Impact of Expectancy-Value and Situational Interest Motivation Specificity on Physical Education Outcomes

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Abstract:

To be successful in learning, students need to be motivated to engage and learn. The domain-specificity motivation theory articulates that student motivation is often determined by the content being taught to them. The purpose of this study was to extend the theory by determining domain-specificity of situational interest and expectancy-value motivation in terms of engagement and achievement outcomes in physical education. A random student sample (N = 346) from eight Chinese middle schools provided data of situational interest, expectancy-value, engagement, and knowledge and skills acquired. Results from correlation, regression, and structural equation model analyses revealed causal inferences demonstrating differentiated effects of motivation components on the outcome measures: task values were specific to knowledge outcome, expectancy beliefs to skills, and situational interest to engagement. The findings imply that physical educators need to adopt motivation strategies compatible to specific learning outcomes to maximize student motivation for engagement and achievement.

Keywords: accelerometry | Chinese students | middle school | structural equation modeling

Article:

To be successful in learning, students need to become motivated to overcome challenges. It has been suspected, however, that motivation in one subject domain may not be transferrable to another (Assor & Connell, 1992). The motivation domain specificity theory hypothesizes that motivation is based on many specific components within a subject matter including the ways it is taught and achievement outcomes it leads to (Bong, 2001; Chen, Martin, Ennis, & Sun, 2008). In other words, learner motivation is likely to fluctuate in terms of the content they are engaged in at a moment. Motivation specificity has been observed in reading (Wigfield, Guthrie, Tones, & Perencevich, 2004), language arts (Durik, Vida, & Eccles, 2006), mathematics and sciences (Bong, 2001; Simpkins, Davis-Kean, & Eccles, 2006), and physical education (Chen et al., 2008).

Motivation Sources

Learner motivation derives from many sources. Bong (2001) has identified self-efficacy, achievement goals, and expectancy-values as primary motivation sources for Korean middle and high school students (n = 424) in studying language arts (Korean and English), math, and science courses, respectively. Motivational function of these sources is characterized by domain specificity. Except the motivation from performance-approach and performance-avoidance sources, which was found transferrable across content domains, motivation from other sources was functioning with clear distinction across domains (Bong, 2001). In physical education, Chen et al. (2008) tested the domain specificity hypothesis with a random sample of elementary school students (n = 298) from 48 intact classes. They found that expectancy beliefs and task values were a stronger motivation source in a fitness unit than they were in a movement/game unit. In addition, motivation specificity was also observed within the fitness education unit. The learners were motivated by different task values they assigned to the content about cardiorespiratory health or about muscular fitness.

The functional mechanisms of motivation specificity remain unclear. Burhl and Alexander (2009), however, articulated a possible explanation for the content-related motivation fluctuation. They believe that vast research evidence suggests learner competence belief is one of the most powerful motivation sources and this belief is related closely to perceived demands of learning in a specific content domain. By connecting one's competence belief to content demands, Burhl and Alexander (2009) argued, the learner will develop an overall view about the value of the content, which is consistent with his or her competence beliefs. This view of the content further develops into a view about the stability of the content. When the learner views the content as stable, he/she is likely to strengthen a positive competence belief for success and value the content in the learning process. When the learner views the content as unstable, he/she "may not value the domain or be interested in learning the material (e.g., 'why bother, it will soon change anyway')" (Burhl & Alexander, 2009, p. 485). Limited research evidence and theoretical work also suggest that learners' academic achievement in a content area can reinforce their valuing the content and developing and sustaining expectancy-value based motivation (Wigfield el al., 2004; Wigfield, Tonks, & Klauda, 2009) or interest-based motivation (Krapp, Hidi, & Renninger, 1992; Schiefele, 2009).

The above perspective is important for understanding children's motivation in physical education. Although physical education can be viewed as a stable content domain, knowledge, skill, and learning tasks can hardly be considered as stable. There are sport-based curricula, fitness-centered programs, and concept-based content, to name a few. Each presents a content focus that can be different from that of the others. In this context, expectancy-value and situational interest can be considered as crucial motivational sources mostly because of their differentiated association with different content domains (Burhl & Alexander, 2009). On the other hand, the two were found to be the most prevalent motivation sources in physical education (Chen, Chen, & Zhu, 2012). Framed in these theoretical perspectives, the purpose of this study was to extend the theory by determining motivation specificity of expectancy-value and situational interest in relation to tangible achievement outcomes expected of physical education students. Studying the relationship between the motivation sources and learning outcomes will facilitate our effort to develop content- and achievement-specific motivation strategies for physical education students.

The Constructs of Expectancy-Value and Situational Interest

The expectancy-value construct postulates that learner motivation derives from two primary sources: Expectancy beliefs for success and recognition of task values. Expectancy beliefs refer to the learner's competence-based beliefs of success in learning a content (Eccles & Wigfield, 1995) and task values refer to perceived importance (attainment value), usefulness (utility value), and enjoyment (intrinsic value) that the content may offer. Expectancy-value has been found to be a strong predictor for high school students' engagement and achievement in literacy (Durik et al., 2006), mathematics and sciences (Simpkins et al., 2006).

