# Adolescent Expectancy-Value Motivation, Achievement in Physical Education, and Physical Activity Participation

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## Abstract:

This study examined the relation between adolescent expectancy-value motivation, achievements, and after-school physical activity participation. Adolescents ($N = 854$) from 12 middle schools completed an expectancy-value motivation questionnaire, pre and posttests in psychomotor skill and health-related fitness knowledge tests, and a three-day after-school Physical Activity Recall. Data were analyzed using structural equation modeling to test an a priori model. Results revealed that expectancy belief significantly predicted adolescent psychomotor achievement, and that psychomotor achievement was the only direct significant predictor for physical activity participation ($p < .05$). Expectancy belief and task values were not significantly directly associated with adolescent physical activity participation ($p > .05$). The findings suggested the relation between adolescent expectancy-value motivation and physical activity participation is likely to be mediated by their psychomotor skill achievement.

**Keywords:** expectancy belief | task value | after school physical activity | learning achievement

## Article:

Physical activity participation is recognized as an important factor to combat the crisis of childhood obesity (Krishnamoorthy, Hart, & Jajalian, 2006). Unfortunately, as children moved from elementary to middle school, their moderate-to-vigorous physical activity (MVPA) participation dropped dramatically for both girls and boys (Nader, Bradley, Houts, McRitchie, & O'Brien, 2008). Specifically during middle-school years, adolescent MVPA participation was found to fall below the recommended minimum of 60 minutes per day (Nader et al., 2008). Research (Dunn et al., 1999) has reported that a physically active lifestyle was just as good as a structured intervention to maintain physical activity and cardiorespiratory fitness. For adolescents, most of their time is structured and restricted during school hours. Hence, bridging adolescent learning achievement in school and after-school behavior becomes critical for nurturing a lifestyle with regular physical activity participation.

Physical education is considered one of the most important and meaningful venues to provide sources of knowledge, skills, and motivation for students to participate in regular physical activities (National Association for Sport and Physical Education [NASPE], 2004). The recent

obesity crisis and physical inactivity of adolescents calls for physical education to emphasize the importance of regular physical activity participation (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). Specifically for school-aged adolescents, after-school physical activity participation becomes very critical as the instructional time for physical education has been continually compressed (NASPE & American Heart Association [AHA], 2006). It is known that students' motor competence is correlated with activity participation (Woods, Bolton, Graber, & Crull, 2007). Scholars have argued that once students are able to apply what they have learned in school, they are likely to participate in physical activities beyond classes (Corbin, 2002). Yet the relation between adolescent achievement in physical education and their after-school physical activity participation remains unclear (Keating et al., 2009). This study examined the relations between adolescent motivation, achievement in physical education, and after-school physical activity participation. Specifically, we examined whether achievement in physical education could be a mediator bridging adolescent expectancy-value motivation and after-school physical activity participation.

**Expectancy-Value Theory**

The expectancy-value theoretical model (Eccles & Wigfield, 2002) incorporates learners' expectancy belief, values, achievement, and experiences, providing a viable framework to explain the relations among adolescents' motivation, achievement, and after-school physical activity participation. It was theorized in the model that students' expectancy-value motivation directly predicts their achievement and behavior choices, and that student achievement over time predicts their behavior choices (Eccles, 1983; Eccles & Wigfield, 2002; Wigfield & Eccles, 2000). Using this theoretical framework as a priori model (Figure 1), this study sought to test the model which specifies adolescent expectancy-value motivation predicting achievement and after-school physical activity participation, and in turn achievement predicting after-school physical activity participation. In other words, within the model, achievement partly mediates expectancy-value motivation and after-school participation. To test the mediation, traditional regression analyses will need three steps: in this case, first to determine whether expectancy-value motivation predicts after-school physical activity, then determine whether expectancy-value motivation predicts achievement, and lastly whether achievement predicts after-school physical activity participation (Baron & Kenny, 1986). Since expectancy-value motivation includes latent variables such as expectancy belief and task values, structural equation modeling approach is more appropriate and effective as it is superior to regression analysis (Iacobucci, Saldanha, & Deng, 2007), and it can simultaneously estimate the hypothesize mediation model while controlling for the other parameters once the measurement model is established (Bentler, 2006).

