the skill before provide KR. He argued that although many time KR facilitate skill learning, yet there are cases that KR hinders learning. Because KR is usually provided by teachers and peers in physical education, and the tasks and KR are normally presented in a public way, the teachers should consider the factors that influence student skill learning before use KR.

Factors Affecting Psychomotor Learning. In addition to KR, several other factors have been identified affecting psychomotor learning. The amount of practice time appears to be the most obvious factor, and extra practice time is beneficial for skill consistency (Melnick, 1971). Yet practice alone does not always make perfect. Once the practice time reaches a certain point, additional practice may not be beneficial and worthwhile for psychomotor learning (Melnick, 1971). Other factors such as practice distribution, task complexity, and learners' motivation also affect psychomotor learning.

The ways that different practice sessions are spaced affects psychomotor learning for different skills (Donovan & Redosevich, 1999). The spacing of practices is referred to as practice distribution, which delineates the relation between practice and rest intervals (Magill, 2001). Earlier research evidence (Baddely & Longman, 1978) suggests that more frequent and shorter practice session produce better psychomotor learning than a few long sessions. The long continuous practice session with few very short or no rest is defined as massed practice, and the shorter and more frequent practice session with relatively long rest between trials is defined as distributed practice. A meta-analysis (Lee & Genovese, 1988) found that for continuous skills which have no obvious beginning or ending (e.g., dribbling), distributed practice consistently leads to better psychomotor achievement. For discrete skills which are brief, well-defined actions that have a clear beginning and ending (e.g., throwing), massed practice results in better outcome.

Task complexity and organization determines the types of practice during the psychomotor learning process (Naylor & Briggs, 1963). Task complexity refers to how many parts or components are in the skill task and it relates to level of processing demands on the performer. Skill organization refers to how spatially and temporally the components are interrelated. For example, jump shot can be of medium task complexity but high skill organization. Research evidence (e.g., Hautala, 1988; Walter & Swinnen, 1994) suggests that learners should practice the whole for skills with low complexity and high organization, and that they should practice parts of the skills with high complexity and low organization.

According to psychomotor learning theory, motivation is conceptualized as the drive that arouses the body to action, energizes its latent responses, and supports its behavior over time (Schmidt & Lee, 2005). Various motivation sources such as self-efficacy and interest have been found associated with students' psychomotor learning in laboratory study and physical education. For example, Jourden, Bandura, and Banfield (1991) found that when students think the skill as acquirable, their self-efficacy will rise, and then the rising self-efficacy results in better performance.

In summary, learning can be defined as a multidimensional process from a broader constructivist perspective (Alexander et al., 2008), which unifies the different conceptualization of learning processes, and products whether they are internal cognition changes or observable performance changes. Alexander and colleagues (2008) define in such a broad way:

> Learning is a multidimensional process that results in a relatively enduring change in a person or persons, and consequently how that person or persons perceive the world and reciprocally respond to its affordances physically, psychologically, and socially. The process of learning has as its foundation the systematic and dynamic relation between the nature of the learner and the object of the learning as

ecologically situated in a given time and space as well as over time (Alexander et al., 2008; p. 27).

Learning in Physical Education

The constructivist and psychomotor learning theories explain how learning occurs in both cognitive and psychomotor domains. These theories define learning as a multidimensional process that will result in changes in the person, the learner. In addition, the theories seem to suggest that learning is domain specific (Alexander & Judy, 1988). Thus, the learning processes can be different in different knowledge domains. Learning in physical education can be understood in a holistic perspective. Rousseau (1762) eloquently asserted that the body and mind should go hand in hand centuries ago:

> If you would cultivate your pupil's intelligence, cultivate the strength it is meant to control. Give his body constant exercise, make it strong and healthy in order to make him good and wise; let him work, let him do things; let him run and shout; let him be on the go… It is a lamentable mistake to imagine that bodily activity hinders the working of the mind, as the two kinds of activity ought not to advance hand in hand, and as if the one were not intended to act as guide to the other (Rousseau, 1762 as quoted in Dewey, 1916; p. 9).

The goal of modern physical education, coincidently concurring with this assertion, is to develop physically educated individuals who have the knowledge, skills, and confidence to enjoy a lifetime of healthful living (National Standard for Physical Education [NASPE], 2004). To demonstrate the integrative learning conception, NASPE (2004) specified the standards for learning in physical education: A physically educated person should (a) demonstrate competency in motor skills and movement patterns needed to perform a variety of physical activities; (b) demonstrate understanding of movement concepts, principles, strategies, and tactics as they apply to the learning and performance of physical activities; (c) participate regularly in physical activity; (d) achieve and maintain a health-enhancing level of physical fitness; (e) exhibit responsible personal and social behavior that respects self and others in physical activity settings; (f) value physical activity for health, enjoyment, challenge, self-expression, and / or social interaction. These standards delineate the ideal achievements of physical education as competence of constructing and applying the knowledge and skills. These achievements can be understood in a broad and integrative domain of learning in physical education based on the constructivist learning theories.

Knowledge and Domain Defined in Physical Education

The conceptual knowledge includes the sum of all translated experiences, and it exists in three states: declarative, procedural, and conditional (Alexander et al., 1991). The declarative knowledge consists of the factual descriptions, definitions, and explanations of the subject. Declarative knowledge is used to describe and explain the world, and to communicate understandings among people. According to Alexander (1997), students new to a topic possess minimal declarative knowledge and this declarative knowledge is often loosely structured. For a competent learner, his / her knowledge to a specific topic is usually more extensive, and more interconnected. Whereas declarative knowledge refers to the *what* of understanding, procedure knowledge explains the *how* of understanding. Procedural knowledge reflects to how learners use their declarative knowledge to carry out procedures and routines (Alexander, et al., 1991). The third state of knowledge is conditional knowledge which refers to the understanding of when, where, and why a learner should use declarative knowledge. In other words, conditional knowledge reflects the way a learner decides to apply his / her knowledge.

Knowledge is domain specific. Domains refer to the formalized bodies of knowledge that constitute a subject area (Alexander, 2006). Within a particular domain, the declarative, procedural, and conditional knowledge are interconnected for the person to be functional in the domain (Alexander & Judy, 1988). In the domain of physical education, for example, the declarative knowledge can reflect the learners' understanding of an exercise principle. The procedural knowledge, on the other hand, describes how the learners conceptually use the exercise principle in practice. The conditional knowledge can be reflected by the extent to which how well the learners employ the exercise principle in a given physical activity context. The learning goals in the domain of physical education represent students' competence of mastering all these types of knowledge and skills (NASPE, 2004).

Learning in psychomotor domain focuses on skillfulness. Skillfulness describes the extent to which a learner can perform a movement efficiently, consistently, and with adaptive versatility (Clark, 1995). A competent learner, therefore, can not only perform a specific skill proficiently, but also perform and apply the skill in different settings in a consistent manner. To become skillful in a sport requires substantial amount of practices and not everybody can easily reach and maintain the skillfulness (Clark & Metcalfe, 2002).

Demonstrated Competence as Achievement

According to expertise research, experts in a topic can execute a procedure more proficiently and make better decisions to use the procedure than novices (Ericsson & Charness, 1994). Within a specific domain, the expertise is reflected in the competence a learner can demonstrate. The demonstrated competence varies in terms of the learning stages: acclimation, competency, and proficiency (Alexander, Jetton, & Kulikowich, 1995). Learners at the acclimation stage can only demonstrate limited knowledge and skill. Learners at the competency stage can demonstrate not only more declarative and procedural knowledge, but also more conditional knowledge. In addition, Alexander et al. (1995) found that competent learners' knowledge is better organized and interconnected in a coherent way. Learners at the proficiency stage are able to demonstrate high quality domain-specific knowledge and skills. They also can demonstrate expertise in applying effective learning strategies in learning new knowledge and skills.

Using the domain learning theory (Alexander et al., 1995) as theoretical framework, Shen (2004) examined student learning and interest motivation in physical education. The data from 202 sixth-grade learners from three middle schools consisted of interest in softball, knowledge and skill levels in softball, and learning strategies used during learning softball. Results of the multivariate analysis of variance [MANOVA] show that the learners in the competency stage scored higher than those in the acclimation stage in individual interest ($p < .001$) and received higher teacher subjective rating on psychomotor skill ($p < .001$). In addition to higher knowledge gain, learners in the competency stage applied more learning strategies during the learning process ($p < .05$). In the follow-up path analysis of the interrelation among these variables, Shen (2004) found stronger relations (i.e., larger path coefficients) and better data-model indices (e.g., χ^2, *p* value etc.) in the model describing learning for the learners at the competency state than that for those at the acclimation stage. Shen's (2004) study provides the evidence that student cognitive and skill learning can occur simultaneously, and that there are significant differences in these performances for the learners at different stages.

Meaningfulness of Learning in Physical Education

The constructivist learning theory postulates that students learn best from authentic experiences, and that learning becomes more meaningful when students can apply their knowledge and skills into real life experiences (Darling-Hammond, 1997; Shuell, 1986). In the domain of physical education, when students become able to apply the knowledge and skills in life, they are not only demonstrating academic achievement but also receiving health-related benefits (US Department of Health and Human Services [USDHHS], 2001). Therefore, it is important in physical education to use self-initiated participation in physical activity, especially in after-school hours, as an indicator of achievement, as specified in the NASPE standards (2004). In this study, I conceptualized student after-school physical activity participation as an important achievement variable in that it partly reflects students' applying the knowledge and skills that they learned in physical education to their lives.

In summary, learning in physical education involves both the body and the mind. Successful learning requires students to be able to demonstrate mastery of both cognitive knowledge and psychomotor skills and to demonstrate changes in person's behavior as a result of the mastery (NASPE, 2004). This conception of learning and achievement in physical education is consistent with the constructivist learning theory in that students are expected to construct knowledge and skill based on authentic experiences involving prior cognitive and physical experiences. They are expected to apply the knowledge and skills learned in school in actual life outside the classroom. Consistently, knowledge acquisition, skill performance, and after-school physical activity behavior change may constitute important indicators of achievement in the domain of physical education (NASPE, 2004).

Motivation Theories

The constructivist learning theory presumes that learners actively construct their own understandings of knowledge individually and collectively. Constructing complex knowledge and skills that they experience in schools requires extended effort, persistence, and guidance. Without learners' motivation to learn, it is argued that, the willingness to exert the effort is unlikely without coercions (Pintrich, 2003). Therefore, constructivist learning theory also acknowledges that motivation is a key component in learning process (Resnick & Klopfer, 1989). In educational practice, educators are encouraged more and more to use motivation strategies to enhance learner effort and commitment to achieving high standards of comprehension and understanding. In this section, I primarily focus on reviewing the motivation theories that have implications for physical education. A particular attention is given to the expectancy-value theory (Eccles & Wigfield, 2000) as it is the motivation construct that my dissertation study focuses on.

Motivation as a term etymologically, comes from Latin verb *movere*, meaning to move. One's motivation signals the individual's energization and the direction of behavior (Pintrich, 2003). In education, motivation theories attempt to uncover what gets students moving (energization) and toward what activities or tasks (direction; Pintrich &

Schunk, 2002). According to social cognitive theory (Bandura, 1986), individuals are agents proactively engaged in their own development and can make things happen by their own actions. Among other personal factors, the fact that individuals possess self-beliefs is important to the sense of agency. Bandura (1986) posited that self-beliefs enable people to exercise a measure of control over their thoughts, feelings, and actions, and that “what people think, believe, and feel affects how they behave” (p. 25). In his view, the beliefs that people have about themselves are critical elements in the exercise of control and personal agency.

Self-concept Based Motivation

Motivation to learn among school-age learners is often associated with the development of self-concept (Shavelson & Bolus, 1982). Self-concept is the accumulation of knowledge about the self, such as beliefs regarding personality traits, physical characteristics, abilities, values, goals, and roles (Damon & Hart, 1988). It reflects one’s collective self-perceptions formed through experiences with the environment and interpretations of those experiences and of interactions with significant others (Shavelson & Bolus, 1982). Self-belief is one of the most important self-concepts in educational research. Two types of self-beliefs in educational contexts, competence belief and control belief are particularly related to students’ motivation and achievement (Schunk & Zimmerman, 2006). Competence beliefs are referred to as one’s perceptions about their means, processes, and capabilities to accomplish certain tasks. These beliefs are self-evaluative because the individual must weigh their knowledge, skills, and strategies, against the demands of the task to result in an acceptable perception for him / herself. Control beliefs are defined as one’s perceptions about the likelihood of accomplishing desired outcomes under certain circumstances. Control beliefs pertain to the outcomes of the tasks or actions, not the tasks themselves. According to Schunk and Zimmerman (2006):

> Both competence belief and control belief are types of expectancies, or perceptions about future events. Competence beliefs are expectancies about one' capabilities to learn or perform actions; control beliefs are expectancies about the consequences of actions (p. 350).

The contemporary motivation theories use self-belief as a construct to explain how motivation functions in the process of achieving a task. Competence-based self-beliefs have become central in research on learning motivation. Among the constructs of self-concept of competence, a salient one is self-efficacy (Bandura, 1997), the other expectancy beliefs (Eccles et al., 1983). Self-efficacy represents the central construct in the Bandura's (1997) social cognitive theory, and expectancy beliefs are the important one in expectancy-value motivation theory (Eccles et al., 1983; Wigfield & Eccles, 2000). Since the expectancy-value theory is evolved from Atkinson's (1957)'s classic motivation theory, I will include Atkinson's motivation theory in the review as well.

Self Efficacy

Social cognitive theory proposes that human behaviors are determined by the interaction between three clusters of factors, personal factors (cognitive, affective, and biological events), environmental factors, and behaviors of self and others (Bandura, 1986, 1997). Through the interaction process, learners obtain information to develop their self-efficacy beliefs from their actual performances, their vicarious experiences, and the others. Self-efficacy beliefs are defined as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (Bandura, 1997; p. 391).

Self-efficacy beliefs have been found to have a strong influence over one's choice of activity, the kind of effort one exerts, and how persistent the effort is in the face of difficulties (Bandura, 1986, 1997; Schunk, 1995). In the educational domain, self-efficacy beliefs have been found to influence students' attitude, their engagement in academic activities, and how strategic they may be when encountering a challenging task (Pajares & Johnson, 1996; Pajares & Miller, 1995). In addition, students' self-efficacy beliefs seem to be significantly correlated to their academic performance (Lane & Lane, 2001). Bandura (1989) suggests that because high-efficacy individuals believe that they have some control over the task, they are less likely to fear the task. Other researchers (e.g., Kanfer, 1990) have shown that competence in a task is associated with more task-enjoyment and satisfaction with task demands. Hence, individuals with high self-efficacy beliefs are more likely to set challenging goals, and are confident of their ability to reach goals (Wood & Bandura, 1989).

Although individuals are typically guided by their self-efficacy beliefs when they engage the world, one's self-efficacy beliefs and actual ability are seldom perfectly matched (Bandura, 1997). Jeng et al.'s study (2002) reported a positive significant relation between treadmill self-efficacy and actual performance among patients with chronic obstructive pulmonary disease. However, they found that the majority of subjects (72.9%) underestimated their treadmill performance and only few subjects (14.6%) assessed their treadmill performance accurately. The study also found that the patient's past experience was the most important predictor for both treadmill self-efficacy and actual performance. Similarly based on their past experiences, some patients might suffer of self-doubt about capabilities they actually possess, while others were confident about what they can accomplish despite possessing inadequate knowledge and skills.

Atkinson's Achievement Motivation Theory

In his classic work, Atkinson (1957) believed that three variables are closely associated with one's achievement motivation: motive, expectancy, and incentive. The strength of achievement motivation is presumed a jointed multiplicative function of motive (subjective probability), expectancy, and incentive. *Motive* is a triumvirate, which is generally conceived of as nondirective but an energizing drive, a disposition to strive for a certain kind of satisfaction, and as a capacity for satisfaction in the attainment of a certain class of incentives. Atkinson (1957) further distinguished achievement motive from avoidance motive. The former is considered a mental disposition to approach success; whereas the latter a disposition to avoid failure or pain. *Expectancy* is a person's anticipation for outcome or consequence given the action the individual takes. It is cued not only by one's perception of competence but also by the situation in which the action is taken. Atkinson (1957) also emphasized that one's motivation is driven by incentive from the action, defined as the "relative attractiveness of a specific goal that is offered in a situation, or the relative unattractiveness of an event that might occur as a consequence of some act" (p. 360). Both extrinsic reward and punishment can be considered "attractive" and "unattractive" incentives, respectively, that control motivation.

In an achievement situation where performance is likely to be evaluated against standards of excellence, Atkinson (1957) assumed that the strength of motivation is a multiplicative function of the strength of motive, expectancy (the act with a consequence of the attainment of incentives), and value of the incentive:

Motivation = *f*(Motive × Expectancy × Incentive) (Atkinson, 1957; p. 361)

Based on the linear function of motivation, Atkinson (1957) proposed that the strength of motivation is greatest when the probability of success (P_s) is .05. When a very difficult task is offered (e.g., P_s = .10), maximal motivation can be achieved with repeated success that gradually elevates P_s to .50. With over-achieved success (e.g., P_s is reaching 1.00), motivation begins to decrease. Atkinson (1957) argued that with the increase of success rate, the sense of incentive (attractiveness of the task) decreases and eventually diminishes; which leads to the decrease of motivation.

Atkinson (1957) reasoned that individuals with strong approach motive should prefer intermediate risk level, while individuals with strong avoidance motive tend to avoid intermediate risk, "preferring instead either very easy or safe undertaking or extremely difficult and speculative undertaking" (p. 367). In contexts with choice decisions, Atkinson (1957) believed, the avoidance motivation will cancel out the approach motivation. In these situations, an individual's choice of "level of aspiration cannot be predicted from the variables intrinsic to the achievement-related nature of tasks" (p. 370). The explanation of the individual's choices should be sought in extrinsic factors, such as the desire to gain social approval.

The Expectancy-Value Theory

Based primarily on the classic achievement motivation theories (Atkinson, 1957; Weiner, 1974), Eccles (Parson) and her associates (1983) proposed a theoretical model to explain the links among cultural factor, one's experiences, values, and achievement behavior. According to Eccles et al. (1983), the model is based on an assumption that "it is not reality itself (past successes or failures) that most directly determines children's expectancies, values, and behavior, but the interpretation of that reality (p. 81)." It is assumed that the influence of reality on achievement outcomes are mediated through "causal attributional patterns of failure and success", perception of one's own needs, values, expectations, and the perception of a task. All of these factors influence the expectancies and values related to the task. The expectancies and values then impact an individual's achievement-related behaviors, such as the choice of the task, persistence on the task, and even the performance of the task.

Eccles and her colleagues have tested and elaborated the expectancy-value model of achievement (Eccles et al., 1983, 1984; Wigfield & Eccles, 2000; Eccles & Wigfield, 2002). As depicted in Figure 1.1 (adapted from Eccles & Wigfield, 2002), student achievement-related choices and performances are directly influenced by expectancy beliefs and subjective values. Expectancies and values, in turn, are impacted by task-specific beliefs and perceptions such as individual goal, self-schema, perceptions of task difficulty, and perceptions of competence. All of these socio-cognitive variables are influenced by socializer's (e.g., peers) belief and behaviors, student perception of others' expectations and interpretations, and student affective reactions and memories. In the end, these variables are presumed to be determined by cultural milieu, individuals' stable genetic traits, and previous experiences.

Expectancy Beliefs

According to the recent developments of expectancy-value theory (Eccles & Wigfield, 2002; Wigfield & Eccles, 2000), expectancy beliefs are defined as students' beliefs about how well they will perform on upcoming tasks / activities either in short or longer term future. The expectancy-beliefs are conceived of as broad beliefs about one's competence in a given domain. Hence, they are measured similarly with the measures of self-efficacy (Bandura, 1997). But the expectancy-beliefs in the expectancy-value motivation theory measure both one's personal and efficacy expectations (Eccles & Wigfield, 2002).

Eccles and colleagues (1983) initially followed Atkinson (1957)'s definition of expectancy in examining their model. For example, in Eccles et al. (1983), the concept of expectancy was defined as the possibility of success on certain tasks, and the self-concept of one's ability was defined as "the assessment of one's own competency to perform specific tasks or to carry out role-appropriate behaviors (p. 82)." They were conceptualized and measured as different variables in the earlier version of the expectancy-value model of achievement. According to Eccles and Wigfield (2002), however, earlier empirical studies (e.g., Eccles et al., 1983) showed that children and adolescents do not distinguish well between these two different levels of beliefs. Therefore, Eccles and colleagues (2000) contended that in real-world achievement situations these two types of belief are highly correlated and "empirically indistinguishable," although these two constructs are theoretically separable.

Subjective Values

According to Eccles et al. (1983), the value of a task is determined not only by the characteristics of the task itself, but also by the needs, goals, and subjective valuation of the person. They elaborated that there are three major values in a certain task: (a) the attainment value of the task, (b) the intrinsic / interest value of the task, and (c) the utility value of the task.

Attainment Value. Attainment value refers to the personal perceived importance of the doing well on the task (Eccles et al., 1983). According to Eccles et al. (1983), attainment value in its broader term incorporates a variety of dimensions, including the perceptions of the task properties (e.g., the difficulty, importance of a task) to confirm or disconfirm the salient and valued characteristics of the self-schema (e.g., masculinity, intelligence, competence etc.), to provide a challenge and opportunities for fulfilling achievement, power, and social needs. The perceptions of the task properties determine the level of attainment value. For example, for a student athlete who thinks himself as "athletic" and believes that shooting a basketball at the basket is important for his athletic career, actively engaging in a basketball unit and perform well in the unit will be of high attainment value.

Intrinsic /Interest Value. Intrinsic value refers to the inherit enjoyment that the individual perceives while being engaged in the activity. It is determined by the perceived interest that the individual may derive in the activity. According to Eccles and Wigfield (2002), the component of the intrinsic value is similar to the construct of intrinsic motivation as defined by Deci and Ryan (1985), and the construct of situational interest (Hidi, 1990). For example, situational interest has been shown to positively influence both cognitive and physical engagements in school settings, with a relatively high predictability for students' in-class physical activity in physical education (Chen, Shen, Tolley, & Scrabis, 2002).

Utility Value. Utility value refers to the perceived usefulness of the task for the individual's current and future goals and agenda. Utility value itself might not be related to the nature of the task at hand (Eccles et al., 1983). For instance, a Chinese college student could be interested in taking a physical activity course not because he or she is interested in the course content itself, but because he or she wanted to fulfill the curricular requirement for graduation (Chen & Liu, 2008). To some extents, utility value captures the "extrinsic" reasons for engaging in a task as described by Deci and Ryan (1985). Yet it relates directly to the individual's internalized immediate and future goals.

Cost

Cost was discussed separately as the fourth component of subjective value (Eccles & Wigfield, 2002). Eccles and colleagues (1983, 2002) conceptualized cost as the negative aspects of engaging in a task. Typically, cost is conceptualized as perceptions of effort exerted on a task, loss of time that could be spent on alternative activities, and potential consequence of failure (Eccles et al., 1983). These three cost factors are supposedly interact (or interfere) with the subjective task values to influence students' achievement and consequently their behavior choices.

Based on Kukla (1972)'s conception that people tend to calculate the minimal amount of effort needed to succeed on a task, Eccles and her colleagues (1983) assumed that individuals have a sense of how much effort that they think is worthwhile for various activities. It is predicted (Eccles et al., 1983) that when individuals perceive the amount of effort for success exceeds the amount of effort considered worthwhile, they tend to lower the values of the task. In other words, as the cost / benefit ratio increases due to the increase in the perceived amount of effort, the value of the task decreases. Another cost factor is derived from the perceived loss of time for other activities that an individual values. Each learning task comes with a potential for the learner to fail. The potential determines the way the learner's motivation affects his / her behavior. According to Eccles et al. (1983), when students encounter with a high potential of failure they most likely will choose to avoid the task, if they are provided with such an option.

The Relation of Expectancy Beliefs and Task Values

There are different perspectives on relation of expectancy beliefs and task values. The classic motivation theory (Atkinson, 1957), reasoned that individuals' expectancy beliefs and task values were inversely related because once the individual's expectancy was high (*Ps* high), the task tended to be easy therefore task values were low. The contemporary theories from Eccles et al. (1983) and Bandura (1997) both supported that the perceived self-ability should influence the development of task values. Bandura (1997) believed that children with high efficacy in a task should be more interested in challenging ones than in easy tasks. From a developmental perspective, Wigfield (1994) proposed that young children's initial expectancy beliefs and task values are likely to be relatively independent of each other. In the academic achievement-related domain, Wigfield (1994) contended that children began to attach more value to the activities that they performed well over time. Fredricks and Eccles (2002) reported that the correlation coefficients between students' expectancy-beliefs and task values ranged from .55 to .67 in mathematics. Using structural equation modeling techniques, Zhu et al. (2009a) observed that the factorial correlation coefficient between middle school students' expectancy belief and task value was .45 in physical education. These research evidences support Wigfield (1994)'s argumentation that students' expectancy-beliefs and task values are positively correlated.

Summary

To sum up, the expectancy-value theory can be used as a theoretical framework to answer student motivation questions, "can I do this task?" and "do I want to do this, and why?" (Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006; p. 937). The answers to these three questions constitute a cohesive ground for motivating students to achieve in a school context. For a particular subject, the question "can I do this task?" can be explained by students' expectancy beliefs. Students' task values including attainment value, intrinsic value, and utility value can help address the question "why do I want to this task?" Student cost perception can directly answer the choice-decision question "do I want to do this task?"

Learning in physical education represents a complex task in that it requires students to not only gain conceptual knowledge and master psychomotor skills, but eventually to learn to make sound choice decisions in their lives (NASPE, 2004). It is reported that students like the subject of physical education, but they do not value it as high as other academic areas (Goodlad, 2004). As students move into middle school and high school, they become less likely to engage themselves in physical education (Ennis, 2000).

Expectancy beliefs, task values, and cost perception are important variables within expectancy-value theoretical framework, which has significant potentials to unravel the relation between student motivation and achievements in physical education. Using the expectancy-value theoretical framework to understand adolescents' cost perception and their expectancy-values of physical education could uncover what middle students are motivated for. In considering the aforementioned review, I choose the expectancy-value theory as a motivation theoretical framework to answer the research questions in this study.

Expectancy-value Motivation and Achievement in Physical Education

Expectancy-value motivation theory provides a meaningful framework to explain students' choice and effort in learning (Wigfield et al., 2006). In this section, I focus on reviewing existing literatures on the relation between student expectancy-value motivation, achievement, and after-school behavior as associated with expectancy-value motivation. The literatures reviewed in this section include the studies in the domain of physical education and those in other academic domains but have implications for future studies in physical education.

My review of the existing studies on students' expectancy-value motivation and learning in physical education can be categorized into three perspectives. The first perspective examined the direct relation between student learning and their expectancy-value motivations in physical education. This perspective attempts to answer the question that to what extent students' expectancy-value motivation contributes to their achievements. The second perspective examined the relation between student expectancy-value motivation and their after-school behavior choices. This perspective attempts to examine the strength and the direction of the relation between these two variables. The third perspective employs a developmental approach investigating how students' expectancy-value motivation changes across different school years. In addition, I will discuss the results from my recent study (Zhu, Chen, Sun, & Ennis, 2009b) that might shed additional light on the relation between students' achievements and their after-school behavior variables as associated with the expectancy-value motivation.

Achievement and Expectancy-value Motivation

Several studies have been conducted to understand the relation between student expectancy-value motivation and student learning in physical education. In a recent study (Xiang et al., 2004), the participants were 125 fourth graders who participated in a running physical education program in a rural elementary school. The researchers employed both achievement goal (Duda & Nicholls, 1992) and expectancy-value motivation (Eccles et al., 1983) theories as theoretical frameworks. Student one-mile-run performance was used as a direct measure of the physical education outcome, students' intention for future participation in running as an indirect measure of physical activity participation. Regression analyses were conducted using the motivational sources (e.g., expectancy beliefs, subjective values, performance goal, etc.) as independent variables and achievements (e.g., mile-run performance) as dependent variables. The results showed that student expectancy-beliefs were the major contributor to students' performance on the one-mile-run test explaining 22 percent of variance. Among all the other motivation sources, students' interest value was the major contributor to their intention for future running participation, explaining 43 percent of its variance. In this study, expectancy-value motivation was found to explain a large amount of variance in the outcome measures, which seems consistent with findings from research in other subject domains such as mathematics (Eccles et al., 1983).

Another study conducted by Zhu et al. (2008) also examined the relation between middle school student expectancy-value motivation and their achievement as manifested by gain scores on fitness knowledge tests, basketball dribbling, and badminton striking performances. A random sample of 6th, 7th, and 8th graders (n = 797) was drawn from 15 middle schools within a large suburban school district. Results from a series of regression analyses indicated that middle school students' expectancy-value contributed a little to their basketball dribbling performance (7% of the variance) and badminton striking performance (4% of the variance), and did not contribute to fitness knowledge gain. These results were not resonant with the findings from Xiang et al.'s study (2004).

In summary, although few studies have examined the relation between student expectancy-value motivation and achievement in physical education, findings from these two studies clearly showed inconsistence. The inconsistent findings from the two studies can result from various factors. Firstly, the conceptualization of learning differs in these two studies. Xiang et al. (2004) employed the students' performance on one-mile-run, which usually is used to measure the cardiovascular component of fitness. Using this measure alone is not consistent with the multidimensional nature of learning. Zhu et al. (2008) utilized students' fitness knowledge gain and their psychomotor skill performance as the indicators of learning. The inclusion of these measures in part reflects the multidimensional nature of learning in physical education. Secondly, the difference of the sample size in these two studies could as well lead to the difference in the magnitude of the relation between expectancy-value motivation and student learning. Finally, the studies were conducted in different curricular contexts and with different groups of students. In Xiang et al. (2004)'s study, the elementary students were learning a single activity curriculum in one rural elementary school, whereas the students in Zhu et al. (2008)'s study were learning a multi-activity curriculum in a large urban/suburban metropolitan area. These contextual differences may lead to the different relations between student expectancy-value motivation and their achievements. The inconsistence suggests a need for additional research on this important topic in physical education.

Expectancy-value Motivation and After-school Behavior Choices

Existing studies on this perspective seek to determine the relation between student expectancy-value motivation and their after-school behavior choices. As manifested in other domains such as reading (cf., Wigfield & Eccles, 2000), subjective task values are a major predictor of student after-school behavior choices. Wigfield and Guthrie (1997) for example, found that students' expectancy-value motivation predicts their reading time and the number of books read after school. In physical education, Xiang and colleagues (2004) found that student subjective value, especially intrinsic interest value contributed significantly to students' intention for future participation in running (43% of the variance, 49% of the variance combined with importance value). In a similar study, Xiang and colleagues (2006) found similar results that 5th grade students' subjective task values contributed over 40% of the variance of students' intention for participation in running in middle school.

