

2-22-2024

A Longitudinal Look at Student Attitude, Perceived Competence, and Fitness Test Performance of Elementary Students

Risto Marttinen

George Mason University, rmarttin@gmu.edu

Kevin Mercier

Adelphi University, kmercier@adelphi.edu

Jung Yeon Park

George Mason University, jpark233@gmu.edu

Kelly L. Simonton

University of Wyoming, kelly.simonton@uwyo.edu

Erin Centeio

University of Hawaii, ecenteio@hawaii.edu

See next page for additional authors

Follow this and additional works at: <https://scholarworks.boisestate.edu/ijpah>



Part of the [Exercise Science Commons](#), [Health and Physical Education Commons](#), [Public Health Commons](#), and the [Sports Studies Commons](#)

Recommended Citation

Marttinen, Risto; Mercier, Kevin; Park, Jung Yeon; Simonton, Kelly L.; Centeio, Erin; Richards, Kevin Andrew; and Wilson, Kathleen (2024) "A Longitudinal Look at Student Attitude, Perceived Competence, and Fitness Test Performance of Elementary Students," *International Journal of Physical Activity and Health*: Vol. 3: Iss. 2, Article 1.

DOI: <https://doi.org/10.18122/ijpah.3.2.1.boisestate>

Available at: <https://scholarworks.boisestate.edu/ijpah/vol3/iss2/1>

A Longitudinal Look at Student Attitude, Perceived Competence, and Fitness Test Performance of Elementary Students

Abstract

The purpose of this study was to assess relationships between students' attitudes toward physical education (PE), their perceived competence toward PE, and their fitness test performance, as well as how these relationships change over time. Measurements were conducted with validated instruments across five time points during two school years with fourth and fifth grade students across ten schools ($n = 636$, 48% = female). This study was developed to address a need for examining how attitudes and perceived competence change over time. Descriptive statistics and latent growth models were run with the variables of interest to investigate four research questions. We found that greater fitness scores are associated with greater competence scores at all time points and that fitness testing may have an impactful, yet brief impact on overall attitudes toward PE. Results showed that fitness test scores predicted higher levels of perceived competence but not higher positive attitudes. Greater attitude levels were predictive of higher competence. Results suggested that previous fitness test experiences shaped future attitudes over time as opposed to "in the moment" attitude scores, a finding not identified in previous research. This study used multiple data points to study PE attitudes and competence, two pillars of behavioral intention. Attitudes can shift and how previous PE content, like fitness testing, can predict future attitudes in PE. The actual relationship between competence and attitude over time is also identified. The results also point to attitude as more of a developed attribute as compared to one that changes only from one event.

Authors

Risto Marttinen, Kevin Mercier, Jung Yeon Park, Kelly L. Simonton, Erin Centeio, Kevin Andrew Richards, and Kathleen Wilson

**A Longitudinal Look at Student Attitude, Perceived Competence, and Fitness Test
Performance of Elementary Students**

Risto Marttinen EdD (ORCID: 0000-0003-3807-5684) *Corresponding Author
George Mason University
rmartin@gmu.edu

Kevin Mercier (ORCID: 0000-0003-3505-2495)
Adelphi University

Jung Yeon Park <https://orcid.org/0000-0001-8473-9416>
George Mason University

Kelly L. Simonton (ORCID: 0000-0001-7261-2047)
University of Wyoming

Erin Centeio <https://orcid.org/0000-0001-5465-4243>
University of Hawaii

Kevin Andrew Richards <https://orcid.org/0000-0003-3045-6001>
University of Illinois- Champaign-Urbana

Kathleen Wilson PhD <https://orcid.org/0000-0001-7179-749X>
California State University, Fullerton

A Longitudinal Look at Student Attitude, Perceived Competence, and Fitness Test Performance of Elementary Students

Daily regular bouts of moderate-to-vigorous physical activity (MVPA) are essential for enhancing or maintaining physical health from adolescence through adulthood. In the United States (US) it is recommended that youth participate in at least 60 minutes of MVPA per day to maximize health benefits and decrease the potential of many chronic diseases (Centers for Disease Control and Prevention [CDC], 2016; US Department of Health and Human Services [USDHHS], 2018). Despite the importance of maintaining optimal levels of MVPA, it is estimated that nearly 75% of youth in the US do not meet daily recommendations of physical activity (PA) and that over 70% of youth exceed the number of hours per day in sedentary behaviors (Katzmarzyk et al., 2016; CDC, 2016). Understanding and changing youth PA behavior has been a challenge. Several health organizations and advocates have identified that healthy habits need to be developed and established at an early age, making K-12 schools an ideal intervention place given the number of hours students spend at school (Cooper et al., 2016; Sallis et al., 2012). School PE programs and afterschool PA programs have been identified as probable points to understand and promote the complex youth behaviors related to an active and healthy lifestyle (Carson & Webster, 2020; Chen et al., 2014).

Subramaniam and Silverman (2007) found that PE and PA-related programs must not only help children develop knowledge and skills for fitness and health through PA opportunities, but they must also influence the attitudes and beliefs students hold for PA behaviors. In other words, considering both the PA experience and one's psychosocial experiences (e.g., attitude and perceived competence) are integral to both facilitating and motivating youth for prolonged PA-related behaviors (Chen et al., 2014; Subramaniam & Silverman, 2007). However, like declines in PA behaviors seen in youth, declines in positive attitudes toward PA endeavors have been identified (Mercier et al., 2017; Silverman, 2017). From elementary school through adulthood, a steady trend in reduced positive PA attitudes and an uptick in negative PA attitudes (Mercier & Silverman 2014; Mercier et al., 2022; Simonton et al., 2019). In youth, a sharper decline in positive attitudes and perceived competence has been identified for females (Mercier & Silverman, 2014, Mercier et al., 2022; Simonton et al., 2019). These trends are particularly concerning because attitudes and perceived competence in PA behaviors are seen as the primary influence for shaping active decisions and habits (Hagger et al., 2002; Solmon, 2003). Despite the importance of these psychosocial variables, less evidence exists as to how psychosocial variables (e.g., attitudes & perceived competence) change over time.