Expectancy-value motivation is characterized by domain specificity. It was noticed (Eccles, Wigfield, Harold, & Blumenfeld, 1993) that expectancy beliefs and perceived task values could be differentiated in terms of activities or content. This observation has been verified in longitudinal data where students' expectancy-value motivation was found changing over time at different rates across domains (Jacob, Lanza, Osgood, Eccles, & Wigfield, 2002). For example, language arts related expectancy-value motivation declines at the elementary school while sport-related motivation will not until high school. In physical education, expectancy beliefs were found to be a predictor for one-mile run performance (Xiang, McBride, & Bruene, 2004), but not for skill and knowledge outcomes (Zhu & Chen, 2010a). Chen et al. (2008) reported similar variations of expectancy-value motivation in learning fitness content.

Situational interest refers to a temporary motivation state generated by arousing characteristics of an activity at the moment of human-activity interaction (Krapp et al., 1992). Situational interest motivation "is characterized by attention and persistence (being engaged and caught-up), positive affective involvement (being fascinated), and curiosity" (Schiefele, 2009, p. 199) and results in high cognitive focus, intense attention, and positive emotions (Krapp et al., 1992). When empirically observed, these characteristics are differentiated as novelty, challenge, exploration intention, attention demand, and instant enjoyment and function as eliciting sources for situational interest (Chen, Darst, & Pangrazi, 1999). Situational interest is powerful due to its content relevance where content-based characteristics are the primary motivation sources.

Situational interest is a teacher-friendly construct. It is induced by a particular situation that can be planned, created, and manipulated by the teacher. In a study of interactive impact of personal and situational interest, Durik and Harackiewicz (2007) observed that college students (n = 241) who did not have a strong initial personal interest in the content relied on situational interest in instructional materials (e.g., visual appeal of text) as primary motivation sources. The finding implies that when teaching students who do not have a sustained personal interest in the content, the teacher should start the learning process by creating situational interest to elevate the students' motivation to engage them in learning (Durik & Harackiewicz, 2007).

Classroom research revealed that situational interest motivates learners to engage (Mitchell, 1993); but it only produces limited explanatory variance (average $r = .27$, r^2=.073) for achievement (Schiefele, 2009). In physical education, research findings are quite similar. Situational interest has been found to be influential on physical or cognitive engagement but have limited impact on achievement outcomes (Zhu et al., 2009). Because both achievement in knowledge and skill development and physical engagement in class are important learning outcomes in physical education, it is important to clarify expectancy-value and situational interest domain specificity in terms of the outcomes. Based on the above articulation, it was hypothesized that: (a) Situational interest would motivate learners for enhanced engagement and (b) expectancy-value would lead to enhanced skills and knowledge outcomes.

Method

Research Context and Participants

The study was conducted in Shanghai, the largest city by population in China where all content areas, including physical education, are high-stake tested in elementary and secondary schools. The study was part of a larger study whose first primary purpose was to design and field-test a concept based physical education curriculum in relation to its impact on learner motivation, physical skill development, and health-related knowledge growth and behavior change. The second primary purpose was to identify curricular and instructional components that might contribute to or hinder learner achievement. The larger study provided a necessary achievement environment to change physical education from a sport/play-based program to a health-centered, standard-based program that helps children learn health benefits of physical activity. This research setting constituted a unique achievement environment where learner motivation could be studied appropriately.

The study was conducted in eight public middle schools randomly sampled from 774 secondary schools in Shanghai based on the following stratification criteria: (a) the schools must have adequate indoor and outdoor space for physical education, (b) physical education instruction must be based on the national standards, (c) the schools must offer three 45-min physical education lesson per week as required by the government guidelines, and (d) all physical education teachers must be certified in teaching physical education with at least a Bachelor's degree in education. The stratification provided a pool of 423 schools. Within the funding constraints, the random selection process rendered four inner-city and four suburban schools with various student enrollment ranging from 314 to 2,298. The eight schools in the sample can be considered representative of middle schools in the greater Shanghai metro area.

The number of physical education teachers in each school ranged from four to nine. Physical education lessons were gender-separated in that boys and girls from the same intact classes would go to different teachers for instruction. Thus, a typical physical education class consisted of boys or girls from difference classrooms. The curriculum was based on a concept-based model where life-time sport skills, fitness, and knowledge were emphasized. Instructions were delivered mostly in direct-teaching styles and high physical activity participation dictated all learning tasks including cognitive ones. In two schools students were required also to participate in daily martial arts exercises for 15–25 min.