In a recent study in physical education, Zhu et al. (2009b) also examined the relation between student expectancy-value motivation and their after-school physical activity behaviors. A sample of 358 elementary students from six suburban schools provided data on measures of expectancy-value motivation in physical education and their after-school activities. Students' after-school behaviors were collected using a modified version of the 3-Day Physical Activity Recall (3DPAR), which provides a grid divided into 15-minute segments or blocks in which students are asked to record all activities performed during the day (McMurray et al., 2004; Weston, Petosa, & Pate, 1997). Students' physical activity range and frequency were utilized as the indicators of their after-school physical activity participation. Structural equation modeling revealed no statistically significant paths from the expectancy beliefs and task values to after-school physical activity participation. The results seem to suggest that student expectancy-value motivation for physical education is less likely to contribute to their after-school physical activity behavior. In another study with middle school students, Zhu et al., (2009c) revealed similar findings.

To sum up, the existing studies conducted within physical education contexts observed no direct significant relation between student expectancy-value motivation and their after-school physical activity participation. The results were not consistent with the findings in other subject domains (Wigfield & Guthrie, 1997) where students' task value was identified as a predictor for their after-school behaviors. Although students reported that they had very high expectancy-value motivation in physical education (Zhu et al., 2008), yet the motivation may not translate into their actual behavior choices for after-school physical activity. Whether or not their relation is mediated by other variables such as their achievement remains unknown. In addition, although cost was recognized as an important component of expectancy-value motivation theory, it was absent from Xiang et al. (2004) and Zhu et al. (2008)'s studies. Cost plays an important role in the decision making process (Buchanan, 1969), and its role in students' motivation process seems still ambiguous (Chen et al., 2008).

Developmental Perspectives of Expectancy-value Motivation

The developmental perspective of expectancy-value motivation examines changes along with student development and changes in the relation between motivation and achievements. For example, Jacobs and colleagues (2002) used the data from the Childhood and Beyond longitudinal study (Eccles et al., 1983) to investigate the development of the expectancy beliefs, task values, and activity choices among 761 students from first grade to 12th grade in 10 public schools. Using the hierarchical linear modeling technique with growth curve analysis, the researchers analyzed changes overtime in the expectancy beliefs and task values in reading, mathematics, and sports. The primary finding was that across all three domains, student expectancy beliefs and task values declined as the children grew older, although the extent and rate of decline varied across domains. Specifically, student expectancy beliefs and subjective values for reading declined rapidly during the elementary school years, but then increase during high school years. For mathematics, the decline continued with a similar pace from elementary to high school years. For sports, students' expectancy beliefs declined more rapidly than reading and mathematics as they moved from elementary to middle and than to high school years. The changes in students' task values for sports demonstrated different patterns for males and females. Males' subjective values for sports declined continuously; whereas females' declined rapidly first during the elementary school years then leveled off during high schools. In the study, Jacobs et al. (2002) also found that expectancy beliefs accounted for much of the age-related decline in task values, explaining 46% of the subjective value change in sports for males, and 36% for females.

Jacobs and colleagues' study (2002) provided a broad picture for understanding student expectancy-value motivation change across three subject domains for 12 years.

The different pathways of student expectancy-value motivation change in these three domains exemplify the domain specificity of the student expectancy-value motivation change across the school years. In the domain of physical education, Xiang and colleagues (2006) examined 113 students' expectancy-value motivation change as they moved from 4th grade to 5th grade in an elementary school. Students in the study were learning in a running program in physical education. The results revealed that students' task values (i.e., attainment, interest, and utility) declined significantly across the school year, whereas their expectancy beliefs did not change significantly. Zhu et al. (2008) compared the expectancy-value motivation among sixth (n = 236), seventh (n = 277), and eighth grade (n = 284) students in physical education and found that students in higher grade rated task values significantly lower than their lower grade counterparts. However, no statistically significant differences were observed in the expectancy-beliefs among the students across the different grades. These findings suggest that it is likely that students' expectancy-beliefs about physical education remain relatively stable across the school years, yet their task values decline significantly as they move to higher grades. It is worth noting that in the same study Zhu et al. (2008) reported that students' fitness knowledge gain varied significantly across the school year, whereas their skill performance did not change significantly. Yet their expectancy motivation contributed little to their knowledge gain and skill performance. It remains not clear what factors lead to the knowledge gain decline and what the decrease in task value results in students' achievement.

Motivation, Achievements, and After-school Behaviors

The purpose of schooling is to facilitate student learn the knowledge and skills that they could not efficiently acquire outside the school by themselves (Dewey, 1916). Accordingly, from the social-constructivist learning perspective, students construct their knowledge through interactions with the curriculum, teachers, and peers, and through connection between what they are learning in school to their real life experiences (Vygotsky, 1978). The knowledge construction experiences then form a new set of knowledge as a new knowledge basis upon which newer knowledge can be constructed in their future learning. During this process, motivation is assumed to determine students' choice decisions on what to engage or disengage and effort decisions on how deep they are willing to engage in the learning process (Pintrich, 2003). Therefore, educational scholars (e.g., Simpkins et al., 2006; Wigfield & Guthrie, 1997) call upon researchers to further examine expectancy-value motivation and its relation with achievements as well as with after-school behavior choices.

In physical education, Chen and Shen (2004) argued that participating in after-school physical activity programs may lead to an active engagement, but may not lead to a parallel achievement. Zhu and colleagues (2009c) collected students' (*n* = 439) expectancy-value motivation, skill performance (including basketball dribbling and badminton striking), and their after-school physical activity data from nine middle schools. They utilized the structural equation modeling techniques to examine the relation between students' motivation, skill performance, and their after-school physical activity participation. They hypothesized in a latent path model that students' expectancy-value motivation predict both their after-school physical activity participation and skill performance, and that skill performance predicts after-school physical activity. The results suggest that middle school students' expectancy beliefs and task values in physical education did not directly predict their after-school participation ($p < .05$). Instead, they predicted the participation indirectly through the mediation of their actual skill performance, with the model explaining 20.4% of variability in skill performance and 7.2% in after-school physical activity respectively. This finding suggests that students' expectancy beliefs and task values for physical education may not lead to desired after-school physical activity behaviors when the expectancy-value is not coupled with a parallel achievement in skill development. The findings, along with those from Chen and Shen's study (2004), suggest the importance of enhancing skillfulness for students to become motivated learners in physical education and become physically active in after-school hours.

Issues for Future Research on Expectancy-Value Motivation

Overall, previous studies (e.g., Xiang et al., 2004, 2006; Zhu et al., 2008) have examined how expectancy-value motivation is related to various behavioral variables, as well as how after-school behaviors influence motivation. From the constructivist learning perspective, students learn best when participating and applying the knowledge and skills in real life experiences (Darling-Hammond, 1997). In other words, the selective after-school behaviors can be viewed as an extension of learning in schools. Therefore, from this perspective, the broadly-defined achievements can be conceptualized as dependent variables influenced by in-school motivation. In this section, I briefly summarized relevant findings from previous studies, identified limitations in the findings, and conceptualized research questions that I intended to address. I also addressed the importance of these questions, and what needs to be done to answer them.

Limitations of the Existing Studies

As defined by Alexander et al. (2008), learning involves a multidimensional process that is often reflected by the changes in the outcome. In physical education, learning traditionally includes three aspects, psychomotor, cognitive, and affective. However, learning has been confined to psychomotor performance in many of the previous studies. For example, Xiang and colleagues' (2004, 2006) operationalized student achievement as only one indicator, the running performance measured at the end of the semester. Although in Zhu et al.'s studies (2008, 2009b, 2009c) students' knowledge gain and after-school physical activity participation were included, skill performance still represented the primary learning indicator. According to NASPE (2004), student cognitive knowledge about physical activity as well as their psychomotor performance should all be included as the learning goal of physical education. In summary, we have learned that students' expectancy-value motivation could predict their psychomotor performances (Xiang et al., 2004; Zhu et al., 2008), yet it remains unknown that this predictive relation will still exist when the psychomotor learning is operationalized as the change in performances. It is reported (Zhu et al., 2009b) that students' psychomotor performance could predict their after-school participation, yet it is not clear whether this predictive relation will exist between their knowledge gain and after-school physical activity participation. In future studies, the multidimensional nature of learning should be conceptualized, and change in psychomotor and cognitive performances should be assessed to reflect the multidimensional conceptualization of learning.

The issue of sampling can become a potential limitation for Xiang and colleagues' studies (2004, 2006) as it may undermine the external validity of the findings. In their studies, samples were drawn from one or two schools with relatively small sizes. Although the studies systematically examined students' expectancy-value motivation in relation to their running performance within the particular school context, the fact that the students were taught by one teacher may limit the representativeness of the responses. For future studies, more representative samples are needed to obtain reasonable external validity of the findings.

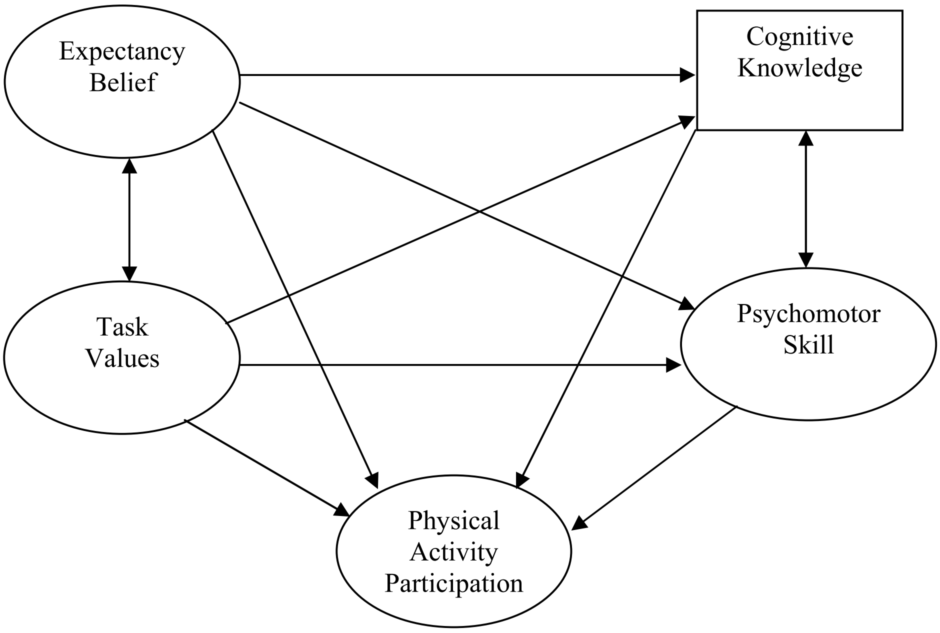
Whereas many of the studies (e.g., Xiang et al., 2004, 2006; Zhu et al., 2008, 2009b) acknowledged that cost is an important component of the expectancy-value theoretical framework, these studies did not examine students' perceptions of cost and its relation to physical education achievement. The lack of evidence about the role of cost in student motivation, learning, and behavior choice limits our understanding of the effect of expectancy-value motivation. Thus, it becomes difficult for us to understand the regulatory process of student expectancy-value motivation in an explicit and holistic way (Schunk & Zimmerman, 2006). Based on the expectancy-value theory (Eccles et al., 1983), student cost perception of physical education could be an important moderator or regulator of students' behavioral choices worthy of further investigations.

The Present Study

As reviewed above, the findings from the existing studies show that students' expectancy-value motivation predicts their psychomotor performances as reflected by running (Xiang et al., 2004) and basketball dribbling (Zhu et al., 2008). It appears that more evidence is needed before this predictive relation can be considered trustworthy or ecologically valid, especially when a change-in-performance conceptualization of psychomotor learning is used to represent learning. The first purpose of the present study was to verify the direct effects of the expectancy-value motivation on student achievements as manifested in changes in knowledge and physical skill performance.

It is clear from the previous studies (Zhu et al., 2009b, 2009c) that contribution of expectancy-value motivation to after-school physical activity behavior is mediated by physical skills. When learning is conceptualized as multidimensional, it is not clear what role mastering cognitive knowledge will play in the relation between expectancy-value motivation and psychomotor skill learning and after-school physical activity. The second purpose of this study, therefore, was to identify the trilateral relation among students' expectancy-value motivation, achievement in knowledge and skill, and their after-school physical activity participation. Specifically based upon the previous studies and the Eccles and Wigfield's (2002, depicted in Figure 1.1) expectancy-value model, I intended to verify the theoretically hypothesized model in Figure 2.1. I hypothesized that student expectancy beliefs and task values predict their cognitive knowledge and psychomotor learning, both of which predict student after-school physical activity participation. In addition, I hypothesized that student expectancy beliefs and task values predict their after-school physical activity participation as well.

Figure 2.1 A *priori* model of student expectancy-value in physical education.



Cost has been theorized as an integral component in the expectancy-value theory in all previous studies (e.g., Xiang et al., 2004, 2006; Zhu et al., 2008, 2009b), however, it has not been specifically identified and measured in physical education. Although it is known that the cost perception about physical education is likely to stem from the curriculum students are learning (Chen et al., 2008), the role of cost in the expectancy-value motivation process remains under-studied for both theoretical understanding and practical application. The expectancy-value theory (Eccles, et al., 1983) demands us to examine this component so that physical education students' expectancy-value motivation can be understood within the intact theoretical framework. The third purpose of this study was to determine the role of cost, as an integral component of the expectancy-value motivation, in relation to expectancy beliefs, task values, and achievement in physical education.

In accordance with the purposes of the present study, I would like to address the following three sets of research questions:

(a) To what extent does expectancy-value motivation directly predict student achievement in physical education? Does expectancy-value motivation and achievement in physical education vary across the middle school years?

(b) Does student motivation and achievement in physical education predict their after-school physical activity participation? From a pedagogical perspective, does student achievement mediate the relation between their expectancy-value motivation and their after-school activity participation?

(c) What are the dimensions of students' cost perception of physical education? What are the properties of these dimensions of cost and whether or not they relate to students' expectancy beliefs, task values, and achievements in school setting?

CHAPTER III

RESEARCH METHODS

To achieve the purposes of this study, I intend to address three sets of research questions: (a) To what extent does expectancy-value motivation directly predict student achievement in physical education? Does expectancy-value motivation and achievement in physical education vary across the middle school years? (b) Does student motivation and achievement in physical education predict their after-school physical activity participation? From a pedagogical perspective, does student achievement mediate the relation between their expectancy-value motivation and their after-school activity participation? And (c) what are the dimensions of students' cost perception of physical education? What are the properties of these dimensions of cost and whether or not they relate to students' expectancy beliefs, task values, and achievement in school setting?

To answer these research questions, I used an existing database from a large-scale, multi-year study that I have been actively involved as a data collector, data manager, and data team leader throughout my years of graduate study at the University of Maryland. In the following sections, I delineated in detail (a) the background of the study, (b) the research context, (c) participants, (d) variables and measures, (e) data collection procedures, and (f) data analysis strategies.

Research Background

In order to facilitate student learning and physical activity participation in physical education, a large school district in the Washington metro area developed, and implemented a physical education curriculum for middle schools. The curriculum is a standard-based educational program that focuses on helping middle school students develop knowledge and skills in health-related fitness, physical skillfulness and concepts, and personal and social responsibility (Curriculum Document[2], 2004). The health-related fitness focus entails the need for students to understand and apply the health-related fitness principles in their daily lives to lead a healthful, physically active lifestyle. The skillfulness and concepts address the need for students to master basic psychomotor skills and tactical knowledge, and to be able to apply them into different movement contexts for various movement purposes. The responsibility focus is to meet the need for students to cherish their personal self-efficacy for a healthful and productive life and to develop a sense of community through the experiences in physical education.

A three-year study was designed to evaluate the effectiveness of the curriculum, which encompassed all the years of my graduate study at Maryland. This study provides a great opportunity to study middle school students' learning and motivation in physical education. It has given me a great deal of practice to formulate, test, and sharpen my research goals and skills. During the course of the research I have led (as a researcher and lead author) the effort of examining the psychometric properties of the Expectancy-Value Questionnaire [EVQ] for middle school physical education students (Zhu et al., 2009a); and have conducted a cross-sectional analysis on students' expectancy-value motivation and learning performances across the 6th, 7th, and 8th grade students (Zhu et al., 2008). I have attempted to investigate the role of expectancy-value motivation in relation to psychomotor skill performance and after-school physical activity participation (Zhu et al., 2009c). Based on all these research experiences and outcomes, I have become interested in pursuing answers to the aforementioned research questions. Therefore, the nature of this dissertation study was a continuation of my previous studies in attempt to unravel

[2] Identifiable information eliminated as required by IRB (IRB #05-0486, PAS Protocol #1443)

these questions about student expectancy-value motivation and achievement in physical education.

My role in the study has been versatile, which has provided me with tremendous opportunities to learn the knowledge and skills necessary to become a competent researcher. I started working as a data collector responsible for three middle schools in the first year of the study. My responsibilities included measuring student height and weight, administering surveys, knowledge and skill tests, as well as collecting caloric expenditure in physical education using accelerometers. In addition, I organized and scanned the surveys and knowledge tests for all of the 15 middle schools. In the second year of the large study, I became the data team coordinator responsible for collecting data at six schools, training data collectors, assisting data collection coordination with participating schools, and developing and piloting surveys and knowledge tests using the *eListen*® and *Scantron*® system. In the third year, besides collecting data at five schools, I continued my role as the data team coordinator, and took additional responsibilities as the database manager responsible for data preparation and preliminary data analysis. These experiences not only deepened my understanding of collecting data in schools, but also prepared me for conceptualizing independent research studies.

Research Context

The school district was the 16th largest metropolitan school district in the United States. At the time of the study, the school district served approximately 137,800 K-12 students. There were approximately 34,000 students attending 38 middle schools in the school district. According to the district's data, the student body represented very diverse ethnicities of more than 160 countries. In addition to the cultural diversity, the students also came with a diverse socio-economic background. The percentage of students enrolled in the federal Free and Reduced Meal System (FARMS %) ranged from 1.5% to 50.3% among the middle schools. On average the FARMS is 25.9% for all of the middle schools. Overall, the student mobility rate in middle school was 13.4% and attendance rate was 95.9%.

The physical education curriculum in the district was based on a framework focusing on developing student movement skills and concepts, health-related fitness, and personal and social responsibility. The basic movement skill as well as the sport-centered skill and game tactics were taught using different approaches including the *Sport Education* and *Tactical Games*. Health-related fitness and fitness concepts as strong components in the curriculum were either organized in independent units or integrated in sport-related content. The national and state standards were fully adopted in the curriculum and integrated into explicit assessments for learning of knowledge (physiological and biomechanical principles of movement, health-related fitness), skill development (skill performance in learning settings and application settings), and dispositions (applying socially responsible principles in physical activity settings). On average, students received 225-minute physical education each week, ranging from 200 to 245 minutes. Instructions were organized into 40-50 min daily lessons or 90 min lessons every other day (A-B day schedule).

Participants

Participants Representativeness

The school district represented the 100 largest U.S. school districts (National Center for Education Statistics [NCES], 2003). The representativeness was determined on the basis that measures of the six key identifiable variables (NCES, 2003) from the district fell within one standard deviation of the means of the 100 largest school districts in the U. S. These key variables included percentage of students from multi-ethnic cultural background, social-economic status (FARMS %), average school enrollment, financial expenditure per student, and teacher / student ratio.

In the stage of school sampling, all middle schools in the district were organized into 15 sampling brackets based on the extent of similarity in FARMS % and enrollment. This procedure produced 15 sampling brackets with two in each. One in each bracket was randomly selected as a participating school in the study. In each participating school, one class from each grade was randomly selected as the data providing class. Permission to conduct the larger study was received from the University of Maryland IRB and the school district's Research Office as well as the Superintendent. Parental consent was received from parents/guardians of the students prior to data collection. The final sample for middle schools, as displayed in Table 3.1, consists of 854 students with diverse ethnic composition. Even though there might be some misreport of their ethnicity from students, the sample as demonstrated in Table 3.1 was representative of the ethnic composition of the middle school students in the district.

Table 3.1 *Ethnic Composition of the County and the Sample*

Ethnicity	African American	Asian	Hispanics	Other	White
District	22.7%	15.1%	21.3%	0.3%	40.6%
Sample	18.3%	14.5%	17.9%	9.7%	39.6%

Variables and Measures

To explore the relation among middle school students' expectancy-value motivation, achievements in physical education, and their after-school physical activity participation, it is important to measure these variables accurately. For measurement purpose, these variables were operationalized using different combinations of indicators. Each indicator was gauged by a specific measure that had been validated prior to the study based on tangible validity and reliability evidence. In the following section, I operationally defined these variables and elaborated on the measures being used in data collection, and presented the validity and reliability evidence for these measures.

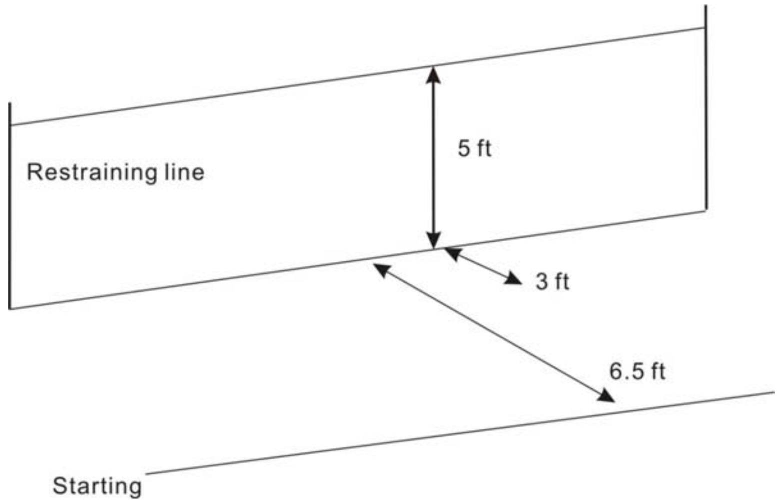
Achievements

In this study, achievements are operationally defined in three categories: skill performance, fitness knowledge, and after-school physical activity participation. The operational definitions are consistent with the Curriculum. Specifically, psychomotor skill performance was measured using two basic skill tests, badminton overhand striking test (Lockerhart & McPerson, 1949), and Basketball dribbling test (American Alliance of Health, Physical Education, and Dance [AAHPERD], 1984). These two tests measure students' object-manipulation skill, space awareness, and footwork movement that provide the basis for lifelong physical activity participation (Gallahue & Cleland, 2003). Students' knowledge about fitness and physical activity was measured using a set of validated, standardized multiple-choice tests (Zhu, Safrit, & Cohen, 1999). Students' after-school behavior was recorded using the modified 3-Day Physical Activity Recall (3DPAR; Weston, Petosa, & Pate, 1997).

Psychomotor Skills. Two fundamental psychomotor skills, badminton striking and basketball dribbling were measured as indicators of students' psychomotor performance. These fundamental skills were chosen as indicators of psychomotor performance because they possess the following two characteristics. First, although these skills cannot be directly translated into athletic performance (e.g., winning the competition and games) (Fischman, Christina, & Vercruyssen, 1982), they are fundamental skills that are considered to be common and applicable to various sports and physical activities (Gallahue & Cleland, 2003). Second, these fundamental skills do not come naturally, they have to be learned, and they are considered as important contents to learn in physical education (Gallahue & Cleland, 2003).

The first psychomotor skill is the badminton overhand clear which can be used to assess overhand striking skill. As a fundamental manipulative skill, the overhand striking skill can be applied in various sport games and other physical activities, for example, tennis overhand smash, baseball throw, volleyball spiking, and racquetball kill-shot. The Lockhart and McPherson (1949) overhand striking test was used because of its standardization and accompanying validated norm for scoring. The test measures the accuracy and consistency of students' badminton overhand clear striking skill. The test-retest reliability coefficient of this test has been reported to be .90, and validity coefficient has been reported ranging from .71 to .90 by using criterion measures of experts' ratings on badminton striking and round robin tournaments (Lockhart & McPherson, 1949).

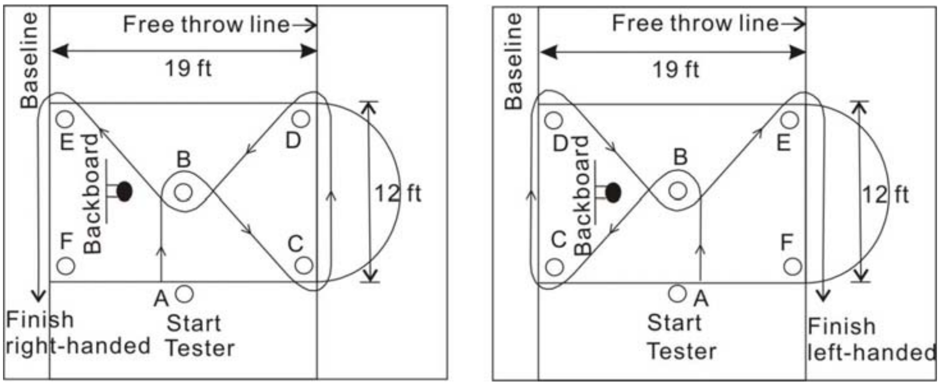
Figure 3.1 Description of the Badminton Striking Test (Lockhart & McPherson, 1949).



When taking the test (Figure 3.1), the student assumes a service stance in back of the starting line on the floor 6 ½ feet from and parallel to the base of the wall. On the signal "Ready, go!" the examinee serves the shuttlecock against the wall. The shuttlecock is then hit as many times as possible during a 30-second time period, as long as it is hit from behind the restraining line, which is 3 feet from and parallel to the base of the wall, and above a 5-foot line on the wall. Three 30-second trials are taken. A 15-second practice session is permitted before testing. One point is scored each time the shuttlecock is hit during each trial and the total test score is the sum of the legal hits in all three trials.

The second skill test is the basketball control dribble test developed by AAHPERD (1984). As a controlled manipulative activity, basketball control dribble tests students' ability of hand manipulative skill, body-limb coordination, and footwork coordination that are of great importance for the participation in various physical activities and sports. Essentially, the test measures how efficient students can travel in a zigzag route while dribbling the basketball. The concurrent validity coefficients were reported to range from .37 to .91, and the test-retest reliability ranged from .93 to .97 for females and from .88 to .95 for males respectively.

Figure 3.2 Description of the AAHPERD (1984) Basketball Control Dribble Test.



As demonstrated in Figure 3.2, the test is administered in the lane of a regular basketball court, where six cones are placed in between of the baseline and the free throw line. When the test starts, the student starts with the non-dominant hand dribbling a basketball from the first cone (cone A) and turns, with preferred hand, at each of the five cones in a fixed sequence (i.e., B to F) as fast as they possibly can without losing control of the ball (Figure 3.2). The diagram on the left side in Figure 3.2 is used for right-handed students and the right one for left-handed ones. The time from the start to finish is recorded by a tester with a stopwatch. The performance score for each trial is the time required to complete the course legally. Each student has two trials in total. The total score is the sum of the times recorded in both trials.

Cognitive Knowledge. Students' knowledge about exercise and fitness principles was measured using a set of validated, standardized multiple-choice questions constructed based on the test developed by Zhu et al. (1999; Appendix A). The questions focused on concepts of health-related fitness and exercise principles and were differentiated for each grade in a progressive manner. The knowledge test for each grade had 10-13 questions with three or four choice answers each. Below is an example for each of the sixth, seventh, and eighth grade, respectively, for the muscular capacity unit (the asterisk denotes the correct answer).

An example question from the sixth grade test:

The ability to contract the muscles many times without tiring or to hold one contraction for a long period of time is called:

(a) Muscular strength

(b) Aerobic endurance

(c) Muscular endurance *

An example question from the seventh grade test:

Which of the following is the best example of muscular endurance?

(a) Five arm curl reps with 20 pounds

(b) Fifteen bench press reps with 75 pounds *

(c) Ten sit-ups

(d) A fifteen-second isometric contraction

An example question from the eighth grade test:

Alternately performing sets of exercises that train opposing muscles, without resting between sets is known as:

(a) Compound sets *

(b) Supersets

(c) Multiple sets

As demonstrated in the examples, each question has only one correct answer. For each correct answer students will receive a score of one, and incorrect answer a score of zero. An arithmetic sum of the total (correct) scores was used as the performance score for the student. Hence, the minimum and maximum possible scores for students may range from zero to the total number of questions (10-13). The pretest and posttest score represents a student's performance at the beginning and ending of the semester, respectively. In order to control for the potential ceiling or floor effect, I will use regression-residual approach in calculating knowledge gain scores. By using this approach, I am able to also control for the initial difference in their prior knowledge (Zimmerman & William, 1982).

After-school Behavior. A modified version of the 3-Day Physical Activity Recall (3DPAR) was used to provide the range and time regarding physical activities that the participants engaged in during their after-school hours, from 3:00 p.m. to 10:00 p.m. The 3DPAR is based on the Previous Day's Physical Activity Recall (PDPAR) validated in middle school students (McMurray et al., 2004; Weston et al., 1997). The original one day version of this instrument demonstrated excellent evidence for test-retest reliability ($r = .98$) and concurrent validity ($r = .77$ with accelerometers) in adolescents (Weston et al., 1997). Recently the reliability and validity evidence of the 3-day PDPAR was assessed in 71 middle-school children. The test-retest correlation was $r = .68$ for moderate to vigorous physical activity [MVPA] (McMurray, Harrell, Bangdiwala, & Hu, 2003). In addition, because the recall period is extended from 1 to 3 days, researchers are able to obtain a reliable estimate of "usual" or "habitual" physical activity in a single reporting session (Trost, 2001).

The modified 3DPAR form provides a grid divided into 15-minute segments or blocks for each hour in which students are asked to record all activities performed during the day after-school from 3:00p.m. to 10:00p.m. (Appendix B). Students take the instrument with them for each of the three days. The instrument provides a list of commonly performed activities grouped into the following categories: sport, fitness, other physical activities, academic/homework, rest, transportation, entertainment, and socialization. For each block of each day, students entered the main activity in which they participated during that 15-min period. The main activity was defined as one that occupied most of the 15-min period. The original 3-day PDPAR was reported to take an average of 28 minutes to complete for adolescents (McMurray et al., 2004).

Expectancy-Value Motivation

Student expectancy beliefs, task values, and cost perceptions about physical education were measured using a modified Expectancy-Value Questionnaire [EVQ] (Eccles & Wigfield, 1995). It includes a 5-point Likert scale with 5 items measuring expectancy beliefs and 6 measuring the attainment (importance), intrinsic (interest), and utility (usefulness) values. The modified EVQ includes two portions. In the first portion of the EVQ, students were asked to respond to the items by indicating their preference on the five-point scale attached to the item. For example, in responding to the item "How important do you think PE is for you?" the student can choose a number between 1 and 5 with 5 indicating "very important" and 1 indicating "not important." The descriptor "very important" and "not important" are printed out explicitly on the EVQ to avoid confusion about the scale. In the second portion of the EVQ, two open-ended questions were designed to elicit students' cost perceptions of physical education. Students are asked to write a few sentences to answer each of the questions. These two questions are:

(a) If there is anything that you don't like in Physical Education, what would that be? Why?

