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Motivational Climates, Achievement Goals, and Physical Education Outcomes: A Longitudinal Test of Achievement Goal Theory

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The present research tested the longitudinal relations over a school-year between motivational climates, achievement goals, and five physical education outcomes, namely intrinsic motivation, perceived competence, positive attitude, exertion, and attendance in physical education. The results showed that students' mastery goals measured early in the school-year (Time 1) predicted all five physical education outcomes one year later (Time 2), controlling for physical education outcomes at Time 1. Two structural equation change models of climates and goals were also tested: (1) change in mastery climate predicted positively change in mastery goals, which positively predicted physical education outcomes after one year; and (2) distinct performance climate sub-factors, namely changes in normative praise and negative emotional tone, predicted positive changes in performance-approach, and performance-avoidance goals, respectively. In turn, change in performance-approach goals predicted positively, and change in performance-avoidance goals predicted negatively, the PE outcomes after one year.

Keywords: motivational climate, achievement goals, physical education outcomes

National statistics and research in Norway indicate that physical activity decreases after early teenage years, and that about half of the population is too seldom active to achieve health benefits from their physical activity (Anderssen & Andersen, 2004; Luepker, 1999; MMI, 2004; Sjøgaard, Bø, Klungland, & Jacobsen, 2000). In schools, the same decline is observed. In Greece, for instance, a decline in physical education effort and behavior are observed from the end of elementary school to the end of high school (Marsh, Papaioannou, Martin, & Theodorakis, 2006). This is unfortunate because physical inactivity among young people aged 15–20 strongly predicts adult physical inactivity levels (Anderssen & Andersen, 2004), and because physical inactivity is related to numerous illnesses such as coronary artery disease, type 2 diabetes, and some forms of cancer (Gardner & Hailwail, 2000; Wichelgren, 1998), and to reduced well-being, mood disturbances, and depression (Carmamach & Martens, 1979; Koplan, Powell, Sikes, Shirley, & Campbell, 1982; McDonald & Hodgdon, 1991). Physical inactivity is a health risk factor among other health behavior risks, which totally are estimated to account for 40% of mortality and up to 75%

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of healthcare costs in the USA (Schroeder, 2007; Woolf et al., 2005). Due to such concerns, physical education at school has become an important arena in which change in physical activity can be stimulated among children and youth. Curriculum contents emphasize the importance of physical education conditions to stimulate young students to learn new skills, to exercise, to have fun, to come together with friends, and to develop positive and healthy attitudes toward physical activity (Norwegian Ministry of Education, 2006). In their action plan for the 2005–2009 period, The Ministry of Health in Norway recommend children and youth to be physically active at least one hour every day at an intensity level ranging from moderate to high (Norwegian Ministry of Health, 2005).

It is known that drop-out from upper secondary education in Norway (Central Bureau of Statistics, 2006; Norwegian Ministry of Education, 2006) and non-adherence to behavioral healthcare regimens (Horwitz & Horwitz, 1993) are monumental problems. Conversely, Achievement Goal Theory research has devoted considerable attention to understanding educational behavior. Achievement Goal Theory evidence and applications indicate that adherence to educational behavior can be facilitated by learning environments emphasizing improvement and personal progress, which make pursuits of mastery goals meaningful for students (Ames, 1992b; Ames & Archer, 1988; Anderman & Midgley, 1997; Church, Elliot, & Gable, 2001; Papaioannou, 1997; Treasure, 1993, 1997). Thus, an aim of the present study was to examine the longitudinal influence of motivational climates in physical education and students' achievement goals on their physical education outcomes.

Motivational Climates and Achievement Goals

In accordance with Achievement Goal Theory models (Church, Elliot, & Gable, 2001; Elliot & Church, 1997), we examined motivational climate variables as antecedents of mastery, performance-approach, and performance-avoidance goals. Achievement goal theory (Ames, 1992a, 1992b; Biddle, 2001; Roberts, 2001) has distinguished mastery- and performance-oriented climates that describe the social context in school classrooms, sport, and physical activity. According to Roberts (2001), mastery or performance climates are related to how significant others (e.g. teacher, coach, or parent) structure the environment. A mastery climate in physical education may be characterized by teachers' promotion of learning and support, and students' perception of a helping atmosphere where effort is important for improvement. Conversely, a performance climate may be described by teachers' promotion of competition and normative comparison of students, as well as students' perception of intra-student rivalry, normative praise, and unequal recognition, the view that mistakes are punished, and students' worries about mistakes (Biddle, 2001; Duda & Whitehead, 1998; Walling, Duda, & Chi, 1993).