Student participants ($N = 346$) were randomly selected from their physical education classes. The number of participants ranged from 44 to 48 per school except one whose enrollment was the smallest, where 27 students were sampled. The sample included 170 girls (49.1%) and 176 boys (50.9%) and were evenly distributed in 6th grade ($n = 113$, 32.7%), 7th grade ($n = 114$, 32.9%), and 8th grade ($n = 119$, 34.4%). The study was approved by the Shanghai municipal government according to China's laws governing research involving human subjects. Written consent was received from all participants' parents before data collection began. Student participants were informed that they would be the representatives of their schools to provide data to the study and the purpose of the study was to examine students' motivation so that educators could improve physical education in the future. They were also informed their rights to withdraw from the study at any time and were ensured that their decisions on participation and their responses to the measures would not affect their grades in physical education.

Variables and Measures

The motivation construct variables included expectancy-value (with components of expectancy beliefs, attainment value, utility value, and intrinsic values; Eccles & Wigfield, 1995) and situational interest (with components of novelty, challenge, exploration intention, attention demand, and instant enjoyment; Chen et al., 1999). Achievement outcome variables included written test on knowledge about exercise principles and benefits, and physical tests on skills needed for life-long physical activity participation. The engagement variable was operationalized as the students' physical activity amount in physical education lessons.

Expectancy-value motivation was measured using the Expectancy-Value Questionnaire (Eccles & Wigfield, 1995). The instrument includes five items measuring expectancy beliefs and two items each for attainment value, utility value, and intrinsic value. Based on Xiang et al.'s (2004) modified version for use in physical education, Zhu, Sun, Chen, & Ennis (2012) further validated the construct structure by testing its measurement invariance and results confirmed that the measurement model of the instrument was preserved very well. Below are some sample items used to measure expectancy beliefs, attainment value, utility value, and intrinsic value, respectively. *If you give 5 to the best student in PE and 1 to the worst, what would you give to yourself?* (1 = worst, 5 = best); *Compared with math, reading, and science, how important is it for you to learn in PE?* (Not very important = 1, Very important = 5); *Compared with your other school subjects, how useful are the knowledge and skills learned in PE?* (Not useful at all = 1, Very useful = 5); *How much do you like your PE classes?* (Don't like it at all = 1, Like it very much = 5).

The instrument was translated into Chinese by a panel of bilingual researchers in U.S. The Chinese version was validated with a college student sample (n = 368, Chen & Liu, 2008) and with a middle school student sample (n = 870, Ding, Sun, & Chen, 2011). Both studies confirmed that the Chinese version shared similar psychometric quality as the English version with the Cronbach alpha reliability coefficients ranging from .68 to .82. The translated instrument was subject to a confirmatory factorial validation with the current data. As reported in Results, the psychometric integrity was well preserved with the current data.

Situational interest was measured using the 24-item Situational Interest Scale developed and validated in the U.S. (Chen et al, 1999). Situational interest is theorized to derive from five dimensional sources in a situation or activity: Attention demand, challenge, novelty, instant enjoyment, and exploration. Each of the five dimensions is measured with four items. Four additional items tap into a dimension of "total interest" for validation purposes (Chen et al., 1999). A 5-point scale is attached to each item; thus the total possible score for a dimension is

20. Sample items are: *What we were learning was a new-fashioned activity for me to do* (Novelty); *What we were learning demanded my concentration* (Attention Demand); and *What we did was enjoyable for me* (Instant Enjoyment). Readers are referred to Chen, et al. (1999) for the scale in its entirety. The Scale was translated by the researchers who were fluent in English and Chinese.

Knowledge about exercise principles and benefits was assessed using a 10-question standardized test. The questions were selected from a test bank validated with a larger student sample (n = 870) (Ding et al., 2011). As recommended by Morrow, Jackson, Disch, and Mood (2005), questions with a difficulty index between 45–55% and a discrimination index above 57% were selected to provide highly valid and reliable data. Sample questions include, *The ability of the heart, lungs, and blood vessels to function efficiently when a person exercises the body is … (a) Muscular endurance, (b) Target heart rate, (c) Cardio respiratory fitness* (6th grade); *All of the following are anaerobic activities EXCEPT… (a) Running up a flight of stairs, (b) Sprinting 40 meters (c) Swimming 400 meters, (d) Running for 30 minutes on a treadmill* (7th grade); *Leisure-time activities do all of the following EXCEPT… (a) Provide an opportunity for social interaction, (b) Guarantee improvements in health-related or skill-related fitness, (c) Provide a source of recreation, (d) Burn calories* (8th grade).