Motivation is concerned with one's "energization and direction of behavior (Pintrich, 2003; p. 669)." Expectancy-value theory postulates that one's motivation is primarily determined by their expectancy belief and task values of the activities/tasks (Eccles, 1983; Eccles & Wigfield, 2002; Wigfield & Eccles, 2000). Expectancy belief is defined as one's thoughts about their possibility of success in upcoming tasks. It was theorized that within a specific domain, students who have higher expectancy beliefs are likely to perform better and more persistently on challenging tasks than those with lower expectancy beliefs. Task values 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 consist of attainment value, intrinsic value, and utility value (Eccles, 1983).

Attainment value refers to how an individual perceives of 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 the experience of participating in an activity.

**Expectancy-Value Motivation, Achievement, and Activity Participation**

Expectancy belief and task values have been identified as predictors for both successful performances in physical education (Gao, Lodewyk, & Zhang, 2009; Xiang, McBride, & Bruene, 2004; Xiang, McBride, Guan, & Solmon, 2003) and physical activity participation intention (Xiang et al., 2003). 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 and colleagues (2006) reported that expectancy belief 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 skill performances were examined, Zhu, Chen, and Sun (2008) reported that student expectancy belief explained 7% of variance in basketball dribbling and 3% in badminton striking, respectively. These findings seem to suggest that the expectancy-value motivation can predict student performances, albeit predictability of expectancy-value motivation in student may differ for students at different developmental stages and/or across different contexts. When student achievement from a learning process is conceptualized as performance change (Alexander, 2006; Magill, 2004), expectancy-value motivation has been found to predict psychomotor achievement, but not knowledge gain in adolescents ranging from 11 to 14 years old (Zhu & Chen, 2010). Although Zhu and Chen (2010) reported relative high expectancy-value motivation and sizable psychomotor skill and fitness knowledge achievement, a more important question remains: "Can student motivation and achievement in physical education be translated into after-school physical activity participation?"

Besides psychomotor skill and fitness, cognitive knowledge about sport and fitness is also an important aspect of assessing whether a student becomes a physically educated person (NASPE, 2004). Particularly, health-related fitness knowledge is believed to be critical for students' future wellbeing (Corbin, 2002; Ennis, 2010). Based on the earlier version of NASPE standards, Zhu, Safrit, and Cohen (1999) developed the *FitSmart* system to test students' health-related fitness knowledge. However, after reviewing decades of research on fitness knowledge, Keating and colleagues (2009) contended that there is a need for more systematic research on students' health-related knowledge. A recent study (Thompson & Hannon, 2012) showed that student health-related knowledge is correlated with their physical activity participation. This finding suggests that future research should further look at the role of health-related knowledge especially in a context where health-related fitness knowledge is taught.

Expectancy belief and task values have been found to be closely related to students' after-school behaviors across different disciplines. 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. In physical education, expectancy-value motivation was found to correlate with

adolescent after-school sport participation (Goudas, Dermitzaki, & Bagiatis, 2001). Student motivation in physical education has also been found to predict their physical activity participation (Xiang et al., 2006) and exercise intention (Li, Shen, Rukavina, & Sun, 2011). In a Sport Education context, adolescents' motivation predicts their extracurricular sport participation and recess physical activity (Wallhead, Hagger, & Smith, 2010). Overall, these findings suggest that expectancy-value motivation in physical education predicts physical activity participation as well as participation intention. It is clear that expectancy-value motivation can predict student performances in physical education. The extent to which how students' expectancy-value motivation and achievement in physical education relates to their after-school physical activity participation is yet to be identified.
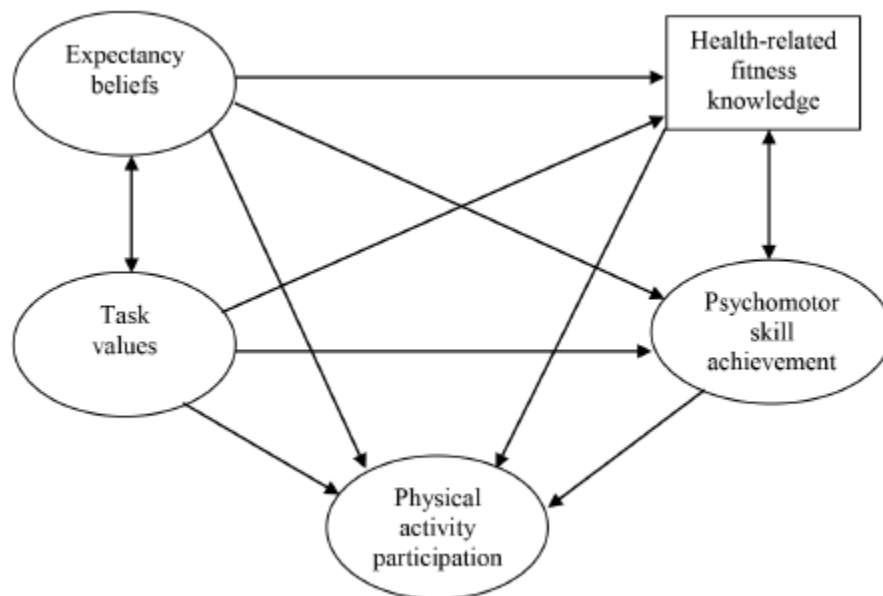


**Figure 1.** The hypothesized structural model (a priori model) of expectancy-value motivation, achievement, and physical activity.