Church et al. (2001) examined teachers' lecture engagement, a classroom environment variable that has a lot in common with a mastery climate due to its stimulation of the learning process, and found it positively associated with mastery goal adoption among students. Mastery goals, which were called learning goals by Dweck and task goals by Nicholls, involve the aim of task learning, improving one's skills, and competence development (Ames, 1992a; Dweck, 1986; Nicholls, 1984). In the description of performance climates above, normative praise/unequal recognition of students and the view that mistakes are punished correspond more to classroom environmental variables labeled "evaluation focus" and "harsh evaluation," respectively, by Church et al. (2001). In their study, they found an evaluation focus to be positively associated with adoption of both performance-approach and performance-avoidance

goals, whereas harsh evaluation was clearly positively linked to only performance-avoidance goals. Recent research supports these links between climates and adoption of achievement goals in physical activity and physical education. A perceived mastery climate among students was most strongly positively correlated with mastery goals, whereas a perceived performance climate was most strongly positively correlated with performance-approach and performance-avoidance goals (Ommundsen, 2006; Skjesol & Halvari, 2005). By definition, performance-approach goals concern striving toward the attainment of normative competence, whereas performance-avoidance goals concern behaving in order to avoid normative incompetence (Elliot & Church, 1997; Elliot & Harackiewicz, 1996).

This reasoning implies that a positive correlation is expected between a perceived mastery climate and mastery goals among students. Conversely, a perceived performance climate with emphasis on normative praise is expected to be positively linked to both performance-approach and performance-avoidance goals, whereas the view that mistakes are punished (labeled negative emotional tune in this study) is expected to be positively linked to performance-avoidance goals.

Achievement Goals and Outcomes

Very few longitudinal Achievement Goal Theory studies have been carried out in the physical education domain (Marsh et al., 2006). Due to this we will also review research in the domains of education in general, physical activity, and sport as a basis for our study hypotheses.

The dichotomous achievement goal theory model made a distinction between mastery and performance goals, also called learning/task goals and ego goals, respectively (Dweck, 1986; Nicholls, 1984). Two recent reviews of research based on this model are available in the domains of education (Vansteenkiste, Smeets, Soenens, Lens, Matos, & Deci, 2010) and physical activity and sport (Roberts, Treasure, & Conroy, 2007). Mastery goals were associated with various positive outcomes such as intrinsic motivation, self-regulated learning, and deep learning, but not performance. Conversely, the findings for performance goals were inconsistently related to the same outcomes. Performance goals were more likely related to negative learning-related outcomes, and were found to predict performance in some studies, but other studies failed to confirm these findings.

Elliot and Harackiewicz (1996; Elliot & Church, 1997) challenged these inconsistencies and suggested splitting the performance goals, defined above, into the classical achievement motivation terms of approach and avoidance (Atkinson, 1964). They argued that performance-approach goals should yield positive performance outcomes because the external focus of these goals leads people to select strategies that yield high achievement. The recent reviews of the research on this trichotomous model (Roberts, Treasure, & Conroy, 2007; Vansteenkiste et al., 2010) confirmed again that the consequences of adopting mastery goals are positive, that the consequences of performance-avoidance goals are negative, and that the implication of adopting performance-approach goals is not invariantly positive, but mixed. Other research adds to the mixed evidence for performance-approach goals among climbers (Sarrazin, Roberts, Cury, Biddle, & Famose, 2002) and soccer players (Thomassen & Halvari, 2007).

The inconsistent findings for performance-approach goals were again challenged by Elliot and colleagues in their 2 x 2 Achievement Goals Model (Elliot, 1999, 2005; Elliot & Moller, 2003; Elliot & Thrash, 2001). They argued that the negative effects of performance-approach