Physical skills for life-long physical activity were assessed using the surrogate approach. It was reasoned (Gallahue, 1996) that the ability to perform arm striking movement and to coordinate whole body movement can have long-term implications for developing and maintaining an active life style. The badminton overhand clear test (Lockhart & McPherson, 1949; recommended in Morrow et al., 2005) was used as the surrogate test for the overhand arm striking skill. During the test, the testee used the overhand clear stroke to continuously strike a shuttlecock against a wall above a line of 5-ft. from the floor. The strikes should be conducted from behind a restriction line 6 1/2 feet away from the wall. One point was given to each successful strike. The total score was the sum of points cumulated in three 30 s trials (See Lockhart & McPherson, 1949, for detailed description of this test). The test was validated (Lockhart & McPherson, 1949) using the concurrent validation approach with experts' rating of playing ability as the criterion measure. The validation study rendered a concurrent validity coefficient between .71 and .90; and the test-retest reliability coefficient was stable at .90 (Lockhart & McPherson, 1949).

The whole-body coordination movement was assessed using the AAHPERD (1984) basketball dribbling test (recommended in Morrow et al., 2005) which requires the testee to coordinate footwork, object-manipulation, and speed in one movement. In the test the testee dribbles a basketball in a zig-zag pattern around five cones placed in the center and four corners of the free-throw zone. The testee must complete the course with legal dribble and the time finishing the course is recorded as the score. The total time of two trials (in seconds) is the final score. The concurrent validity coefficients were between .37 to .91. The test-retest reliability coefficients ranged from .93 to .97 for females and from .88 to .95 for males.

Student learning engagement was operationalized as the amount of physical activity that students were engaged in a lesson (Chen, Sun, Zhu, & Ennis, 2012). The measure is particularly relevant, for physical education being the only activity-based learning experience in the school curriculum. In-class physical activity was determined using the total average activity caloric expenditure (total calories minus resting calories, in Kcal) in six physical education lessons that covered a variety of content areas including fitness and skill development. The data were recorded using RT3 accelerometers (Stayhealthy.com, Monrovia, CA) that were deemed as dependable devices capable of providing highly valid and reliable caloric expenditure data (Rowlands, Thomas, Eston, & Topping, 2004) with excellent intrainstrument reliability and inter-instrument reliability ranging from .86 to .89 (Melanson, & Freedson, 1995).

Data Collection

During the data collection period, the students were learning fitness concepts focused on benefits of regular physical activity and exercise principles such as the FITT. These concepts were taught via life-time sport activities such as soccer, badminton, table-tennis, martial arts, etc. throughout the data collection semester. The data were collected by a data collection team consisting of graduate students at a top-ranking kinesiology institute in China. The data collectors received six-hour training where they learned data collection procedures detailed in a data collection manual. To minimize threats to validity and reliability, the data were collected in the following sequence: the accelerometer data were collected in one lesson every other week throughout the semester, approximately in a total of six lessons for each participating student. Situational interest data were collected in the middle of the semester. Expectancy-value data were collected one week after the situational interest. The skill tests were conducted in the last three weeks of the semester and the knowledge test was given in the final examination week. It was determined that spacing out measuring engagement and measuring motivation could minimize the interactive impact due to completing the motivation scales.

The data collectors followed the data collection protocol closely. For example, students' height and weight were measured along with age and gender information during the first week. The information was brought back to the laboratory for the researchers to select boys and girls who represented different categories of body sizes (based on their calculated body mass index: BMI). On the basis of the selection, the data collectors programmed the accelerometers individually for each student. In data collection, they followed the protocol to affix the accelerometer on the selected student's waist directly above the right knee and activated the device. After the lesson, the data collector retrieved the accelerometers from each student and uploaded the data immediately into a laptop computer.

In collecting situational interest and expectancy-value data, the data collectors monitored the students to ensure no student-to-student interaction. The knowledge test was given in classrooms with seating identical to those used in any standardized tests. In the skill tests, the data collector tested the students individually with the teacher assisting in organizing the students.

Data Reduction and Analysis

Based on the expectancy-value theory and interest theory, there are three distinct task values but one situational interest. Thus, the measures were reduced into the latent constructs of expectancy beliefs, attainment value, utility value, and intrinsic value, and situational interest. Each correct answer to a knowledge test question was given a score of 1 and an incorrect answer a 0. The total knowledge achievement was represented by the percent-correct score which was calculated by dividing the number of correct answers by the total number of questions. Raw scores from the skill tests were converted into T-scores for analysis. Active caloric expenditure due to physical activity engagement was determined by subtracting individual student's basal metabolic rate (in Kcal) from the total caloric expenditure recorded during the lesson. The average caloric expenditure from the six lessons was used in the data analysis.

Primary data analysis included the following steps. A confirmatory factor analysis and a test for internal consistency (Cronbach α) were conducted on situational interest and expectancy-value data to verify their construct integrity. Then correlation and regression analyses were conducted to assess associations among situational interest, expectancy-value, knowledge, skill, and engagement and to explore variances of the associations. Lastly, based on the information from the regression analyses a structural model was constructed and tested to determine domain specificity relations. Collectively, the regression and structural equation modeling analyses tested causal inferences of hypothesized motivation specificity relations between situational interest and engagement and between expectancy-value and achievement outcomes.