(b) If you had a choice, would you rather NOT come to Physical Education, why?

Xiang et al. (2003, 2004) have reported that the first portions the EVQ could produce reliable data for elementary and middle school students with the Crobach alpha coefficients ranging from .63 to .87. Using the confirmatory factor analysis, Zhu et al. (2008) found that the measurement model of EVQ was preserved very well in 903 sixth, seventh, and eighth grade students from 13 middle schools (S-B $\chi^2 = 77.129$, df=40, $p<.05$, CFI= .972, SRMR= .036, RMSEA= .046, CI_{90}: .030, .061) with a latent structural reliability coefficient *Rho* (ρ) = .906. This evidence suggests that EVQ can be used to measure middle school students' expectancy-value motivation about physical education. Appendix C displays the EVQ in its entirety.

Data Collection and Management

Even though there is convincing validity and reliability evidence, any inappropriate handling of the instruments in the process of data collection and management could potentially jeopardize data integrity. We employed a variety of procedures and protocols to safeguard the integrity of data collection and data management.

Data Collection Procedures

Because the data collection took place simultaneously in multiple schools each semester, trained data collectors were employed. I served as a data collector in the first year of the study, and as the Data Team Coordinator in the second and third year. Each year I was personally responsible for collection data from three to five schools. In addition, I was responsible for training data collectors. On average, I devoted 20 hours each week to data collection and management during the data collection period.

Data Collector Training. I was the primary trainer for data collectors and physical education teachers who collected knowledge and skill data as part of learning assessment designated by the curriculum. Most data collectors were juniors and seniors majoring in kinesiology and public health. An extensive training program was designed for the purpose of data collection for the large study. The program required three six-hour training sessions. The topics in training programs encompassed from the way of entering the schools to administering tests. Training materials directly relevant to the data used in the dissertation study were included in Appendix D. In the training sessions, they were provided with an overview of the larger project and data collection protocols (Appendix D). They had to learn the related policies and regulations of the county's public schools system. One hands-on session was devoted to practicing data collection procedures and conducting inter-observer agreement reliability checks. In addition, both the physical education teachers and data collectors received a detailed timeline (Table 3.2) for administering tests and surveys to ensure the consistency of the procedure across different school sites.

Parental Consent and Participant Protection. The data collection procedure and data protection procedure along with parent consent forms, student accent forms, were approved by the University of Maryland Internal Review Board (IRB) for the duration of 2005-2008 (UM IRB Application and Approval #: 05-0486). Since the data collection was completed in May 2008 and the data had been de-linked with the identifiers, the protocol is considered to be closed. After consulting with the IRB manager, I was advised that I can directly proceed with data analysis for my dissertation study (Email communications with the IRB manager, 2009; Appendix E). Prior to the data collection, the consent forms were received from physical education teachers and participating students' parents or legal guardians in October of 2005, 2006, and 2007. The participating students and their parents or guardians were informed that the purpose of the study was to assist the school district to develop and evaluate a new physical education curriculum. The students were told that their knowledge and skill tests were part of their physical education learning assessment so their teachers would use the results for grading. They were also informed that their responses to the surveys would not be shared with anyone including their parents, teachers, and school administrators and would not affect their grades.

Table 3.2 *Data Collection Timeline*

Time	Measure
December 2006 (End of the fall semester)	Knowledge tests (Pretests)
December 2006 (End of the fall semester)	Psychomotor skill tests (Pretests)
Early April 2007	EVQ survey (Expectancy-value motivation)
Mid April 2007	3DPAR (After-school behavior)
Late April 2007 (End of the spring semester)	Knowledge tests (Posttests)
Early May 2007 (End of the spring semester)	Psychomotor skill tests (Posttests)

Data Collection Protocols. Prior to the data collection, all the surveys and knowledge tests were proofread by multiple persons on the research team and the physical education instructional specialist of the district to eliminate typos and other errors. For the knowledge tests and EVQ survey, because they were developed on the *Scantron*® system, we printed a small amount of the tests and surveys and tested for scanning accuracy in our research lab. I was responsible for over 90 percent of the survey construction using the survey/test development software *e-Listen*®. Once it was determined that all the surveys and tests deployed on the system could be scanned with 100% accuracy, I printed the surveys for each individual student for data collectors to bring them to their assigned classes.

The cognitive knowledge tests (pretests) were collected at the end of the fall semester in 2006, posttests and surveys at the end of the spring semester in 2007 primarily by the physical education teachers, or by the trained data collectors. The knowledge tests were administered either in the classroom or in the gymnasium. In either case, the physical educator and the data collector followed specific step-by-step directions printed on the test envelope. These directions consisted of having students answer the questions independently, read the questions to the students, make sure the students understand the questions, and enforce the use of pencil and correct bubbling on the *Scantron*® tests. For example, a set of directions states:

Read the following aloud to students:

1. Write your name on the BOTTOM line only (No writing anywhere else on the sheet)

2. Write your last name first, then first name

3. Fill in the bubble COMPLETELY & press HARD

4. Mark ONE answer for each question

5. Read each question and choice answers to students

When finished, please

1. DO NOT clip tests together with paper clips or fold the tests

2. Arrange the completed tests in alphabetical order by last name

3. Place all test sheets in this envelop

4. Put a current class roster in the envelope

This procedure was used to collect all knowledge test and survey data. By using these standardized procedures, the data collectors made sure that students understood the questions and knew the correct way to put their responses.

The psychomotor skill tests were conducted twice, pretest at the end of the fall semester in 2006, and posttest at the end of the spring semester in 2007. Mostly the physical education teachers administered the psychomotor skill tests according to the protocols (see Figure 3.1 and Figure 3.2). Data collectors and I assisted during the tests. Normally, a small group of students were asked to come to the test station and help set up the test station, pick up the ball, and collect the shuttles, while one student was taking the tests at a time.

In April in 2007, the 3DPAR was administered to the students. The students completed the survey three times during in a period of two weeks, each on a different day. The students were given ample time for completing the time log each time. The data collectors and physical education teachers answered questions that the students raised about the survey.

Data Management Protocols

A set of protocols were employed to control for potential threats to the validity and reliability of the data. During the data collection process, I met with the data collectors each week to log in the data that they had collected during the week. After that, I double-checked data completion and compliance with data collection procedures. The collected surveys and knowledge tests were then scanned into a database and results from the psychomotor skill tests were entered into the database by hands. A data shell (template) was created with student, class, school ID information so that the data entered in the different data-entry processes could be merged. I was responsible for the database construction and for about 60 percent of data scanning. A lab assistant entered the psychomotor skill data and scanned about 40 percent of the surveys and knowledge tests under my supervision. In addition, the principal investigator of larger project met with other data collectors and me weekly to address the issues arose in the data collection and management processes.

To ensure minimal error in data entry, I regularly cross-examined the database with the original data forms. I randomly selected a small portion of data forms (surveys, knowledge tests, skill test score recording sheets, etc.), traced the students in the database by their names on the form, and then compared the scores on each form with those entered in the database for that student. The process was conducted weekly. In case where inconsistency was identified, the forms for the class or school were re-scanned. The verification process was repeated, until 100% accuracy was achieved. This procedure was also carried out for the psychomotor skill tests, and 3DPAR data, although they were entered by hands. Student cost perception data were entered verbatim in the database as long string variables. In addition, when the data entry was completed, I examined descriptive statistics such as frequency diagrams and histograms to examine for unusual scores that might be due to possible mishandlings of the data during data entry.

Data Analyses for the Dissertation Study

In order to address the three sets of research questions, I conducted multiple quantitative analyses to answer the question sets (a) and (b). To answer the question set (c), I used qualitative analytic methods to categorize participants' written responses to the open-ended questions about cost perceptions. This method allowed me to derive meaningful thematic codes based on which a coding system can be developed to further examine the responses collectively. In the following section, I described the procedures for data preparation and analyses.

Data Preparation and Reduction

Data Reduction. To prepare for the data analysis, I conducted data conversion and preliminary calculation to have the variables ready for analyses. First, I aggregated students' cognitive knowledge test scores from the pretest and posttest, then converted them into percentage-correct score by dividing the number of correct answers by the total number of questions. In addition, I computed the residual gain score as students' cognitive achievement for the data analysis. In a pre-post test context, the residual gain score is conceptualized as the residual error using the pre-test as the predictor and post-test score as the dependent variable (Williams, Maresh, & Peebles, 1972). The residual gain score is uncorrelated with the pretest score, whereas it can be expected that the raw gain score (i.e., numerical value of the difference between the posttest and pretest score) shows a negative correlation with initial states (Williams et al., 1972).

Second, for the psychomotor skill data, they were converted into standard T scores based on the existing data to represent students' psychomotor skill performances and allow for cross-sectional comparisons. The formula for calculating T scores was as follows, $T = [10 * (X - \overline{X}) / s] + 50$, where X represents the raw score, $\overline{X}$ the pooled average, and s the pooled standard deviation. Particularly for the basketball dribbling test scores, because a smaller numeric value of the test score represents a better performance (i.e., using less time), students' test scores was converted using the following logarithm function, x' = ln (1 / x), where x refers to the raw score time, and x' the new score. In this way, the basketball dribbling performance (x') was transformed into a similar variable as the badminton striking, with which a larger score indicates a better performance. Therefore, the x' was used as the raw score for T score conversion for basketball dribbling.

Third, the students' 3DPAR behavior data were coded according to the activity codes (Appendix B) once the data are cleaned. Then I counted the number of time segments that students indicated participating in physical activities to form the indicator of after-school physical activity participation time. I recorded different kinds of physical activities that students reported doing to form an indicator of physical activity type. I might also include other activities, such as socialization and entertainment to provide a broad description of student after-school activity.

Lastly, because expectancy beliefs and task values were measured with different number of items, they were computed as the average of aggregated values of the items for inferential statistical analyses. In this way, the range for the value of these variables remained between 1 and 5. Students' responses to each item were preserved for the latent path analysis using structural equation modeling. Since cost perception was a long string variable, I read through them and coded them according to emerging themes (also explained in later sections).

Missing Data Manipulation. The study involved 15 middle schools and has multiple data collection points; therefore, it was inevitable to have missing data at certain data points for some students. In this study, I used the following strategies to handle the missing data. First, within each intact class if over one third of students reported missing data on one variable or even more variables, the class was removed from data analysis on the variables. However, if less than one third of students had missing data, the missing values were estimated with a full information maximum likelihood approach (Dempster, Laird, & Rubin, 1977). Second, in addition to the above strategy, when a data analysis involves multiple variables all schools need to have data for all the variables included in the analysis. The above strategy was employed in case there were missing values. These strategies were applied prior to the final data analysis.

Quantitative Data Analysis

I conducted descriptive analysis, correlation and regression analysis, and structural equation modeling (SEM) to answer the first two sets of research questions: (a) To what extent does expectancy-value motivation directly predict student achievement in physical education? Does expectancy-value motivation and achievement in physical education vary across the middle school years? (b) Does student motivation and achievement in physical education predict their after-school physical activity participation? From a pedagogical perspective, does student achievement mediate the relation between their expectancy-value motivation and their after-school activity participation?

The Unit of Analysis. Data can be analyzed at individual level (e.g., student) or group level (e.g., class). For inferential statistical analysis (e.g., Analysis of Variance), it is considered better to use group than individual as the unit of analysis particularly when the study includes intact groups (e.g., class, school) as the sampling unit (Hopkins, 1982). Therefore, I used class as the unit of analysis for inferential statistical analysis in the dissertation study, under the assumption that the students' responses to the instruments with interactive influences so that the data were auto-correlated. For correlational analysis (e.g., correlation, regression, and path analysis) where the auto-correlation issue is not a concern, the unit of analysis was set at individual level.

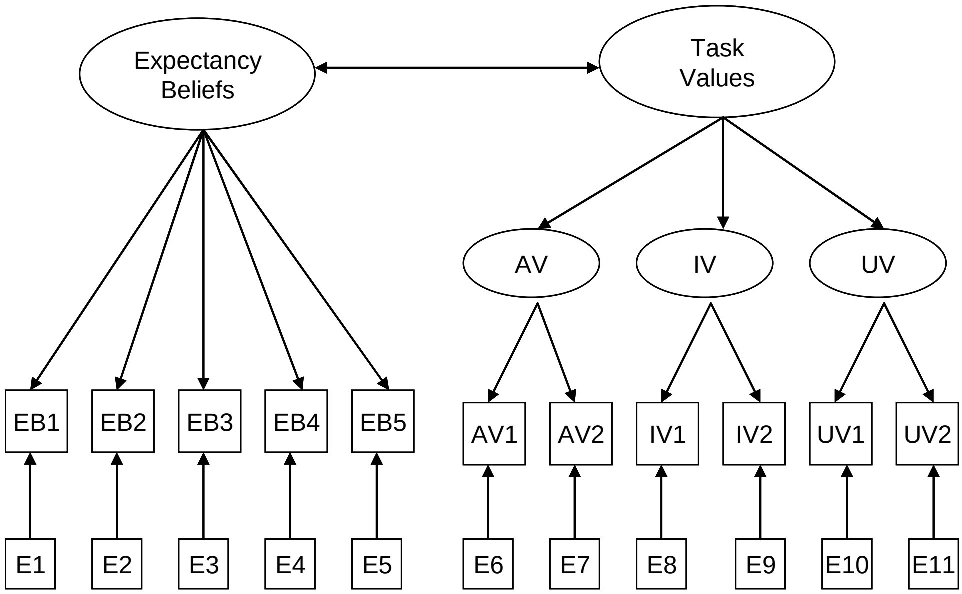
Descriptive Analysis. I conducted descriptive data analysis to check for data distribution normality. Specifically, I used skewness and kurtosis to determine a single variable normality, and Madia's coefficient (i.e., $b2, p$) to determine multivariate normality. Further, I used Levene or Box's M test to determine the homogeneity of variance. These parameters together helped me determine whether the statistical assumptions (i.e., normality and homogeneity of variance) were met for further statistical analysis (e.g., SEM). I also used the descriptive data analysis to detect the irregular responses (outlier) and the impact of the missing values.

Correlation and Regression Analyses. The Pearson product-moment correlation analysis was conducted among all the variables including expectancy-value motivation, psychomotor learning, knowledge gain, and after-school physical activity participation in order to test for linearity to determine the possibility of model tenability. In addition, the correlation analysis results helped to describe the strength and direction of the relation between variables. The multiple regression analysis [MRA] was conducted as well to test the direct predictive power of student expectancy-value motivation to achievements. These analyses helped to address the research question (a), the direct predictability of student expectancy-value motivation to their achievement. The MRA and correlation analysis together was also used to test the collinearity which refers to the fact that an observed variable is a linear combination of another observed variable. Collinearity can lead to a non-positive definite covariance matrix, which is problematic in SEM because estimation of SEM requires that the covariance or correlation matrix analyzed must be positive definite (Byrne, 2006).

Structural Equation Modeling. SEM is a statistical procedure that allows the researcher to address theory-driven research questions involving with both latent variables and observable variables (Hancock & Mueller, 2006). By using SEM, the researchers can test an entire system of structural equations simultaneously to determine how well the data would fit the hypothesized model. Structural equation modeling can also provide estimates of error variances in order to control for systematic measurement errors. These advantages of SEM can help researcher to test mediation effect or even complex causal relations among multiple variables. In this study, therefore, SEM was employed to examine the relation between student expectancy-value motivation, achievement in both cognitive knowledge and psychomotor, and after-school physical activity participation (i.e., research question b). Specifically, I used SEM to test the tenability of the hypothesized model depicted in Figure 2.1.

According to Byrne (2006), the SEM analysis consists of two steps. The first step is concerned with testing and the specification of the measurement model (a priori). Within this step, an initial measurement model where all factors are allowed to co-vary should be tested first. Then a model re-specification might be conducted if the data do not fit the measurement model well. The model re-specification is usually based on (a) intermediate outcomes of SEM. These outcomes consists of sets of indices (e.g., Lagrange Chi-square and *p* values) that suggest possible improvement of data-model fit based on relation of the observed and latent variables; and (b) the researcher's subjective adjustment based on alternative theoretical articulation that is corresponding to the intermediate outcomes of SEM. The re-specification may lead to the redefinition of the latent variable, and subsequently, modify the relation between the variables. It is emphasized that the re-modeling must rely on theoretical compliance of the data (Hancock & Muller, 2006). When the data did not fit the hypothesized model, and the suggested adjustment did not make theoretical sense, I stopped re-specification and went back to revisit my theoretical articulation and re-analyzed the data. Specifically in this study, I first tested the initial measurement model of EVQ as displayed in Figure 3.3. If the data fit the measurement model very well, I continued to conduct the second step of SEM to test the hypothesized model delineated in Figure 2.1.

Figure 3.3 The measurement model of EVQ.



Note: AV = Attainment Value, IV = Intrinsic Value, UV = Utility Value.

The second step of SEM focuses on examining the tenability of the hypothesized structural model. Within this step, the tested initial measurement is imposed as a priori to test the theory-driven hypothesized structural model. If the data are found not fit the hypothesized structural model, a model re-specification will be employed within the realm of a valid theoretical articulation. Particularly in this study, I hypothesized that students' expectancy-value motivation predicted to their achievement and after-school physical activity participation. I also hypothesized that students' achievement predicted their after-school physical activity participation, and that their cognitive knowledge co-varied with their psychomotor learning (as demonstrated in Figure 2.1). Throughout the analysis of SEM, Hu and Bentler (1999)'s cut-off criteria for data-model fit indices were applied. These criteria include absolute fit indices that evaluate how close the observed variance-covariance matrix is to the estimated matrix (e.g., chi-square, and Standardized Root Mean Square Residual [SRMR] < = .08), parsimony correction index that incorporates a penalty function for poor model parsimony (e.g., Root Mean Square Error of Approximation [RMSEA] < = .06), and comparative fit indices that evaluate the fit of the hypothesized model to the null model (e.g., Comparative Fit Index [CFI] > = .95; Tucker-Lewis Index [TLI] > = .95).

The purpose of conducting SEM analysis was to examine the tenability of the hypothesized a priori model (Figure 2.1). By testing the tenability of the model, I can address the research question (b): Does student motivation and achievement in physical education predict their after-school physical activity participation? From a pedagogical perspective, does student achievement mediate the relation between their expectancy-value motivation and their after-school activity participation?

Open Question Response Analysis

Students' responses for the open-ending questions in EVQ were analyzed using open coding (Strauss & Corbin, 1998). First, students' responses were coded into relevant categories using open coding with the imaginative use of theoretical comparisons

(Strauss & Corbin, 1998). Next the data were reassembled with the initial open-coding categories (e.g., “sweating” and “muscle pain”) grouped into broader categories (e.g., “physical uneasiness”). I also use constant comparison technique to code the data until the identified categories are saturated. According to Chen & Liu (in press), only 2 strong thematic categories can emerge from analyzing student responses to the open-ending questions in EVQ: student liking or disliking of physical education (liking/disliking), and hypothetical decisions to continue physical education (choice decision/opportunity cost) if they had the option not to take physical education. The variables generated from the qualitative analysis, liking/disliking of physical education, choice decisions were subject to statistical analyses to further explore the impact of the students’ expectancy beliefs, task values, and cost perception on their physical education achievements and after-school physical activity participation.

Data Analysis Timeline

I expected to complete the data preparation and analysis within one month after the approval of the proposal. While I conducted the data analysis, I summarized the results and findings and prepared for dissertation writing. I planed to structure the results and discussion sections into manuscripts in accordance with the research purposes and questions. Hence eventually, my goal was to finalize the dissertation study by three manuscripts with each addressing one set of the research questions. I anticipated completing these manuscripts for publication in physical education pedagogy or educational psychology journals in July.

CHAPTER IV: STUDY A

Student Expectancy-Value Motivation and Achievements in Physical Education: A Cross-Sectional Descriptive Examination

Introduction

A physically educated person is expected to be knowledgeable about and skillful in physical activities, to participate in physical activities regularly, and to value physically active lifestyles (National Association for Sport and Physical Education [NASPE], 2004). Physical education curricula are often developed to help students learn fundamental knowledge and skills that lead to these desired outcomes. An important factor influencing students' learning in physical education and participating in physical activities out of school is motivation. As Chen and Ennis (2004) postulated, research effort in searching for optimal student motivation should be focused on content/context relevant motivation constructs relevant to the learning process. The expectancy-value motivation theory provides such a motivation construct that relates learner motivation to content-relevant expectancy beliefs for success and perceived task values (Eccles et al., 1983; Wigfield & Eccles, 2000). The purpose of this cross-sectional study was to examine middle school students' expectancy beliefs and perceived task values in relation to their knowledge and skill achievements from sixth through eighth grade.

Expectancy-value Theory

The expectancy-value theory concerns with students' expectancy-beliefs for success in learning and subjective task values of the content (Eccles et al., 1983). It suggests that students are more likely to become motivated when they expect to be successful in learning and perceive the content to be important (attainment value), useful (utility value), and interesting to learn (intrinsic value). According to the expectancy-value theory (Eccles et al., 1983), students' motivation derives from and is influenced by (a) expectancy beliefs, (b) attainment value, (c) intrinsic value, (d) utility value, and (e) cost. The expectancy beliefs are students' thoughts about the possibility of succeeding in upcoming learning tasks. Although closely related to self-efficacy (Bandura, 1986), which refers to the belief about ability to do an activity, the expectancy belief is tapping into the realization of chances of succeeding in the activity. Previous studies indicated that students' expectancy beliefs impacted their motivation, behavior, and learning achievement (Eccles et al., 1983; Eccles & Wigfield, 2002). Students who have high expectancy beliefs for success are likely to perform better in learning and to be more persistent on challenging tasks than those with low expectancy beliefs in both classrooms and gymnasia (Xiang, McBride, & Bruene, 2004).

Subjective task values are defined as students' perception of worth of a task, consisting of attainment value, intrinsic value, utility value, and cost (Eccles et al., 1983). Attainment value refers to the extent to which a learner perceives the importance of succeeding in learning a task/activity. Intrinsic value refers to the enjoyment an individual derives in the learning experience as characterized as interest. Utility value reflects the learner's perception of usefulness of the content or the learning task/activity to his/her own life. Cost is defined as anything perceived or experienced in an activity that hinders the learner's effort to pursue success. As the majority of studies on subjective task values have concentrated on attainment value, intrinsic value, and utility value, cost dimension has been under studied. These task values and cost are theorized to be independent from expectancy beliefs and are likely to have distinct impact on achievement (Wigfield & Eccles, 2000).

Variation of Expectancy-Value Motivation

Expectancy beliefs and task values have been identified being domain specific (Wigfield, 1997), that is, a student may hold different expectancy beliefs and task values for different subject areas. An early cross-sectional study conducted by Eccles and colleagues (Eccles et al., 1983) found that students' task value for mathematics decreased through grades five to 12 whereas the task values for English increased. The results of this cross-sectional study on the one hand demonstrate the domain specificity of students' expectancy beliefs and task values; on the other hand suggest how students' expectancy beliefs and task values differ across different grades in different domains. In physical education, Chen, Martin, Ennis, and Sun (2008) reported that students' expectancy-value motivation could differ for different domain contents.

Expectancy-Value as a Motivator for Achievement

Expectancy beliefs and task values have been identified as predictors for both academic achievements and student performance in physical education. Xiang and colleagues (2004) found that expectancy-related beliefs emerged as the only significant positive predictor for elementary students' running performance and explained 22.05% and 20.87% of the variance for boys and girls, respectively. In another study, Xiang et al. (2006) verified that expectancy belief in running was a significant predictor for students' running performance and their persistence in running. The researchers further revealed that students' task values are predictors for their intention for future running participation.

There is initial evidence suggesting that at a different developmental stage, the motivation function of expectancy-value components may vary. For instance, Chen and Liu (2008) reported that college students in China were motivated by the intrinsic and utility values to continue attending physical education, but motivated by the attainment value to participate in self-initiated after-school physical activity programs. The role of the expectancy beliefs was found insignificant in predicting achievement in physical education for the college students. Chen and Liu (2008) reasoned that college students are able to accurately assess their ability thus tend to hold reasonable perception of expectancy beliefs. Hence for college students, success defined in physical education and after-school physical activity becomes anticipated and motivationally unimportant. The task values, therefore, are perceived to be important factors in their college lives and future health. The motivation role of the task values becomes salient for their participation in physical education and after-school physical activities.

In summary, previous studies have indicated that students' expectancy beliefs and task values can be strong motivators for their academic achievements, choices, and after-school activity participation intentions (Eccles & Wigfield, 2002; Wigfield & Eccles, 2000). Specifically in physical education, it is known that elementary students' expectancy beliefs can predict their running performance, and that the task values predict students' future running participation intention (Xiang et al., 2004; Xiang et al., 2006). It remains unknown, however, that how students' expectancy-value motivation relates to their achievement in psychomotor and knowledge learning in physical education. Particularly, empirical studies on adolescents and secondary students' expectancy beliefs and task values about physical education are still lacking. It appears clear that students' expectancy-value motivation in sport and some subject areas (e.g., reading) declines as they grow older (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002) and their expectancy beliefs about physical education remain unchanged while their task values decline as they grow older (Xiang et al., 2006). Whether or not and how students' expectancy-value motivation vary across middle years is still not clear.

Scholars (Eccles, Lord, Roeser, Barber, & Jozefowicz, 1997) reported that the transition from elementary into middle school has caused maladjustments for young adolescents who are experiencing various developmental changes. Keeping middle-school students well-adjusted and motivated for academic achievement has become an important task for educators because of the transition and developmental changes (Eccles et al., 1997). However, as students grow older, their achievement motivation for learning in physical education, sport, and other disciplines is likely to decline (Jacobs et al., 2002; Xiang, McBride, & Bruene, 2006). Specifically for physical education, although students generally are motivated to participate in physical education (Chen, Chen, & Zhu, 2009), research indicates that more than 50% percent of adolescents ranked physical education as the least important subject in their curriculum (Tannehill, Romar, O'Sullivan, England, & Rosenberg, 1994). The fact that middle-school students are motivated to but not value physical education have piqued researchers' interest in examining motivation and learning in physical education classes in terms of students' perceptions of values (Chen & Ennis, 2004; Goodlad, 2004).

The purpose of this study was to examine middle-school students' expectancy-value motivation and its relation to psychomotor and knowledge learning a curricular context where student learning in skills and knowledge were emphasized. Specifically in this study, we attempted to answer the following questions: (a) Do middle school students' expectancy beliefs and task values of physical education vary sixth through eighth grade in the curricular context? (b) How much did students achieve over the year? (c) To what extent do students' expectancy beliefs and task values as motivators directly predict their fitness knowledge and psychomotor achievements? In answering these questions, we hope to better understand the motivational aspects of expectancy beliefs and task values about physical education in relation to student achievements in middle school context.

Methods

Participants

The participants in the present study were middle school students involved in a larger study. The students (N = 854) were in 6th (n = 287), 7th (n = 286), and 8th grade (n = 281) from a stratified sample of 12 middle schools in a large U.S. metropolitan area. The participants included 13.8% Asian, 19.2% African American, 17.4% Hispanics, 39.9% Caucasian, and 9.6% from other ethnic backgrounds; and 50.4% males and 49.6% females. They represented a population of diverse socioeconomic and ethnic backgrounds.

The school district was representative of the 100 largest U.S. school districts (National Center for Education Statistics, 2003) based on the following variables: student ethnicity, student social-economic status (percentage of students on the federal Free and Reduced Meal System - FARMS %), average school enrollment, financial expenditure per student, and teacher-student ratio). Statistics on these variables from the school districts were within one standard deviation of the means of the 100 largest U. S. school districts. At the time of the study, the school district served approximately 137,800 K-12 students. There were approximately 34,000 students attending 38 middle schools.

In sampling the schools, we organized all 38 middle schools 15 sampling brackets based on FARM, enrollment, and teacher-student ratio. This procedure provided 15 sampling brackets with two or three in each. A school was randomly selected from each sampling bracket to participate in the study. In each school, we randomly selected one class from each of the 6th, 7th, and 8th grade as data providing classes. The study was approved by the University's Institutional Review Board, and parental consent and participating student ascent were received prior to data collection. Three schools were not included in this study because the data on several key variables were deemed un-usable and un-remediable through statistical procedures due to excessive missing values (described in the data collection section).

Research Context

The school district was adopting a fitness and skill-centered physical education curriculum with a strong emphasis on developing motor skills and active, responsible lifestyles in children. The curriculum aligned its goals closely with the National Association for Sport and Physical Education [NASPE] (2004) standards and placed its emphasis on sport-center skills, fitness, fitness concepts, exercise principles, and positive dispositions toward healthful, active lifestyles. The sport-centered skill and strategies were taught using different approaches including the *Sport Education* and *Tactical Games*. Fitness was a strong component in the curriculum that was taught as an independent unit. Fitness concepts and exercise principles also were integrated in sport-related content. The curriculum emphasized evidence-based teaching and learning. Each lesson started with an "essential problem" and ended with assessing students' success in solving the problem. Students' overall learning assessment was based on two competence-based area, knowledge (physiological and biomechanical principles of movement, health-related fitness) and psychomotor development (skill performance in learning settings and application settings), and one non-competence-based area: positive dispositions (applying responsible principles to exercise and physical activity settings). On average, students received 225-minute physical education each week, ranging from 180 to 245 minutes in three of the four quarters in a school year, with one quarter designated to health education. Instructions were organized into 45-minute daily lessons or 90-minute lessons every other day (A-B day schedule).

Variables and Measures

Expectancy beliefs and task values. Student expectancy beliefs and task values about physical education were measured using modified Expectancy-Value Questionnaire (EVQ; Eccles & Wigfield, 1995). It is a 5-point likert scale of 11 items with five indicating "very important" and one indicating "not important". Five items were designed to measure expectancy beliefs and six items to measure task values. A sample item used to measure student attainment value reads: "How important do you think PE is for you?" In responding to the questionnaire, students were asked to complete the items by choosing only one of the five choices within in each item. Xiang et al. (2004) have reported that the questionnaire could produce reliable data for elementary school students with the Crobach alpha coefficients ranging from .63 to .87. Using confirmatory factor analysis, Zhu, Chen, Sun, and Ennis (2009) confirmed its construct validity and found that the measurement model of EVQ was preserved very well in 903 sixth, seventh, and eighth grade students from 13 middle schools (*S-B* χ^2 = 77.129, *df* = 40, $p < .05$, CFI = .972, SRMR = .036, RMSEA = .046, CI_{90}: 030, 0.061) with a latent structural reliability coefficient Rho (ρ) = .906. This evidence suggests that EVQ can be used to measure middle school students' expectancy-value motivation in physical education.