goals were primarily found in empirical studies in which ego-validation concerns were part of the measure or induction of performance-approach goals. Achievement goals can be undergirded by different regulations or motives, one of which is ego-involvement. Thus, Elliot and colleagues removed ego-involvement from the definitions of performance goals. By definition, performance-approach goals are pursued by an aim to attain and demonstrate competence by performance, which surpasses the performance of others or of normative standards, whereas performance-avoidance goals are aimed at avoiding doing worse than specific others or below a normative standard (see also Vansteenkiste et al., 2010). The present study used the Achievement Goal Questionnaire (AGQ; Elliot & Church, 1997). In order to be consistent with the new definition of performance-approach goals proposed, items focusing on ego-involvement were removed (see the Methods section). The reason for choosing the Achievement Goal Questionnaire and not the more recent scale developed by Elliot and McGregor (2001) was related to results from a Norwegian study (Skjesol & Halvari, 2005), which yielded indications of good reliability and validity for the Achievement Goal Questionnaire. However, the Achievement Goal Questionnaire has been challenged by critique because the prefixes of some items focus on a value (e.g., "It is important for me to do better than other students"), an affect (e.g., "I am afraid..."), or a concern (e.g., "I worry...") rather than an aim (Elliot & Murayama, 2008). Such values, affects, and concerns may overlap with the wording of items used to measure motives or reasons behind goals, and might therefore in particular be problematic in studies which model the motive to achieve and the fear of failure as antecedents of achievement goals.

The recent literature for the 2 x 2 Achievement Goal Model has been reviewed by Moller and Elliot (2006) and by Roberts, Treasure, and Conroy (2007). In general, the consequences of adopting a mastery-approach goal are overwhelmingly positive. In the review by Roberts and colleagues the performance-approach goal orientation was the only goal to be positively associated with superior performance. This goal was also positively associated with adaptive achievement outcomes such as more absorption, competence valuation, and intrinsic motivation, and with less anxiety. In the few studies conducted so far on the 2 x 2 Achievement Goal Framework in the domain of sport and exercise, the performance-approach goal orientation was not associated with any maladaptive achievement consequences. In the literature review by Moller and Elliot (2006), performance-approach goals were also positively correlated with performance in different studies but also positively associated with maladaptive help seeking strategies. Thus, performance-approach goals are potentially valuable, but represent vulnerable forms of behavior regulation at the same time. The consequences of mastery-avoidance and, particularly, performance-avoidance goals were consistently maladaptive (Moller & Elliot, 2006), that is, positively associated with test anxiety, worry, emotionality, disorganization, health center visits, and maladaptive help seeking strategies, and negatively linked to indications of learning (Moller & Elliot, 2006; Roberts, Treasure, & Conroy, 2007). In the summary of research related to sport and physical activity, consequences of performance-avoidance goals were very negative for both learning indications and performance, as well as for intrinsic motivation (Roberts, Treasure, & Conroy, 2007).

Structural Models with Hypotheses

In the structural models achievement goals are conceptualized as mediators, structurally situated between motivational climates and specific behaviors or outcomes (Church et al.,

2001). This means that the links between perceived mastery and performance climates on outcomes are posited to be indirect through goals, and the relations between goals and outcomes are suggested to be direct and proximal. We used a longitudinal model for two waves of data recommended by Cole and Maxwell (2003) to test the links between motivational climates and achievement goals at T1 on physical education outcomes one year later, controlling for T1 outcomes. Next, a structural model (Church et al., 2001) was tested in which change in motivational climates and achievement goals from T1 to T2 were tested on physical education outcomes at the end of the school-year. For both approaches, the following hypotheses were tested: (H1) perceived mastery climate among physical education students is expected to be indirectly positively related to physical education outcomes through mastery goals; (H2) perceived performance climate among physical education students is expected to be indirectly positively related to physical education outcomes through performance-approach goals; and (H3) perceived performance climate among physical education students is expected to be indirectly negatively related to physical education outcomes through performance-avoidance goals.

Methods

Participants

Students in a junior high school in Norway were tested. A sample of 173 students were first tested in the fall of 2005 (Time 1) and 152 of the same students were tested one year later in the fall of 2006 (Time 2). In the fall of 2005 the age range of students was from 13 to 14 years (i.e., grade level 8 and 9; females = 50%). Immediately after the first round of data collection, the students were offered an opportunity to be physically active for one hour every school-day. This was the first trial with daily physical activity at school in Norway, and was limited to this school. Daily physical activity contrasted with the normal curriculum with only three physical education lessons per week. On the two week-days without physical education, the first hour of the school-day was free for outdoor physical activity and the students were encouraged to choose their activity themselves. No professional teacher organization of the two days with morning physical activity was offered. Thus, at the second round of data collection all the students had experienced daily physical activity or physical education at school for one year and, therefore, we measured positive attitudes toward daily physical activity at school after one year as one of five outcomes (see below).