**The Present Study**

The purpose of this study, therefore, was to examine relations between adolescent expectancy-value motivation, achievement in physical education (including psychomotor achievement and health-related fitness knowledge), and after-school physical activity participation. Based upon the theoretical model of expectancy-value motivation (Eccles, 1983; Eccles & Wigfield, 2002; Wigfield & Eccles, 2000), it was hypothesized that adolescent expectancy-value motivation would directly predict adolescent after-school physical activity participation. It was also hypothesized that adolescent achievements would mediate the relation between expectancy-value motivation and after-school physical activity participation (Figure 1). In testing these hypotheses through structural equation modeling, this study attempted to test (a) whether adolescent expectancy-value motivation predicts their achievements in physical education, (b) whether adolescent achievements in physical education predict their after-school physical activity participation, and (c) whether adolescent expectancy-value motivation directly predicts their after-school physical activity participation. The findings could better the understanding of the

relations among these three variables in efforts to find meaningful approaches to promote adolescent achievement and physical activity participation.

**Methods**

*Study Context*

The study was a part of a larger study, and used the data collected from a large school intervention project in the mid-Atlantic region. The intervention project aimed to enhance student achievements, motivation, and healthy lifestyle through physical education in sixth through eighth grades. To facilitate student learning and physical activity participation in physical education, the intervention curriculum centered on helping middle school students develop (a) knowledge and skills in health-related fitness, (b) physical skillfulness and concepts, and (c) personal and social responsibility, particularly after-school physical activity behaviors. The health-related fitness content (a) entailed 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 psychomotor skillfulness and concepts (b) addressed the need for students to master basic psychomotor skills and tactical knowledge, and to be able to apply them into different movement contexts for multiple movement purposes. The personal and social responsibility focus (c) emphasized that students needed to assume their responsibility to live for a healthful and physically activity lifestyle, improve personal expectancy outcome, and value physical activity in social and community contexts. The variables in the current study, expectancy-value motivation, achievements in health-related fitness knowledge and psychomotor skills, and after-school physical activity participation corresponded to these three foci of the intervention curriculum.

Through the intervention, the participating schools implemented the physical education curriculum, which aligned its goals closely with the NASPE (2004) standards and placed its emphasis on psychomotor skills, health-related fitness, fitness concepts, exercise principles, and positive dispositions toward healthful, active lifestyles. The psychomotor skills and strategies were primarily taught using *Tactical Games* approaches. Fitness concepts and exercise principles also were integrated in the skill-related content. The intervention curriculum also emphasized evidence-based teaching and learning. Each lesson started with an "essential problem" and ended with assessing students' success in solving the essential problem. Students' overall achievement was assessed based on two competence-based areas, knowledge (health-related fitness, physiological and biomechanical principles of movement) and psychomotor development. The psychomotor skills were assessed not only because they were taught in the sports of badminton and basketball but also because they can be widely applicable in various physical activity and sport contexts. On average, students received 225-min 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.

*Participants*

The participants ($N = 854$; Table 1) were from a stratified sample of 12 middle schools in a large U.S. metropolitan area, representing a population with diverse socioeconomic and ethnic backgrounds (National Center for Education Statistics, 2003). The participants consisted of

13.82% Asian, 19.20% African American, 17.45% Hispanics, 39.93% Caucasian, and 9.60% from other ethnic backgrounds; and 50.35% males and 49.65% females. The participants were 12.30 (*SD* = .97) years old. The research protocols were reviewed and approved by the University's Institutional Review Board. Parental/guardian consents and subject assents were obtained before data collection.