Fitness knowledge. Students' knowledge about fitness and physical activity was measured using a set of questions based on standardized fitness knowledge tests developed and validated by Zhu, Safrit, and Cohen (1999). The criterion for question selection was the consistency between the content specified in the curriculum and the questions that would appear in the test for each grade. Because the test was developed for high school students, the questions selected were then reviewed and revised by a group of expert teachers from the district who were responsible for editing and revising the curriculum each year and the researchers. The item pool of questions was validated with a sample of middle school students using a known-group method in which the index of difficulty and index of discrimination were computed. The common standards, the difficulty index between 40-60% and the discrimination index greater than 40%, were used to judge the usability of each question. The questions that met the criteria were selected into a pool of test bank. Those used in the current study were selected from the pool. The knowledge tests for each grade included 10-13 multiple choice questions. An example question for the seventh grade is (the asterisk denotes the correct answer):

Which of the following is the best example of muscular endurance?

(a) Five arm curl reps with 20 pounds

(b) Fifteen bench press reps with 75 pounds *

(c) Ten sit-ups

(d) A fifteen-second isometric contraction

Psychomotor skills. Several skill assessments were administered to students as a component of the curriculum assessment of student learning. In this study, two fundamental psychomotor skills, badminton overhand striking and basketball dribbling, were selected as indicators of students' psychomotor learning. These fundamental skills were chosen not because of their representations for the respective sports, but because of their possible implications for life-long physical activity participation. Badminton overhand striking was assessed using a test developed by Lockerhart and McPerson (1949). The test was reported that the predictive validity (actual game performance) coefficients ranged from .71 to .90, and test-retest reliability was .90 (Lockerhart & McPerson, 1949). Although the validation was conducted with college female samples, it is believed that the test is appropriate for both males and females as young as middle school age (Strand & Wilson, 1993). The second skill test was the basketball control-dribble test developed by American Alliance of Health, Physical Education, and Dance [AAHPERD] (1984). The reported validity coefficients range from .37 to .91; and test-retest reliability coefficients were from .84 to .97. The original scoring methods for both tests were employed for scoring in this study.

Data Collection

As assessment components of the curriculum, physical education teachers administered the knowledge and skill tests after they were trained for collecting these assessment data. The researchers and trained data collectors collected knowledge test and EVQ, and assisted physical education teachers administering skill tests. The trained data collectors primarily were juniors and seniors in physical education major, and graduate students who were trained for data collection. Skill and knowledge tests were administered at the beginning of the school year (i.e., the fall semester) as pre-test and the end of the year (i.e., the spring semester) as post-test. Students completed the Expectancy-Value Questionnaires in their physical education classes during the early spring semester of 2007. Students' psychomotor skill tests, EVQ, and fitness knowledge test were administered in the gymnasia or classrooms. When taking the knowledge tests and surveys, students were asked to sit apart and complete the tests/survey independently while the data collector and physical education teacher read the questions to them.

Data Analysis

Data reduction. Prior to statistical analysis, preliminary data calculation and conversion was conducted. First, we aggregated students' knowledge test scores from the pretest and posttest, then converted them into percentage-correct score through dividing the number of correct answers by the total number of questions. Second, students' performances on both psychomotor skills were standardized into *T* scores to ensure comparability. Third, students' achievement in psychomotor and knowledge learning was conceptualized and calculated as the change in their performance from pretest to posttest. Finally, expectancy beliefs and task values of physical education were calculated as the arithmetic mean of the student rating on the items.

Statistical analysis. A series of statistical analyses were conducted to answer the research questions. First, we conducted descriptive statistical analysis to describe the central tendency and distribution of the data. Second, we tested the homogeneity of variance between the variables (e.g., Levene's test) to determine the selection of further statistical analysis. Specifically, to answer research question (a) on the variation of student expectancy-value motivation across middle school years, we conducted a multivariate analysis of variances (MANOVA) on students' ratings of expectancy belief and task values to test grade effect on these variables. Follow-up post-hoc tests (Tukey's HSD) were also conducted to identify the potential differences among three grades. In conducting MANOVA, we used class as the unit of analysis because the participants are in an intact group (i.e., class; Hopkins, 1982). In order to answer research question (b) on student learning, dependent-sample *T* tests were conduct using class as the unit of analysis. To address research question (c) on the extent to which students' expectancy-value motivation predicts their achievement, we conducted a series of multiple regression analyses (MRA) to identify the possible predictability of students' expectancy beliefs and task values on their fitness knowledge and psychomotor skill achievements in physical education. In this data-analysis step, the unit of analysis was individual student because auto-correlation was not a concern.

Results

Descriptive statistics of all variables in the study, as reported in Table A.1, showed that on average students' expectancy beliefs about physical education were relatively high with an average rating score of 4.08 on a five-point scale. Overall students' task values of physical education were rated well above average 3.00. Students' badminton striking skill was significantly improved with an effect size of .87 (Cohen' *D*), and their knowledge gained a sizable amount with Cohen' *D* = .27. However, students' basketball dribbling performance did not improve much over the year. The results suggested that middle-school students on average might have a high expectancy belief and task values about physical education and that their performances generally improved over the year.

[Insert Table A.1 here]

Box's *M* test of equal covariance among three grades on class means of students' expectancy beliefs and task values suggested that the equal covariance matrices was assumed (Box's $M = 36.91$, $F = 1.50$, $df = 20$, $p = .07$). The results of multivariate analysis of variance on class means showed statistically significant effect of grade on task values, attainment value ($F = 3.60$, $df = 2$, $\eta^2 = .18$, $p < .05$), intrinsic value ($F = 3.87$, $df = 2$, $\eta^2 = .20$, $p < .05$), and utility value ($F = 3.84$, $df = 2$, $\eta^2 = .19$, $p < .05$); but insignificant on expectancy beliefs ($F = 2.01$, $df = 2$, $\eta^2 = .11$, $p = .15$). There was statistical significance among the differences in students' rating of task values by grades. The post-hoc tests (*Tukey's HSD*) revealed that 6th-grade students rated task values significantly higher than their 8th grade counterparts ($p < .05$); but as can be seen in Figure A.1, there was no statistically significant differences in students' task values between 6th and 7th, and 7th and 8th grades ($p > .05$). Results from cross-sectional regression analyses on the expectancy-value motivation variables as displayed in Table A.2, produced similar evidence on declining trend of students' motivation across the three grades (all standardized $\beta < 0$, $p < .01$).

[Insert Figure A.1; Table A.2 here]

How much students did achieve over a year at class level appears to vary among different contents. As reported in Figure A.2, for the badminton striking skill test, results from dependent *T* test suggested that students almost gained one standard deviation of the *T* score ($T_{gain} = 8.23$; $T = 6.50$, $df = 34$, $p < .01$; Cohen's $D = 1.40$). The results of dependent *T* test on basketball dribbling, however, suggested that students learned a little on dribbling over the year (T_{gain} = .93; *T* = .93, *df* = 34, *p* = .36; Cohen's *D* = .13). For fitness knowledge, the results of dependent *T* test suggested that students gained about 4.18 percent in percent-correct rate in fitness knowledge ($Percent_{gain}$ = 4.18; *T* = 3.17, *df* = 34, $p < .01$; Cohen's *D* = .58).

[Insert Figure A.2 here]

In the multiple regression analyses students' achievements (i.e., performance change from pretest to posttest) in badminton striking, basketball dribbling, and fitness knowledge were the dependent variables. Expectancy-value motivation components were independent variables that were entered with stepwise selection. The results in Table A.3 revealed that students' attainment value accounted for 2.4% of the variances in basketball dribbling achievement (β = .154, $p < .01$) and intrinsic value accounted for .6% in the badminton striking achievement (β = .079, $p < .05$), respectively. Unfortunately, neither expectancy beliefs nor task values were identified as predictors for the fitness knowledge achievement.

[Insert Table A.3 here]

Discussion

The purpose of this cross-sectional study was to examine students' achievements, the variation of expectancy beliefs and task values about physical education across three grades in middle-school years, and their predictability to students' achievements in psychomotor skill and fitness knowledge achievements. The results suggested that there was no statistically significant difference in students' ratings on expectancy beliefs across the three grades; however, there were statistically significant differences in their ratings on subject task values of physical education between the sixth and eighth grades. Over the year, middle-school students achieved a sizable amount in fitness knowledge and badminton striking skill, but very little in basketball dribbling skill. Students' achievements in different contents seemed to vary in a year. In addition, the findings from this study seem to suggest that students' ratings on expectancy beliefs and subject task values predicted very little on their psychomotor skill and knowledge achievements.

The Variation of Expectancy-Value Motivation

Through examining students' expectancy beliefs and task values about physical education cross-sectionally, this study found that students' expectancy beliefs did not vary significantly among the three grades in middle schools. The findings, however, suggested that eighth graders' task values about physical education significantly lower than sixth graders'. This finding is consistent with that reported in a 12-year longitudinal study (Jacobs et al., 2002), and that reported by Xiang and colleagues about students' task values of a running program (Xiang et al., 2006). While Jacobs et al.'s (2002) study primarily focused on students' expectancy-value motivation about sports, in Xiang et al.'s (2006) study, the participants were elementary students enrolled in a running program. The results of the present study, in which multiple psychomotor skills and fitness concepts were emphasized through the middle-school years, added further evidence on the declining trend of students' expectancy-value motivation.

Student Achievement

In this study, students' performances in psychomotor skills and fitness knowledge improved over a year in different degrees. Results from paired sample *T* tests suggested that students' performance in basketball dribbling did not improve significantly over the year, whereas their performance in badminton striking skill and fitness knowledge showed sizable improvement. Specifically, based on Cohen's (1988) criteria, students' achievement in badminton striking skill is large with Cohen's $D = .87$ at individual level, and 1.40 at class level. Students fitness knowledge gain can be regarded as with small effect size (Cohen's $D = .27$) at individual level, but medium (Cohen's $D = .58$) at class level. According to Tallmadge (1977), a common guideline for gauging achievement effects in education is an effect size equal to, or greater than .25. The effect size at, or over this level can been defined as "educationally significant (p. 34)". Consequently, we consider that middle-school students' achievements in badminton striking skill and fitness knowledge are educationally meaningful.

In contrast to their achievements in badminton striking, students' achievement in basketball dribbling appears to be minimal with an effect size of .11 at individual level, and .13 at class level. According to Cohen's (1988) criteria, these effect sizes are smaller than the small effect size threshold .20. This finding suggests that students' basketball dribbling skill was not significantly improved over the year and that the achievement is not "educationally significant". One potential reason might be that basketball was one of the most common sports that were often included in physical education classes and that it was also one of the most played sports in the U.S. (Conn, Annest, & Gilchrist, 2003); therefore, middle-school students might have already achieved a certain level of basketball dribbling skills through their previous experiences. Without deliberate practices, it might be difficult to improve students' dribbling performance.

Predictability to Achievement in Psychomotor Skills and Fitness Knowledge

Inconsistent with previous findings (Xiang et al., 2004; Xiang et al., 2006; Zhu, Chen, & Sun, 2008), the results from this study suggest that students' expectancy beliefs and task values contributed very little to the psychomotor skill and knowledge achievements. In Xiang and colleagues' studies (2004), students' expectancy belief emerged as the only predictor for students' running performance and it accounted for 20 percent of the variance. The results of this study, however, indicates that students' attainment value only explains 2.4 percent of variance in basketball dribbling and intrinsic value explains .6 percent of badminton striking skill improvement. Students' expectancy beliefs were not even identified as a significant predictor for their psychomotor achievement. An obvious difference in Xiang et al.'s (2004) study and this one lies in the measurement of dependent variable. In Xiang et al.'s (2004) study, students' running performance was measured as the only dependent variable, a one-shot measure (i.e., time). In this study, students' achievement represents a performance change, a pre-post measure (i.e., gain). Combined with the findings from previous studies (e.g., Xiang et al., 2004), results from this study suggest that expectancy-value motivation can directly predict students' performance in psychomotor skills and running in physical education, but not so much of their psychomotor achievements measured by the performance changes.

In this study, no component of students' expectancy-value motivation was identified as a significant predictor for their knowledge gain. Zhu et al. (in press) reported that interest-based motivation did not significantly predict students' knowledge gain within a curriculum context where conceptual knowledge was primary content being emphasized in physical education. Although the curriculum contexts differ between these two studies, the collective evidence from these two studies seems point to a tentative conclusion that students' achievement motivation might have a very low predictability for their knowledge achievement in physical education. The low predictability of students' expectancy-value motivation to their fitness knowledge achievement might come from multiple sources. As argued by Zhu et al. (in press), a plausible possibility could be that students perceived the expectancy beliefs and task values primarily from physical activity participation, not from learning fitness knowledge, therefore, students' expectancy-value motivation in physical education did not predict their knowledge achievement. More studies are needed to identify the motivational sources of students' achievement motivation in physical education.

The findings of this study seem to suggest that the relation between students' expectancy-value motivation and their achievement on knowledge and skill tests in physical education can be complex in present curricular context, where multiple psychomotor skills, fitness activities, and fitness knowledge were emphasized. Although physical education curricula that involve multiple physical activities in short units has been criticized for not fostering student learning (Sidentop, 2002), it is still arguably one of the most pervasive models being widely used in the U.S. by numerous physical educators. The low predictability of students' expectancy-value motivation to their achievement, and their relatively low performance in psychomotor skills and fitness knowledge might in part result from the curricular context. It is important to note that students' expectancy belief rating was relatively high, 4.04 on a 5-point scale on average across three grades. Therefore, it might be reasonable to argue that improving students' psychomotor skills and knowledge achievement seems more urgent than raising students' expectancy-value motivation for curriculum developers and physical educators in the curricular context.

In conclusion, this study provided a preliminary picture of middle school students' expectancy beliefs and task values of physical education and their relation with psychomotor skill and fitness knowledge achievements. In the present research context, middle-school students learned sizable amount of fitness knowledge and badminton striking skill over a year. Overall, students' expectancy-value motivation for physical education was relatively high although the data showed that the higher the grade, the lower their task values tended to be. The results of multiple regression analyses suggested that students' expectancy-value motivation explained very little of the variance in their psychomotor skill achievements, none in their fitness knowledge gain. Other sources such as students' previous experiences and curriculum context might be strong determinants for their achievements in physical education.

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Table A.1.

Descriptive Statistics of Variables

Variable	Mean	*SD*	Skewness	Kurtosis	*ES* (Cohen' *D*)
Expectancy Belief	4.08	.65	-.95	1.45	—
Attainment Value	3.57	.93	-.56	.06	—
Interest Value	3.89	1.02	-.97	.43	—
Utility Value	3.76	.98	-.89	.51	—
Basketball Dribbling Achievement[a]	1.07	9.97	-.29	2.77	.11
Badminton Striking Achievement[a]	8.01	10.45	.00	.99	.87
Fitness Knowledge Gain[a]	4.51	18.62	.13	.30	.27

Note. SD = Standard Deviation; *ES* = Effect Size; *a*. Gain score = post – pretest; the unit of analysis is individual student (*N* = 854).

Table A.2.

Cross-sectional Multiple Regression Analysis Results (Independent variable: Grade)

Dependent variable	R^2	Std. β	p
Expectancy Beliefs	.015	-.124	.000
Attainment Value	.047	-.216	.000
Intrinsic Value	.057	-.239	.000
Utility Value	.056	-.236	.000

Note. The unit of analysis is individual student (N = 854).

Table A.3.

Multiple Regression Analysis Results

Dependent variable	Predictor	Std. β	R^2	p
Badminton Striking	Intrinsic Value	.08*	.006	.020
Basketball Dribbling	Attainment Value	.15**	.024	.000
Fitness Knowledge	None	—	—	—

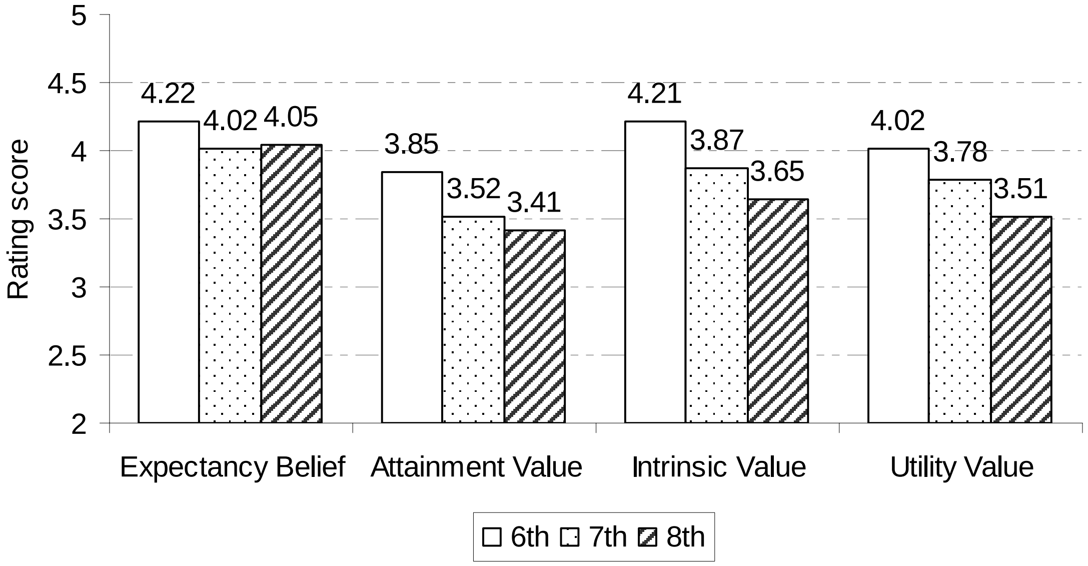
Note. The unit of analysis is individual student (N = 854); * p<.05, ** p<.01

Figure Caption

Figure A.1. Rating Score of Expectancy Beliefs and Task Values at Class Level

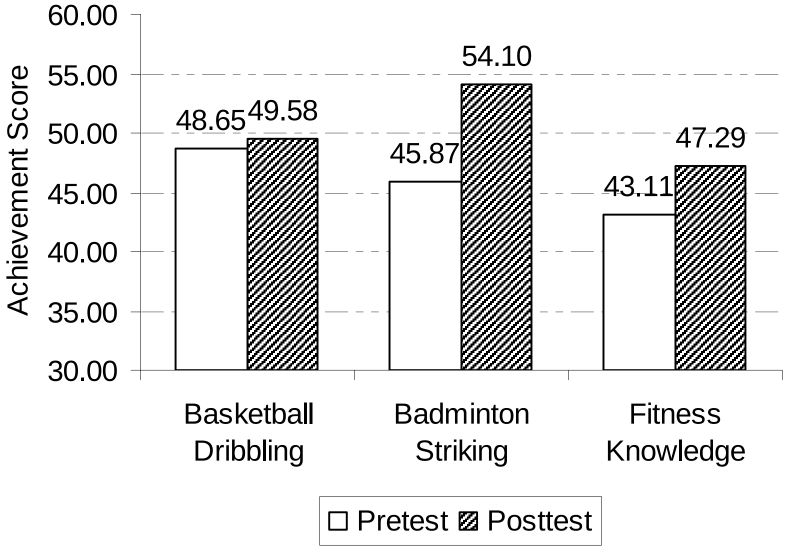
Figure A.2. Student Performance on Psychomotor Skills and Fitness Knowledge Tests at Class Level

Figure A.1. Rating Score of Expectancy Beliefs and Task Values at Class Level



Note. The unit of analysis is class (*N* = 35)

Figure A. 2. Student Performance on Psychomotor Skills and Fitness Knowledge Tests at Class Level



Note. The unit of analysis is class ($N = 35$); the effect size (Cohen' *D*) equals .13 for basketball dribbling, 1.40 for badminton striking, and .58 for fitness knowledge at class level.

CHAPTER IV: STUDY B

Psychomotor Learning: A Mediator for Student Expectancy-value Motivation and After-school Physical Activity Participation

Introduction

The recent obesity crises and physical inactivity of school-aged students calls for physical education to emphasize the importance of regular physical activity participation. Specifically for school-aged adolescents, after-school physical activity participation becomes very critical as the instructional time for physical education has been continually compressed. Unfortunately, researchers (e.g., McKenzie, 2001) noted, that there is a sharp decline in physical activity participation for students during adolescence. To promote physical activity participation, physical education classes in schools have been considered as one of the most important and meaningful venues to provide sources of knowledge, skills, and motivation for students to participate in physical activities (National Association for Sport and Physical Education [NASPE], 2004). Scholars (e.g., Corbin, 2002) have argued that once students become able to apply what they learned in school, they are likely to participate in physical activities beyond physical education classes. Yet the relation between students' learning in physical education and their after-school physical activity participation remains not clear.

The theoretical model of Eccles and Wigfield's (2002) expectancy-value motivation incorporates learners' expectancy beliefs, values, achievement, and experiences; therefore provides a viable framework to understand the important relation between students' motivation, achievements in physical education, and after-school physical activity participation. It is theorized in their model that students' motivation predicts their learning and achievement-related behavior choices, and that student learning over time predicts their achievement-related behavior (Eccles & Wigfield, 2002). By using this theoretical framework as a priori, the purpose of this study seeks to explore the trilateral relation between middle-school students' expectancy-value motivation, achievements in physical education, and their after-school participation.

Expectancy-value Motivation Theory

Expectancy-value theory explains that students' motivation is primarily determined by their expectancy beliefs and task values of the activities or tasks (Eccles et al., 1983; Eccles & Wigfield, 2002; Wigfield & Eccles, 2000). Expectancy beliefs and task values are considered as important motivation sources for learners in elementary and secondary schools (Wigfield & Eccles, 2000). Expectancy beliefs are defined as students' thoughts about their possibility of success in upcoming learning tasks, which are closely related to students' beliefs about their ability in a specific domain (i.e., self-efficacy; Bandura, 1986). Students' expectancy beliefs impact their motivation, behavior, and achievement in schools (Bandura, 1986; Eccles et al., 1983). It is theorized that in a specific domain, students who have higher expectancy beliefs are likely to perform better and more persistent on challenging tasks than those with lower expectancy beliefs in the domain.

Task values are identified as motivation sources that normally influence students' behavior choices. They are conceptualized as students' perception of the worthiness of a task in relation to their personal goals and agenda. Task values of a specific domain are conceptualized consisting of attainment value, intrinsic value, and utility value (Eccles et al., 1983). Attainment value refers to how an individual perceives the importance of succeeding in performing a task. Intrinsic value refers to how enjoyable an individual perceives the experience of participating in a task. Utility value refers to how useful an individual perceives of participating in an activity. According to Eccles et al. (1983), these different values together with one's perception of the task properties (i.e., the cost, efforts needed) determine one's task values of the task and achievement-related choices.

Expectancy-value Motivation and Achievement

Expectancy beliefs and task values have been identified as predictors for both performance in physical education and physical activity participation intention (Xiang, McBride, Guan, & Solmon, 2003; Xiang, McBride, & Bruene, 2004). For example, Xiang et al. (2004) found that expectancy-related beliefs emerged as the only significant positive predictor for elementary students' running performance and explained 22.05% and 20.87% of the variance for boys and girls, respectively. Within the same context, Xiang, McBride, and Bruene (2006) reported that expectancy beliefs in running was a significant predictor for students' running performance and their persistence in running, and that students' task values are the statistically significant predictors for their intention for future running participation. In a middle school context where student achievement in physical education was reflected by skill performances, however, Zhu, Chen, and Sun (2008) reported that students' expectancy-value motivation contributed little directly to their skill performances. Student expectancy beliefs were reported to explain their performance 7% of variance in basketball dribbling, and 3% in badminton striking respectively. These findings seem to suggest that the predictability of expectancy-value motivation in student achievement may differ for students at different developmental stages and/or across different contexts. These studies (Xiang et al., 2003; Zhu et al, 2008) have shown that students' expectancy beliefs have predictability to students' performance in running and other skills, however, when student achievement from a learning process is conceptualized as a change of performance (Alexander, Schaller, & Reynolds, 2008; Magill, 2004), the predictability of expectancy-value motivation remains unknown in physical education.

Students' expectancy-value motivation has been found to be closely related to their after-school behaviors in other subject areas. For instance, Wigfield and Guthrie (1997) reported that students' reading motivation predicted their after-school reading time and the number of books that they read. Simpkins and colleagues (2006) found that adolescent students' math and science participation predicted their expectancy-value motivation, which in turn, predicted the number of high school courses and grades that they selected. In physical education, Chen and Shen (2004) suggested that participating in out-school physical activity programs may lead to an active engagement, but may not lead to a parallel achievement in physical education classes. Although researchers (Xiang et al., 2006) reported that students' motivation in physical education can significantly predict their future physical activity participation intention, the extent to which how students' expectancy-value motivation and achievement in physical education relates to their actual after-school physical activity participation is still unidentified.

In summary, it seems evident that students' expectancy beliefs and task values could predict their performance in physical education, although whether or not the predictability retains when the dependent variable becomes achievement (i.e., performance change) appear yet to be known. Even though Xiang et al.'s study (2006) suggests that student task values predict their future physical activity participation intention. Yet it remains unclear as to whether or not students' expectancy beliefs and task values relate to their actual after-school physical activity participation. Although scholars (e.g., Corbin, 2002) believed that when students have chances to apply what they learned in physical education they are more likely to participate in regular after-school physical activity, yet it seems not clear as to the predictability of student achievement to after-school physical activity participation.

[Insert Figure B.1 here]

The purpose of this study, therefore, was to explore the trilateral relation among middle school students' expectancy-value motivation, achievement in physical education, and after-school physical activity participation. Based upon the theoretical model of expectancy-value motivation (Eccles & Wigfield, 2002), we hypothesized that students' expectancy-value motivation could directly predict their achievements in physical education and after-school physical activity participation. As shown in Figure B.1, we also hypothesized that students' achievements in physical education could predict their after-school physical activity participation. In testing the hypotheses through structural equation modeling, we attempted to answer three questions: (a) whether or not and to what extent does students' expectancy-value motivation predict their achievements in physical education? (b) Whether or not and to what extent do students' achievements in physical education predict their after-school physical activity participation? And (c) whether or not and to what extent does students' expectancy-value motivation directly predict their after-school physical activity participation? In answering these questions, we could better the understanding of the relation among these three variables in efforts to find meaningful approaches to promote student learning and physical activity participation through physical education.

Method

Participants

The participants in the present study (*N* = 854) were in 6th (*n* = 287), 7th (*n* = 286), and 8th grade (*n* = 281) from a stratified sample of 12 middle schools in a large U.S. metropolitan area. The participants consisted of 13.8% Asian, 19.2% African American, 17.4% Hispanics, 39.9% Caucasian, and 9.6% from other ethnic backgrounds; and 50.4% males and 49.6% females. The participants were representative of the middle school students in the large school district, representing a population of diverse socioeconomic and ethnic backgrounds.

Sampling. The public middle schools in a large school district (described later) were arranged into 15 sampling brackets based on the following criteria: the composition of student ethnicity, student social-economic status (percentage of students on the federal Free and Reduced Meal System - FARMS %), average school enrollment, financial expenditure per student, and teacher/student ratio. This arrangement produced 15 sampling brackets with at least two schools in each. Then from each sampling bracket a school was randomly selected to participate in the study. One class from each grade at all chosen middle schools was randomly selected to provide data for this study. This sampling procedures result in the final sample of 15 middle schools, within which one class from 6th-8th grade provided data. In the participating schools, students' assent and parental/guardian consents were collected prior to data collection. Three schools were not included in this study because they missed data points.

Research Context

School context. This study was conducted in a large metropolitan school district that represents one of the largest 100 public school districts in the United States (National Center for Education Statistics, 2003). At the time of the study, the school district served approximately 137,800 K-12 students, including about 34,000 of them attending 38 middle schools. Middle-school students in the school district on average received about 225 minutes of physical education classes. Physical education classes were organized differently from school to school, but generally students either received 40-50-minute daily lessons or 90-minute lessons every other day.

Curriculum context. The whole school district was implementing a skill-centered physical education curriculum, which aligned its goal with the National Association for Sport and Physical Education [NASPE] (2004) standards. The curriculum emphasized on evidence-based learning and instruction as well as standard assessment. Specifically, the curriculum underlined students' learning on psychomotor skills, health-related fitness, fitness concepts and physical activity principles, and physical activity dispositions. The psychomotor skills and strategies were structured to be taught in different approaches such as tactical games. The fitness and physical activity principles were structured with fitness unit or sport-related units. Students' learning in the psychomotor skills, fitness knowledge, and disposition was assessed. For instance, during the data collection of this study, two psychomotor skills, basketball dribbling and badminton striking were assessed among all middle-school students.

Variables and Measures

Expectancy beliefs and task values. The modified Expectancy-Value Questionnaire (EVQ; Eccles & Wigfield, 1995) was employed to measure students' expectancy beliefs and task values about physical education. The EVQ is 5-piont likert scale consisting of 11 items. Five items of the scale were designed to measure expectancy beliefs, and six items to measure task values including attainment value, intrinsic value, and utility value. In each of the item, a question was asked with five choices forming a continuum, five indicating "very good" and one indicating "not good". For example, one item used to measure students' expectancy beliefs follows: "How good are you in physical education?" In responding to the questions, students were asked to only choose one of the five choices reflecting their actual perception.

The EVQ has been used in physical education research and reported with sufficient reliability. For instance, Xiang et al. (2004) reported that the questionnaire could be used among elementary-school students with Cronbach alpha ranging from .63 to .87. Its construct validity and reliability for using with middle-school students has also been supported by a recent study (Zhu, Chen, Sun, & Ennis, 2009a). By using confirmatory factor analysis, Zhu et al. (2009a) confirmed the questionnaire's construct validity from the data collected among 903 middle-school students. The study also yielded evidence for the questionnaire's structural reliability with high Rho (ρ) = .906, a better reliability indicator than Cronbach alpha for multidimensional scales.