Drop-outs

From the first to the second data collection 21 students (11.6 %) dropped out of the study due to sickness or they were absent for other reasons. A comparison of drop-outs and participants ($n = 152$) yielded no significant differences for age ($X^2 = 0.01$, $p = 0.94$) or gender ($X^2 = 0.00$, $p = 1.00$). In addition, the tests for differences between means for drop-outs and participants were not significant for Time 1 measures of perceived mastery climate ($t = -0.81$, $p = .42$), mastery goals ($t = -1.26$, $p = .21$), performance-approach goals ($t = 0.03$, $p = .97$), performance-avoidance goals ($t = -0.15$, $p = .88$), intrinsic physical education motivation ($t = 0.43$, $p = .67$), perceived physical education competence ($t = 0.23$, $p = .82$), and physical education exertion ($t = 0.33$, $p = .74$). The results also yielded marginally significant differences between the means of the two groups for perceived performance climate at T1 (i.e., higher scores for drop-outs; $t = 1.91$, $p = .06$) and physical education

attendance at T1 (i.e., lower scores for drop-outs; $t = -1.89$, $p = .06$, all tests for significance are two-tailed).

Measures

Motivational climate. *Motivational climate* was assessed at Time 1 and 2 using the Motivational Climate in Sport Questionnaire (MCSQ; Walling, Duda, & Chi, 1993), adapted to a context of physical education at school (Skjesol & Halvari, 2005). This questionnaire assesses performance and mastery climates. It consists of 28 items with 14 items supposed to assess each of the two climates. A factor analysis of the 28 items yielded 3 mastery climate factors and 3 performance climate factors (see results section). Example items with the highest factor loading for each factor are given: (1) "In my physical education class, we help each other to get better and excel" (mastery climate with focus on helping each other); (2) "In my physical education class, the teacher makes sure students improve skills they're not good at" (mastery climate with focus on improvement); (3) "In my physical education class, we believe that all students have the possibility to succeed" (mastery climate with focus on the belief that all can succeed); (4) "In my physical education class, the teacher favors some students more than others" (performance climate with focus on "stars"); (5) "In my physical education class, only the best students get praise" (performance climate with focus on normative praise); and (6) "In my physical education class, someone gets angry at me if I make a mistake" (performance climate with a negative emotional tune).

Items were responded to on a 5-point scale that varied from "never" (1) to "always" (5). Recent research in Norway indicates acceptable reliability for the MCSQ adapted to the school context. The alpha coefficients for mastery and performance climate items among high-school students were respectively .91 and .89 (Skjesol & Halvari, 2005). See Tables 1 and 2 for descriptive statistics, reliability, and validity indications for motivational climates in the present study.

Achievement goals. The achievement goal orientations were assessed at Time 1 and 2 using the Achievement Goal Questionnaire (Elliot & Church, 1997). This scale assesses individuals' mastery, performance-approach and performance-avoidance goals. It consists of 18 items, with 6 items supposed to assess each of the 3 goals. We adopted a context of physical education at school. Example items are: (1) "I prefer physical education activities that arouse my curiosity, even if it is difficult to learn" (mastery goal); (2) "My goal is to do better than most of my classmates" (performance-approach goal); and (3) "I often think to myself: what if I do badly?" (performance-avoidance goal). For the performance-approach goal measure to be consistent with the new definition proposed by Elliot (1999, 2005; Elliot & Moller, 2003), one item focusing on ego-involvement was removed, i.e., "I want to do well to show my ability to family, friends, coaches and others." Thus, this change in measurement is supposed to be consistent with the performance-approach goal defined as trying to do better than specific others or merely trying to do well in relation to a norm. Items were responded to on a 7-point scale that varied from (1) "not at all true for me" to (7) "very true for me." Previous research in Norway using the Achievement Goal Questionnaire supports its reliability. Alpha coefficients for the mastery, performance-approach, and the performance-avoidance goals were .83, .90, and .71, respectively, among high-school students (Skjesol & Halvari, 2005). See Tables 1 and 2 for descriptive statistics, reliability, and validity indications for achievement goals in the present study.