**Table 1.** Sample Descriptors and Descriptive Statistics of Variables

| | n | % | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Gender | | | | | | | | |
| Female | 430 | 50.35 | | | | | | |
| Male | 424 | 49.65 | | | | | | |
| Ethnicity | | | | | | | | |
| Asian | 118 | 13.82 | | | | | | |
| Black | 164 | 19.20 | | | | | | |
| Hispanic | 149 | 17.45 | | | | | | |
| White | 341 | 39.93 | | | | | | |
| Other | 82 | 9.60 | | | | | | |
| Grade | | | | | | | | |
| 6th | 287 | 33.61 | | | | | | |
| 7th | 286 | 33.49 | | | | | | |
| 8th | 281 | 32.90 | | | | | | |
| **Variable** | **Mean** | **SD** | | | **Bivariate Correlations (r)** | | | |
| | | | 2 | 3 | 4 | 5 | 6 | 7 |
| Motivation | | | | | | | | |
| 1. Expectancy beliefs[a] | 4.08 | .65 | .52* | .27* | .11* | -.01 | .12* | .11* |
| 2. Task values[a] | 3.74 | .85 | — | .16* | .07 | -.04 | .04 | .05 |
| Achievement | | | | | | | | |
| 3. Basketball dribbling[b] | 0 | 7.58 | | — | .26* | -.01 | .13* | .05 |
| 4. Badminton striking[b] | 0 | 9.12 | | | — | -.04 | .06 | .03 |
| 5. Health-related knowledge | 0 | 15.95 | | | | — | -.02 | .01 |
| Physical activity | | | | | | | | |
| 6. Activity time | 5.47 | 3.36 | | | | | — | .61* |
| 7. Activity range/type | 1.79 | 1.13 | | | | | | — |

[a]Arithmetic mean of items.
[b]Regression residual gain score.
SD = Standard Deviation.
* p < .01

*Measures*

***Expectancy Belief and Task Values.*** The Expectancy-Value Questionnaire (EVQ; Eccles & Wigfield, 1995) was employed to measure adolescent expectancy belief and task values. The EVQ is a 5-point likert scale consisting of 11 items. Five items of the scale were designed to measure expectancy belief and six items to measure task values including attainment value, intrinsic value, and utility value. In each of the items, 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 belief 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 perception. The EVQ was reported to be used among elementary students with Cronbach $\alpha$ ranging from .63 to .87 (Xiang et al., 2004). By using a confirmatory factor analysis, researchers reported the questionnaire's construct validity using data from 903 middle-

school students and its structural reliability with a high Rho ( $\rho$ ) = .906 (Zhu et al., 2012). The internal reliability (Cronbach $\alpha$ ) for the current sample was .85, .76, .89, and .83 for expectancy belief, attainment value, intrinsic value, and utility value, respectively.

***Health-Related Fitness Knowledge.*** Paper-and-pencil tests were used to measure adolescent health-related fitness knowledge. In the tests, a set of questions was singled out from the standardized health-related fitness knowledge test bank, which was similar with the one developed by Zhu et al. (1999). However, we did not use the *FitSmart* software (Zhu et al., 1999) to generate test scores; we used the raw scores instead. The questions were chosen by a team of expert teachers from the school 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 for each grade level 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 remained in the item pool. The test items were then programmed into two equivalent sets of tests for each 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.*** Two psychomotor skills, badminton striking and basketball dribbling were chosen to be psychomotor achievement indicators because of their applicability to various sports and lifetime physical skills and their representation of skills being taught in the curriculum (Gallahue & Cleland, 2003; NASPE, 2004). In particular, students' basketball dribbling skill was assessed using the basketball control-dribble test developed by the American Alliance of Health, Physical Education, and Dance [AAHPERD] (AAHPERD, 1984). The validity coefficients for the test had been reported to range from .67 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 Lockhart and McPherson (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, and was considered appropriate for both males and females as young as middle-school age (Strand & Wilson, 1993).

***After-School Physical Activity Participation.*** The 3-Day Physical Activity Recall (3DPAR; Weston, Petosa, & Pate, 1997) was used to provide the range/type and time of physical activities that the adolescents participated in Sunday through Tuesday. The 3DPAR provided a grid divided into 15-minute blocks in which adolescents were asked to record all activities performed during the after-school hours (e.g., from 3:00–10:00 p.m.). For each 15-minute block, adolescents entered the main activity in which they participated during that period. The 3DPAR was previously validated and reported with acceptable reliability (McMurray et al., 2004; Weston et al., 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 was 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).