A great deal of research has been conducted cross-sectionally on student attitudes towards PE (Subramaniam & Silverman, 2002; 2007), fitness testing (Mercier & Silverman, 2014; Simonton et al., 2019), and PA (Mercier et al., 2022; Simonton et al., 2021). These studies have related attitudes to both intentions and self-reported PA behaviors (e.g., Mercier et al., 2022). Yet attitudes are perceptions that form over time and across many experiences. In addition to the lack of longitudinal evaluation of changes in attitude is the limited knowledge on how attitudes interact with other key variables, such as one's perceived competence and their experiences with the activities in which they are participating. Mercier et al. (2022) and Simonton et al. (2019) suggested that prolonged and multifaceted data collection that includes student attitudes and other related measures is required for researchers and practitioners to effectively understand changes in attitudes. Grounded in the Theory of Planned Behavior (TPB; Ajzen, 1991; Fishbein & Ajzen, 2010), this study sought to include and track both youth attitude

and perceived competence components over time to yield deeper insight in youth PA attitudes, behaviors, and physical fitness development in several PE programs.

Theoretical Framework

According to the TPB, your attitude, combined with your perception about how capable you are performing in PE (i.e., perceived behavioral control), and perceived pressures from others to be active in PE or how others will view your performance (i.e., subjective norm) will contribute to decisions on if and how to be active in PE. Within this theory, attitude, perceived behavioral control, and subjective norms influence behavioral intentions, which impact behavior (Ajzen, 1991; Fishbein & Ajzen, 2010). While all three TPB components likely lead to intentions and behaviors, meta-analysis results show that attitudes and perceived behavioral control are the strongest predictors for physical activity (McEachan et al., 2011). In some cases, attitude has been reported to carry the strongest held relationship in predicting intention (Chatzisarantis & Hagger, 2005; Silverman, 2017). Also, there is reason to believe that the relationship between attitude and intention is moderated by perceived control in that perceived control is required, but serves more of an assisting role in explaining, intention (Wang & Hollett, 2022). One must feel some degree of competence to have intentions, but those feelings of confidence are working in conjunction with one's attitudes before intentions are developed or acted upon.

Within the TPB model, various background factors are thought to influence the formation of attitudes and perceived behavioral control through various beliefs (Fishbein & Ajzen, 2010). Such beliefs reflect the experiences people have and could include exposure to information such as that contained in performing related behaviors such as fitness testing (Fishbein & Ajzen, 2010). For example, a PE student may observe their performance (good or bad) in fitness testing and derive information from that which influences how they perceive their own abilities and their attitudes towards PE. Qualitative studies have explored how competition and perceived ability affect attitudes (Bernstein et al., 2011) and how students' experiences influence their attitudes toward PE (Phillips et al., 2020), but no quantitative study has looked at how perceived competence and attitude are related or the role of performance on fitness testing. Further, the combination of limited work on multiple facets of TPB and the lack of longitudinal data collection, that likely explains how these components interact, has been nascent but is needed to further our use and understanding of the TPB in the PE setting (Mercier & Silverman, 2014; Silverman, 2017).

Attitudes Towards PE

Student attitude has been studied avidly in the field of physical education (PE) for the past two decades. Reviews of literature (Silverman, 2017; Subramaniam & Mercier, 2017) document the development and growth of attitude research in PE over this time period. The previously highlighted studies have evaluated student attitudes grounded in the dual component view of measuring attitude where both the cognitive and affective components contribute to the formation of attitudes, which can change and develop over time (Silverman, 2017). The cognitive component refers to how useful or important a construct is, and the affective to how fun or enjoyable you find the construct – in our case, towards PE.

Attitudes have been shown to impact decisions to be physically active throughout life (Graham et al., 2011; Solmon, 2003) a frequently stated goal for PE (SHAPE America, 2014).

Through studies conducted on attitude in PE there are some aspects that are clear. For instance, it is clear from several studies that attitudes toward PE decline as students get older, starting in late elementary school, and oftentimes at a sharper rate for girls than boys (Mercier et al., 2020; Mercier et al., 2017; Mercier & Silverman, 2014; Phillips et al., 2020; Phillips & Silverman 2015; Simonton et al., 2019; Subramaniam & Silverman, 2000; 2007). Results from these investigations indicate the teacher, the curriculum, and experiences with fitness testing contribute to changes in attitudes.

Perceived Physical Competence

Perceived competence is defined as an individual's beliefs in having the necessary abilities to complete a task successfully (Barnett et al., 2008). Perceived physical competence involves one's belief in their capability to perform physical tasks such as running and playing sports. In this study, perceived competence was viewed synonymously with construct of perceived behavioral control from TPB as perceived behavioral control has been defined to include a person's capability to perform a behavior (Fishbein & Ajzen, 2010). Given that perceived physical competence is in line with PE-related skills, perceived competence was thought to be a suitable proxy. Similarly, previous research has utilized the concept of self-efficacy to identify the concept of control in PA behaviors (Hagger et al., 2002). Previous research has documented perceived competence to be an important correlate of PA in youth, showing that PA participation is associated with perceived competence (Raudsepp et al., 2002; Sallis et al., 2000). Positive perceptions of sports competence were shown in a longitudinal study to be a key predictor of both PA outcomes as well as fitness outcomes (Barnett et al., 2008). The connection between attitude and perceived competence has however been understudied to date and a more complete understanding of the relationship would inform future practice.

Fitness Testing and PE

The use of fitness testing remains prevalent worldwide (Alfrey & Gard, 2014) and fitness testing has been identified as the most common form of assessment in physical education (Ferguson et al., 2007). Presented benefits of fitness testing include the ability to assess physical fitness levels, to assess educational goals, and to help students with self-assessment abilities for outside of school activities (Cooper et al, 2010; Silverman et al., 2008; Welk, 2008). Despite its frequency of use, fitness testing has become a controversial component of PE (Gard & Plum, 2017) and the relationship between attitudes and fitness testing continues to be investigated (Mercier et al., 2022; Simonton et al., 2020; Phillips et al., 2020). Negative effects of fitness testing have also been reported and they include decreased motivation, the formation of negative attitudes, the development of feelings of embarrassment or humiliation (Alfrey & Gard, 2014; Cale & Harris, 2009). Recommendations for the proper use of fitness testing have been introduced (Silverman et al., 2008) but are often not followed (Mercier et al., 2016) highlighting that the potential benefits students could be gaining are not being realized.