Fitness knowledge. Paper-and-pencil tests were utilized to measure students' fitness knowledge learning in physical education. Specifically in the tests, a set of questions were singled out from the standardized fitness knowledge test bank developed and validated by Zhu, Safrit, and Cohen (1999). The questions were chosen by a team of expert teachers from the district who were responsible for developing and revising the curriculum in accordance with the curriculum content being taught each semester. Those chosen questions were further tested by researchers through item analysis to determine their usability. Eventually, the items that yielded a difficulty index between 40-60% and discrimination index greater than 40% were kept in the item pool, and then programmed into the tests for different grade. The number of items for the knowledge test ranged from 10 to 13, and all the items were in multiple-choice format. For instance, a question from the eighth grade tests reads (the asterisk indicates the correct answer):

> Alternately performing sets of exercises that train opposing muscles, without resting between sets is known as:
>
> (a) Compound sets *
>
> (b) Supersets
>
> (c) Multiple sets

Psychomotor skills. As an important part of the curriculum assessment, students' psychomotor skills were evaluated through different types of skill tests. At the time of this study, two fundamental skills, badminton striking and basketball dribbling, were taught and evaluated throughout the school district. In particular, students' basketball dribbling skill was assessed using the basketball control-dribble test developed by American Alliance of Health, Physical Education, and Dance [AAHPERD] (1984). The validity coefficients for the test have been reported to range from .37 to .91. The test-retest reliability coefficients were determined to range from .84 to .97. Students' badminton overhand striking was measured using a test developed and validated by Lockerhart and McPerson (1949). The test has been reported with a sufficient predictive validity with coefficients ranging from .71 to .90, and a high test-retest reliability .90 (Lockerhart & McPerson, 1949). Although the original validation process was conducted with college female samples, it is considered that the test is also appropriate for both males and females as young as middle-school age (Strand & Wilson, 1993).

After-school physical activity participation. A modified version of the 3-Day Physical Activity Recall (3DPAR, Appendix B.2) was used to provide the range and time regarding physical activities that the students participated in. The 3DPAR provides a grid divided into 15-minute segments or blocks in which students are asked to record all activities performed during the after-school hours (e.g., from 3:00 - 10:00 p.m.). Students took the instrument with them for each of the three days. The instrument provides a list of 30 common activities grouped into the following categories: sport, fitness, other physical activities, academic / homework, rest, transportation, entertainment, and socialization. These activities were not considered mutually exclusive; instead, they were grouped based on the primary activity of the time frame. For each 15-min block, students entered the main activity in which they participated during that period. The main activity was defined as one that occupied most of the 15-min period. The 3DPAR was previously validated and reported with convincing reliability in youth (McMurry et al., 2004; Weston, Petosa, & Pate, 1997). It demonstrated excellent evidence for test-retest reliability (r = .98) and concurrent validity (r = .77 with accelerometers) in adolescents (Weston et al., 1997). In addition, because the recall period is extended from 1 to 3 days, researchers are able to obtain a reliable estimate of “usual” or “habitual” physical activity in a single reporting session (Trost, 2001).

Data Collection

Several data points were included in the collection process. First, psychomotor skills and fitness knowledge tests were administered twice as pretest and posttest, once at the beginning of the spring semester, and the other at the end of the fall semester. Second, the EVQ and the 3DPAR were collected during the early spring semester. The physical educators distributed the 3DPAR to students and collected them once students finished. As required by the district curriculum, trained physical educators in the schools administered the psychomotor skill and fitness knowledge tests in the gymnasia. When weather not permitted, the teachers also arranged the fitness knowledge tests in the classroom. The researchers and trained data collectors administered the EVQ in the gymnasia and occasionally assisted the teachers on the psychomotor tests. Students were arranged to sit apart and asked to complete the tests/surveys independently when taking the knowledge tests and the questionnaire. The physical educators and trained data collectors were asked to read the questions to students and explain the questions to them in case they had understanding issues.

Data Analysis

Missing data. Since the study involved multiple data points at 13 schools, missing data at certain points were inescapable. On average, the missing data for different variables ranged from 15.4% to 30% for all students, and 39.3% of the students had one data point missing during the course of data collection. Although the sample size was sufficiently large, simple listwise deletion of these data with missing values would result in biased parameter estimates and lower statistical power (Little & Rubin, 1987). As recommended by Peuph and Enders (2004), therefore, the missing data were estimated using a full information maximum likelihood approach with EM algorithm (Bentler, 2005; Dempster, Laird, & Rubin, 1977).

Data reduction. Preliminary data calculation and conversion was conducted prior to statistical data analysis. First, we aggregated students' cognitive knowledge test scores from the pretest and posttest, and then converted them into percentage-correct score by dividing the number of correct answers by the total number of questions. Second, the psychomotor skill data were converted into standard T scores based on the existing data to form two indicators for students' psychomotor skill performances that have the same unit. The formula for calculating T scores is as follows, $T = [10 * (X - \overline{X}) / s] + 50$, where X represents the raw score, $\overline{X}$ the pooled average, and s the pooled standard deviation.

In addition, the residual gain score for knowledge and psychomotor learning was computed as students' achievement for the data analysis. In a pre-post test context, the residual gain score is conceptualized as the residual error using the pre-test as the predictor and post-test score as the dependent variable (Williams, Maresh, & Peebles, 1972). The residual gain score will be uncorrelated with the pretest score, whereas it can be expected that the raw gain score (i.e., numerical value of the difference between the posttest and pretest score) will show a negative correlation with initial states (Williams et al., 1972). Third, the students' 3DPAR behavior data were coded according to the activity codes (Appendix B.2) once the data were cleaned. Then we counted the number of time segments that students indicated participating in physical activities to form the indicator of after-school physical activity participation time. We also recorded different kinds of physical activities that students reported doing to form an indicator of after-school physical activity range (i.e., the number of different kinds of activities).

Statistical analysis. To address the research questions, a series of statistical analyses were conducted. First, we conducted descriptive statistical analysis to describe the central tendency and distribution of the data, and to test for the normality assumptions for subsequent analysis. Second, prior to testing the hypothesized structural model, we conducted a confirmatory factor analysis (CFA) to further examine the construct validity and internal reliability of the expectancy-value questionnaire in this specific research context. Finally, in order to answer the three research questions, a series of steps of model testing using structural equation modeling (SEM) technique (Bentler, 2005) were performed to test the tenability of the hypothesized structural model (Figure B.1). In testing the hypothesized model, Lagrange and Wald tests were also performed to elucidate possible model re-specification suggestions. Throughout the analysis of SEM, Hu and Bentler (1999)'s cut-off criteria for data-model fit indices were applied. These criteria include absolute fit indices that evaluate how close the observed variance-covariance matrix is to the estimated matrix (e.g., chi-square, and Standardized Root-mean Square Residual [SRMR] < = .08), parsimony correction index that incorporates a penalty function for poor model parsimony (e.g., Root Mean Square Error of Approximation [RMSEA] < = .06), and comparative fit indices that evaluate the fit of the hypothesized model to the null model (e.g., Comparative Fit Index [CFI] > = .95; Non-Normed Fit Index NNFI or Tucker-Lewis Index [TLI] > = .95).

Results

Descriptive Statistics

As demonstrated in Table B.1, the mean values of the expectancy-value indicators, on average are greater than 4 on a five-point scale and greater than 3 for task values, indicating that students rated relatively high on their expectancy beliefs and task values about physical education. On average, students reported that they participated in 1.79 different types of physical activities and spent 82.05 minutes (5.47 * 15 minutes) on them each day during after-school hours. Pearson product-moment correlation coefficients suggest that all the indicators in the Expectancy-Value Questionnaire were correlated well ($r > .50$; $p < .01$). Expectancy beliefs indicators significantly correlate with psychomotor learning indicators and after-school physical activity indicators, although the correlations are not strong (.08 =< *r* =< .25, $p < .05$; Table B.1). However, student fitness knowledge achievement does not seem to correlate with other variables (mostly $p > .05$). The values of data skewness and kurtosis of indicators suggested a potential violation of normality. Further analysis indicated that the Madia's multivariate coefficient was 50.93, suggesting that the multivariate normality was not assumed. Hence in the subsequent analyses, the robust estimation approach and associated indices were used (e.g., $S\text{-}B\ \chi^2$; Satorra & Bentler, 1994) considering that the sample size for this study was sufficiently large.

[Insert Table B.1, Table B.2 about here]

Confirmatory Factor Analysis

Prior to testing the hypothesized structural model, a confirmatory factor analysis (CFA) was conducted to test the tenability of the measurement model of expectancy-value questionnaire. In the CFA model, two latent factors including expectancy beliefs (five items) and task values (six items) were assumed to correlate with each other (Eccles & Wigfield, 2002). As displayed in Table B.2, the Goodness-Of-Fit indices suggest that

CFA[a] model fit well. Yet the Lagrange test suggest that adding a covariance between measurement error of the first two items of expectancy beliefs (i.e., E1, E2 in Table B.1) can significantly improve the Goodness-Of-Fit indices. According to a recent study (Zhu et al., 2009a), it is suggested that an error correlation between the first item (EB1) and the second item (EB2) in the questionnaire should be allowed considering the fact that these two items ask similar questions. Therefore, as displayed in Figure B.2, the error covariance was specified in the measurement CFA[a] model. The results of the CFA[b] showed significantly better goodness-of-fit indices ($\Delta \chi^2 = 48.137$, $df = 1$, $p < .01$; Table B.2), suggesting that the CFA[b] measurement model was better preserved in the context (see Figure B.2). Wald test suggested that none of the free parameters should be dropped from the measurement model. Hence, the CFA[b] measurement model was preserved for subsequent data analysis. The result of CFA confirms the construct validity of Expectancy-Value Questionnaire in the population. The composite reliability coefficient *Rho* (ρ) was found to equal .916, suggesting a relatively high reliability of the questionnaire in the context.

[Insert Figure B.2 about here]

Structural Equation Modeling

Based on the satisfactory results from the CFA measurement model, subsequently the hypothesized structural model (Model[c]) was tested. According to Hu and Bentler (1999)'s cutoff criteria, the subsequent analysis also produced sound goodness-of-fit indices (Model[c], Table B.2). The hypothesized structural model, as displayed in Figure B.3, explained .3% of variability in students' residual knowledge gain, 14.8% of

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[a] Model CFA[a] refers to the original measurement model of EVQ.
[b] Model CFA[b] adds an error covariance between items EB1 and EB2 (Figure B.2).
[c] Model[c] represents the hypothesized structural model (see Figure B.3).

psychomotor achievements, and 3.3% of after-school physical activity participation. In the Model[c], students' psychomotor skill achievement was found to be the only statistically significant factor predicting the variance of after-school physical activity participation ($p < .05$), and students' expectancy beliefs were found to be the only significant factor predicting the variance of psychomotor skill achievement ($p < .05$). No path coefficient between expectancy-value motivation, and knowledge gain, or after-school physical activity participation, however, was found to be statistically significant ($p > .05$).

[Insert Figure B.3 about here]

There might be content specificity effect of student learning in physical education affecting the insignificant paths associated with knowledge gain. That is, students who gained fitness knowledge through physical education might not be the ones who gained psychomotor skills. The results of Wald test in Model[c] suggested removing the three free parameters associated with knowledge gain, which appears to support this point. Evidence from other two sources seems also support removing the three free parameters associated with knowledge gain. First, as shown in Table B.1, knowledge gain (RKN) does not correlate with other variables in the study (all $r =< .07$, $p > .05$). Second, students knowledge gain scores and psychomotor achievements (e.g., RBD and RBS) were recoded into "higher achiever" (residual gain score greater than 0) and "low achiever" (residual gain score smaller than 0). Then the measurement of agreement Cohen's Kappa (κ) was calculated between knowledge gain and basketball dribbling ($\kappa = .013$, $p = .696$), knowledge gain and badminton striking ($\kappa = -.025$, $p = .468$), respectively to test the content specificity of students' learning. These results further supported the existence of content specificity of student learning in physical education.

[Insert Figure B.4 about here]

Based upon the aforementioned analysis and findings from a previous study (Zhu et al., 2008) that students' expectancy-value motivation did not significantly predict their fitness knowledge gain, therefore, free parameters associated with knowledge gain in the hypothesized model were removed. By removing these parameters, as demonstrated in Table B.2, the Goodness-Of-Fit indices of Model[d] improved when compared with Model[c], although the critical chi-square value is 19.68 for 11 degree of freedom was slightly larger than 19.658 ($\Delta\chi^2$ of c vs. d; $p > .05$). The final structural model (Figure B.4) explains 14.6% of variance in students' psychomotor learning, and 3.3% of variance in after-school physical activity participation, respectively. In the final model, students' expectancy beliefs are the only significant factors contributing to their psychomotor achievements, and psychomotor achievement are the only significant factors predicting after-school physical activity participation.

Discussion

The purpose of this study was to examine the relation among middle school students' expectancy-value motivation, achievements in physical education, and their after-school physical activity participation. The results suggest that students' psychomotor achievements were the only statistically significant predictors for their after-school physical activity participation, and that students' expectancy beliefs were the only significant predictors for their psychomotor achievements. Students' task values and fitness knowledge gain was found to predict neither psychomotor achievements nor their

[d] Model[d] represents the final structural model (see Figure B.4).

after-school physical activity participation. These findings suggest that content specificity of student learning and the function of expectancy-value motivation in explaining its relation to achievements in physical education and after-school physical activity participation.

The Relation between Expectancy-value Motivation and Achievements in Physical Education

The results of this study suggested that students' expectancy beliefs significantly predicted their psychomotor achievement in physical education (expectancy beliefs → psychomotor achievement $r = .378$, $p < .05$; Figure B.4). This finding adds to the current understanding about the function of expectancy-value motivation. It has been documented that students' expectancy beliefs could predict their skill performances (Zhu et al., 2008) and running performance in physical education (Xiang et al., 2004; Xiang et al., 2006). In this study, students' psychomotor achievements are conceptualized as their performance changes over an academic year. The finding is pedagogically meaningful in that when students have higher expectancy beliefs about their psychomotor skill, they are likely to learn better over a period of time.

Students' task values were not significant predictors for either psychomotor skill achievement or fitness knowledge achievement in physical education in this study (Figure B.3 and B.4). This finding seems to be consistent with Xiang et al. (2004)'s findings where students' task values were not found be significant predictors for their running performance. This finding, however, was not consistent with the results of Chen and Liu (2008)'s study where college students' task values were found to be predicating their physical education achievement. It is argued that college students could have a relatively accurate evaluation about their physical activity ability, thus their achievements in physical education are primarily motivated by task values (Chen & Liu, 2008). Together with the findings from previous studies (e.g., Chen & Liu, 2008; Xiang et al., 2004), preliminary evidence appears to suggest that students' motivation in physical education could vary at different developmental stages. It is likely that as students learn more learning about physical education; their task values might be internalized to become contributing factors for achievements. More research is needed to examine the role of task values in explaining students' achievements in physical education. Ideally, future studies should employ longitudinal design as students' task values about physical education seem change significantly over time (Xiang et al., 2006).

The fact that students' knowledge achievement is removed from the structural model (Figure B.4) and its low correlation with other variables of the study (Table B.1) delineates the content specificity of student learning and its relation to motivation. In this study, students who have higher psychomotor skill achievements might not be the ones who also have higher fitness knowledge achievement. Bong (2001) asserted that curriculum could superimpose a content specific context (e.g., a curriculum context) that mediates students' motivation. It is likely that learning cognitive knowledge and getting assessed on knowledge may be still a small part of physical education. The perception of "physical" success in physical education can be pronounced stronger than cognitive success in physical education, leading to an unbalanced learning orientation among students – some are knowledge oriented, some are skill focused. Even within a concept-oriented curriculum context, Chen, Martin, Ennis, & Sun (2008) found that students' expectancy beliefs and task value components could vary for different contents. The findings from this study provide further evidence on content specificity of students' motivation and learning. In addition, this finding piqued researchers to continue on searching motivators for students' knowledge learning in physical education.

Students' Expectancy-value Motivation and After-school Physical Activity Participation

Although task values have been found to predict students' academic choices in other disciplines (Eccles & Wigfield, 2002) and to predict students' future running participation intention (Xiang et al., 2006), they are not significantly predictive for students' reported after-school physical activity participation in this study. This finding appears also not consonant with findings in other domains. In reading for example, Wigfield and Guthrie (1997) found that students' expectancy-value motivation predicts their after-school reading time and the number of books that they read. The inconsistency among findings from different studies can be explained in multiple ways. One explanation from motivation perspective is revolved around what students are motivated for in different domains. In reading, students might value reading/reading achievement itself; however, in physical education they might not value for participating in physical activity or skill performance itself, but for something else associated with it, "fun" for example (O'Reilly, Tompkins, & Gallant, 2001).

Similarly, students' expectancy beliefs were also found to be not significantly predictive for their after-school physical activity participation (Figure B.3 and B.4). Students' expectancy beliefs to a certain extent could be directly translated into psychomotor performances and achievements (Xiang et al., 2004; Zhu at al., 2008). However, they might not be directly translated into voluntary behavior. This finding is consistent with the findings from another study (Zhu, Chen, Sun, & Ennis, 2009b) conducted with a younger population, where elementary-school students' psychomotor skill performance was found to be accountable for their after-school physical activity participation. Overall, it seems that more studies on what students are motivated/not motivated for in physical education are warranted to help unravel this issue of direct predictability of expectancy-value motivation to after-school physical activity participation.

The Importance of Skill Learning

The results of this study suggest that students' psychomotor skill achievement in physical education can be a mediator for their expectancy-value motivation in physical education and after-school physical activity participation. This finding implies that students' expectancy-value motivation might not direct influence their after-school physical activity participation; rather it can directly influence psychomotor skill learning in physical education. Students' psychomotor achievements in turn directly influence their after-school physical activity participation. These findings highlighted the importance of psychomotor skill achievements in both physical education class and after-school physical activity participation (NASPE, 2004). It seems that when students' psychomotor achievements are improved they are more likely to participate in physical activities voluntarily during after-school time. Thus it appears that student psychomotor learning, traditionally an important goal of physical education teaching, should not be neglected in the time of health crises and physical inactivity.

Based on the findings reported in Table B.1, students' expectancy-value motivation in general are relatively high; yet their performances in physical education are relatively low (see Study A). Hence, it might not matter as much whether or not students are motivated for physical education as to what/how much students learned in physical education that can be translated into their actual after-school physical activity participation. This, however, does not mean that student motivation in physical education should be ignored. On the contrary, the insignificant paths between student motivation, knowledge achievement, and after-school physical activity participation should further lead us to seek what motivates students in physical education and physical activity participation. After all, physical education should not be merely for keeping students "busy, happy, and good" (Placek, 1983), it should help them learn and achieve.

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Table B.1

Descriptive Statistics and Pearson-Moment Correlation Coefficients among All Indicators

Indicator	EB1	EB2	EB3	EB4	EB5	AV1	AV2	IV1	IV2	UV1	UV2	RBD	RBS	RKN	PAT	PAR
EB2	.68**	–														
EB3	.46**	.40**	–													
EB4	.62**	.54**	.52**	–												
EB5	.57**	.51**	.35**	.62**	–											
AV1	.28**	.28**	.35**	.41**	.36**	–										
AV2	.21**	.22**	.25**	.25**	.22**	.40**	–									
IV1	.29**	.25**	.27**	.35**	.32**	.54**	.41**	–								
IV2	.36**	.32**	.34**	.42**	.37**	.56**	.36**	.80**	–							
UV1	.32**	.32**	.35**	.39**	.33**	.60**	.43**	.57**	.56**	–						
UV2	.38**	.33**	.39**	.40**	.34**	.62**	.43**	.57**	.60**	.71**	–					
RBD	.25**	.25**	.12**	.22**	.22**	.17**	.10**	.09**	.12**	.12**	.16**	–				
RBS	.10**	.11**	-.02	.12**	.13**	.10**	.02	.05	.08*	.06	.02	.26**	–			
RKN	.00	.01	-.06	.01	.03	-.01	.03	-.07*	-.04	-.02	-.07*	-.01	-.04	–		
PAT	.11**	.14**	.07*	.08*	.08*	.04	.06	.01	.04	.01	.04	.12**	.06	-.01	–	
PAR	.09**	.14**	.10**	.07*	.02	.02	.06	.02	.04	.03	.04	.05	.03	.00	.61**	–
Mean	4.13	3.79	4.02	4.27	4.21	4.12	3.02	3.81	3.97	3.88	3.64	.00	.00	.00	5.47	1.79
SD	.84	.80	.87	.79	.82	1.01	1.22	1.12	1.04	1.03	1.09	7.58	9.12	15.95	3.36	1.13
Skewness	-.97	-.42	-.76	-1.12	-1.11	-1.24	-.13	-.91	-1.00	-.97	-.67	.43	.59	.10	.98	2.48
Kurtosis	1.11	.55	.47	1.19	1.33	1.11	-.79	.20	.55	.66	-.09	1.57	.94	-.08	2.69	14.57

Note. ** p <.01, * p <.05; EB = Expectancy Beliefs; AV = Attainment Value; IV = Intrinsic Value; UV = Utility Value; RBD = Regression Residual Gain of Basketball Dribbling; RBS = Regression Residual Gain of Badminton Striking; RKN = Regression Residual Gain of Fitness Knowledge; PAT = Physical Activity Time; PAR = Physical Activity Range.

Table B.2

Structural Equation Modeling Procedures and Goodness-Of-Fit Indices

Model*	*S-B* χ^2	*df*	*NNFI*	*CFI*	*RMSEA*	CI_{90}	*SRMR*	$\Delta\chi^2$	Δdf
CFA[a]	122.339	40	.960	.971	.049	.039, .059	.038	–	–
CFA[b]	74.202	39	.983	.988	.033	.021, .044	.029	–	–
a vs. b	–	–	–	–	–	–	–	48.137*	1
Model[c]	166.517	91	.975	.981	.031	.024, .039	.030	–	–
Model[d]	146.859	80	.978	.983	.031	.023, .039	.030	–	–
c vs. d	–	–	–	–	–	–	–	19.658	11

Note. * p <.01; NNFI = Bentler-Bonett Non-Normed Fit Index (i.e., equivalent to Tucker-Lewis Index); CFI = Comparative Fit Index; RMSEA = Root Mean Squared Error of Approximation; SRMR = Standardized Root Mean-square Residual; CFA = Confirmatory Factor Analysis; Model CFA[b] refers to the original measurement model of EVQ; Model CFA[b] adds an error covariance between items EB1 and EB2 (Appendix B.1); Model[c] represents the hypothesized structural model (see Figure B.2); Model[d] represents the final structural model (see Figure B.3).

Figure Captions

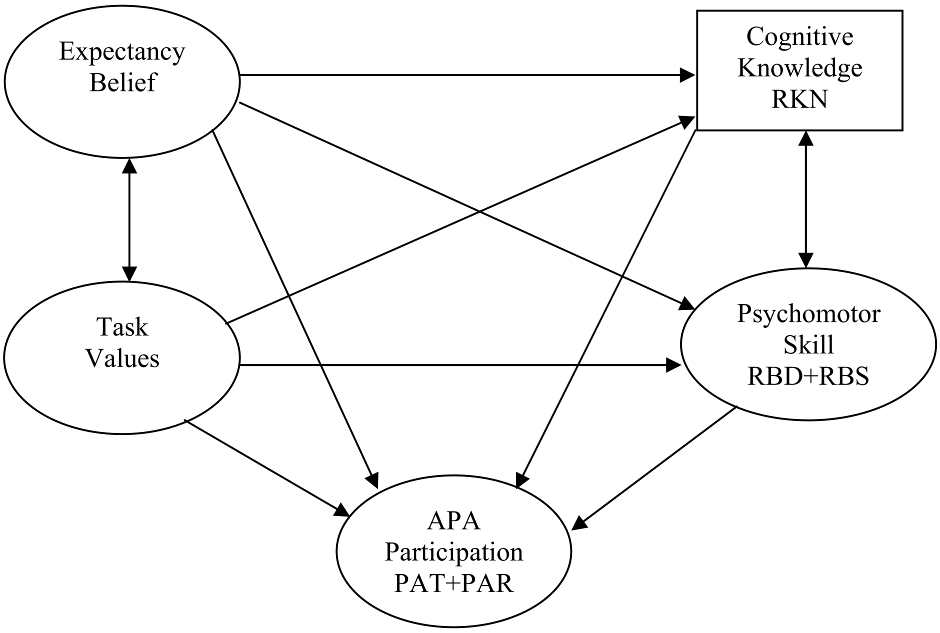
Figure B.1. The hypothesized structural model (a priori model)

Figure B.2. The final measurement model of EVQ

Figure B.3. The hypothesized structural model with standardized path coefficients

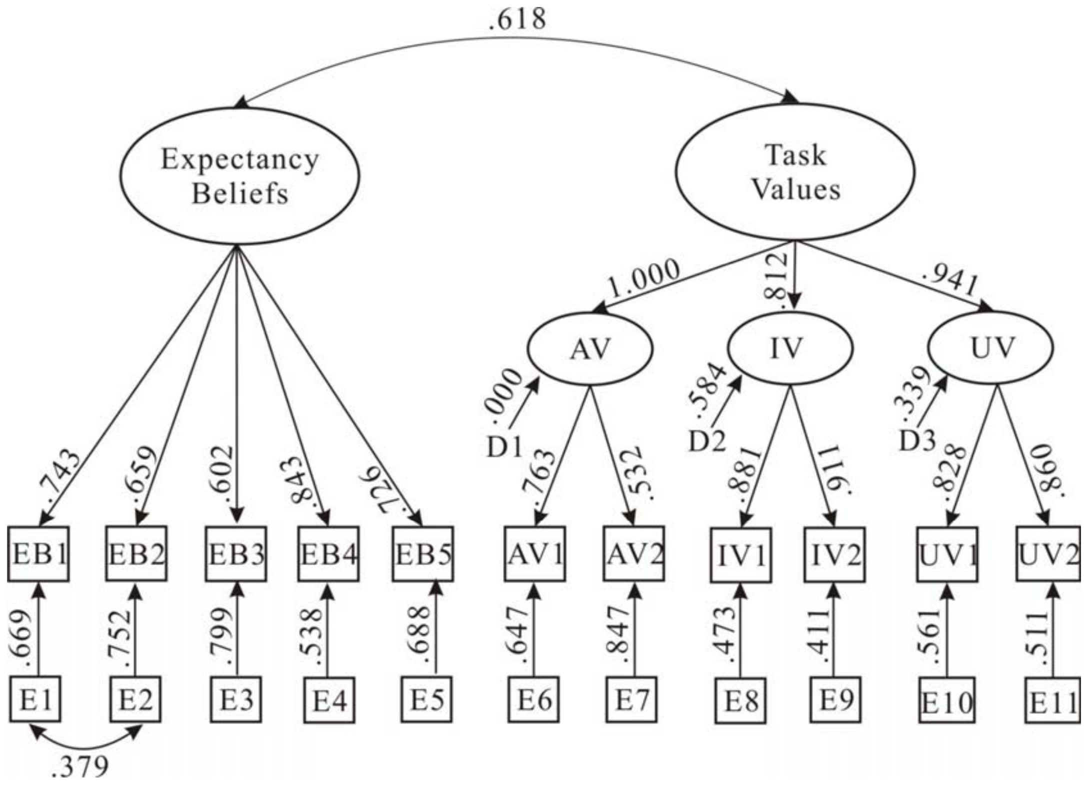
Figure B.4. The final structural model with standardized path coefficients

Figure B.1. The hypothesized structural model (a priori model)



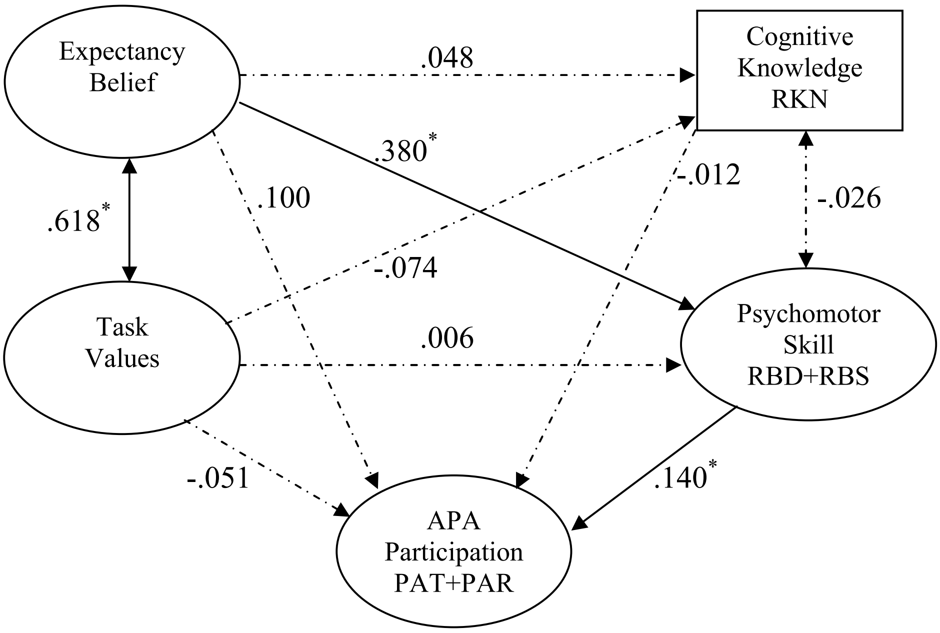
Note. RBD = Regression Residual Gain of Basketball Dribbling; RBS = Regression Residual Gain of Badminton Striking; RKN = Regression Residual Gain of Fitness Knowledge; PAT = Physical Activity Time; PAR = Physical Activity Range; APA = After-school Physical Activity.

Figure B.2. The final measurement model of EVQ



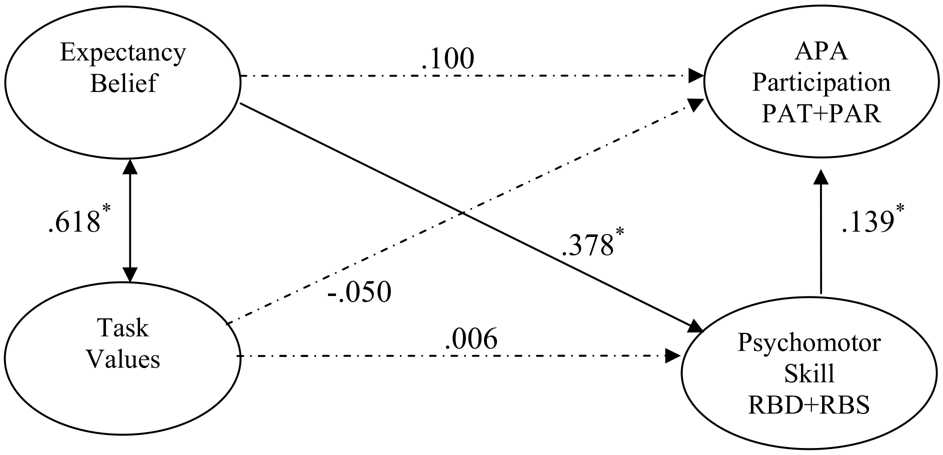
Note. All paths are statistically significant at p <.05; EB = Expectancy Beliefs; AV = Attainment Value; IV = Intrinsic Value; UV = Utility Value.

Figure B.3. The hypothesized structural model with standardized path coefficients



Note. * $p < .05$; RBD = Regression Residual Gain of Basketball Dribbling; RBS = Regression Residual Gain of Badminton Striking; RKN = Regression Residual Gain of Fitness Knowledge; PAT = Physical Activity Time; PAR = Physical Activity Range; APA = After-school Physical Activity.