Results

The confirmatory factor analyses revealed acceptable construct-data fit for both situational interest (χ^2 =144.95, $p < .05$; Root Mean Square Error of Approximation (RMSEA) = .034, RMSEA 90% Confidence Interval (CF)= .028–.071, RMSEA $p = .062$) and expectancy-value construct (χ^2 =111.41, $p < .05$; RMSEA = .048, RMSEA 90% CF= .037–.092, $p = .20$) with significant ($p < .05$) links from observed indicators to their respective latent dimensions. Cronbach's α coefficients, reported in Table 1, indicate satisfactory data reliability.

Table 1. Descriptive of the Measures (N = 346)

Variables	**Mean**	**SD**	**α**
Situational Interest			
Novelty	13.30	4.53	.78
Challenge	11.09	4.08	.74
Attention Demand	14.58	4.02	.84
Instant Enjoyment	14.39	4.90	.72
Exploration	14.04	4.09	.83
Total Interest	14.48	4.35	.88
Expectancy-Value			
Expectancy Belief	3.52	.85	.85
Attainment Value	4.05	.88	.69
Intrinsic Value	3.93	.99	.80
Utility Value	3.96	.96	.81
Knowledge			
% correct	.46	.17	
Skill			
Striking (T-Score)	47.65	7.40	
Coordination (T-Score)	49.70	7.60	
Overall (T-Score)	48.67	5.85	
Physical Activity			
Active KCal	205.61	185.54	

Table 2 reports the results from correlation analysis. It is worth noting that the coefficients in the shaded areas suggest a pattern consistent with the hypotheses: situational interest is likely to be associated with engagement while the expectancy-value with outcome measures. This initial evidence indicated a need for further analysis. Subsequently, four regression analyses were conducted to explore contributing relations of both motivation constructs to the engagement and outcome measures. As summarized in Table 3 and Figure 1, engagement was determined solely by situational interest (R^2=.59, β =.77, p = .001) and two task values predicted knowledge outcome; but only the utility value was meaningful (R^2=.61, β =.75). The striking skill score was accounted for mainly by expectancy beliefs (R^2=.14, β =.38) with only 2% of the variance accounted for by the challenge dimension of situational interest (R^2=.02, β =.12). The coordination skill was accounted for largely by the intrinsic value (R^2=.31, β =.41) with a fraction of contribution from the expectancy beliefs.

The linear effects from the motivation sources on the respective outcome measures were further confirmed in the structural equation modeling analysis. Figure 2 presents the structural model with standardized path coefficients. The γ indices from the predictors to outcomes were significant (t ranging from 3.21 to 4.55, p < .05). The model-fit indices are $\chi^2_{(df\,360)}$=1125.17, p<.001 (χ^2/df ratio = 3.13), RMSEA=.038 (90% CI=.00; .071), p = .08; Goodness of Fit Index (GFI)=.99, and Adjusted Goodness of Fit Index (AGFI)=.96.

Table 2. Correlation Coefficients Between Variables Including Motivation Dimensions (N=346)

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**
Kcal (1)													
Novelty (2)	.59**												
Challenge (3)	.11*	.34**											
Attention (4)	.56**	.64**	.18**										
Enjoyment (5)	.61**	.69**	.14**	.64**									
Exploration (6)	.62**	.69**	.21**	.80**	.71**								
Interest (7)	.77**	.76**	.15**	.72**	.80**	.77**							
Exp Belief (8)	.18**	.16**	-.02	.22**	.18**	.28**	.19**						
Attainment (9)	.26**	.27**	.03	.33**	.31**	.36**	.34**	.33**					
Intrinsic (10)	.35**	.31**	-.04	.34**	.31**	.40**	.39**	.44**	.55**				
Utility (11)	.30**	.32**	.02	.35**	.33**	.42**	.35**	.37**	.50**	.70**			
Knowledge (12)	.32**	.32**	-.01	.31**	.31**	.37**	.33**	.33**	.45**	.59**	.78**		
Striking (13)	.09	.11*	.12*	.07	.10	.11*	.10	.36*	.10	.08	.13*	.12*	
Coordination (14)	.18**	.12*	-.01	.15**	.18**	.17**	.18**	.48**	.33**	.50**	.36**	.30**	.22**

** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Discussion

Similar to findings from most motivation studies, Table 1 clearly show that the students were motivated. The mean response in each situational interest dimension ranged from 13.30 to 14.58 on the 20 point scale, except in the dimension of Challenge (11.09). Composite average response scores for the expectancy-value components ranged from 3.52 to 4.05 on the 5-point scale. These statistics are encouraging because they support the observations in the U.S. that students in K-12 schools are motivated for physical education (Chen, Chen, & Zhu, 2012).