Similar to attitudes toward PE, attitudes towards fitness testing have been shown to decrease over time (Mercier & Silverman, 2014). To our knowledge, only one study has looked at the relationship between students' attitudes towards PE and students' performance on fitness tests. Simonton and colleagues (2019) reported decreased positive attitudes toward PE and identified significant relationships (with small effect sizes) between students' fitness test

performance and future attitudes toward PE. This study also reported gender differences as boys attached a greater importance to fitness testing performance than girls. A common aspect of the previous studies on attitudes is the one-time data sample and the use of cross-sectional designs. Silverman (2017) identified the lack of and need for longitudinal studies on attitude and Simonton et al. (2019) called for future longitudinal research to examine if and how the fitness test implementation modifies relationships between fitness test performances and students' attitudes toward PE to determine if the small effect sizes were due to study design.

Purpose

Very few studies have taken a longitudinal approach to examining students' attitudes. Notable exceptions are Marttinen et al. (2018) who looked at attitude changes in middle school students across a unit of instruction (approximately 5 weeks). This study showed that attitude does indeed change in a short period of time. Another study taking a longitudinal approach was conducted by Mercier and colleagues (2017) who followed three cohorts of students over three years. It is important to note that these two studies only focused on attitude and did not examine the relationship to other constructs (e.g., fitness testing, perceived competence). Research on attitude could benefit from stronger study designs with multiple data times and points to allow the results to be discussed with more confidence. To date, no study that we found has looked at attitude across two consecutive years in a longitudinal fashion, and specifically focusing on time points (4th and 5th grade) in which attitude has been shown to decline (Donovan et al., 2015; Phillips & Silverman, 2012).

The purpose of this study was to assess elementary students' (4th and 5th grade at the beginning of the study) attitudes toward PE, their perceived competence toward PE, and their fitness test performance across five time points during their academic school year. The following research questions guided our study:

RQ1: How do attitudes of 4th grade students and 5th grade students change over time?

(Rationale: past research has been single time points, and this is a time period where we see the initial design and past research has called for more longitudinal studies)

RQ2: How does perceived competence of those students change over time?

RQ3: What relationships exist between attitude and perceived competence towards PE over time?

RQ4: What relationship exists between fitness test scores and students' attitudes and perceived competence towards PE over time?

Methods

Participants

In this study, the students (N=333) who began measurement in 4th grade were considered cohort 1 and the students (N= 332) who began the study in 5th grade were considered cohort 2. Students were included in the analysis if they participated in the baseline measurement and at least one more point across the study. Final analysis, therefore, included 317 4th graders ($M_{age} = 9.29$, $SD = 0.48$) in cohort 1 and 319 5th graders ($M_{age} = 9.29$, $SD = 0.48$) in cohort 2. The students identified themselves as 160 females (50%) and 157 males (50%) for cohort 1; and 146 females (46%) and 173 males (54%) for cohort 2.

Setting

Students were recruited from ten schools in a large urban district in California, USA. Eight K-6 elementary schools and two private K-8 Catholic schools participated. During the 2017-2018 school year, the school district demographics consisted of: 51.9% Hispanic of Latino, 16.3% Asian, 15.2% White, 9.5% Filipino, 3.1% two or more races, 3% African American and 1% other. The school district solely served elementary schools except for the two nonpublic, nonsectarian schools which also included 7th and 8th grade students. A total of 4,327 students were enrolled across the district with 59.7% coming from communities affected by poverty, 29.1% representing English language learners, and 0.4% as foster youth. A total of 5.9% of students were considered chronically absent. The school district did not disclose the percentage of students with disabilities who were enrolled.

Ethics

This study was approved by a university ethics board, and the ethics board of the school district in which the study took place. Prior to participation, consent was obtained from parents/guardians and students signed assent forms explaining the study.

Procedures & Instrumentation

This study was part of a 2.5-year Carol M. White Physical Education Program (PEP) Grant funded research study examining a variety of factors related to fitness, nutrition, attitudes, and perceived competence of over 4,300 students. Data were gathered at five time points. Baseline data were collected in May 2017 at the end of the 4th grade year for cohort 1 and the end of the 5th grade year for cohort 2. The returning students who attended the same school then repeated the tests in October 2017, November 2017, and March 2018. During these five data collection times students completed questionnaires and the battery of fitness tests included in the FITNESSGRAM (Plowman, 2013).

Attitudes Towards PE

Utilizing the Students Attitudes Towards PE (SATPE; Subramaniam & Silverman, 2000), researchers measured the dual-component view of attitudes including affective and cognitive subcomponents. This tool has been previously validated within PE settings (Mercier et al., 2017; Marttinen et al., 2018; Simonton et al., 2019; Subramaniam & Silverman, 2000) and contains 20 items with 10 measuring each of the cognitive and affective subcomponents. Participants were prompted to select the degree to which they felt each item in PE. An example cognitive item included, “the games I learn in PE make PE class interesting to me.” An example affective item was, “I feel like my PE teacher makes learning in PE fun for me.” All items were rated on a five-point Likert scale ranging from “strongly disagree” (1) to “strongly agree” (5). A mean score was used to reflect the attitudes of students with higher scores reflecting more positive attitudes towards PE.

Perceived Competence Towards PE

Self-esteem and self-concept were evaluated using the athletic competence subscale from Harter's (1992) perceived competence scale. Students were given prompts such as "some kids think they can do well at just about any new sports activity they haven't tried before" and were asked to select if that statement was "really true for me" or "sort of true for me." The scoring protocols outlined in the manual were followed for the subscales (Harter, 2012). Higher scores reflect greater perceived competence.

Fitness Tests

Physical fitness was assessed in all participants using the FITNESSGRAM battery of tests (Plowman, 2013). These tests consisted of the PACER, curl-up, push-up, sit and reach, BMI (height and weight were measured), and trunk lift. The FITNESSGRAM is a validated and reliable test for fitness in youth populations and was adopted by the state of California as a standardized test with mandatory reporting in select grades. Each test has a standard that the students need to meet to 'pass' the test or be in the "healthy fitness zone". The percent of the tests that a student passed compared to the total number of tests participated in is used to reflect their performance on the fitness tests. FITNESSGRAM tests were administered as suggested in the reference guide for the test (Plowman, 2013) by research assistants who were trained to administer the test by the first author.