*Procedure*

The data collection process involved the researchers, physical educators, and trained data collectors (i.e., graduate and undergraduate physical education majors). All data collectors completed three-day training sessions and demonstrated that they were able to strictly follow the data collection protocols before administering any test. Psychomotor skills and health-related fitness knowledge tests were administered twice as a pretest and posttest, once at the beginning of the fall semester, and the other at the end of the spring semester. The EVQ and the 3DPAR were collected during the early spring semester. As required by the district curriculum, physical educators in the schools administered the psychomotor skill and knowledge tests in their gymnasia. The researchers and trained data collectors administered the EVQ in the gymnasia and assisted the teachers on the psychomotor skill tests. Adolescents were arranged to sit apart while completing the knowledge tests and questionnaires independently.

*Data Analysis*

Before statistical analysis, adolescent health-related fitness knowledge test scores from the pretest and posttest were aggregated, and then converted into a 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 to form two indicators for adolescent psychomotor skill performance that carried the same unit. In addition, the residual gain score for knowledge and psychomotor learning was computed as adolescent achievement for the final analysis. In a prepost test context, the residual gain score was conceptualized as the residual error using the pretest as the predictor and posttest 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). Finally, the time that adolescents spent on physical activities and the range/type of physical activities that they participated in was extracted from 3DPAR as indicators for their after-school physical activity participation.

As displayed in Figure 1, the hypothesized model included a mediating role of adolescent psychomotor skill achievement and fitness knowledge gain between expectancy-value motivation and after-school physical activity participation. To test the mediation, we chose to use structural equation modeling (*SEM*) over the traditional three-step regression model approach (Baron & Kenny, 1986), because studies had suggested that *SEM* performed better than traditional regression models, especially when latent variables were involved (Brown, 1997; Iacobucci et al., 2007). In *SEM*, the direct and indirect paths are fit simultaneously to estimate each effect while statistically controlling for the others. Hence, the total effect of exogenous variables, such as expectancy-value motivation and psychomotor skill achievement, can be decomposed; and the ratio of indirect-to-total or proportion of mediation can be calculated to indicate the level of partial mediation (Brown, 1997).

Since our dataset had a multilevel structure (i.e., students nested in schools), there was a potential of nonindependence, which could result in biased model estimation (Kenny & Judd, 1986). Because the unit of measurement and generalization of the study focused on the student level, not school level or cross-level interaction, we examined the extent of nonindependence through the intraclass correlation coefficients (ICC). Muthén (1997) suggests that when the variable ICC values are larger than .10 combined with group sizes exceeding 15, the multilevel structure of the data should be modeled. Our group (school) size was 12. The ICCs ranged from .01 for after-school physical activity time to .10 intrinsic value (ICCs for other variables were below .10). Subsequently, we analyzed the data only on student level as the school level variances appeared to be small. In testing the hypothesized structural model (Figure 1), a confirmatory factor analysis (CFA) was conducted to further examine the construct validity and internal reliability of the EVQ in the current research context. Second, a series of model testing using *SEM* (Bentler, 2006) were performed to test the tenability of the hypothesized structural model. During the model testing process, multivariate normality was checked using Mardia's coefficient. In testing the hypothesized model as a priori, Lagrange Multiplier and Wald tests were also performed to elucidate possible model respecification suggestions. Throughout the *SEM* analysis, multiple cut-off criteria for Goodness-Of-Fit indices were applied (Hu & Bentler, 1999). 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). The data analyses were conducted using *EQS 6.1* (Multivariate Software, Inc.; Encino, CA).

**Results**

As demonstrated in Table 1, adolescents' expectancy belief on average was greater than 4 on a five-point scale, $M = 4.08$, $SD = .65$; and task values averaged 3.74 ($SD = .85$), indicating that adolescents rated relatively high on their expectancy belief and task values for physical education. On average, adolescents reported that they participated in 1.79 different kinds of physical activities and spent 82.05 min (5.47 * 15 minutes, $SD = 3.36$) each day during after-school hours. Further analysis indicated that the Mardia's multivariate coefficient was 50.93, suggesting that data multivariate normality was not assumed. Hence in subsequent analyses, the robust estimation approach and associated indices were reported (e.g., S-B $\chi^2$) considering that the sample size for this study was sufficiently large (Satorra & Bentler, 1994).