Table 3. Results of Regression Analyses

Outcome	Predictors	R^2	β	*t*	p	95% CI for β
Engagement	Interest	.60	.77	22.03	.001	29.79–35.63
Knowledge	Utility Value	.61	.75	21.30	.001	1.17–1.41
	Engagement	.01	.11	2.98	.003	Not Meaningful
Striking Skill	Exp Belief	.14	.38	7.55	.001	2.44–4.16
	Challenge	.02	.12	2.35	.019	.36–3.91
Coordination	Intrinsic Value	.31	.41	8.74	.001	2.04–3.22
	Exp Belief	.09	.33	7.07	.001	1.80–3.19

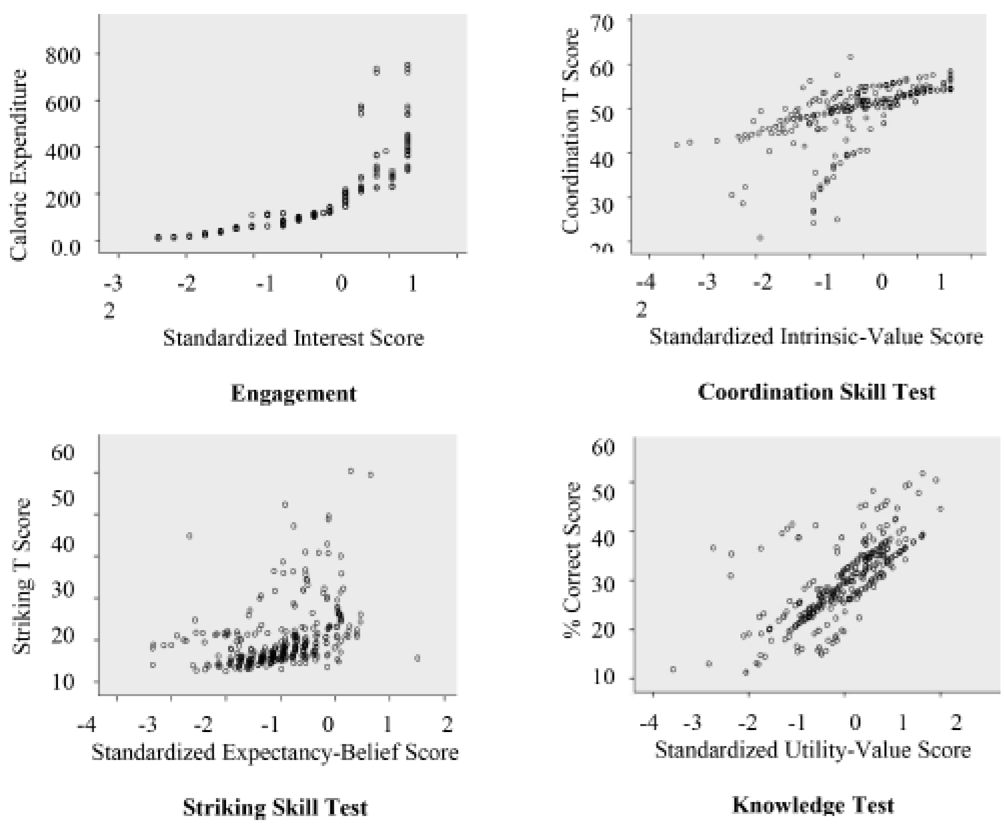

Figure 1. Regression Scatterplots for Predictive Relation of Motivation Constructs and Outcomes

Physical education is a content area that requires the learner to invest both physical and cognitive effort in learning (Chen & Ennis, 2009). The students appeared to rely on the situational interest and expectancy beliefs as motivational sources for the physical dimension and rely on the task values as motivational sources for learning in the cognitive dimension. Components in situational interest and expectancy-value worked across conceptual borders of the constructs as motivators for physical engagement and skill achievement. Particularly, the correlation coefficients (Table 2) suggest that the situational interest components are strongly associated with physical engagement (caloric expenditure), while the expectancy-value components are associated with knowledge and skill learning outcomes. The subsequent results from the regression analysis identified specific motivation source components that contributed to the outcome. Interest, for example, accounted for 59% variance of caloric expenditure and the utility value accounted for 61% variance in knowledge test score. Expectancy beliefs and the intrinsic value are primary motivation sources that accounted for a large portion of changes in skill test scores. The structural model provides additional evidence beyond the results from the binary correlation analysis and regression analysis in that it differentiated clear directional impact of the motivation sources in terms of the outcome measures.