Table 1

Means, Standard Deviations, and Reliability of Motivational Climates, Achievement Goals, and Physical Education Outcomes at Time 1 and Time 2 (n = 152)

Measure and time	Total		Reliability
	<i>M</i>	<i>SD</i>	Cronbach's α
Mastery climate			
T1	3.78	0.56	.90
T2	3.58	0.66	.92
Performance climate			
T1	2.18	0.45	.83
T2	2.27	0.51	.85
Mastery goal			
T1	5.59	0.97	.80
T2	5.29	1.19	.89
Performance-approach goal			
T1	4.66	1.18	.72
T2	4.14	1.44	.88
Performance-avoidance goal			
T1	3.72	1.19	.81
T2	3.40	1.43	.81
Intrinsic motivation			
T1	5.75	1.17	.93
T2	5.57	1.31	.93
Perceived competence			
T1	4.72	1.12	.84
T2	4.56	1.27	.88
Positive attitude; DPA T2	4.54	1.31	.90
PE exertion T1	14.4	3.79	—
PE exertion T2	14.2	3.49	—
PE attendance T1	2.30	0.69	—
PE attendance T2	2.08	1.18	—

DPA = positive attitude toward Daily Physical Activity at school

Table 2

Fit Indexes of Measurement Models

	χ^2	<i>df</i>	<i>p</i>	χ^2/df	CFI	RMSEA	SRMR
Measurement model for 3 mastery climate sub-factors and the mastery goal	137	59	.00	2.3	.94	.086	.056
Measurement model for 2 performance climate sub-factors and the 2 performance goals	94	38	.00	2.5	.94	.091	.062

CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual.

Intrinsic motivation and perceived competence in physical education. At Time 1 and 2, intrinsic physical education motivation was assessed using the 7-item interest/enjoyment subscale, and perceived competence was assessed by the 6-item subscale of “The Intrinsic

Motivation Inventory” (IMI: McAuley, Duncan, & Tammen, 1989). For this investigation the questions were adapted to a context of physical education. Example items are: “I enjoy doing physical education activities very much” (intrinsic motivation) and “I am pretty good at physical education activities” (perceived competence). Responses to items were given on a 7-point scale ranging from (1) not at all true for me to (7) very true. The scales have been used in relation to research on self-regulation (e.g., Deci, Eghrari, Patrick, & Leone, 1994; Plant & Ryan, 1985; Ryan, Connell, & Plant, 1990; Ryan, Koestner, & Deci, 1991; Ryan, Mims, & Koestner, 1983). McAuley, Duncan, and Tammen (1989) examined the psychometric attributes of the IMI and their results yielded strong support for its validity.

Attitude toward daily physical activity at school. This was assessed at Time 2 using a questionnaire partly developed for this study and based on the Attitudes Toward Organizational Change Questionnaire (ATOCQ) developed by Folkedal, Vaag, Halvari, and Svebak (2000). The 16 items focus on students’ beliefs about, and evaluation of, the change into daily physical activity at school. The items are: “To what extent do you think daily physical activity at school has led to a more exciting school day for you?” Other items focused on “a more meaningful school day for you,” “a more varied school day for you,” “less press and stress for you,” “better relations among students,” “less absenteeism/sickness for you,” “better cooperation between students and teachers,” “more social closeness among students,” “better performance in theoretical subjects for you,” “more efficient schoolwork for you,” “better physical fitness for you,” “a better health for you,” “more interest in theoretical subjects at school,” “more alert and happy,” “more energy for theoretical lessons,” and “more nice experiences with other students.” All responses to items were given on a 7-point scale ranging from (1) “to a small extent” to (7) “to a great extent.”

Exertion. Exertion in the last physical education session at Times 1 and 2 and in daily physical activity at Time 2 was measured by the Ratings of Perceived Exertion Scale (RPE Scale: Borg & Ottoson, 1986). This is a scale which determines the experienced exertion. The pupils determine their own feeling of exertion in their last session on a 15-point scale ranging from 6 to 20. Numbers are explained for the pupils as “no exertion at all” (6), “light exertion” (7–10), “moderate exertion” (12–14), “high exertion” (15–17), “very high exertion” (19), and “maximum exertion” (20).

Attendance. Attendance in physical education at Times 1 and 2 and in daily physical activity at Time 2 was assessed by students’ answers to the following question: “How many times did you attend physical education last week?” Responses could be “no” (0); “1 time” (1); “2 times” (2); and “3 times” (3).