*Confirmatory Factor Analysis for EVQ*

Before testing the hypothesized structural model, a CFA was conducted to test the tenability of the measurement model of EVQ. In the CFA model, two latent factors of expectancy belief (five items) and task values (six items) were assumed to correlate with each other (Eccles & Wigfield, 2002). As displayed in Table 2, the Goodness-Of-Fit indices suggested that CFA[a] model fit well. Yet the Lagrange Multiplier test suggested that adding a covariance between measurement errors

of the first two items of expectancy belief could significantly improve the Goodness- Of-Fit indices. It was suggested that an error covariance between the two items should be allowed considering the fact that these two items ask similar questions (Zhu et al., 2012). Therefore the error covariance was specified in CFA[b] model. The results of the CFA[b] showed significantly better goodness-of-fit indices ($\Delta \chi^2 = 48.137$, $df = 1$, $p < .01$; Table 2), indicating that the measurement model was better preserved in the context. Hence, the CFA[b] model was preserved for structural model testing. The composite reliability coefficient Rho ($\rho$) was found to be .916, suggesting a relatively high reliability of EVQ in the context.

**Table 2.** Goodness-Of-Fit Indices for CFA and Structural Models

| Model* | S-B $\chi^2$ | df | NNFI | CFI | RMSEA | CI90 | SRMR | $\Delta\chi^2$ | $\Delta df$ |
|---|---|---|---|---|---|---|---|---|---|
| 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 | .971 | .031 | .024, .039 | .030 | — | — |
| Model[d] | 146.859 | 80 | .978 | .983 | .031 | .023, .039 | .030 | — | — |
| Model[e] | 132.461 | 50 | .954 | .971 | .044 | .035, .053 | .040 | — | — |
| c vs. d | — | — | — | — | — | — | — | 19.658 | 11 |
| d vs. e | — | — | — | — | — | — | — | 14.398 | 30 |

[a]The original CFA model of EVQ.
[b]The CFA model of EVQ with the added error covariance.
[c]The hypothesized (a priori) model (Figure 1).
[d]The final structural model (Figure 2).
[e]The alternative model with nonlatent attainment, interest, and utility values.
* p <.01
CFA = Confirmatory Factor Analysis.
CFI = Comparative Fit Index.
NNFI = Bentler-Bonett Non-Normed Fit Index (equivalent to Tucker-Lewis Index).
RMSEA = Root Mean Squared Error of Approximation.
SRMR = Standardized Root Mean-square Residual.

*Testing the Hypothesized Structural Model*

Based on the satisfactory results from the CFA measurement model, subsequently the hypothesized structural model was tested. According to Hu and Bentler's (1999) cutoff criteria, the *SEM* analysis produced sound goodness-of-fit indices (Model[c] in Table 2). The hypothesized structural model, explained 0.3% of variability in adolescent residual knowledge gain, 14.8% of psychomotor achievement, and 3.3% of after-school physical activity participation. In Model[c], adolescent psychomotor skill achievement was found to be the only statistically significant factor predicting the variance of after-school physical activity participation ($p < .05$), and expectancy belief was 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 was found to be statistically significant ($p > .05$).

Adolescents who gained fitness knowledge through physical education might not equally gain psychomotor skills. The results of Wald test for Model[c] suggesting removal of the three free

parameters associated with health-related fitness knowledge gain appeared to support this possibility. Evidence from a previous study (Zhu et al., 2009) suggested that student motivation did not significantly predict their fitness knowledge gain; therefore, three parameters associated with knowledge gain in the hypothesized model were freed. By removing these parameters, the Goodness-Of-Fit indices of Model[d] improved in comparison with Model[c] (Table 2), although the critical chi-square value is 19.68 for 11 degree of freedom was slightly larger than the 19.658 threshold ($\Delta \chi^2$ of c vs. d; $p > .05$). The model[d] explained 14.6% of variance in students' psychomotor learning, and 3.3% of variance in after-school physical activity participation, respectively.

Alternatively, we tested a model[e] which estimated the function of three task values separately. We did not use the original latent measurement model for task values to separate the three task values, as the model would be statistically under-identified. As such, we tested the model[e] without using the latent structure of task values. The results rendered a good model fit (Table 2), explaining 4.2% of variance in after-school physical activity, 5.6% in psychomotor skill achievement, and 0.1% in knowledge gain, which is very similar with the model[d]. In fact, there was no significant improvement when comparing model[d] with model[e] ($\Delta \chi^2 = 14.398$, $\Delta df = 30, p > .05$). However, because the model[e] was much more complex (with substantially more parameters to be estimated) yet showed no significantly higher statistical power, we decided to retain the model[d] as the final structural model for the purpose of maintaining statistical parsimony as well as the latent measurement model of EVQ. In the final model (Figure 2), adolescents' expectancy belief was a statistically significant predictor for their psychomotor achievements and physical activity participation, and psychomotor achievements predicted after-school physical activity participation. As shown and decomposed in Table 3, adolescent expectancy belief had a statistically significant total effect on their physical activity participation, while psychomotor skill achievement partially mediated the effect with the ratio of indirect-to-total = .35 (i.e., proportion of mediation; Brown, 1997).