Analytic Approach

The primary aim of this study was to examine the changes in two TPB outcomes, attitude and perceived competence towards PE, across five measurement occasions for the two cohorts. We also explored relationships between attitudes, competence, and students' fitness performance in both current and previous occasions as fitness testing was routinely done multiple times per academic year for all students. The data analyses were conducted with R 4.1.1 (R Core Team, 2021) and Mplus 8.3 (Muthén & Muthén, 2017). To determine the growth patterns for students' longitudinal outcomes, univariate growth models were fitted for attitude data and competence data. Subsequently, a multivariate latent growth model fitted was employed to examine dynamic relations between attitude towards PE and perceived competence overtime. Finally, a univariate latent growth model was utilized to assess whether fitness test scores (measured both at previous and current occasions) predicted changes in attitude and perceived competence over time.

Regarding the dataset for 4th graders, approximately 17% of the data was missing for attitude and 22% for competence. Similarly, for 5th graders, there were approximately 17% missing data for attitude and 21% for competence. The missing data in this study were primarily due to student absences and school transfers, which were not significantly related to any systematic reasons (e.g., race). To handle the types of missingness, the full information maximum likelihood (FIML) method was employed. Multiple indices were used to assess model fit, including comparative fit index (CFI; Bentler, 1990) >.95, Tucker–Lewis index (TLI; Tucker & Lewis, 1973) >.95, and root mean square error of approximation (RMSEA; Steiger, 1990) <.08.

Results

Descriptive Statistics

First, reliability scores (Cronbach's Alpha > .70) were confirmed for all multi-item variables which were then followed by created composite mean scores for all variables. Table 1 presents the means and standard deviations of attitude and perceived competence scores for the two cohorts. Pearson correlations among the measured scores at five different occasions are provided on Table 2. Overall, there were moderately to highly positive correlations between measurement occasions within attitude scale and competence scale. Specifically, the correlations between measurement occasions for attitude scores range from $r = .46$ to $.77$, while for competence scores they range from $r = .50$ to $.70$. Further, the correlations between attitude and competence scores suggest weak but significant correlations between the two measures (e.g., $r = .24$, $p < .01$ between attitude and competence scores at Time 3 in Table 2).

Table 1.

Means and standard deviations for attitude, competence, and fitness test score

	Grade 4			Grade 5		
	Female	Male	Total	Female	Male	Total
<i>Attitude</i>						
Time 1	3.84(0.57)	3.79(0.60)	3.81(0.58)	3.76(0.55)	3.71(0.59)	3.73(0.57)
Time 2	3.79(0.60)	3.78(0.64)	3.79(0.62)	3.67(0.62)	3.60(0.69)	3.63(0.66)
Time 3	3.71(0.67)	3.79(0.65)	3.75(0.66)	3.65(0.55)	3.60(0.66)	3.63(0.61)
Time 4	3.79(0.65)	3.72(0.73)	3.75(0.69)	3.69(0.57)	3.66(0.69)	3.67(0.64)
Time 5	3.68(0.71)	3.69(0.66)	3.69(0.68)	3.62(0.56)	3.63(0.70)	3.63(0.64)
<i>Competence</i>						
Time 1	2.62(0.70)	2.85(0.64)	2.73(0.68)	2.63(0.69)	2.77(0.73)	2.71(0.71)
Time 2	2.58(0.78)	2.80(0.70)	2.69(0.75)	2.74(0.69)	2.78(0.74)	2.76(0.71)
Time 3	2.63(0.75)	2.93(0.71)	2.78(0.74)	2.72(0.78)	2.91(0.75)	2.82(0.73)
Time 4	2.63(0.77)	2.98(0.62)	2.81(0.72)	2.66(0.76)	2.80(0.71)	2.73(0.73)
Time 5	2.59(0.78)	2.91(0.67)	2.75(0.74)	2.61(0.68)	2.91(0.73)	2.77(0.72)
<i>Fitness</i>						
Time 1	54.20(26.83)	58.80(28.17)	56.47(27.55)	44.71(29.90)	44.37(27.78)	44.52(28.72)
Time 2	57.71(28.73)	58.59(32.12)	58.14(30.41)	63.55(27.06)	58.99(29.49)	61.07(28.46)
Time 3	57.38(23.23)	59.91(27.95)	58.71(25.79)	56.99(25.87)	54.75(28.06)	55.77(27.06)
Time 4	66.18(20.60)	69.17(24.82)	67.74(22.90)	66.23(23.73)	66.93(26.93)	66.61(25.45)
Time 5	68.06(24.48)	66.63(29.25)	67.31(27.04)	66.97(27.15)	67.35(28.65)	67.17(27.91)

Note. Mean (Standard Deviation)

Table 2.
Zero-order Pearson correlations of outcome variables.

Variable	1	2	3	4	5	6	7	8	9
1. att.1									
2. att.2	.63**								
3. att.3	.55**	.69**							
4. att.4	.54**	.63**	.78**						
5. att.5	.46**	.60**	.72**	.77**					
6. comp.1	.18**	.13**	.20**	.21**	.14**				
7. comp.2	.13**	.18**	.19**	.17**	.13**	.59**			
8. comp.3	.17**	.22**	.24**	.21**	.17**	.50**	.63**		
9. comp.4	.14**	.15**	.21**	.17**	.17**	.50**	.61**	.70**	
10. comp.5	.11*	.06	.12*	.16**	.18**	.51**	.59**	.63**	.70**

Note. ***= $p < .001$; **= $p < .01$; *= $p < .05$

Examining Growths of Attitude and Competence Over Time

Growth of Attitude Toward PE

To examine the growth of students' attitude toward PE across five occasions, a univariate growth analysis was conducted for the combined sample. As seen in Table 3, the results of comparative fit indices (CFI, TLI, RMSEA) indicate that the model fits well for the attitude outcomes (CFI= 0.962, TLI = 0.973, RMSEA = 0.057 [0.038, 0.076]). With regard to attitude, the mean linear slope was significant and negative, indicating that students' positive attitude toward PE tended to decrease over time ($\mu = -0.09, p < .01$), suggesting that attitudes toward PE did show changes over time in both cohorts. Therefore, in response to RQ1 we observe significant changes in attitude toward PE over time.