Figure B.4. The final structural model with standardized path coefficients



Note. * *p* <.05; RBD = Regression Residual Gain of Basketball Dribbling; RBS = Regression Residual Gain of Badminton Striking; PAT = Physical Activity Time; PAR = Physical Activity Range; APA = After-school Physical Activity.

Appendix B.1

Expectancy-Value Questionnaire (adopted from Xiang et al., 2003)

1. How good are you in physical education? [EB1]
Very good 5 4 3 2 1 Not good

2. If you give 5 to the best student in PE and 1 to the worst, what you give to yourself? [EB2]
Best 5 4 3 2 1 Worst

3. Some kids are better in one subject than in another. For example, you might be better in math than in reading. Compared to most of your other school subjects, how are you doing in PE? [EB3]
A lot better 5 4 3 2 1 A lot worse

4. How well do you think you are doing in learning in PE? [EB4]
Very well 5 4 3 2 1 Very poorly

5. How well are you keeping yourself physically active in PE? [EB5]
Very well 5 4 3 2 1 Very poorly

6. How important do you think PE is for you? [AV1]
Not very important 1 2 3 4 5 Very important

7. Compare to math, reading, and science, how important is it for you to learn PE content? [AV2]
Not very important 1 2 3 4 5 Very important

8. In general, how fun do you think your PE classes are? [IV1]
Very boring 1 2 3 4 5 Very fun

9. How much do you like your PE classes? [IV2]
Don't like it at all 1 2 3 4 5 Like it very much

10. Some things that you learn in school help you do things better outside of school. We call this being useful. For example, learning about plants at school might help you grow a garden at home. How useful do you think the concepts you learned in PE are? [UV1]
Not useful at all 1 2 3 4 5 Very useful

11. Compared to your other school subjects, how useful are the skills learned in PE? [UV2]
Not useful at all 1 2 3 4 5 Very useful

Appendix B.2
After-School Physical Activity Recall

INSTRUCTION: The following table divides each hour from 3:00 p.m. to 10:00 p.m. into four 15-minute boxes. You task is to think about what you did yesterday during this time and fill in each 15-minute box with the activities listed below. If you did not do any of the activities during a 15-minute period, write "none" in that box. You can use a line to show the same activity you did in more than one 15 minute period. Do not leave any boxes unfilled.

IMPORTANT: Please turn in the completed form to your physical education teacher tomorrow. Otherwise you will have to sit with the UMD data collector to fill out the form during your physical education class.

EXAMPLE:

3:00-3:15 p.m.	3:16-3:30 p.m.	3:31-3:45 p.m.	3:46-4:00 p.m.
Walking home	*Nap*	*Homework*----------	-------------------

TIP: You can do this quickly if you ask your parents (or someone who looked after you yesterday afternoon) to help you.

Print: Name ____School ______________________________________

Grade:___________________ Age:__________ Gender (circle one): Boy / Girl Date:__________/_______/_______

Example Activities:					
(You should write any activities you did, even they are not in the example)	Eating Homework Napping On bus/car	Reading Sleeping TV Badminton	Baseball Basketball Bike Bowling	Dance Football Golf Gymnastics	Karate Ping pong Running Soccer	Swimming Tennis Volleyball Walking

3:00 - 3:15 p.m.	3:16 - 3:30 p.m.	3:31 - 3:45 p.m.	3:46 - 4:00 p.m.

4:00 - 4:15 p.m.	4:16 - 4:30 p.m.	4:31 - 4:45 p.m.	4:46 - 5:00 p.m.

5:00 - 5:15 p.m.	5:16 - 5:30 p.m.	5:31 - 5:45 p.m.	5:46 - 6:00 p.m.

6:00 - 6:15 p.m.	6:16 - 6:30 p.m.	6:31 - 6:45 p.m.	6:46 - 7:00 p.m.

7:00 - 7:15 p.m.	7:16 - 7:30 p.m.	7:31 - 7:45 p.m.	7:46 - 8:00 p.m.

8:00 - 8:15 p.m.	8:16 - 8:30 p.m.	8:31 - 8:45 p.m.	8:46 - 9:00 p.m.

9:00 - 9:15 p.m.	9:16 - 9:30 p.m.	9:31 - 9:45 p.m.	9:46 - 10:00 p.m.

CHAPTER IV: STUDY C

What Motivates Students to Attend Physical Education? A Cost Perspective

Introduction

In order to better understand learner motivation from the Expectancy-value perspective, it is necessary to not only investigate functions of positive expectancy beliefs and task values but also explore impact of factors that counter these functions (Eccles & Wigfield, 2002). Determining the extent of negative influence of cost articulated in the theory in relation to the motivation influence of expectancy beliefs and task values (Eccles et al., 1983; Eccles & Wigfield, 2002; Wigfield & Eccles, 2000) affords the opportunity to explore what motivates/demotivates students in physical education and how these factors interact to influence students' achievement in physical education. Guided by the expectancy-value theoretical framework, the present study attempted to examine middle-school students' cost conception of physical education and how the conception interacts with students' expectancy beliefs, task values, and achievements in physical education.

Expectancy Beliefs and Task Values

The expectancy-value theory presumes that students' motivation is primarily determined by their expectancy beliefs and task values (Eccles et al., 1983; Eccles & Wigfield, 2002). Expectancy beliefs are defined as students' beliefs about how well they will perform on upcoming tasks/activities either in short or longer term future. Expectancy-beliefs are conceived of as broad beliefs about one's competence in a given domain. According to Eccles et al. (1983), the value of a task is determined not only by the characteristics of the task itself, but also by the needs, goals, and subjective valuation of the person. They elaborated that there are four major values in a certain task: (a) the attainment value of the task, (b) the intrinsic/interest value of the task, (c) the utility value of the task, and (d) the cost perception of the task.

It is theorized that the attainment value, intrinsic value, and utility value are positively related with expectancy beliefs, whereas cost perception represents the perceived negative perspective associated with a task (Wigfield & Eccles, 2000). Attainment value refers to the personal perceived importance of the doing well on the task (Eccles et al., 1983). Intrinsic value refers to the inherit enjoyment that the individual perceives while being engaged in the activity. It is determined by the perceived interest that the individual may derive in the activity. Utility value refers to the perceived usefulness of the task for the individual's current and future goals and agenda. Utility value itself might not be related to the nature of the task at hand, yet it relates directly to the individual's internalized immediate and future goals (Eccles et al., 1983).

Conception of Cost

Eccles et al. (1983) believed that the value of each activity ought to be inversely related to cost assuming that individuals have a conception of both the costs and the benefits of engaging in an activity. The conception of cost is theorized as the perceived negative aspects of engaging in a task (Eccles et al., 1983; Eccles & Wigfield, 2002). According to Eccles et al. (1983), the conception of cost derives from three primary sources: (a) perceived excessive effort associated with the task, (b) the perceived loss of time that could be used to accomplish other alternative activities, and (c) psychological intolerance of potential failure of the task. Eccles and colleagues (1983) assumed that individuals have a sense of how much effort that they think is worthwhile for various activities. They predicted that as the perceived amount of effort increases in relation to the amount of effort considered worthwhile the value of the task to the individual should decrease. In other words, one perceives high cost when the demand for effort is high. As the cost increases due to the increase in the perceived amount of effort, the value of the task should decrease. Another type of cost is perceived loss of time for other valued alternative tasks. It is also being referred to as opportunity cost (cf., Buchanan, 1969). That is, the time that could have created opportunities for other activities has been lost because of participating in one activity.

A third type of cost is negative effects due to unsuccessful experience in a task. Every achievement-related activity comes with a potential of failure. According to Eccles et al. (1983), the perceived cost of potential failure encompasses negative psychological effects as well as avoidance behavior choices. When students encountered with high perceived cost of potential failure they most likely would choose to avoid the task, if they were provided with such an option (Eccles et al., 1983). Schools in many cases, however, is a restricted context not allowing such options to exist. Theorists (e.g., Covington & Beery, 1976; Nicholls, 1976) suggested that in such a restricted context, students would exert necessary but minimal effort to get through. They reasoned that this strategy has two advantages: first, it prevents complete failure; second, it provides students with a face-saving attribution for lack of success or ability. In order to maintain self-esteem, students tend to think the face-saving attribution cost less than the attribution to lack of ability to succeed.

Function of Expectancy-Value Motivation

To foster a positive motivation experience for the learner, Alexander (2006) argued that, the very first step for educators to take is to understand the nature of learner motivation because complex knowledge and skill acquisition requires extended effort and persistence. Previous studies have shown that students' expectancy-value motivation have a profound function in explaining their achievements and achievement-related choices (Eccles & Wigfield, 2002; Wigfield & Eccles, 2000). Specifically, expectancy beliefs have been identified to predict students' performances in various disciplines in schools, and task values have been identified to predict students' achievement-related behavioral choices. In Study B of this dissertation, students' expectancy beliefs were found to predict their psychomotor achievement but not knowledge gain or their after-school physical activity participation. Task values, however, were found to predict neither students' achievements nor their after-school physical activity participation. These findings confirmed the function of expectancy beliefs, but generated questions about the function of task values in physical education.

Cost, as an important component of the task values, however, has been reported to have negative impact on achievement behavior in education. Anderson (2000) found that cost was significantly correlated with female students' task value. Chen, Martin, Ennis, and Sun (2008) reported that 69% of elementary-school students perceived something as cost to their motivation in attending physical education. They identified four factors that students perceived as cost to their motivation in physical education: curriculum content 68%, teacher 6%, peer behavior 14%, and physical discomfort 12%. Despite the fact that these factors constituted perceived cost, all elementary students in Chen et al.'s (2008) study responded that they would choose to attend physical education. The results of these studies offered initial evidence on students' conception of cost and its relation to expectancy-value motivation and behavior choices. Yet, the relation between students' cost conception and expectancy-value motivation, achievement, as well as behavior choices is not clear. Particularly for middle-school students, no known study has been reported on what constitutes cost to their motivation in physical education and whether or not the cost interacts with students' expectancy beliefs and task values, and achievements in physical education.

The purpose of this study, therefore, was to explore middle-school students' cost conception of attending physical education and its relation to their expectancy beliefs, task values, and achievements in physical education. Specifically, the present study sought to address the following research questions: (a) what dimensions constitute middle-school students' cost conception of physical education? (b) does students' cost conception relate to their expectancy beliefs and task values about physical education? and (c) does students' cost conception relate to their achievements in physical education? By addressing these questions, the findings of this study will deepen our understanding on students' cost conception of attending physical education, and its relation to expectancy-value motivation and achievements in physical education.

Method

Participants

The participants of this study include 593 (out of 854) middle-school students who provided legible responses for the open-ending questions about cost in Expectancy-Value Questionnaire [EVQ] (see Appendix C.1) as well as all other data points (will describe later, see also Study A & B). The middle-school students were in 6th, 7th, and

8th grades in 11 schools. Included in the sample of 593 students, 47.7% of them are male and 52.3% are female. The sample represented a diverse population, consisting of 14.3% Asian, 16.4% African American, 17.0% Hispanics, 43.5% Caucasian, and 8.8% from other ethnic groups. On average, the middle-school students had 225-minute physical education class each week, ranging from 200 to 245 minutes.

In order to test whether the participants of this study (*n* = 593) can still represent the original sample of 854 students, a descriptive analysis on students' demographic variable ethnicity was conducted to compare with the original sample. Ethnicity was chosen as the auxiliary variable because the cost variables in the dataset were ordinal, thus could not be used to perform conventional missing value analysis (Rubin, 1987). In addition, no other variables that were known to serve as an auxiliary variable for cost because it was under-researched. Hence ethnicity was chosen to infer the representativeness of the sample in this study. Students who did not provide cost variable data included 13.6% Asian, 16.3% African American, 18.5% Hispanics, 39.6% Caucasian, and 11.9% from other ethnic groups, similar with ethnic of makeup of those who did, suggesting that the missing values might be random.

Research Context

A large school district was selected to carry out the study. The physical education curriculum that was implemented in the school district was skill-centered with a strong emphasis on standardized assessment, and was consistent with the National Association for Sport and Physical Education [NASPE] (2004) standards. Sport-centered skills, fitness, fitness concepts, and physical activity dispositions were strongly emphasized. Sport-centered skills and strategies were instructed using a variety of methods including the Sport Education and Tactical Games. Fitness concepts and physical activity principles were either organized in independent units or integrated in sport-related content. Because the curriculum emphasized evidence-based teaching and learning, assessment became an important component of the curriculum. Based on six explicit standards from NASPE (2004), the assessment evaluated students' fitness knowledge, psychomotor learning, and dispositions. Physical education teachers were trained and required to teach the contents, administer the assessments, and report on them.

Variables and Measures

Expectancy beliefs and task values. In this study, we used a modified EVQ (Appendix C.1; Eccles & Wigfield, 1995) to measure students' expectancy beliefs and task values about physical education. Using a 5-point Likert scale (with 5 = "very important", and 1 = "not important"), expectancy beliefs were evaluated using the first five questions, and task values using the following six questions. An example question that measures students' attainment value follows: "Compare to math, reading, and science, how important is it for you to learn PE content?" Students were allowed to only choose one of the five choices. The questionnaire has been reported to provide reliable data for elementary-school students with Crobach alpha coefficients ranging from .63 to .87 (Xiang et al., 2004). Studies by Zhu, Chen, Sun, and Ennis (2009) reported its construct validity and reliability among middle-school students in that the measurement model of EVQ was preserved very well in among 903 sixth, seventh, and eighth grade students from 13 middle schools with a latent structural reliability coefficient *Rho (ρ)* = .906. Therefore, it is suggested that EVQ can be used to measure the expectancy-value motivation of middle-school students.

Question 12 in EVQ is an open-ending question that asked students whether or not there was anything that they did not like in physical education and why they did not like them. In responding to the question, students were asked to describe the negative aspects that they perceived when attending to physical education (i.e., the cost to their motivation). For question 13, students were asked whether or not they were going to choose to participate in physical education if they were given an opportunity to choose not to participate, and why. These questions elicited students' cost conceptions and potential behavioral choices based on the cost conception. Middle-school students have acquired sufficient cognitive ability to process sophisticated questions, express their thoughts, and understand subtle nuances (Anfara, Mertens, & Caskey, 2007). Therefore, it was expected that the middle-school students could understand and respond to these open-ended questions.

Fitness knowledge. To measure students' knowledge about fitness, we constructed a question pool of selected questions from the standardized fitness knowledge tests developed and validated by Zhu, Safrit, and Cohen (1999). Questions in the pool were selected according to the criteria of maintaining the consistency between the content structured in the curriculum and the questions that would appear in the tests. The question pool was evaluated by expert teachers from the district who were responsible for editing and revising the curriculum each year. Based on the curriculum content of different grades, a test of 10 to 13 item in the form of multiple choices were programmed from the question pool. An example question from the test of sixth grade is as follows (the asterisk denotes the correct answer):

The ability to contract the muscles many times without tiring or to hold one contraction for a long period of time is called:

(a) Muscular strength

(b) Aerobic endurance

(c) Muscular endurance *

Psychomotor skills. At the time of data collection, two sport-centered skills were emphasized by the school district, basketball and badminton. Therefore in this study, we evaluated students' psychomotor learning by monitoring these two fundamental psychomotor skills: badminton overhand striking and basketball dribbling. The first skill was assessed using the test developed by Lockerhart and McPerson (1949), which had a test-retest reliability of .90, and predictive validity (actual game performance) coefficients of .71 to .90.The original test was used on college females, however, it is believed that the test is applicable to both female and male students as young as middle-school ages (Strand & Wilson, 1993).The second skill was assessed using the basketball control-dribble test developed by American Alliance of Health, Physical Education, and Dance [AAHPERD] (1984). Reported test-retest reliability coefficients and validity coefficients are .84–.97, and .37–.91, respectively. The physical educators were trained to use the original scoring methods for both tests.

Data Collection

The knowledge and skill tests were administered by trained physical education teachers, and occasionally assisted by researchers and trained data collectors, who collected the test results. The researchers and trained data collectors administer the EVQ. The EVQ were completed in the early spring semester of 2007, whereas the skill and knowledge tests were conducted at the end of fall 2006 and the beginning of spring 2007 semesters as pre- and post- tests. Students were required to sit apart and complete the tests and questionnaire independently in the gymnasia. Questions were read to the students by physical education teachers or trained data collectors, who were primarily junior and senior students in physical education and were familiar with the research context.

Data Analysis

Data reduction. Prior to data analysis, preliminary data calculation and conversion was conducted. First, students' cognitive knowledge test scores from the pretest and posttest were aggregated, and then converted into percentage-correct score by dividing the number of correct answers by the total number of questions. Second, for the psychomotor skill data, they were converted into standard *T* scores based on the existing data to represent students' psychomotor skill performances. The formula for calculating *T* scores is as follows, $T = [10 * (X - \overline{X}) / s] + 50$, where X represents the raw score, $\overline{X}$ the pooled average, and s the pooled standard deviation. In addition, the residual gain score for knowledge and psychomotor learning was computed as students' achievement for the data analysis. In a pre-post test context, the residual gain score is conceptualized as the residual error using the pre-test as the predictor and post-test score as the dependent variable (Williams, Maresh, & Peebles, 1972). The residual gain score will be uncorrelated with the pretest score, whereas it can be expected that the raw gain score (i.e., numerical value of the difference between the posttest and pretest score) will show a negative correlation with initial states (Williams et al., 1972). Third, students' expectancy beliefs and task values were calculated as the arithmetic mean of the items (i.e., item 1-11 in EVQ) measuring their expectancy-value components.

Open-ending question analysis. Students' responses to the open-ending questions in EVQ were analyzed using open coding approach analyzing a whole sentence or paragraph (Strauss & Corbin, 1998). First, for each question, students' responses of "yes" and "no" were recoded into a new categorical variable with 0 = "yes" and 1 = "no". Second, when coding a sentence or paragraph students wrote, the data analyst asked, "what is the major idea the student brought out in this sentence or paragraph in the context?" Then a code (i.e., a short name) was given to the sentence or paragraph and entered in a new string variable. Next the codes in the new string variable were reassembled and (e.g., "sweating" and "muscle pain") grouped into broader categories (e.g., "physical uneasiness"). This approach, according to Strauss and Corbin (1998), is "especially useful when the researcher already has several categories and wants to code specifically in relation to them" (p. 120). Based upon Chen and Liu (2009)'s categorization and Eccles et al. (1983) theorization as a taxonomy, the above open coding approach seems proper for this study. For example, one student responded to open-ending question 12: "Yes. I don't like going outside when it is very cold." In coding this student's response, the analyst first recoded "Yes" into a categorical variable as with the value of 0. Then the sentence following "Yes" was coded as "cold weather" and entered into a string variable. Finally, "cold weather" along with other codes was assembled as a broader category "learning context" in physical education.

To ensure reliability and trustworthiness of the coding process, two data analysts who were familiar with the research context read students' responses and open coded them. The codes were entered into the string variable only when both analysts agreed on them (e.g., "cold weather" as in the above example). In case the two data analysts could not agree upon the code name for a student's response, a third external reviewer was brought in to read the response and assign it to one of the two codes provided by the two analysts. Then the code which won two analysts' support was retained and entered into the string variable for further analysis.

Statistical analysis. A series of statistical analyses were conducted to answer the research questions concerning the impact of students' cost conception on their expectancy beliefs, task values, and achievements in physical education. First, the codes generated from the qualitative analysis (i.e., open coding), liking/disliking of physical education, choice decisions were saved as new variables for statistical analyses. Second, descriptive statistical analysis was conducted to describe the central tendency and distribution of the new variables. Third, to further explore the impact of students' cost conception on expectancy beliefs, task values, and their achievements in physical education, chi-square analysis and multivariate analysis of variance were performed.

Results

Dimensions of Cost Conception

The results of statistical analysis showed that 70.3% of the 593 middle-school students perceived negative aspects of attending physical education, and the rest (29.7%) did not perceive any cost. The students who reported no cost indicated that they liked everything in physical education. For example, Mike[1] responded that "No. I like everything in PE, nothing is wrong that we have fun playing activities". The constant comparisons on the responses of having cost revealed three dimensions of cost

[1] All names are pseudonyms.

conception that are quite consistent with Eccles et al.'s (1983) conceptualization of sources: excessive effort, potential of failure, and lost opportunities for other activities.

Perceived effort of attending physical education. The results of qualitative analysis suggest that one major source of cost conception came from perceived excessive effort. In addition, students attributed the excessive effort cost to the curriculum (e.g., physical activities) and physical uneasiness associated with participating in the physical activities. For instance, Natalie wrote "I don't like weight training, because it's hard and the next day your muscles hurt"; and Jose wrote "I don't like all running because it hurts to breathe afterwards". For Natalie and Jose, it was the physical activity and its associated physical uneasiness that constitutes perceived excessive effort to attend physical education. In many cases, taking tests became excessive effort that they needed to overcome to attend physical education. Tim wrote "I hate having tests in PE because it's supposed to be an elective. Also you're supposed to learn in PE by DOING things, not having someone tell you and then have a test. We should be graded on participation". For a few students, the learning context was perceived as requiring additional effort. For instance, Steven thought cold weather was something that he needed to stand when attending physical education classes; he explained "I love PE except when it's very cold outside".

Most students who perceived excessive effort that were derived from physical activities, tests, and learning context were still willing to attend physical education even if they were provided with an option not to take physical education. Steven for example, wrote that "No, I would come, because I think it is a great way to stay fit and learn to do exercises that are useful". For Steven, even though he needs effort to stand the cold weather sometimes he valued exercises because they help him stay fit. Tim would choose to attend "because it's fun and easy to do, also it's healthy". Natalie, on the other hand, would come to physical education too, but for a different reason - "because it is sort of like recess". For Jose, whether choose to attend physical education became conditional. If the perceived excessive effort is too high, Jose would rather not take physical education. He wrote "Yes. I would not come if we had to run the mile run".

Psychological meaning of potential failure. The psychological meaning of potential failure was present among middle-school students, although the data analysis suggests that its presence is much less frequent. Students' psychological meaning of potential failure for physical education seems to have been derived from the embarrassment due to lack of competence or social support. For example, Nyomie wrote "you feel embarrassed when you can't keep up with other kids, and even though you tried you still get a C". The fact that Nyomie lacked competence in certain physical activities led to her perceived potential failure for physical education, which resulted in her cost conception of attending physical education. John thought that there was a cost to his motivation in physical education when his peers were not supportive; he wrote "I don't like other people watching and getting mad when I do things wrong."

Students' psychological meaning of potential failure appeared to influence their decision to choose to attend physical education if there were options. The perceived embarrassment undoubtedly deterred Nyomie from choosing to attend physical education; she wrote "I would rather not come, I am not good at sports, do not enjoy playing them and never will. I would rather take another subject of my choice." The psychological meaning of potential failure, however, did not seem to influence John' choice to attend physical education; he wrote “I would come to PE because I don’t usually have to write and it’s usually fun.” For John, the fact that his physical education classes did not involve much writing task overcame the cost of the embarrassment derived from potential failure.

Opportunity cost. Not many responses indicate a strong perceived opportunity cost for attending physical education. The perceived opportunity cost seemed can only be identified from students’ responses to the second open-ended question that was related to their choices of attending physical education in a hypothetical situation. In other words, the opportunity cost is often related to the middle-school students’ participation decision. In this study, when opportunity cost was perceived and reported by a student, the student normally chose not to attend physical education if she/he was provided with options.

From students’ responses, it appeared that their perceived opportunity cost has to do with fun and the opportunity to learn in physical education. For example, Sarah responded “I would not come to PE, the classes aren’t fun and I would rather have a second art class.” For Sarah, attending physical education classes cost her opportunity to take another art class, which she believed was much more fun than physical education. Another student, Xavier reported similar response; he wrote “PE is a welcomed break from academics and of course I would go to PE unless the other option seemed more interesting.” It appeared more prominent from Xavier’s response that he seeks solely for fun from physical education, and that the opportunity cost for attending physical education is the lost opportunity to attend something else more interesting. For a number of students, the opportunity to learn constitutes the perceived opportunity cost for attending physical education classes. For instance, Hao thought that he already knew the content being taught in his physical education classes, thus the perceived cost to attend physical education for him is the opportunity to learn. He wrote "Probably not [choose to attend physical education], because I hate being taught to do something I already know how to do."

In summary, the data from this study support Eccles et al.'s (1983) conceptualization of cost in that all the three dimensions were identified in students' responses. Through analyzing students' responses to the open-ended questions, it is evident that students' cost conception might have impacts on their intentions to attend physical education if they had the options, although the impact may vary among the cost dimensions. It is still not known, however, whether or not students' cost conception interacts with their expectancy beliefs, task values, and achievement in physical education.

Cost, Expectancy-Value Motivation, and Achievement in Physical Education

According to Chen & Liu (2009), two strong thematic categories can emerge from analyzing student responses to the open-ended questions in EVQ: student liking or disliking of physical education (liking/disliking), and hypothetical decisions to continue physical education (choice decision/opportunity cost). In this study, students' responses to the open-ended questions were first open coded (Appendix C.2), then summarized in a similar approach (Table C.1 and C.2). As displayed in Table C.1, 29.7% of the middle-school students perceived no cost for physical education, and 70.3% of them perceived potential costs for physical education. The potential cost came from many factors that students disliked, the leading three including curriculum content 42%, learning context 18.7%, and social support 5.2%. As demonstrated in Table C.2, even though 70.3% of students perceived potential cost for attending physical education, 84% of them still would choose to attend if they had options not to, 11% chose not to, 3.9% depending, and 1.2% not sure. The top three groups of students chose to attend physical education because of motivation for physical education (31.2%), benefits of physical activities (25%), and no reason (23.9%).

[Insert Table C.1 and C.2 here]

Relation between cost conception and hypothetical choice. Qualitative data analysis of students' responses to the open-ended questions showed that students' cost conception interacted with their hypothetical choice of attending physical education classes. After students' responses were open-coded, chi-square analysis was performed on the coded new variables (Table C.1 and C.2) to test whether not that was an association between cost conception and subsequent hypothetical choice. The result of chi-square analysis revealed that these two variables were associated ($\chi^2 = 29.45$, $df = 15$, $p = .01$).

Impact of cost conception on expectancy-value motivation. In order to test whether students' cost conception impacts their expectancy-value motivation, a multivariate analysis of variance (MANOVA) was conducted to detect any possible difference among difference cost conception conditions. Because the three leading cost conditions, no cost, curriculum content, and learning context, were identified by more than 90% of students, these cost conditions were used as grouping variables in a multi-group comparisons. Table C.3 shows the descriptive statistics of students' expectancy-value motivation in the three groups. The results of Box*' M* test suggested that multivariate normality for students' achievements is likely to be violated (*Box' M* = 61.503, F (20, 0) = 3.308, $p = .000$). Therefore, Pillai's Trace value was used in

MANOVA. The results of MANOVA, Pillai's Trace = 5.436, F (8, 0) = 5.436, p = .000, η^2 = .039, suggest that there is a significant effect of cost conception on students' expectancy-value motivation in physical education.

[Insert Table C.3 here]

Because the variance homogeneity assumption was violated for post hoc comparisons (all p < .05 in Levine's test), *Games-Howell* test was used for multiple comparison (Seaman, Levin, & Serlin, 1991). The results of multiple comparisons (Table C.3) revealed that there is no significant difference in students' expectancy beliefs among the three groups (p > .05). There are significant differences in students' task values (i.e., attainment value, intrinsic value, and utility value) between no cost group and curriculum content (p < .05), no cost and learning context group (p < .05). Students who perceived no cost rated their task values significantly higher than those who perceived cost from curriculum content and learning context, however, no significant difference in task values was found between curriculum content and learning context group (p > .05). In summary, it appears that students' task values differed between no cost and potential cost groups, yet their expectancy beliefs do not.

[Insert Table C.4 here]

Impact of cost conception on achievements. In order to test whether students' cost conception impacts their expectancy-value motivation, a multivariate analysis of variance (MANOVA) was also conducted to identify possible differences among the three cost conception conditions. The descriptive statistics of students' achievements in physical education for the three groups were displayed in Table C.4. The results of *Box' M* test showed a violation of the multivariate normality assumption (*Box' M* = 25.166, F (12, 0)

= 2.078, p = .015). Therefore, Pillai's Trace value was used in MANOVA. The results of MANOVA, Pillai's Trace = .014, F (6, 0) = 1.211, p = .298, η^2 = .007, suggest that there is no significant effect of cost conception on students' achievements in physical education. Hence, no post hoc test was needed.

Discussion

The purpose of this study was threefold: (a) to explore middle-school students' cost conception about physical education, (b) to examine the interaction between students' cost conception and expectancy-value motivation, and (c) to identify possible interaction between students' cost conception and achievements in physical education. The results of qualitative data analysis revealed that middle-school students' cost dimensions in physical education are consistent with Eccles et al.'s (1983) conceptualization of cost, including perceived effort, psychological meaning of potential failure, and opportunity cost. Further quantitative analysis (e.g., Chi-square) on the open-code variables suggests that students' task values differ between no-cost and with-cost groups. However, no difference on expectancy beliefs was found between these groups. In addition, the results of MANOVA indicate that students' achievements do not significantly among students who have different conceptions about attending physical education classes.

Students' Cost Conception

The results of this study suggest that middle-schools students are capable of verbalizing their cost conception in answering open-ended questions. In particular, most students were able to identify the aspects that they perceived to be not favorable and needed excessive effort to conquer to attend physical education. Majority of the negative perspectives were derived from the curriculum content (42%) and learning context (18.7%). This phenomenon suggests the importance of motivation-relevant curriculum (Chen & Ennis, 2004) in that curricula often times prescribe learning experiences. Combing these two groups, it is self-evident that students' perceived cost relation to the excessive efforts is primarily from two important determinants of their learning experiences in physical education, curriculum content and learning context.

Some students elaborated their perceived psychological meaning of potential failure in physical education, and the perceived psychological meaning mainly appeared from two sources, embarrassment and lack of social support. The perceived embarrassment associated with potential failure appears to have a detrimental effect on students' intention of attending physical education classes in their responses to the hypothetical question (i.e., question 13). This finding is consistent with the findings in previous studies (e.g., Ennis, 1999, 2000) where high school girls' found to be embarrassed in physical education because of their perceived low physical competence and irrelevance of the curriculum.

Not many students reported their perceived opportunity cost although it appeared to be closed related with their choices. When reported, the opportunity cost seemed to derive primarily from two sources: (a) loss of opportunities to have more fun, and (b) the loss of opportunities to learn. This finding suggested that some students either perceived the curriculum to be boring or with few opportunities to learn. In either case, this finding can have important implications for the physical education curriculum. Based on the findings from Study A where students' learning in basketball, for example, was minimal, it is likely that there was not enough depth for the particular content because students felts that they have already known “how to do” the activities.