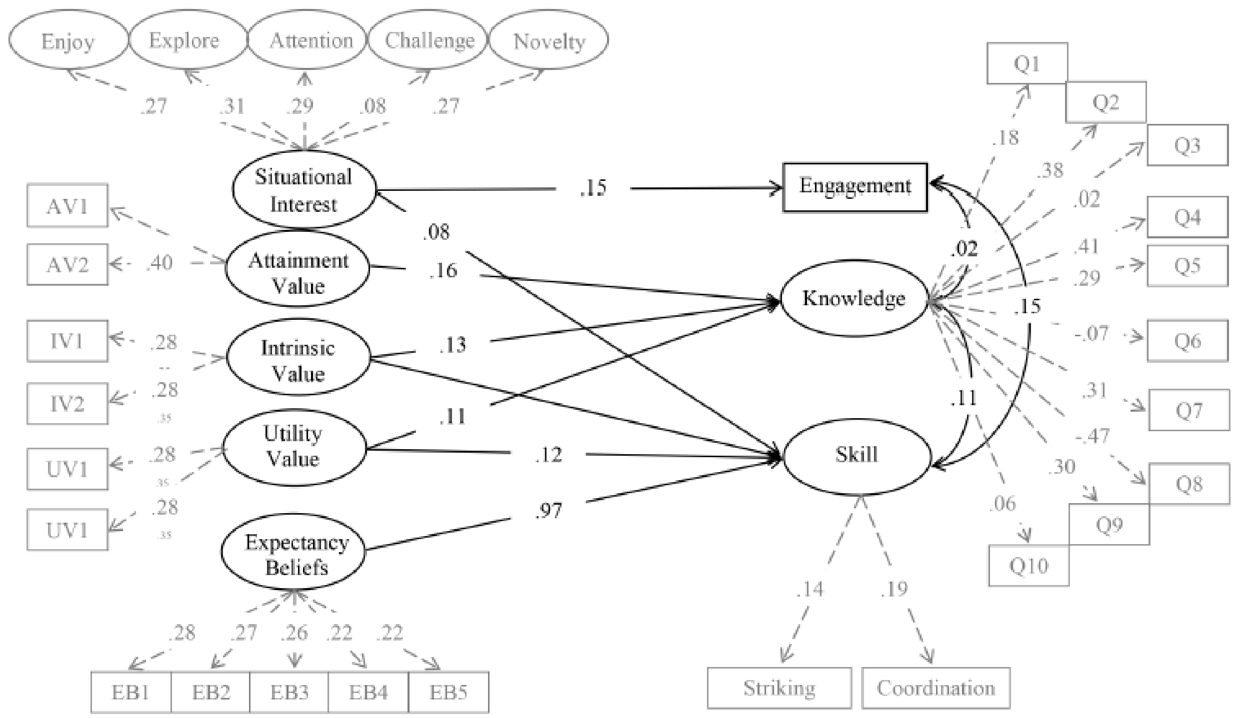

Figure 2. The Structural Model for Motivational Impacts on Outcome Variables. *Note*: Grayed areas and coefficients are parts of the measurement models for the corresponding latent constructs. Engagement (total active caloric expenditure in Kcal) is an observed variable and is specified as Y in the tested model. All paths except from Knowledge to Q3, Q6, and Q10, from Situational Interest to Challenge, and from Engagement to Knowledge are statistically significant (t from 3.21 to 4.55, $p < .05$). AV = Attainment Value, IV = Intrinsic Value, UV = Utility Value; Q1—Q10 = Question 1 to Question 10 of the knowledge test. Major model fitness indexes: $\chi^2_{(df\,360)}$ =1125.17, p<.001, χ^2/df ratio = 3.125, RMSEA=.038 (90% CI=.00; .071), GFI=.988, AGFI=.960

It is clear that situational interest is the sole contributor to the physical engagement. What is not clear is the role of its components (subdimensions) in this process. Due to sample size limitations and a lack of a priori theoretical articulation, a full structural model involving all subdimensions of situational interest could not be built and tested. Particular in question is the role of challenge in formulating situational interest. As theorized with previous data (Chen et al., 1999), challenge is a viable component that stimulates the learner to derive an interest in tasks. Especially when the task is novel, challenge will have positive contribution to learner motivation. The results from this study, however, show a diminished influence from challenge. Two items in the challenge dimension did not load positively on the construct and the overall dimension did not contribute meaningfully to situational interest (see Figure 2). Students in physical education are challenged in both physical and cognitive dimensions. Therefore, it may be reasoned that physical challenge may impose a unique situation where learners' motivation is likely to demonstrate unclear patterns, which resulted in this ambiguous role of challenge in this group of Chinese middle school students. The finding suggests that the role of challenge dimension requires further empirical attention.

The results from the series of analyses indicate that expectancy-value motivation impacted achievement outcomes. The structural equation model analysis, in fact, helped clarify the contributing components by partitioning out their individual roles in the structural model. For example, the structural model revealed that both attainment value and utility value contributed to knowledge outcome rather than the utility value being the sole contributor as indicated in the regression results. In addition, when skill outcome is considered as a latent outcome measure composed with aggregated T-scores from both skill tests, the intrinsic and utility values were identified as contributing motivational sources as well as expectancy beliefs. This finding is particularly interesting when taking into account the correlation analysis results that show a low-moderate correlation between expectancy beliefs and intrinsic ($r = .44$) and utility ($r = .37$) values and a moderately high correlation between intrinsic and attainment ($r = .55$) and utility ($r = .70$) values (see Table 2). Taken together, they seem to suggest that while knowledge is accounted for by the values, skill outcome primarily relies on students' expectancy beliefs for success.