Growth of Perceived Competence

Similarly, a univariate growth analysis was conducted for the competence measure, too (see Table 3). The results of comparative fit indices indicate a good fit (CFI= 0.963, TLI= 0.974, RMSEA= 0.057 [0.039, 0.077]). Unlike the attitude toward PE measure, there were no significant changes observed in students' competence over time (i.e., slope in Table 3). This is

indicated by the nonsignificant mean slope. Therefore, in response to RQ2, we did not observe significant changes in competence toward PE over time.

Table 3.

Estimated parameters of univariate linear growth models for attitude and competence.

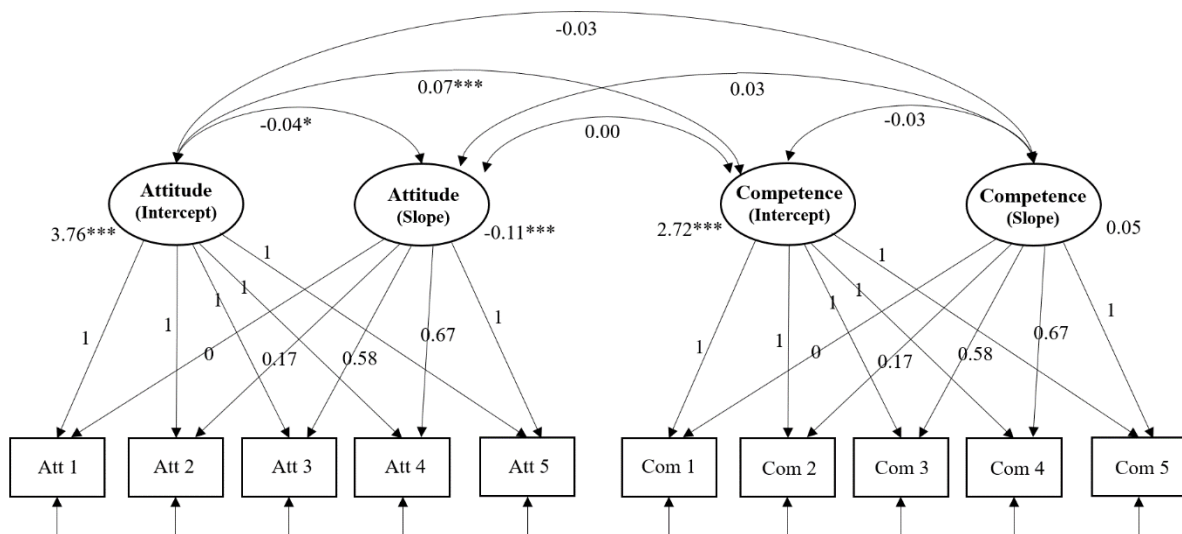
	Attitude	Competence
Intercept	3.72***	2.72***
Slope	-0.09**	0.05
Var(Intercept)	0.30***	0.30
Var(Slope)	0.15**	0.15
Cov(Intercept,Slope)	-0.05*	-0.03
CFI	0.962	0.963
TLI	0.973	0.974
RMSEA	0.057 [0.038, 0.076]	0.057 [0.039, 0.077]

Longitudinal Relationship Between Attitude and Competence

To investigate the longitudinal relationships between attitude and competence (RQ3), a multivariate growth model (McArdle, 1988) was fitted to the combined sample. The analysis results are summarized in Figure 1. The results indicate that students with more positive initial attitude toward PE tend to exhibit higher initial competence, as indicated by the significant covariance between intercept of attitude and the intercept of competence ($\sigma = 0.07, p < .001$). Additionally, students who with more positive initial attitude toward PE tended to change over time exhibit a room for more rapid decline over time ($\sigma = -0.04, p < .05$).

Figure 1.

The Multivariate Latent Growth Model of Attitude and Competence. Unstandardized Estimates.



Note. CFI= 0.964, TLI= 0.966, RMSEA= 0.049 [0.038, 0.060]; ***= $p < .001$; **= $p < .01$; *= $p < .05$

Fitness as a Time-Varying Covariate Predicting Attitude and Competence

To examine the predictive power of fitness test scores, we conducted a linear growth model with covariates. In this model, fitness scores (percent of fitness scores passed), gender (female and male), and grade (grade 4 and grade 5) were included as covariates (predictors), while attitude toward PE and perceived competence served as the dependent variables. Since the fitness test scores could vary across different measurement occasions for each individual, the variable was treated as a time-varying covariate with both the current fitness test score and the immediate past occasion were entered as predictors.

Fitness Predicting Attitude Toward PE Over Time

The results are summarized in the first two columns of Table 4. In partial response to RQ4, our research question concerned that students' attitude in the current occasion are correlated with their fitness test scores at both current and previous occasions. Therefore, we included their fitness scores measured at the current occasion and the immediate past occasion as predictors. As seen in Table 4, we did not find any relationships between fitness scores and attitude across measurement occasions. This suggests that attitude toward PE may not be influenced by students' fitness scores in this cohort.

Table 4.

Unstandardized estimates of univariate linear growth models for attitude and competence with fitness score (percentage of pass) as a time-varying covariate

	Attitude	Competence
Intercept	4.214***	2.705***
Slope	-0.452	0.012
Fitness	0.000	0.002***
Fitness Lag1 (2)	0.000	0.001
Fitness Lag1 (3)	0.001	0.003***
Fitness Lag1 (4)	0.001	0.003***
Fitness Lag1 (5)	0.002	0.003***
Gender (Intercept)	0.019	-0.172**
Gender (Slope)	-0.045	-0.006
Grade (Intercept)	-0.109*	-0.006
Grade (Slope)	0.050	-0.036
Var(Intercept)	0.271***	0.279***
Var(Slope)	0.202***	0.156***
Cov(Intercept, Slope)	-0.043*	-0.056*
CFI	0.961	0.942
TLI	0.956	0.935
RMSEA	0.049 [0.034, 0.063]	0.053 [0.039, 0.067]

Note. ***= $p < .001$; **= $p < .01$; *= $p < .05$

Fitness Predicting Perceived Competence Over Time

The same model was used to examine the impact of fitness test scores on students' perceived competence. Specifically, we found that the greater fitness scores from the immediate past occasions were correlated with greater perceived competence in general ($b = .003, p < .001$ for time 3, time4, and time5). Additionally, there was a significant relationship between fitness score and competence scores measured at the same time point ($b = .003, p < .001$). In all cases, those who performed better on the fitness tests, reported greater perceived competence in the following assessment. Therefore, in response to RQ4, we found that students' perceived competence is significantly influenced by their fitness levels at both the current and previous occasions.