**Table 3.** The Estimates of Standardized Effect on Physical Activity Participation

| Path | Direct | SE | Indirect | SE | Total | SE |
|---|---|---|---|---|---|---|
| Psychomotor achievement → PAP | .139* | .036 | — | — | .139* | .036 |
| Expectancy beliefs → PAP | .100 | .027 | .053 | .013 | .153* | .032 |
| Task values → PAP | -.050 | .009 | .001 | .000 | -.049 | .019 |

Note * p <.05
SE = Standard Error.
PAP = Physical Activity Participation

**Discussion**

The purpose of this study was to examine the relation between student achievement in physical education, expectancy-value motivation, and after-school physical activity participation. We hypothesized that (a) expectancy-value motivation predicted student achievement in physical education; (b) achievement in physical education predicted after-school physical activity participation; and (c) expectancy-value motivation also predicted physical activity participation. The results partially supported the hypotheses (a) and (b) indicating the mediating role of

psychomotor achievement, but did not support hypothesis (c). The specific relevant findings were discussed below.
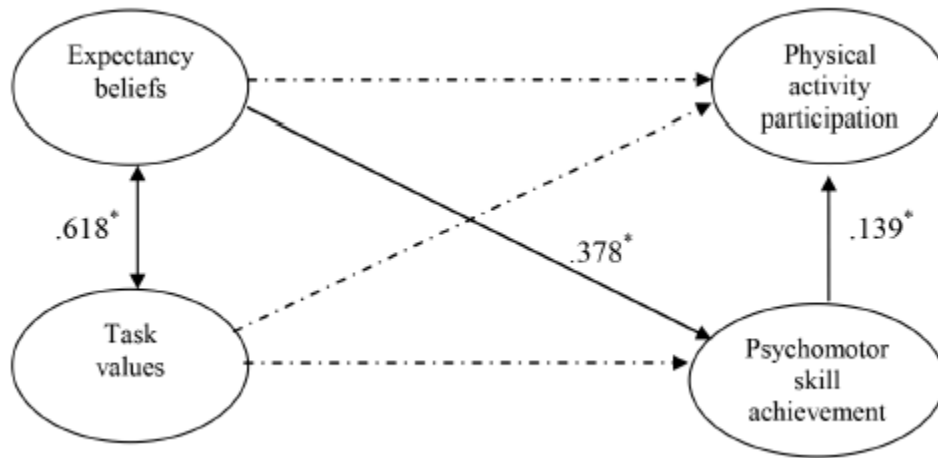


**Figure 2.** The final structural model with standardized path coefficients. *Note * p < .05*

*Psychomotor Achievement as a Mediator*

The results of this study suggested that adolescents' psychomotor skill achievement in physical education partially mediated the relation between expectancy-value motivation and after-school physical activity participation (Figure 2). This finding bridged adolescents' achievement in physical education and their after-school behaviors, and it implied that adolescents' expectancy-value motivation might not directly influence their after-school physical activity participation. Instead, expectancy belief directly influenced their psychomotor skill achievement in physical education. Psychomotor achievement in turn influenced their after-school physical activity participation. After-school physical activity participation requires psychomotor skills and sport-related skills, which are presumed to be taught in physical education for all students (NASPE, 2004). It is not surprising in this study that the psychomotor skill achievement mediated adolescents' motivation and physical activity participation because the learned psychomotor skills (e.g., striking and dribbling) assessed in this study are applicable to many physical activity and sport contexts. The partial mediating role of psychomotor skill achievement suggests that adolescents not only need motivation, but also psychomotor skills for physical activity participation. Overall, the results suggest that adolescents' psychomotor achievement was likely to positively relate to their participation in after-school physical activity ($\beta = .139, p < .05$; Table 3). Thus it was suggested that physical education as a school discipline should not focus merely on physical activity for physical activity accumulation in the time of health crisis and physical inactivity, but should also focus on psychomotor learning which has traditionally been an important goal of physical education. Physical education curriculum should be designed to help students learn psychomotor skills through physical activity, as psychomotor skills are not only an important aspect of achievement in physical education, but necessary for continuous physical activity participation (Ennis, 2011).