Impacts of Cost Conception

The results of this study suggested that students’ cost conception is related with their choices in answering a hypothetical question. This finding, in particular, supports Buchanan’s (1969) theorization of opportunity cost. Buchanan (1969) presumed that when people make decisions, not only do they consider the actual efforts of participating in an activity, but also consider the valuation and opportunity cost of the participation. Although the findings of this study provide evidence of the relation between cost conception and hypothetical choices, how the actual decision is made in considering one’s cost conception is yet to be known, and may require case-by-case analysis.

In this study, students’ cost conception was found to significantly impact their task values but not expectancy beliefs. Students who perceived no cost for attending physical education reported higher task values than those who perceived potential cost. According to Eccles and Wigfield (2002), students’ task values can predict their achievement-related choices. Combining the finding on the relation between students’ cost conception and hypothetical choices, this result supports the theorization of Eccles and Wigfield (2002). It seems that when students perceived no cost in physical education, they reported higher task values; on the contrary, when they perceived potential cost of excessive effort, potential of failure, and loss of other opportunities, they reported lower task values. However, further evidence is needed from future studies to support this conclusion.

Students' cost conceptions were not found to significantly impact their achievement in physical education. This finding suggests that the students' achievement in fitness knowledge and psychomotor learning are less likely than task values to be influenced by their cost conceptions. Together with other findings in this study, it seems that students' cost conception only significantly relates with their task values and hypothetical choices, but not with their expectancy beliefs and achievement. As reported in Study A and other previous studies (e.g., Xiang et al., 2004), students' expectancy beliefs but not task values significantly influence their performance and achievement in physical education. Although students' expectancy beliefs and task values are positively correlated (Wigfield & Eccles, 2000; Zhu et al., 2009), through the relation to cost conception expectancy beliefs and task values each seem have different functions working independently. More studies are needed to further explore these relations.

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Table C.1.

Frequencies of Potential Cost Conception (like/dislike) of Physical Education [PE]

Cost	Code	Frequency	Percent	Total
No cost	Like everything in PE	176	29.7%	29.7%
Potential cost	Curriculum content	249	42%	70.3%
	Learning context	111	18.7%	
	Social support	31	5.2%	
	Physical uneasiness/lack of competence	5	.8%	
	Teacher factor	21	3.5%	

Table C.2.

Frequencies of Hypothetical Decisions to Attend Physical Education [PE]

Decision	Code	Frequency	Percent	Total
Attend PE	Attend PE with no reason	142	23.9%	84.0%
	Academic requirement	23	3.9%	
	Motivation	185	31.2%	
	Benefits of physical activities in PE	148	25.0%	
Not attend PE	Not attend PE with no reason	7	1.2%	11.0%
	Have enough physical activity	13	2.2%	
	Curriculum content difficult/boring/not useful	31	5.2%	
	Do not like the teacher	3	.5%	
	Uncomfortable learning context	11	1.9%	
It depends	It depends	23	3.9%	3.9%
Not sure	Not sure	7	1.2%	1.2%

Table C.3.

Results of Multiple Comparisons (Games-Howell) on Expectancy-Value Motivation

Variable	Mean	*SD*	Group (I)	Group (J)	Mean difference I-J	*SE*	*p*
	4.18	.58	No cost	Content	.109	.062	.185
EB	4.07	.69	—	Context	.119	.076	.262
	4.06	.65	Content	Context	.009	.076	.991
	3.81	.79	No cost	Content	.334	.088	.001
AV	3.47	1.03	—	Context	.358	.112	.004
	3.45	1.00	Content	Context	.024	.115	.977
	4.31	.76	No cost	Content	.509	.089	.000
IV	3.80	1.07	—	Context	.601	.121	.000
	3.70	1.12	Content	Context	.099	.126	.715
	4.06	.84	No cost	Content	.313	.090	.002
UV	3.75	1.01	—	Context	.562	.121	.000
	3.50	1.09	Content	Context	.249	.121	.103

Note. SD = Standard Deviation; *SE* = Standard Error; EB = Expectancy Beliefs; AV = Attainment Value; IV = Intrinsic Value; UV = Utility Value.

Table C.4.

Descriptive Statistics of Achievements in Physical Education

Group	Knowledge[a]		Basketball dribbling[a]		Badminton striking[a]	
	Mean	*SD*	Mean	*SD*	Mean	*SD*
No cost	-.869	16.75	.000	7.71	1.176	9.13
Content	1.023	17.46	-.242	7.69	-.464	9.39
Context	.000	16.06	-.223	7.04	-.979	7.73

a. Residual gain score.

Appendix C.1

EXPECTANCY-VALUE QUESTIONNAIRE (adopted from Xiang et al., 2003)

1. How good are you in physical education?
Very good 5 4 3 2 1 Not good

2. If you give 5 to the best student in PE and 1 to the worst, what you give to yourself?
Best 5 4 3 2 1 Worst

3. Some kids are better in one subject than in another. For example, you might be better in math than in reading. Compared to most of your other school subjects, how are you doing in PE?
A lot better 5 4 3 2 1 A lot worse

4. How well do you think you are doing in learning in PE?
Very well 5 4 3 2 1 Very poorly

5. How well are you keeping yourself physically active in PE?
Very well 5 4 3 2 1 Very poorly

6. How important do you think PE is for you?
Not very important 1 2 3 4 5 Very important

7. Compare to math, reading, and science, how important is it for you to learn PE content?
Not very important 1 2 3 4 5 Very important

8. In general, how fun do you think your PE classes are?
Very boring 1 2 3 4 5 Very fun

9. How much do you like your PE classes?
Don't like it at all 1 2 3 4 5 Like it very much

10. Some things that you learn in school help you do things better outside of school. We call this being useful. For example, learning about plants at school might help you grow a garden at home. How useful do you think the concepts you learned in PE are?
Not useful at all 1 2 3 4 5 Very useful

11. Compared to your other school subjects, how useful are the skills learned in PE?
Not useful at all 1 2 3 4 5 Very useful

12. If there is anything that you don't like in PE, what would that be? Why? (Open-ended)

13. If you had a choice, would you rather not come to PE? Why? (Open-ended)

Appendix C.2

Sample Responses to Open-ended Questions and Codes

Question # 12: If there is anything that you don't like in PE, what would that be? Why?		
Students' response	Category	Code
None / nothing / I like everything	No cost	1
I don't like all the running because it is boring.	Curriculum content	2
I don't like going outside when it is very cold.	Learning context	2
I don't like when people yell at me because I mess up.	Social support	2
Weight training because its hard and the next day your muscles hurt	Physical uneasiness / Lack of competence	2
Teacher force you do something you don't like / couldn't do	Teacher factor	2

Note. 1. No perceived cost; 2. Potential cost.

Question # 13: If you had a choice, would you rather not come to PE? Why?		
Students' response	Category	Code
I would love come to PE./ Rather not.	Attend PE with no reason	1
PE is a welcomed break from academics and of course I would go to PE	Academic grade/requirement	1
I would still come to PE because it is fun to play sports with your friends.	Motivation for physical education	1
No, because I think it is a great way to stay fit and learn to do exercises that are useful.	Utility/benefits of physical activity	1
I would not come to PE.	Not attend PE with no reason	2
I do a lot of activities after-school, no need more.	Enough activity	2
I would not come, the classes aren't fun and I would rather have a second art class.	Content too difficult/boring/not useful	2
Probably not because I hate being taught to do something I already know how to do	Opportunity cost	2
Probably not, the teachers are rude and mean.	Teacher	2
Not come, I' d rather play sports elsewhere	Context	2
Yes / No. It would depend what I could do if I didn't come.	It depends	3
I'm not sure, PE is fun but my other classes are more important.	Not sure	4

Note. 1. Attend PE; 2. Not attend PE; 3. It depends; 4. Not sure.

CHAPTER V

SYNTHESIZED SUMMARY AND RECOMMENDATION

Summary of the Findings

The results of study A showed that overall students learned a significant amount of badminton striking and fitness knowledge over the year. Although generally students' basketball dribbling skill was improved, yet the improvement was not statistically significant. These findings indicate the content specificity of students' achievements in physical education and have implications for curriculum design. The results from Study A, cross-sectional examination, suggest that the students in higher grade tended to rate task values of physical education lower than their younger counterparts. Students' expectancy beliefs, however, were found to be steadily high across the three grades. The finding indicates that in physical education students are likely to maintain their competence beliefs but gradually reduce their valuation for the content. Overall, the students' expectancy-value motivation was generally rated over the average of the scale (greater than 3.0 mid-point), supporting the notion that middle-school students were motivated for physical education (Chen et al., 2009). Within a traditional regression analytic context, however, students' relatively high expectancy-value motivation did not explain much of the variance for their psychomotor achievements, and nor for their fitness knowledge gain in physical education.

From a constructivist perspective, when students value the content and feel confident about their ability in learning the content, they are likely to achieve in learning, and to apply the knowledge and skills learned to their lives. To the same token, constructivist learning theory also accentuates the importance of previous experiences in learning new knowledge and skills (Shuell, 1986). Although the data showed that students' expectancy-value motivation explains a little about their achievements, students showed sizable achievement over the year in both psychomotor skills and fitness knowledge. In physical education, when students value the content and learned the content (evidenced in Study A), whether or not they use and apply the content into their real lives remains unknown. In Study B, therefore, the constructivist learning theory premise about the trilateral relation among students' expectancy-value motivation, achievements, and after-school physical education was examined.

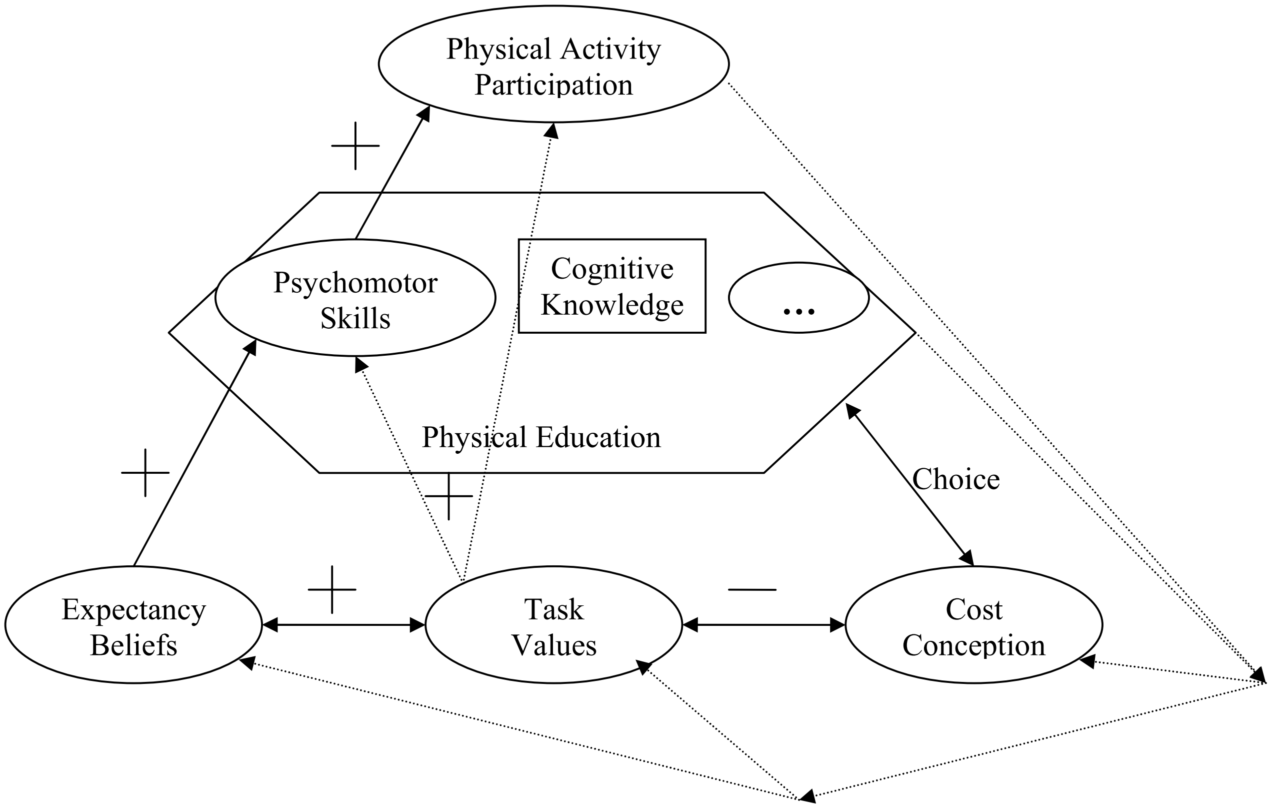
Through structural equation models (SEM), Study B tested the hypothesis that students' expectancy-value motivation leads to their achievements in physical education, which in turn, predict their after-school physical activity participation. The results partially support the hypothesis in that students' expectancy beliefs were found to significantly relate with their psychomotor achievement, which then leads to after-school physical activity participation. Students' task values, however, were neither found to predicts their achievements, nor to their after-school physical activity participation. Students' fitness knowledge gain was not included in the final structural model due to the fact that it does not significantly correlate with other variables (e.g., psychomotor skill achievements and expectancy-value indicators). Based on the results from Study A we could safely suggest that middle-school students' expectancy-value motivation was relatively high (on average greater than 4 on a 5-point scale). The curriculum reform effort, the final structural model in Study B seems to suggest, should place significant emphases on developing students' psychomotor skills in order to promote students' after-school activity participation.

Within the expectancy-value theoretical framework, cost is a construct that has been under-researched because of its complexity. Study C attempted to address the question what motivates students choose to attend physical education from a cost perspective. The analysis of students' responses to the open-ended questions suggested that the three dimensions of cost conception, perceived effort, perceived psychomotor meaning of potential failure, and perceived opportunity cost were identified from multiple categories. Different dimensions of cost conception may had different impacts on students' hypothetical decisions on whether or not they choose to attend physical education if they were given a choice not to. Subsequent quantitative analysis revealed that students' cost conception inversely interacts with their expectancy beliefs and task values about physical education; but not with achievement. Despite of the perceived cost, most students (84%) still were willing to choose physical education for the reasons of having fun (31.2%) and receiving health benefits (25%). The 11% students who did not choose to attend physical education attributed mainly to the curriculum content boring/not useful, had enough physical activity, uncomfortable learning context, and the teacher.

An Expectancy-value Model of Achievement in Physical Education

The dissertation study was guided by the premises of constructivist learning theory that students learn best when they apply the knowledge and skills taught in school in their real-life experiences (Shuell, 1986). The real-life experiences later on become students' prior experiences, which will be conducive to their future learning. The constructivist learning theory emphasizes the active role of the learner, therefore acknowledges that motivation is an important factor that influences student learning and behaviors. Based upon Eccles and Wigfield's (2002) expectancy-value model of achievement, this study examined the relation between student expectancy-value motivation, achievement in middle-school physical education, and after-school physical activity participation.

Figure 5.1. An expectancy-value model of student achievement in physical education



Based on Eccles and Wigfield's (2002) theoretical model and the results of the present study, a conceptual model of students' expectancy-value motivation, achievements in physical education, and after-school physical activity participation is illustrated in Figure 5.1. The solid lines in Figure 5.1 represent the significant relation that was identified in this study. The doted lines represent the theorized paths. The plus sign indicates a positive path and the minus sign indicates a negative path. In accordance with this model, students' expectancy-value motivation influences their achievements and achievement-related choices, and their achievements and choices then influences their after-school experiences. Over time, it is theorized that students' experiences will then impact their expectancy-value motivation (Eccles & Wigfield, 2002).

Consistent with Wigfield and Eccles's (2000) theorization, the CFA model in Study B showed that students' expectancy beliefs and task values were positively correlated with a latent path $r = .618$. The findings in Study C support Eccles et al.'s (1983) assertion that students' task values negatively interact with their cost conception. For a specific task, the higher the cost students perceive, the lower the task values they tend to perceive. Students' perceived cost, however, seem to be independent from their expectancy beliefs. The results of study C showed that students' hypothetical choices of attending physical education were associated with their cost conceptions. From students' responses to the open-ending questions, it is clear that their task values play a critical role in their decision-making. In summary, the relation between students' cost conception, task values, and behavioral choices can be far more complicated than that shown in Figure 5.1.

In a middle-school context as exemplified by the present study, it seems that students' expectancy beliefs are the only significant positive predictor for their psychomotor achievement. Students' psychomotor achievement then positively relates with their after-school physical activity participation (Figure 5.1). As shown in Study B, students' expectancy-value motivation in physical education does not significantly relate to their after-school physical activity participation. When using regression analysis to examine the impact of students' expectancy-value motivation (Study A), task values were found to explain a little of the variance in their psychomotor learning. In both Study A and Study B, no significant relation was identified between students' fitness knowledge gain and the components of expectancy-value motivation. It is likely that students' motivation in physical education is not responsive to their knowledge learning. As indicated in Figure 5.1, students' other achievements, especially noncompetence-based achievement in physical education, was not studied in the study. How these achievements relate to students' motivation and after-school physical activity participation is worth further exploration.

The findings from this study are based on the responses from a population of middle-school students. The relations depicted in Figure 5.1 could evolve as the students' developmental stage changes. For example, studies conducted among elementary students (Xiang et al., 2004, Xiang et al., 2006) and middle-school students (Zhu et al., 2008) suggest that students' expectancy beliefs are the only significant predictors for their performance in physical education. Yet studies (e.g., Chen & Liu, 2008, 2009) conducted among college students suggest that task values not expectancy beliefs become a significant factor influencing their achievement and choices. Although no known study has been conducted with high-school students, the initial evidence seem to suggest that the function of students' expectancy-value motivation evolve at different developmental stages.

Application of the Expectancy-value Theory in Physical Education

The expectancy-value theory (Eccles et al., 1983; Eccles & Wigfield, 2002; Wigfield & Eccles, 2000) as a whole provided a paradigm to examine students' motivation in relation to their achievement as well as behavioral choices in the domain of physical education. In particular, studies (e.g., Xiang et al., 2004) have shown that students' expectancy beliefs can positively predict students' performance in running as well as other skill performances (Zhu et al., 2008). Task values were found be related with students' hypothetical choices in participating physical activities (Chen et al., 2008; Xiang et al., 2006). Overall, the predictability the expectancy-value theory in students' physical performances appears to be small, although significant.

Along with the results reported from other studies (e.g., Zhu et al., 2008), the theoretical model of expectancy-value application in this study, however, appears to have little explanatory power in predicting students' cognitive learning in physical education. Particularly in this study, students' knowledge gain was not significantly associated with any of the constructs in the theoretical model of expectancy-value theory. Although yet to be known, it is likely that students' motivation in physical education is primarily derived from physical participation, not cognitive engagement.

The expectancy-value theory can still be promissory for the domain of physical education if researchers started to examine the construct and the theory from a different perspective. For instance, we need to understand what the sources of students' expectancy beliefs and task values are in physical education. We also need to understand what the factors and elements are that are perceived of task values and expectancy beliefs, and what the factors are that could cost/diminish them. Once we understand these issues (e.g., Usher, 2009), the theory could be refined, and the measure of its constructs could be reconceptualized and reconstructed in and for physical education. Then a new theoretical paradigm might be generated in physical education and higher predictive power should be expected and further tested.

Recommendations

The results and the investigation process of this dissertation study afford recommendations for both practical curriculum implications and methodological considerations for future studies. First, the results reported in Study A quantified students' learning in three emphasized content areas. Students' achievement varied to a certain extent that basketball dribbling skill for example, was possibly one of the most familiar content in physical education among students, however, was learned the least (effect size .11 at individual level, and .13 at class level). This finding piqued the researchers to suggest re-examining the curriculum contents and instruction of the basketball unit. It might be that fact the basketball unit was not designed with a depth in consideration to the fact most students might have had basketball unit in their physical education several times before middle school.

Curriculum Implications

Besides health benefits, participating in after-school physical activity have been found to influence many aspects of middle-school students' lives (e.g., Mahoney et al., 2005).The findings from study B reminded us the importance of students' psychomotor learning for increasing their after-school physical activity participation. Besides that, results of Study C showed that about 25% of students choose to continue their physical education for the health benefits despite of their cost conception. This finding suggested that teaching students the knowledge of health benefits of physical activity might actually be conducive to their continuation of participating in physical education and physical activities. Both implications can be useful for future physical education curriculum development for middle-school students in similar contexts.

Middle-school students' responses in Study C appear to call for a physical education curriculum that is "fun" and rich in meaningful learning opportunities. Although 70.3% of students reported cost for attending physical education, 84% of them were still willing to attend physical education for the motivation of "fun" (31.2%) and health benefits of physical activities (25%). This finding revealed that students valued their motivation for "fun" and the health benefits of physical activities, and that in many cases their valuation prevails over the perceived cost of physical education. It is worth noting that for those students who did not choose to attend physical education (11%), the reasons for their decisions were related to curriculum or context of physical education: they perceived the curriculum boring or not useful, they had enough physical activity already, and they disliked the learning context. As evidenced in Ennis's (1999) study, a curriculum that provides meaningful learning experiences could better engage students, even those disengaged ones. The finding of Study C calls for a curriculum that provides not only "fun" physical activities, but also rich and meaningful learning opportunities.

Methodological Considerations for Future Studies

It is self-evident that the predictive power of expectancy-value motivation to students' psychomotor achievement differs in two studies, when comparing the results from Study A to Study B. When it comes to examining the relation between expectancy-value motivation and students' psychomotor achievement, these two studies were conducted based on the dataset. The way how the data was analyzed, however, was seemingly different. In study A, the expectancy beliefs and task values were computed as the arithmetic mean of the indicators. Students' psychomotor achievements were calculated as the pretest and posttest gain. Multiple regression analysis was conducted on these variables to examine how much variance of psychomotor achievement students' expectancy-value accounts for. In study B, students' expectancy beliefs and task values were analyzed as latent variables, and psychomotor achievement was analyzed as latent composite of both badminton striking and basketball dribbling.

These analytic strategy differences produced very different results on the predicative power of students' expectancy-value motivation to their psychomotor achievements. In Study A, task values were found to be significant predictors for psychomotor achievements, accounting totally for 3% of the variance. The results of study B, however, students' expectancy beliefs were found to significantly contributing to their psychomotor achievements, with the model explaining 14.6% of its variance. The comparison suggests that SEM analysis seems equipped with more power than the traditional regression analysis when dealing with latent variables (Hancock & Mueller, 2006). It is recommended that when the indicators of the factors/variables can be or should be analyzed as latent variables, it appears more powerful to use the latent analytic approach.

APPENDIX A

KNOWLEDGE TESTS

6th Grade Knowledge Test Questions (Correct answer is highlighted)

Item #	Question		
1	Physical activity done in short, fast bursts in which the heart cannot supply oxygen as fast as the muscles use it is		
	aerobic activity	anaerobic activity	muscular endurance
2	Physical activity for which the body can supply adequate oxygen to allow performance to continue for long periods of time		
	aerobic activity	anaerobic activity	muscular strength
3	Ability of the heart, lungs, and blood vessels to function efficiently when a person exercises the body is		
	muscular endurance	target heart rate	cardio-respiratory fitness
4	Lacking the necessary amount of body fluid is called		
	hydrated	sweating	dehydrated
5	The ability to move the joints through a full range of motion		
	aerobic fitness	core activities	flexibility
6	A muscle that when contracted bends a joint in the body		
	extensor	flexor	abdominal
7	The ability to contract the muscles many times without tiring or to hold one contraction for a long period of time		
	muscular strength	aerobic endurance	muscular endurance
8	The ability to use strength quickly is called		
	power	energy	fitness
9	The rule that states that in order to improve fitness, one needs to do more physical activity than one normally does is called		
	principle of progression	principle of specificity	principle of overload
10	The rule that states that the amount and intensity of physical activity needs to be increased gradually		
	principle of progression	principle of specificity	principle of overload
11	The rule that states that specific types of exercise improve specific parts of fitness or specific muscles		
	principle of progression	principle of specificity	principle of

overload

12 The extent of movement one can move a joint is

flexibility joint strength range of motion

13 To drink liquids to replace those lost during physical activity is

re-hydrate dehydrate thirsty

14 A force that acts against the muscles

power energy resistance

15 Being inactive or participating in very little physical activity is

sedentary obese overweight

16 Stretching slowly as far as possible without pain is

ballistic stretch active stretch static stretch

17 A series of quick but gentle bouncing or bobbing motions designed to stretch muscles is

ballistic stretch active stretch static stretch

18 Physical fitness affects

physical health social health mental and emotional health All of the above

19 The overload principle involves an increase in

physical activity or exercise above what you normally do

the improvement you would normally expect

the changes that normally occur in your body

the negative effects the occur in your body

20 The principle which states that the factors in your FITT change as your fitness levels increase is

specificity progression overload mode

21 Teens who are at least moderately active and in good health are advised to work at

between 60 and 90 percent of their target heart rate range

45 percent of their target heart rate range

between 60 and 90 percent of their estimated $VO_{2\ max}$

45 percent of their estimated $VO_{2\ max}$

22 When stretching, your goal should be to reach the point where

a muscle or connective tissue is barely stretched a muscle or connective tissue is stretched just beyond its normal resting state

a muscle or connective tissue is stretched well beyond its normal resting state

None of the above

23 The top of the Physical Activity Pyramid consists of activities that you should

cut down on   do 2 or 3 times a week   do every day   None of the above

24 The amount of force that a muscle can produce is

muscular strength   aerobic endurance   muscular endurance

7th Grade Knowledge Test Questions (Correct answer is highlighted)

Item #	Question			
1	A heat unit referring to the energy available in food and the energy used by body activities is			
	calorie	degree	carbohydrate	
2	A nutrient in starches and sugars that provides energy is called			
	Calorie	Protein	Carbohydrate	
3	Exercises that strengthen the muscles of the trunk and help the body maintain a good posture are called			
	Core exercises	Aerobic exercises	Flexibility exercises	
4	A muscle contraction in which the length of the muscle remains the same under tension			
	Isometric contraction	Isotonic contraction	Limited contraction	
5	A muscle contraction that pulls on the bones and produces movement of body parts			
	Isometric contraction	Isotonic contraction	Full contraction	
6	The condition of having a very high percentage of body fat is called			
	Obesity	BMI	Body composition	
7	The number of consecutive times one does an exercise is called			
	Sets	Repetition	Circuit training	
8	A group of repetitions of a specific exercise is called a			
	Set	Repetition	Circuit training	
9	Your exercise intensity is affected by your			
	level of fitness	fitness goals	length of each workout session	all of

the above

10 What type of physical activity is especially important for you to include in your personal fitness program if you are trying to lose body fat, but gain weight?

Flexibility Plyometric Aerobic Weight training

11 Done regularly, aerobic activity does all of the following EXCEPT

Strengthen the heart Strengthen the lungs Strengthen the arm muscles Raise the heart rate

12 Factors affecting cardiorespiratory endurance include

Age Gender Heredity All of the above

13 All of the following are anaerobic activities EXCEPT

Running up a flight of stairs

Sprinting 40 yards

Swimming 100 meters

30 minutes on a treadmill

14 Which of the following is the best example of muscular endurance?

Five arm curl reps with 20 pounds

Fifteen bench press reps with 75 pounds

Ten sit-ups

A fifteen-second isometric contraction

15 Which of the following is NOT a benefit of weight training?

Significant increase in cardiovascular efficiency

Increased bone strength and density

Reduction in stress

Faster metabolism and better self-esteem

16 Kristin is considering a weight-training program. Which of the following should she consider before developing her goals?

Her current level of strength

Her daily schedule

Past injuries

All of the above

17 If you do ten push-ups, one right after the other, you have done which of the following

One set of ten reps

Ten sets of one rep each

Ten sets of one exercise

None of the above

18 Your flexibility is influenced by all of the following EXCEPT

Heredity

Age

Height

Physical activity level

19 The one factor that has the greatest negative influence on your flexibility levels is

Lack of physical activity

Excess body fat

Injured joints

Your gender

20 Exercises that create resistance by using one's own body weight are called

Calisthenic exercises | Barbell exercises | Dynaband exercises

8th Grade Knowledge Test Questions (Correct answer is highlighted)

Item #	Question		
1	The make up of the body tissues, including muscle, bone, body fat, and all other body tissues is called		
	BMI	Body composition	Weight
2	A method of assessing body composition is		
	Mile run	BMI	Push ups
3	A type of physical activity program in which the person performs a group of exercises in a sequence with brief rests between exercises is known as		
	Interval training	Circuit training	Repetitions
4	A summary of the results of self-assessments of several fitness components is a		
	Fitness profile	Fitness guide	Fitness prescription
5	Physical activity in which short bursts of high-intensity exercise are alternated with rest periods		
	Interval training	Circuit training	Repetitions
6	A food substance required for the growth and maintenance of body cells is		
	Nutrient	Fat	Mineral
7	A type of training designed to increase athletic performance using jumping,		

hopping, and other exercises that causes muscles to lengthen followed by a shortening contraction is known as

Interval training   Circuit training   Plyometrics

8 A nutrient that builds and repairs body cells is

Carbohydrates   Protein   Fat

9 Using free weights or machines to develop muscular endurance or strength is called

Interval training   Resistance training   Circuit training

10 Before your body can use carbohydrates for energy, it must convert them to

Fiber   Glucose   Fats   Electrolytes

11 Candy bars, cookies, and soft drinks all contain a category of nutrients known as

Simple carbohydrates   Fiber   Complex carbohydrates   Fats

12 What is the minimum recommended amount of essential fat for teen males?

1 percent   7 percent   12 percent   18 percent

13 What is the minimum recommended amount of essential fat for teen females?

1 percent   7 percent   12 percent   18 percent

14 Your body composition is influenced by which of the following?

Genetics   Age   Gender   All of the above

15 If you want to lose weight, your eating plan should include

Mainly carbohydrates   Mainly proteins   Nutrient-dense foods   Vitamin-rich foods

16 If you want to lose weight, how many pounds per week maximum would be healthful?

1 to 2   3 to 5   5 to 7   10

17 A person with a BMI higher than the 95th percentile is

Within normal limits   Underweight   Overweight   At risk for overweight

18 A person with a BMI lower than the 5th percentile is

Within normal limits   Underweight   Overweight   At risk for overweight

19 How often should you check your body composition during a weight-control program?

Every 3 months   Every 6-8 weeks   Every 3 weeks   Every 1-2 weeks

20 Leisure-time activities do all of the following EXCEPT

Provide an opportunity for social interaction

Guarantee improvements in health-related or skill-related fitness

Provide a source of recreation

Burn calories

21 Alternate sets of exercises without rest between sets is known as

Compound sets Supersets Multiple sets

22 Varying exercise or activity routine or type is called

Circuit training Cross training Interval training

23 A breakdown of a fitness program based on the FITT of physical activity or exercise is a

Fitness profile Fitness guide Fitness prescription

24 Lifting the same amount of weight for three to five sets is called

Compound sets Supersets Multiple sets

25 Alternately performing sets of exercises that train opposing muscles, without resting between sets is known as

Compound sets Supersets Multiple sets

APPENDIX B
3 DAY PHYSICAL ACTIVITY RECALL AND ACTIVITY CODES

After-School Physical Activity Survey

INSTRUCTION: The following table divides each hour from 3:00 p.m. to 10:00 p.m. into four 15-minute boxes. You task is to think about what you did yesterday during this time and fill in each 15-minute box with the activities listed below. If you did not do any of the activities during a 15-minute period, write "none" in that box. You can use a line to show the same activity you did in more than one 15 minute period. Do not leave any boxes unfilled.