Discussion

The purpose of this study was to assess students' attitudes toward PE and perceived physical competence over time to explore potential relationships and predictive factors of their fitness test performance. One of the major contributions of this study, supported by the TPB (Ajzen, 1991), is that it is one of the first studies showing longitudinal relationships and potential interaction of attitudes and competence towards PE, which are two pillars of behavioral intention. This study shows how attitudes can shift and how previous content can predict future attitudes. We also found that understanding the actual relationship between competence and attitude over time allows for a better understanding of the components of the TPB within the PE context.

The data suggest that attitudes tend to change over longer periods of time, more so than students' perceived competence, which tends to change more in the moment and less over time. However, when attitudes did change, particularly in the positive direction, there was an associated positive change in perceived competence. This suggests that when attitudes change there is likely a strong contribution from one's perceived competence changing in the moment as well. This relationship likely works in reverse in that if one's attitude towards PA reduces it is likely connected to a reduction in their perceived competence as well.

The results also point to the fact that attitude is more of a global perspective than one that changes within any particular event. The evidence found that while attitude at one time point was not predictive of fitness scores or competence at that same time point, trends, and signification predictions from previous time points of attitude were predictive of subsequent outcomes at future time points. Previously developed attitudes, and likely vicarious experiences remembered from previous fitness testing and PE practices, were more impactful than "in the moment" attitudes. Thus, it is not that surprising that attitude is not a predictor at the time point, but it is a predictor for future attitude in subsequent time points. A student might not have a strong, positive or negative attitude in the moment, yet they could have a strong attitude based on the previous experiences they had (e.g., embarrassing experiences during previous fitness testing).

These findings may explain why research shows this age group begin to show separations on the spectrum of attitudes from being in the middle to more of the extreme ends of positive and negative attitudes over time. In other words, attitude scores become either highly negative or highly positive, and we may lose the "middle ground" as has been evident in past research where standard deviations of attitude scores move to the poles quite dramatically as students progress through middle school (Mercier et al., 2017). This study provides evidence that attitudes, on

average, across youth are not changing much, yet we are seeing more severe negative and positive attitudes form within youth pushing them to the boundaries of the attitude spectrum from positive to negative. Therefore, it may be that those who have strong, positive previous experiences of fitness testing are going to continue to sway in that direction as their competence builds strengthening their attitude while negative experiences and reduced competency push students to further held negative attitudes for PE and other PA activities.

Logical interpretation of this data would suggest that regardless of the content (i.e., fitness testing or another activity), that continued negative and unfavorable experiences with PE content will perpetuate stronger and continued negative experiences for students. This is particularly concerning because attitudes can progressively become more solidified and rigid making them more difficult to change and students less susceptible to new and novel PE experiences. However, it appears that competence can dictate attitude and likely intention, so this component can likely strengthen one's held attitude beliefs or potentially change their attitudes. Basically, when we see a spike in competence, we are likely to see a strong incremental growth in continued competence over time. Thus, competence may also be a prerequisite that is required to increase student attitudes at a higher rate. Importantly, the same is true in the opposite direction. The less competent a student feels over time, the sharper their decline in attitude towards those activities.

According to TPB (Ajzen, 1991; Silverman, 2017) both competence and attitude influence intention, yet information on how these components interact or influence one another has not received as much attention. These concepts do not appear to be isolated fully and interventions are needed to make longitudinal changes. Our data suggests that building competence in the moment and reflecting on previous positive experiences that sparked positive attitudes needs to be referred to often to maintain a positive trajectory in attitude growth and potentially mitigate the onset of negative attitudes or engrained siloed negative feelings. Interventions should consider identifying students with previous negative experiences, and/or those susceptible to finding the task difficult, and take deliberate steps to reduce or eliminate their negative experiences and subsequent beliefs that form due to the negative beliefs.

Separation in attitudes towards PE, PA, and fitness has continued to be identified and the same was found in this study. While 4th and 5th grade students did show relatively close mean scores in perceived attitudes and competence, it was interesting to see the competence and the testing mechanisms themselves tended to continue to favor male students. So, even if fitness testing has some sort of merit which many have argued against (Alfrey & Gard, 2014; Gard & Pluim, 2017), we are still seeing that male confidence, the mechanisms, and the testing protocol tend to still favor male participants, or at least their perceived attitudes. Therefore, we should not be expecting female students to gain more confidence and more positive attitude in this test/experience if we continually see it is favoring male students.

In PE, teachers and fitness testing traditionally promotes masculinity, and a competitive nature that favors more muscular people who want to perform at the highest level (Domangue & Solomon, 2009). Thus, it should not be surprising that those who start with positive attitudes in a traditional physical education setting, and who experience teachers who further reinforce the traditional values in PE in which males and especially muscular and fit males fit into continue to excel, and have positive attitudes. Conversely, those students who feel left out of this "group" end up liking PE even less the more they experience it. Thus, to "fix" PE we must start at an earlier age, by doing things that help promote attitude, motivation, and engagement, to students who may not ordinarily enjoy the things we traditionally do in PE.

Simonton and colleagues (2019) found a lack of relationship between fitness testing as a singular PE component, and students' attitudes towards PE. So, in a cross-sectional evaluation, research has not connected fitness testing to values of PE. But we argue, based on the longitudinal nature of this study, if students are repeatedly asked to do fitness testing, it may begin to impact their perceived attitudes and competence towards PE. From a practical perspective, do students see fitness testing as a key component of the PE experience and connected to the goals of PE, or is it simply viewed as "in addition" to PE with less value and need? Our results suggest that it is imperative to evaluate attitudes and competence as they relate to performance and behavior over time because of the nature of these psychosocial variables. Previous research shows that intervention timelines (Chatzisarantis & Hagger, 2005) that span as long as 8- 16-, and even 32-weeks show little change in behavior and beliefs, traditionally. To fully evaluate the TPB's ability to explain attitudes and behaviors the interactive nuances, the context, and gender of the participants must be considered.

Conclusion

This study was developed to fill a gap of longitudinal research on both attitudes and perceived competence. We found that greater fitness scores at current and previous time points is associated with greater competence scores at all time points. While general attitudes toward PE and fitness testing have shown downward trends (Silverman, 2017), these data help to identify the magnitude of those fluctuations which provides potential suggested points to intervene. Additionally, it appears the shared or cyclical relationship between attitude and competence work together to shape changes over time.