*Role of Expectancy-Value Motivation*

Physical education is deemed to be an important avenue to provide students knowledge, skill, and motivation for regular physical activity participation (NASPE, 2004). Based on the results reported in Table 1, adolescent expectancy belief and task values in general were rated relatively high; yet they were not directly significantly related to their physical activity participation ($\beta$ = .100, .050, $p$(s) > .05; Table 3). Hence, it might not matter as much whether adolescents are motivated for physical education as to what/how much adolescents learned in physical education that can be translated into their actual after-school physical activity participation. This result, however, does not mean that adolescent motivation in physical education should be ignored as students who participated in voluntary physical activities tend to either seek fun or follow their interest (Castelli & Valley, 2007). On the contrary, the insignificant direct paths between adolescent motivation, knowledge achievement, and after-school physical activity participation should further lead us to seek what motivates adolescents in physical education and after-school physical activity participation. After all, physical education should not be merely for keeping adolescents "busy, happy, and good" (Placek, 1983), it should help them learn the necessary knowledge and skills so that they can develop a physically active lifestyle when they are on their own (Ennis, 2010).

In a similar study, task values were reported to significantly relate to children's future running participation intention (Xiang et al., 2003). Task values in this study, however, were not significantly predictive for adolescent physical activity participation or achievement in physical education. This finding suggests that adolescent task values of physical education might not be directly or indirectly translated into voluntary physical activity participation through psychomotor and health-related fitness knowledge learning, at least in the current research context. In other words, what adolescents learned in physical education, either psychomotor skill or health-related fitness knowledge, might not be valued in their after-school contexts, and thus could not be translated into voluntary physical activities. This finding appears also not consonant with findings in other domains. 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 these findings from different studies can be explained in multiple ways. From a motivation perspective, one plausible explanation is revolved around what students are motivated for in different domains. In reading, students might value reading and/or reading achievement itself; however, in physical education they might not value participating in physical activity or skill performance, but for something else associated with it, "fun" for example (O'Reilly, Tompkins, & Gallant, 2001).

*Role of Health-Related Knowledge*

Although conceptual knowledge is recognized as an important aspect of student achievement in physical education by NASPE (2004), the data from this study suggest that health-related fitness knowledge does not significantly relate with expectancy-value motivation or after-school physical activity participation. Different from the expert conceptualization (Corbin, 2002) and recent study findings (Thompson & Hannon, 2012), the health-related fitness knowledge learned in our context did not directly translate into after-school physical activity participation. One explanation could be that the students' after-school activities were still mostly prearranged by

their parents in the study context, hence they were not "on their own" (Ennis, 2010), directly making lifestyle decisions using the learned health-related knowledge. The fact that expectancy-value motivation did not significantly predict health-related knowledge achievement in physical education was not a surprise, as others have reported that student motivation in physical education explained very little about knowledge gain (Zhu & Chen, 2010). Possibly, as suggested by Zhu (2013) that students might primarily expect to be physically active, but rarely expect to learn conceptual knowledge in physical education.

*Limitations and Conclusions*

The results of this study suggested that adolescents' psychomotor learning bridged their motivation in physical education and after-school physical activity participation. Although statistically significant paths were identified through structural equation modeling analysis, the model only explained a very small portion of the variance in physical activity participation. Factors from other sources could account for its variance as well such that physical activity variations due to season, weather, locality and other external factors can play an important role. Second, the mediating function of adolescent psychomotor achievement reported in this study, which was correlational in nature, should be interpreted with precautions. Third, due to the context limitation, the after-school physical activity measure was collected before the posttest to capture the habitual after-school behavior. Ideally, factors influencing student after-school behaviors should be controlled, and thus the after-school physical activity could be collected after the posttest. Finally, this study used self-reported 3DPAR data for physical activity participation from adolescents. Although 3DPAR has been reported to be valid and reliable, it might not be as accurate as accelerometers and other multisensor systems (Corder, Ekelund, Steele, Wareham, & Brage, 2008; Trost, 2001).

In summary, the results from the study suggested a mediating function of adolescent psychomotor achievement between expectancy-value motivation and after-school physical activity participation. That is, adolescents' psychomotor achievements were statistically significant predictors for their after-school physical activity participation; and adolescents' expectancy belief predicted their psychomotor achievements. Adolescent' task values and health-related fitness knowledge achievement were found to associate with neither psychomotor achievements, nor their after-school physical activity participation. These findings demonstrated the possibility of the content specificity of student achievement in physical education and the complex function of expectancy-value motivation in explaining its relation to physical education achievements and after-school physical activity participation. Future studies should continue to examine the functions of motivation and physical education achievement in contributing to adolescents' after-school physical activity participation.

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