IMPORTANT: Please turn in the completed form to your physical education teacher tomorrow. Otherwise you will have to sit with the UMD data collector to fill out the form during your physical education class.

EXAMPLE:

3:00-3:15 p.m.	3:16-3:30 p.m.	3:31-3:45 p.m.	3:46-4:00 p.m.
Walking home	*Nap*	*Homework----------*	-------------------

TIP: You can do this quickly if you ask your parents (or someone who looked after you yesterday afternoon) to help you.

Print: Name ______________________ School ______________________

Grade:__________ Age:________ Gender (circle one): Boy / Girl Date:_____/_____/_____

Example Activities: **(You should write any activities you did, even they are not in the example)**					
Eating	Reading	Baseball	Dance	Karate	Swimming
Homework	Sleeping	Basketball	Football	Ping pong	Tennis
Napping	TV	Bike	Golf	Running	Volleyball
On bus/car	Badminton	Bowling	Gymnastics	Soccer	Walking

3:00 - 3:15 p.m.	3:16 - 3:30 p.m.	3:31 - 3:45 p.m.	3:46 - 4:00 p.m.

4:00 - 4:15 p.m.	4:16 - 4:30 p.m.	4:31 - 4:45 p.m.	4:46 - 5:00 p.m.

5:00 - 5:15 p.m.	5:16 - 5:30 p.m.	5:31 - 5:45 p.m.	5:46 - 6:00 p.m.

6:00 - 6:15 p.m.	6:16 - 6:30 p.m.	6:31 - 6:45 p.m.	6:46 - 7:00 p.m.

7:00 - 7:15 p.m.	7:16 - 7:30 p.m.	7:31 - 7:45 p.m.	7:46 - 8:00 p.m.

8:00 - 8:15 p.m.	8:16 - 8:30 p.m.	8:31 - 8:45 p.m.	8:46 - 9:00 p.m.

9:00 - 9:15 p.m.	9:16 - 9:30 p.m.	9:31 - 9:45 p.m.	9:46 - 10:00 p.m.

After-School Activity Codes

Old Code	New Code	Activity	Old Code	New Code	Activity	Old Code	New Code	Activity
1	1	Basketball	22	2	Exercise	43	4	Drawing
2	3	Dance	23	3	Skateboarding	44	7	Church
3	2	Bike	24	5	Napping	45	1	Karate
4	1	Football	25	3	Throwing/catching	46	1	Baseball/softball
5	4	Reading	26	2	Walking	47	2	Stretching
6	2	Running	27	1	Volleyball	48	2	Sit-up
7	6	Watching TV	28	3	Shopping	49	2	Fitness
8	5	Eating	29	3	Kickball	50	1	Ping pong
9	5	Sleeping	30	2	Climbing	51	3	Trampoline
10	4	On bus	31	2	Pushup	52	5	Cooking
11	4	Homework	32	4	Music instrument	53	1	Hockey
12	6	Listen to the music	33	3	Soccer	54	7	Horse riding
13	7	Scooter	34	1	Badminton	55	6	Magic smart youth
14	7	Phone	35	1	Tennis	56	6	Baby-sitting
15	6	Games	36	6	Taps	57	1	Lacrosse
16	5	Shower	37	6	Wall ball	58	1	Golf
17	7	Chatting/family time	38	1	Tae Kwon Do	59	4	Drama practice
18	1	Gymnastics	39	1	Swimming	60	7	Hanging out with friends
19	6	Playing cards	40	3	Chore/year work	61	4	Choir
20	2	Jumping rope	41	6	Video game	62	7	After-school activity
21	6	Computer	42	6	Party	63	6	Circus
						64	2	Step

Note: 1 = Sport; 2 = Fitness; 3 = Other Physical Activity; 4 = Sedentary – Academic;

5 = Rest; 6 = Sedentary – Entertainment; 7 = Sedentary – Socializing

APPENDIX C
EXPECTANCY-VALUE QUESTIONNAIRE (adopted from Xiang et al., 2003)

1. How good are you in physical education?
Very good 5 4 3 2 1 Not good

2. If you give 5 to the best student in PE and 1 to the worst, what you give to yourself?
Best 5 4 3 2 1 Worst

3. Some kids are better in one subject than in another. For example, you might be better in math than in reading. Compared to most of your other school subjects, how are you doing in PE?
A lot better 5 4 3 2 1 A lot worse

4. How well do you think you are doing in learning in PE?
Very well 5 4 3 2 1 Very poorly

5. How well are you keeping yourself physically active in PE?
Very well 5 4 3 2 1 Very poorly

6. How important do you think PE is for you?
Not very important 1 2 3 4 5 Very important

7. Compare to math, reading, and science, how important is it for you to learn PE content?
Not very important 1 2 3 4 5 Very important

8. In general, how fun do you think your PE classes are?
Very boring 1 2 3 4 5 Very fun

9. How much do you like your PE classes?
Don’t like it at all 1 2 3 4 5 Like it very much

10. Some things that you learn in school help you do things better outside of school. We call this being useful. For example, learning about plants at school might help you grow a garden at home. How useful do you think the concepts you learned in PE are?
Not useful at all 1 2 3 4 5 Very useful

11. Compared to your other school subjects, how useful are the skills learned in PE?
Not useful at all 1 2 3 4 5 Very useful

12. If there is anything that you don’t like in PE, what would that be? Why? (Open-ended)

13. If you had a choice, would you rather not come to PE? Why? (Open-ended)

APPENDIX D
DATA COLLECTION PROTOCOLS AND TRAINING MATERIALS

Project Learn for Life

Data Collection Protocol

There are several types of data to be collected in this 3-year project. The data will be collected twice a year. Data collection will follow the protocol below to maintain their psychometric properties. Thank you.

IMPORTANT: Obtain a class roster from the teacher on Day 1 and keep updating it.

1. **Student body height and weight.** You should take the measurements yourself. The measurement should be done in such a way that the information is only available to you and the child him/herself. The measurement can be done in
   - School's health room
   - A quiet, relatively private location outside the gymnasium (you may need to borrow the scale from the health room), or
   - A quiet, relatively private location outside the gymnasium with calibrated tape measure and weight scale that you bring to the school

   Preparation

   (a) Prepare about 30 index (3x5) for each class, write/print Name, Grade, Gender, Age, Height, Weight along the lines for students to fill in the information;

   (b) Locate the school's health room and see if it is too far from the gymnasium; if it is, talk to the physical education teacher to see if you can borrow the height/weight scale for the time you are measuring the students; so you can move it close to the gymnasium to save your time;

   (c) You may bring your tape measure and weight scale, but calibrate them for accuracy. If so, you can tape the tape measure on the wall and set the scale beside it.

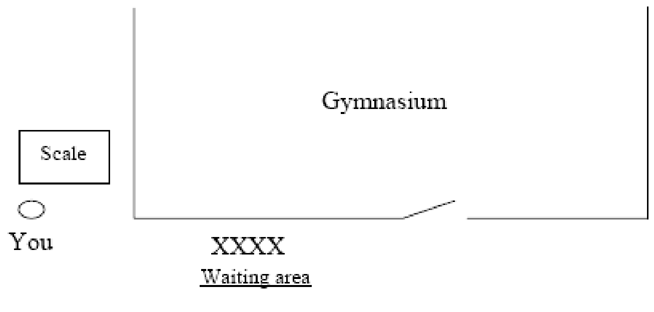
   Data Collection

   (a) Consult with the teacher to take a small group (4-5) from class to measure at a time, make sure you organize the group in an orderly manner,

   (b) Give each student an 3x5 index card and ask them to write down their name, grade, gender, and age (use birthday as the cut),

   (c) Take the measure individually and ask the student write the results down on the card, record in pond and feet / inch, round up in nearest pond and inch.

IMPORTANT: keep other students where it is close by but they can't see the measurement. Ideally, you can locate a corner close to the gymnasium as shown below:



2. <u>**Accelerometer and Active Learning Time**</u>. The two types of data must be collected simultaneously (in the same class period).

<u>Preparation</u>

(a) Consult with the teacher to find 6 students, 3 boys and 3 girls from the class. They should be in different body sizes.

(b) Have their name, gender, age, height, weight information written on a data sheet.

(c) Prior to the lesson from which the data are collected, program the accelerometers on a computer (you may ask the teacher to set the software up in his/her computer – PC only, no Macintosh please) for all 6 students individually (use the numbers on the accelerometers). It will be much quicker if you use your own laptop.

(d) Prepare a copy of the <u>*Duration Recording Form*</u> and re-set the stopwatch.

<u>Data Collection</u>

(a) Before or when the lesson starts, quickly clip the accelerometer on each student's waistband and activate it, send students back to class right away.

(b) At the same time, start the stopwatch; keep an eye on what is going on in class and quickly start recording on <u>*Duration Recording Form*</u>.

(c) When the class is over, ask the students to return the accelerometers to you, start downloading the data into your computer. Each student's data will be saved as an individual Excel sheet. You must give a unique name to the file. The file name should include student's name/code, school, grade, and date.

(d) If there are back-to-back classes, you should program the accelerometers quickly after downloading the data for the next group of 6 students.

(e) When finished, you should make sure that the name of the data file in your computer can be easily identified by school, grade, student, and date; and the files can be easily matched to the time recording sheet. So please write down all necessary information for matching the data later on.

<u>**IMPORTANT**</u>: email the data as attachments to Joe Hearn (jwh@umd.edu) and Dr. Chen (angchen@umd.edu) as soon as you can after each data collection.

3. <u>**Attitude Surveys**</u>. There are 3 sets of survey data to be collected from your students: <u>*Expectancy-Task Value Inventory*</u>, <u>*Situational Interest Scale*</u>, and the <u>*3-Day After-School Physical Activity Recall*</u>.

<u>Preparation</u>

(a) The <u>*Expectancy-Task Value Inventory*</u> and the <u>*Situational Interest Scale*</u> are in the Scantron forms and are packed in manila envelopes by class. <u>*The sruveys are specially made for each student and printed on special paper. They must be handled carefully. Any folding, scratching, or other damages will make the tests unscannable, resulting in loss of data*</u>. You should contact the Project Coordinator, Joe Hearn, to pick them up after you have scheduled a date for collecting the data with your teacher. It is important to follow the directions on the envelope when administering the surveys. Please read the items to know the survey content.

(b) The <u>*3-Day After-School Physical Activity Recall*</u> is a 3-page survey for the same information on 3 days. It asks students to record their physical activities they did after school hours on 3 days. Please contact the Project Coordinator, Joe Hearn, to find out whether they can be picked up in the Pedagogical Studies Laboratory (HHP 2130) or at your school.

Data Collection

(a) The *Expectancy-Task Value Inventory* and the *Situational Interest Scale* must be administered to students in their classes. Depending on their grade, the students may need 15 - 30 minutes to complete the two surveys. Longer time may be needed for elementary school students. So please schedule a class with the teacher for collecting the data.

(b) Consult with your teacher to see if you have time in a class to administer both *Expectancy-Task Value Inventory* and the *Situational Interest Scale* in one class period; or you have to do them separately. In either situation, you must administer the *Expectancy-Task Value Inventory* first.

(c) When administering the *Expectancy-Task Value Inventory* and the *Situational Interest Scale*, you must read each survey item aloud to them, give them enough time (30 seconds – 1 minute) to respond, then make sure all students have made their choices before moving on to the next item. You certainly can ask the teacher to help you in collecting the data.

(d) The *3-Day After-School Physical Activity Recall* is a take-home log. You should give students one page (one-day) each day starting from the first day; then give them another when they have turned in the previous one. Students tend to forget to turn things in, so please work with your teacher closely to make sure you have a 100% return rate. (*Most students want to be in physical education classes badly, so you might want to use this, pulling out of PE, as leverage for them to complete the form on their own.*)

IMPORTANT: Each time you give out a survey, please announce to the students that **there are no right or wrong answers** to any of the questions; they should **answer the questions independently** (do not look at others'); and the answers **will not affect their grades** in physical education or any other classes.

4. **Fitness, Knowledge, and Physical Skills**. Student fitness, lifetime physical skills, and knowledge of exercise data will be collected by the teacher. If asked, you should assist him/her in collecting these data, especially with the knowledge test.

   The knowledge tests are printed in our Pedagogical Studies Laboratory and are packed for each class. You should bring them to your teacher. *The tests are specially made for each student and printed on special paper. The tests must be handled carefully. Any folding, scratching, or other damages will make the tests unscannable, resulting in loss of data*.

   (a) *Knowledge tests data*: gather completed forms from the teacher; sort them alphabetically by students' last name (if the teacher has not sorted them); put them in the original envelope; and turn them to Joe Hearn for further processing.

   (b) *Fitness and physical skills*: it the teacher has these data in a spreadsheet program (e.g., Microsoft Excel), copy them onto your flash memory or floppy, then email them to Joe Hearn and Dr. Chen with a note of school, grade, class, and teacher name. You certainly can bring your flash memory or floppy disk to Joe Hearn for him to download them into his computer.

IMPORTANT: YOU MUST FOLLOW THE DATA COLLECTION SEQUENCE ON THE NEXT PAGE.

Project Learn for Life

Data Collection Sequence

Day 1	**<u>Before you go:</u>** 1. Prepare enough 3x5 index cards or ask the teacher for a copy of class roster to record body height/weight, gender, age information 2. Prepare the 1st *<u>After-School Physical Activity Recall</u>* surveys **<u>At school:</u>** 1. Arrive early to arrange the equipment and organization for body height/weight measurements 2. Introduce yourself to the class, measure body height and weight 3. Give students the 1st *<u>After-School Physical Activity Recall</u>* survey at the end of the class and explain what to do (ask the teacher for about 5 minutes class time) 4. Identify 5 students (2 boys, 3 girls) for accelerometer data collection **<u>Afterwards</u>:** 5. Put the 5 students' information into accelerometer data sheet
Day 2	**<u>Before you go:</u>** 1. Check the batteries in the accelerometers and docking station and program them on your laptop for the 1st class (or arrive at school early to do so on the teacher's computer if she/he can share it with you) 2. Make sure you have students' accelerometer data sheets for other classes that you plan to collect data from on this date 3. Prepare a copy of *<u>Duration Recording Form</u>* for EACH class you are observing on the day 4. Check and reset the stopwatch to 0 (do so after each class) 5. Prepare copies of the 2nd After-School Physical Activity Recall form **<u>At school</u>:** 1. Put the accelerometers on the 5 students immediately when they come to the class, and ACTIVATE the device; and start the stopwatch 2. Start recording lesson events on the *<u>Duration Recording Form</u>* for the lesson 3. When the class is over, quickly collect the accelerometers, download the data, save the Excel files, and program the accelerometers for the next class 4. Label all *<u>Duration Recording Forms</u>* by school, date, time, grade, lessons, teacher name, etc. and write down anything you think worth noting on that day 5. Collect the 1st *<u>After-School Physical Activity Recall</u>* survey at the end of the class and give out the 2nd **<u>Afterwards</u>:** 1. Summarize the data from each *<u>Duration Recording Form</u>* and enter the data into an

	Excel database, save it with school, date, time, grade, lessons, teacher name, etc. 2. Organize all the original data sheets by data, school, and grade in a folder and keep them in a safe place (you are required to turn them in after the data collection is over for the period)
Day 3	**Same as Day 2**, except to prepare copies of the 3rd *After-School Physical Activity Recall* form, give them out at the end of each class, and collect the 2nd *After-School Physical Activity Recall* form
Day 4	If necessary, repeat Day 2 and Day 3 to make sure you have all the data that are supposed to be collected so far. Make sure to collect the 3rd *After-School Physical Activity Recall* form from the students at the end of each class. Otherwise proceed as follows: **Before you go:** 1. Prepare the *Expectancy-Task Value Inventory* and the *Situational Interest Scale*. They should be ready in the envelopes. Check the numbers to see if they match the number of students in the classes. Please notice the *Situational Interest Scale* has an **elementary school version** and a **middle school version**. Please prepare the correct version accordingly 2. Contact the teacher to inform him/her that you need the class time to administer the surveys. If he/she has planned something for the class that you feel you may not have enough time, reschedule. **At school:** 1. Administer the surveys to each class. ALWAYS administer the *Expectancy-Task Value Inventory* first 2. Read aloud each item to students and make sure they respond independently 3. Collect the survey and SORT them by last name in the alphabetical order, then put them in the original envelope **Afterwards**: 1. Turn the completed survey to Joe Hearn for scanning immediately (Please do not keep the forms for a long period of time. The pencil marks on the form tend to fade, that will cause scanning problems)
Day 5-10	Gather fitness, knowledge tests, and physical skills data from the teacher, and help him/her collect them if necessary. Repeat Day 2, 3, or 4 if necessary. Or assist the teacher with data collection on fitness, knowledge, and physical skills. If necessary, ask the teacher permission to pull out the students who have not return their *After-School Physical Activity Recall* forms and ask them to do it during the class time (*most students want to be in physical education classes badly, so you might want to use this, pulling out of PE, as a leverage for them to complete the form on their own*).

IMPORTANT: Please schedule your time carefully so that the sequence can be kept. If you have a good plan, 10 trips to each school is more than enough to collect all the data. Key: Please discuss the sequence with the teacher to have his/her support, when he/she asks for your help in collecting fitness, knowledge, and skills data, please do help out!

APPENDIX E

EMAIL COMMUNICATIONS WITH THE UNIVERSITY IRB MANAGER

YAHOO! MAIL Classic

Re: Fw: IRB #05-0486(PAS# 1443) Friday, February 27, 2009 10:06 AM

From: "Joseph Smith" <jsmith@umresearch.umd.edu>
To: xihe_zhu@yahoo.com
Cc: "Ang Chen" <A_CHEN@uncg.edu>

-----Inline Attachment Follows-----

Xihe,

If all of the data has been de-linked from the identifiers, the protocol can be closed and you can proceed with data analysis.

Let me know if anything changes or if you have any additional questions.

Thanks, Joe
Joseph M. Smith, MA, CIM IRB Manager University of Maryland, College Park Lee Building, Room 2100 College Park, MD 20742-5121 301-405-0678 (Office) 301-314-1475 (Fax)
http://www.umresearch.umd.edu/IRB

>>> Xihe Zhu <xihe_zhu@yahoo.com>
2/27/2009 9:42 AM >>> Thanks Mr. Smith,

All the identifiers (including student and school names) in the database had been removed and replaced with numbers. If the protocol is considered closed in our case, what will be the next step for me to use the data for my dissertation? Thank you,

Xihe

On Fri, 2/27/09, Joseph Smith <jsmith@umresearch.umd.edu> wrote: From: Joseph Smith <jsmith@umresearch.umd.edu>Subject: Re: Fw: IRB #05-0486(PAS# 1443) To: xihe_zhu@yahoo.com
Cc: "Ang Chen A_CHEN" <A_CHEN@uncg.edu>
Date: Friday, February 27, 2009, 8:13 AM
Xihe,

In order to move forward we need to know if there are any identifiers linked to the data that has been collected. If so, a renewal must be submitted. In this case, if the PI is no longer a faculty member, a new PI must be identified on the protocol renewal with an explanation. If the identifiers have been destroyed and all that remains is collected data without identifiers, a renewal submission is not required and the protocol will be considered closed.

Let me know what the status of the data is and we can go from there.

Thanks, Joe

Joseph M. Smith, MA, CIM IRB Manager University of Maryland, College Park Lee Building, Room 2100 College Park, MD 20742-5121 301-405-0678 (Office) 301-314-1475 (Fax)
http://www.umresearch.umd.edu/IRB

>>> Xihe Zhu <xihe_zhu@yahoo.com> 2/26/2009 2:59 PM >>>

Hi Mr. Smith,

My name is Xihe Zhu, a doctoral student with Dr. Ang Chen in the department of kinesiology. I have discussed the IRB issue with the department liaison Dr. Rogers, and he advised me to further communicate with you to see if there still is a possibility to do renewal. The current situation is that we had already finished data collection prior to the current IRB expiration date (1/22/09) and now we just need IRB approval for me to use the data for my dissertation study. Essentially, there is no more data collection for my dissertation study, just a matter of gaining access to analyze the data. The attached includes Dr. Chen's communication with Tykisha. Could you let me know what the best approach for me to go forward is? Thank you very much.

Xihe

Forwarded by Ang Chen A_CHEN/facultystaff/uncg on 02/17/2009 05:25 PM ----

"Tykisha Bell" <tbell@umresearch.umd.edu> 02/16/2009 03:58 PM To
"Ang Chen A_CHEN" a_chen@email.uncg.edu cc "Joseph Smith"
<jsmith@umresearch.umd.edu>
SubjectRe: #05-0486(PAS# 1443)

The study was administratively closed on 1/22/2009 because the IRB did not receive a renewal application. No research activities should be conducted once the study has expired (this include analyzing data). I recommend you or the student (Xihe Zhu) contact Joe Smith the new IRB manager to determine the best approach. He can be reached at 301-405-0678 (telephone) and I have also cc'd him on this email.

Most likely a new initial application will need to be submitted for approval. However, since you are no longer a faculty member there is a possibility a new PI will need to be assigned and you can be listed as a co-PI. Hope this helps!

Best regards,

Tykisha Bell, M.B.A.

IRB Assistant Manager Institutional Review Board Office University of Maryland, College Park
Lee building Room 2100 B

College Park, MD 20742-5121 301-405-7326 (voice) 301-314-1475 (fax)
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>>> Ang Chen A_CHEN <A_CHEN@uncg.edu> 2/16/2009 3:31 PM >>>

Hello Tykisha,

I am Ang Chen, used to be a faculty member in the Department of Kinesiology. I left UMD last fall. The Department of Kinesiology forwarded Dr. Ottinger's letter to me last week, which informs me the expiration of the IRB approval for the project "Learn for Life." I do have a situation:

I am continuing to advise a doctoral student at Maryland. His dissertation, as we planned, will use the data from the project. Of course, the ID information for the participants will be removed before he starts his work. He is completing his proposal and we expect to have his proposal committee meeting in the middle of March. What should we do to allow his dissertation to go forward? Thanks!

Ang Chen, Ph.D.

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APPENDIX F
PARENTAL AND STUDENT CONSENT FORMS

UNIVERSITY OF MARYLAND

Department of Kinesiology
2351 Health & Human Performance Bldg
College Park, Maryland 20742-2611
301.405.2450 TEL 301.405.5578 FAX

Parent/Guardian Permission Information Sheet

Montgomery County Public Schools has received a grant from the U.S. Department of Education to develop a new physical education curriculum to improve children health by providing them more knowledge, skill, and active learning time needed for a healthy, active lifestyle. Your child's school has been randomly selected to provide data for the evaluation of the curriculum. Dr. Ang Chen from the University of Maryland will lead an evaluation team from the university to work closely with your child's physical education teachers to collect evaluation data. One class from each grade in your child's school will be the data providing unit. If chosen, your child will help provide the following information. The information gathering procedures do not pose any known physical and/or mental risks to your child. Physical, and sometimes mental, discomfort (such as fast pulse and breathing, sweating, etc.) may occur. The discomfort is normal physiological responses to physical activity in physical education. The discomfort is expected to be minimal during data collection. If your child experiences more than minimal discomfort, data collectors, physical education teachers, and/or the school nurse will follow the established educational counseling procedures to provide attention, relief, and comfort to your child.

1. Physical activity behavior and motivation. If chosen, your child will complete a 3-Day Physical Activity Record and Physical Activity Interest Survey. He/she will be asked to provide time (minutes) spent on various physical activities in the past 3 days after school (e.g., riding bike, playing volleyball) and rate their interest in particular physical activities (e.g., basketball, swimming, tennis, walking) on a 1-5 scale. The survey will be administered in small groups and in a quiet classroom by a trained data collector with assistance of your child's physical education teacher. The process will take about 20-40 minutes.
2. Body height and weight. Body height and weight are to be used to compute the Body Mass Index (BMI, an indicator of body weight). The measures will be taken in the school health room by trained data collectors with physical education uniform on (shorts and T-shirt) and shoes off. The measurement will be taken privately and will take about 2 minutes for each child.
3. Motivation sources questionnaire. Your child will complete a motivation sources questionnaire that asks about how she/he thinks about her/his physical abilities and about values of physical activity. Sample questions include "What we were learning in PE was appealing to me," "How well are you keeping yourself physically active in PE?" Your child will respond on a 1-5 scale to show their agreement with the statements. The survey will be administered by a trained data collector with assistance of your child's physical education teacher.
4. Physical education variables. Your child's learning in physical education will be gathered from his/her physical education teacher. The information includes fitness test results, skill and knowledge test results, attendance record, and samples of his/her in-class work. Five students will also be asked to wear a motion sensor during 2 to 3 selected physical education lessons to measure physical intensity of the lessons. If chosen, your child will be wearing the device (about the size of a small pager) on his/her waist band during the lesson.

During the process, demographic data (ethnicity, age, and gender) will be collected using a personal data sheet. Providing the information described above will not have any known physical and/or mental risks to the children. Participation is absolutely voluntary. If you wish, you can request withdrawal of your child from the project at any time. Upon that request, all the information collected from your child will be destroyed. The withdrawal will not affect your child's grades in physical education and any other courses. Participation in the project will not provide direct benefits to your child personally. But the findings will help us improve the new curriculum so that future physical education students can benefit from it.

Information related to your child's identity (name, gender, grade, ethnicity, etc.) will be sealed and locked in a box in the Curriculum and Instruction Research Laboratory in the Department of Kinesiology, University of Maryland. Only Dr. Chen and a data analyst can access them. All children will be represented by codes in the database. The original data sheets will be shredded during the fifth year after the final project report is submitted to the funding agency, the U.S. Department of Education.

Results of the study may be published in research journals relevant to health and physical education, and/or curriculum studies. Your child's personal and school identity will not appear in anyway in the publications. The phrase "students from elementary/middle schools in the Washington-Baltimore Metro area" will be used to describe the participating students in all possible publications.

If you have questions and concerns about the project, please feel free to contact Dr. Ang Chen at (301) 405-0344 or angchen@umd.edu. If you think your child's rights have been violated, please contact the manager of Institutional Review Board (IRB) at the University of Maryland, at (301) 405-0678 or irb@deans.umd.edu.

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Parent/Guardian Permission Form

By signing below, I acknowledge that I am over 18 years of age and the parent or guardian of the child named below.

By signing below, I acknowledge that I have read and understand the information in the Parent Consent Information Sheet attached to this form. I also acknowledge that my child's right to withdraw from the curriculum evaluation process at any time is guaranteed and such a withdrawal will not affect my child's grades in physical education and any other courses.

By signing below, I acknowledge that there will be no known physical and/or mental risks to my child. I also acknowledge that although the new curriculum is designed to improve the quality of physical education, my child's improvement in the course is not guaranteed by participating in the project.

Please check one below:

(_______) I grant my permission for my child (Print name) ________________________ to participate if chosen.

(_______) I do not grant permission for my child (Print name____________________________ to participate if chosen

Signature: ______________________________________ Date: __________________

Thank you very much for your support and timely reply. Please have this form brought to your child's physical education class by tomorrow.

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Child Assent Information Sheet

Dear Student:

Your school is participating in a project of the U.S. Department of Education to improve the quality of physical education in Montgomery County Public Schools to help students become more physically active in physical education and at home. For the project, your physical education classes will be evaluated. With permission from parents/guardians you and other students in your class will provide following information. There are no known physical or mental risks in the data providing procedure.

1. Physical activity behavior and motivation. If chosen, you will complete a 3-Day Physical Activity Record and Physical Activity Interest Survey, asking how many minutes you spent on different activities in the past 3 days (e.g., riding a bike, playing volleyball) and rate your interest in some physical activities (e.g., swimming, tennis, walking) on a 1-5 scale. It will take about 20-40 minutes.
2. Body height and weight. Body height and weight will be measured in the school health room by a trained data collector. When measuring, you should be in your physical education uniform (or shorts and T-shirt) with your shoes off. It will take about 2 minutes without other people watching.
3. Motivation sources questionnaire. You will complete a questionnaire asking about how you think about your physical ability and about values of physical activity, such as "What I was learning in PE was appealing to me," "How well are you keeping yourself physically active in PE?" You will respond on a 1-5 scale to show if you agree with each statement. It will take about 10 minutes.
4. Physical education variables. Information about your learning in physical education will be gathered from your physical education teacher. The information includes fitness test results, skill and knowledge test results, attendance record, and samples of your in-class work. Five students in your class will be asked to wear a motion sensor (size of a small pager) to provide physical intensity information of a lesson. If chosen, you will wear the device on your waist band during some classes.

We will also ask you to fill out a personal data sheet about your age, gender, and cultural background. Providing all the above information does not have any known physical and/or mental risks to you. Participation is absolutely voluntary. If you wish, you can stop participation at any time. If you stop participation, all the information from you will be destroyed. Your participation and/or withdrawal will not increase or decrease your grades in physical education and in any other courses. Participation will not benefit you personally. But the information you give us will help improve the physical education curriculum so that future students can benefit from it.

Information about your identity (name, gender, grade, ethnicity, etc.) will be sealed and locked in a box in the Curriculum and Instruction Research Laboratory in the Department of Kinesiology, University of Maryland. Only should Dr. Chen (the evaluation director) and a data analyst can see them. In the database, you will be represented by a code. The data sheets you fill out originally will be shredded during the fifth year after the final project report is submitted to the U.S. Department of Education.

We might write some research papers about the curriculum and publish them in research journals. Your personal and school identity will never appear in anyway in the papers. We will use the phrase "students from middle schools in the Washington-Baltimore Metro area" to describe you and other student participants in these papers.

If you have questions and concerns about the project, please feel free to ask your parent / guardian or your teacher to contact Dr. Ang Chen at (301) 405-0344 or angchen@umd.edu or Ms. Roslyn Edson, Manager of Institutional Review Board (IRB) at the University of Maryland, at (301) 405-0678 or redson@umresearch.umd.edu.

I fully understand the above information. I am willing _____ or I am not willing ____ to participate.

My Name (print) ____ **Date** ____________

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