Funding

This work was supported by the Carol M. White Physical Education Program (PEP) and America on Track.

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational and Human Decision Processes*, 50, 179-211.
- Alfrey, L., & Gard, M. (2014). A crack where the light gets in: A study of health and physical education teachers' perspectives on fitness testing as a context for learning about health. *Asia-Pacific Journal of Health, Sport and Physical Education*, 5, 3-18. <https://doi.org/10.1080/18377122.2014.867790>
- Barnett, L. M., van Beurden, E., Morgan, P. J., & Beard, J. R. (2008). Perceived sports competence mediates the relationship between childhood motor skill proficiency and adolescent physical activity and fitness: A longitudinal assessment. *International Journal of Behavioral Nutrition and Physical Activity*, 5(40), 1479-1458. <https://doi.org/10.1186/1479-5868-5-40>
- Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, 107(2), 238-246.

- Bernstein, E., Phillips, S. R., & Silverman, S. (2011). Attitudes and perceptions of middle school students toward competitive activities in physical education class. *Journal of Teaching in Physical Education, 30*, 69–83. <https://doi.org/10.1123/jtpe.30.1.69>
- Cale, L., & Harris, J. (2009). Fitness testing in physical education: A misdirected effort in promoting healthy lifestyles and physical activity. *Physical Education & Sport Pedagogy, 14*(1), 89-108. <https://doi.org/10.1080/17408980701345782>
- Carson, R., & Webster, C. (2020). *Comprehensive School Physical Activity Programs*. Illinois: Human Kinetics.
- Center for Disease Control and Prevention. (2016). *National health and nutrition examination survey*. <https://www.cdc.gov/nchs/nhanes/index.htm>.
- Chatzisarantis, N. L. D. & Hagger, M. S. (2005). Effects of a brief intervention based on the theory of planned behavior on leisure-time physical activity participation. *Journal of Sport and Exercise Psychology, 27*(4), 470-487. <https://doi.org/10.1123/jsep.27.4.470>
- Chen, S., Sun, H., Zhu, X., & Chen, A. (2014). Relationship between motivation and learning in physical education and after-school physical activity. *Research Quarterly for Exercise and Sport, 85*(4), 468–477. <https://doi.org/10.1080/02701367.2014.961054>
- Cooper, K. H., Everett, D., Meredith, M. D., Kloster, J., Rathbone, M., & Read, K. (2010). Preface: Texas statewide assessment of youth fitness. *Research Quarterly for Exercise and Sport, 81*(sup3), sii-siv. <https://doi.org/10.1080/02701367.2010.10599687>
- Cooper, K. H., Greenberg, J. D., Castelli, D. M., Barton, M., Martin, S. B., & Marrow, J. R. (2016). Implementing policies to enhance physical education and physical activity in schools. *Research Quarterly for Exercise and Sport, 87*, 133-140.
- Domangue, E. A., & Solmon, M. A. (2009). Feminist poststructuralist examination into the president's challenge physical fitness awards program. *Gender and Education, 21*(5), 583–600. <https://doi.org/10.1080/09540250802467943>
- Donovan, C. B., Mercier, K., & Phillips, S. R. (2015). Investigating attitudes toward physical education: Validation across two instruments. *Measurement in Physical Education and Exercise Science, 19*(2), 91-98. <https://doi.org/10.1080/1091367X.2015.1012511>
- Ferguson, R. H., Keating, X. D., Bridges, D. M., Guan, J., & Chen, L. (2007). California secondary school physical education teachers' attitudes toward the mandated use of Fitnessgram. *Journal of Teaching in Physical Education, 26*(2), 161–176. <https://doi.org/10.1123/jtpe.26.2.161>
- Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior: The reasoned action approach*. Psychology Press. <https://doi.org/10.4324/9780203838020>
- Gard, M. & Pluim, C. (2017). Why is there so little critical physical education scholarship in the United State? The case of Fitnessgram. *Sport, Education and Society, 22*(5), 602-617.

- Graham, D. J., Sirard, J. R., & Neumark-Sztainer, D. (2011). Adolescents' attitudes toward sports, exercise, and fitness predict physical activity 5 and 10 years later. *Preventive Medicine, 52*(2), 130-132. <https://doi.org/10.1016/j.ypmed.2010.11.013>
- Hagger, M. S., Chatzisarantis, N. L. D., & Biddle, S. J. H. (2002). A meta-analytic review of the theories of reasoned action and planned behavior in physical activity: Predictive validity and the contribution of additional variables. *Journal of Sport and Exercise Psychology, 24*(1), 3-32. <https://doi.org/10.1123/jsep.24.1.3>
- Harter, S. (2012). Self-perception profile for adolescents: Manual and questionnaires. Denver, CO: University of Denver, Department of Psychology
- Harter, S. (1992). *The relationship between perceived competence, affect, and motivational orientation within the classroom: Processes and patterns of change*. Cambridge University Press.
- Katzmarzyk, P. T., Denstel, K. D., Beals, K., Bolling, C., Wright, C., Crouter, S. E., McKenzie, T. L., Pate, R. R., Saelens, B. E., Staiano, A. E., Stanish, H. I., & Sisson, S. B. (2016). Results from the United States of America's 2016 report card on physical activity for children and youth. *Journal of Physical Activity & Health, 13*(11 Suppl 2), S307–S313. <https://doi.org/10.1123/jpah.2016-0321>
- Martinen, R., Fredrick, R., & Silverman, S. (2018). Changes in student attitude toward physical education across a unit of instruction. *Journal of Physical Education and Sport, 18*(1), 62-70. <https://doi.org/10.7752/jpes.2018.01008>
- McArdle, J. J. (1988). Dynamic but structural equation modeling of repeated measures data. Chap. In J. R. Nesselroade & R. B. Cattell (Eds.), *Handbook of multivariate experimental psychology*, (pp. 561–614). Plenum Press. https://doi.org/10.1007/978-1-4613-0893-5_17
- McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviours with the theory of planned behaviour: A meta-analysis. *Health Psychology Review, 5*(2), 97-144. <https://doi.org/10.1080/17437199.2010.521684>
- Mercier, K., Simonton, K., Centeio, E., Barcelona, J., & Garn, A. (2022). Middle school students' attitudes toward physical activity and physical education, intentions, and physical activity behavior. *European Physical Education Review 0*(0), 1–15 <https://doi.org/10.1177/1356336X221106051>
- Mercier, K., Donovan, C., & Gibbone, A. (2020). Investigating the effects of federal funding on students' attitudes toward physical education. *The Physical Educator, 77*(1), 59-77. <https://doi.org/10.18666/TPE-2020-V77-11-9546>
- Mercier, K., Phillips, S., & Silverman, S. (2016). High school physical education teachers' attitudes use of fitness tests. *The High School Journal, 99*(2) 179-190. <https://doi.org/10.1353/hsj.2016.0001>