The attainment value has been found to be the most persistent motivational source in classroom research (Bong, 2001; Eccles & Wigfield, 1995; Jacob et al., 2002; Wigfield et al., 2004). Its absence as a contributor to the skill outcome is noticeable in both the regression and the structural models. It may be speculated that the attainment value functions at a global level of motivation source enticing into the understanding of overall value of content, rather than function at an outcome-specific level. Thus, it is manifested as a motivator for the learner to appreciate the overall content of physical education rather than a motivator to learn specific physical skills. Another possibility is that its function at the outcome-specific level is likely to have been accounted for by the utility and intrinsic values, which suggests a sequential rather than parallel relation among the values in terms of the values' motivation specificity nature. Speculatively, another possibility could be that for this group of students, learning knowledge was viewed more important than learning physical skills. Thus, knowledge, especially those related to fitness and health, is valued on the importance (attainment value) platform while physical skills are valued on enjoyment (intrinsic value) and usefulness (utility value) platforms. Regardless, research is needed to further explore these component's domain specific functions.

The role of engagement is noticeably important in interpreting the result. The finding (see Figure 2) seems to support a hypothesis (Chen, Chen, Sun & Zhu, 2013) that physical engagement might impose an important yet delicate relation with learning in physical education. Related solely to situational interest, engagement seemd to be a significant determinant for the skill outcome, but not for the knowledge outcome (see Figure 2). Shen, McCaughtry, Martin, and Dillion (2006) cautioned that situational interest derived from a situation where learning objectives are not clearly defined will become "seductive details" which motivate students to engage but contribute little to learning outcomes. As a type of situational interest, seductive details still can motivate learners by attracting their attention, providing instant enjoyment, and giving unique and novel experiences. But it cannot generate effort contributing to learning relevant content. It is clear that seductive details are not a productive motivation source for learning. The relatively weak link from situational interest to knowledge may be considered as partial consequence of seductive details. Speculatively, as Shen et al. (2006) observed, situational interest in physical education may naturally contain substance of seductive details. Although it will motivate students to engage, it may not directly lead to achievement.

The findings should be interpreted in the context of Chinese education. Profound cultural, social, and educational differences exist between China and the West. For one aspect, physical education is a high-stake tested area of study in China. K-12 students need to pass fitness, skill, and knowledge standards in physical education to advance to the next level of education (elementary to middle, middle to high schools, and high school to college). Teaching to the standards (or tests, rather) may result. Nevertheless, studies (e.g., Ding et al., 2011) have shown that Chinese students are motivated in physical education by similar values and interest observed in U.S. students. It should be interesting in future research to develop cross-culture models to examine the universality of the motivation constructs.

The findings also need to be interpreted within the theoretical limitation of the expectancy-value construct. From its inception, cost has been theorized as a component in the value dimension. It is defined as what an individual has to give up or anticipated effort for accomplishing a task (Wigfield et al., 2009). Cost may off-set the motivation effects from the values (Eccles & Wigfield, 1995). However, cost has not been included in research in both classrooms and gymnasia for a long time (Chen & Ennis, 2009) due to its inability to have observable influence on motivation. In fact, quantified measures of cost have not been readily developed for empirical use in either classrooms or gymnasia. Researchers in physical education (Chen & Liu, 2009; Zhu & Chen, in press) studied impact of cost using qualitative designs. These studies have shown that cost is perceived by students as a potential impediment to their motivation. However, its negative impact has not materialized as a real obstacle to engagement and achievement. Nevertheless, the current results should not be interpreted as though potentially negative impact from cost has been partitioned out or accounted for. In contrast, the observed positive impact from the motivation sources on outcome measures might be drastically reduced if cost in the research context would turn out to be impactful to the outcome measures.

Conclusions

In summary, the data support the research hypotheses that the situational interest was the primary motivator for physical engagement and the expectancy-value led to enhanced skills and knowledge outcomes. The study has helped identify and differentiate motivation specificity of the two powerful motivational constructs. Theoretically, the findings have the potential to advance our understanding about motivation specificity as associated with both engagement and achievement outcomes. It can be reasoned that the findings contribute to the limited motivation specificity literature, which allows interpreting motivation specificity beyond content characteristics revealed by Chen et al., (2008) by defining motivation specificity in relation to outcome measures. Potentially, the findings pinpoint to a possibility to diversify motivation strategies in terms of its outcome-specific functions. For example, designing situationally interesting tasks will attract high engagement, while emphasizing task values that address real life needs will amplify cognitive learning. The potential should be studied in intervention studies from which the specific functions of the motivation can be further identified and targeted to enhance learning in physical education. Helping students become appreciative of their learning potentials may assist them in identifying a successful path to skill and knowledge mastery and will facilitate them to effectively develop and sustain a physically active life.

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