- Mercier, K., Donovan, C., Gibbone, A., & Rozga, K. (2017). Three-year study of students' attitudes toward physical education: Grades 4-8. *Research Quarterly for Exercise and Sport*, 88, 307-315.
- Mercier, K., & Silverman, S. (2014). High school students' attitudes toward fitness testing. *Journal of Teaching in Physical Education*, 33(2), 269-281. <https://doi.org/10.1123/jtpe.2013-0153>
- Muthén, L. K., & Muthén, B. O. (2017). *Mplus: Statistical Analysis with Latent Variables: User's Guide* (Version 8). Los Angeles, CA: Authors.
- Phillips, S., Marttinen, R., Mercier, K., & Gibbone, A. (2020). Middle school students' perceptions of physical education: A qualitative look. *Journal of Teaching in Physical Education*, 40(1), 30-38. <https://doi.org/10.1123/jtpe.2019-0085>
- Phillips, S., & Silverman, S. (2015). Upper elementary school attitudes toward physical education. *Journal of Teaching in Physical Education*, 34(3), 316-327.
- Phillips, S.R., & Silverman, S. (2012). Development and validation of scores of an instrument to measure fourth and fifth grade student attitude toward physical education. *Measurement of Physical Education and Exercise Science*, 16, 316-327. <https://10.1080/1091367X.2012.693359>
- Plowman, S. A. (2013). Muscular strength, endurance, and flexibility assessments. *Fitnessgram/Activitygram reference guide*, 8, 1.
- R Core Team. (2021). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>
- Raudsepp, L., Liblik, R., & Hannus, A. (2002). Children's and adolescents' physical self-perceptions as related to moderate to vigorous physical activity and physical fitness. *Pediatric Exercise Science*, 14(1), 97-106. <https://doi.org/10.1123/pes.14.1.97>
- Sallis, J. F., McKenzie, T. L., Beets, M. W., Beighle, A., Erwin, H., & Lee, S. (2012). Physical education's role in public health. *Research Quarterly for Exercise and Sport*, 83(2), 125-135.
- Sallis, J. F., Prochaska, J. J., & Taylor, W. C. (2000). A review of correlates of physical activity of children and adolescents. *Medicine and Science in Sports and Exercise*, 32(5), 963-975. <https://doi.org/10.1097/00005768-200005000-00014>
- Silverman, S. (2017). Attitude research in physical education: A review. *Journal of Teaching in Physical Education*, 36(3), 303-312. <https://doi.org/10.1123/jtpe.2017-0085>
- Silverman, S., Keating, X. D., & Phillips, S. R. (2008). A lasting impression: A pedagogical perspective on youth fitness testing. *Measurement in Physical Education and Exercise Science*, 12(3), 146-166. <https://doi.org/10.1080/10913670802216122>

- Simonton, K. L., Mercier, K., & Garn A. C. (2019). Do fitness test performance predict students' attitudes and emotions toward physical education? *Physical Education and Sport Pedagogy*, 24(6), 549-564. <https://doi.org/10.1080/17408989.2019.1628932>
- Simonton, K. L., Mercier, K., & Garn, A. C. (2021). Development of youth physical activity attitude scale (YPAAS) for elementary and middle school students. *Measurement in Physical Education and Exercise Science*, 25(2), 110-126. <https://doi.org/10.1080/1091367X.2020.1847113>
- Society of Health and Physical Educators. (2014). *National standards and grade-level outcomes for K-12 physical education*. Reston, VA: Author.
- Solmon, M. A. (2003). Student issues in physical education classes: Attitude, cognition, and motivation. In S. J. Silverman & C.D Ennis (Eds.), *Student learning in physical education: Applying research to enhance instruction* (2nd ed., pp. 147-156). Champaign, IL: Human Kinetics
- Steiger, J. H. (1990) Structural model evaluation and modification: An interval estimation approach. *Multivariate Behavioral Research*, 25, 173-180. https://doi.org/10.1207/s15327906mbr2502_4
- Subramaniam, P. R., & Mercier, K. (2017). Attitudes matter in physical education. *International Journal of Physical Education*. 54(4), 22-30.
- Subramaniam, P. R., & Silverman, S. (2000). Validation of scores from an instrument assessing student attitude toward physical education. *Measurement in Physical Education and Exercise Science*, 4(1), 29-43. https://doi.org/10.1207/S15327841Mpee0401_4
- Subramaniam, P. R. & Silverman, S. (2002). Using complimentary data: An investigation of student attitude in physical education. *Journal of Sport Pedagogy*, 8, 74-91.
- Subramaniam, P. R. & Silverman, S. (2007). Middle school students' attitude toward physical education. *Teaching and Teacher Education*, 23(5), 602-611. <https://doi.org/10.1016/j.tate.2007.02.003>
- Tucker, L. R., & Lewis, C. (1973). A reliability coefficient for maximum likelihood factor analysis. *Psychometrika*, 38, 1-10. <https://doi.org/10.1007/BF02291170>
- United States Department of Health and Human Services. (2018). *Physical activity guidelines for Americans* (2nd ed.). U.S. Department of Health and Human Services.
- Wang, Y., & Hollett, N. L. (2022). Cognitive, affective, and global attitude toward physical activities with different intensities. *International Journal of Sport and Exercise Psychology*, 20, 551-568. <https://doi.org/10.1080/1612197X.2020.1869803>
- Welk, G. J. (2008). The role of physical activity assessments for school-based physical activity promotion. *Measurement in Physical Education and Exercise Science*, 12(3), 184-206. <https://doi.org/10.1080/10913670802216130>