Data Analysis

The data in the present study reflects both class level (e.g., motivational climates) and student level (e.g., achievement goals) variables and Multi Level Modeling (MLM) was therefore considered to be used (Singer & Willett, 2003). However, with only nine classes in the present study this is below the recommendations for conducting MLM, and with a minimum of 7 and a maximum of 16 students in these classes the power of MLM become

low (Bryk & Raudenbush, 1992). Due to these limitations we conducted a preliminary analysis of change in the dependent motivational climates and achievement goal variables by class, age, and time using a repeated-measures multivariate analysis of variance (MANOVA). The MANOVA used class and age as between-group factors crossed with T1 and T2 assessments as the repeated measures factor (Time). The analysis yielded significant effects for age ($F = 3.46, p < .01$) and for time ($F = 3.01, p < .05$). However, negligible and non-significant class variance was detected ($F = 1.33, p > .05$). Due to this we proceeded with student-level analyses of the data.

Data analyses were performed in the following order: First, because the scale measuring motivational climates were adapted to the physical education domain (Skjesol & Halvari, 2005), we tested the factor structure of motivational climates in relation to achievement goals. Second, Pearson correlations between measures were presented. Third, motivational climates at T1 were expected to be indirectly related to physical education outcomes at T2, controlling for T1 outcomes, through achievement goals at T1. This was tested by LISREL using the longitudinal model for two waves of data recommended by Cole and Maxwell (2003). Fourth, structural or hierarchical models of change in mastery climates and achievement goals on physical education outcomes after a year were tested by LISREL analysis. In these models we hypothesized that changes in motivational climates would influence changes in achievement goals, which would influence physical education outcomes at T2. In LISREL it is suggested that the sample size should be related to the number of indicators (k), where $n = (k [k - 1])/2$ (Bollen, 1989). Accordingly, for the sample size of 152 in the present study the number of indicators should not exceed 18. With 61 indicators at Time 1 and 77 indicators at Time 2 (total = 138) this is well above the suggested figure. Therefore, we used an alternative approach and tested two reduced structural models with latent variables. Indirect associations in the final structural model were tested by bootstrapping, a non-parametric resampling procedure based on the distribution of the product approach. Bootstrapping is recommended for relatively small sample sizes as in the present study. Indirect relations can also be tested with bootstrapping in cases where the independent variable is not significantly associated with the dependent variable (Preacher & Hayes, 2008).

Results

Descriptive Statistics and Reliability

Means, standard deviations, and reliability coefficients for measures are given in Table 1. Reliability coefficients are acceptable and good according to the literature (Kline, 2005).

Factor Analysis of Motivational Climate and Achievement Goal Items

Research indicates that the Perceived Motivational Climate in Sport Questionnaire (Walling, Duda, & Chi, 1993) consists of different subscales (Biddle, 2001; Newton & Duda, 1993; Newton, Duda, & Yin, 2000). Because this scale was adapted to the physical education domain, it was important in the present study to test the factor structure of the MCSQ and its divergent validity in relation to achievement goals.

A factor analysis of the items in the MCSQ at Time 1 yielded six factors (maximum likelihood extraction and oblique rotation). Two items were omitted due to high cross-loadings. The first factor comprised six items reflecting a mastery climate sub-factor with focus on "helping each other" (eigenvalue after rotation: 5.01; explained variance: 29%; factor loadings

ranged from .82 to .66), the second factor comprised three items reflecting a performance climate sub-factor with focus on “normative praise” (eigenvalue after rotation: 1.99; explained variance: 9.7%; factor loadings ranged from .87 to .53), the third factor comprised six items reflecting a performance climate sub-factor with a focus on “stars” (eigenvalue after rotation: 2.89; explained variance: 5.8%; factor loadings ranged from .78 to .47), the fourth factor comprised the three items reflecting a performance climate sub-factor with focus on a “negative emotional tune” (eigenvalue after rotation: 2.6; explained variance: 5.3%; factor loadings ranged from .67 to .48), the fifth factor comprised four items reflecting a mastery climate sub-factor with a focus on “improvement” (eigenvalue after rotation: 2.5; explained variance: 2.8%; factor loadings ranged from .67 to .50), and the sixth factor comprised four items reflecting a mastery climate sub-factor with a focus on “the belief that all can succeed (eigenvalue after rotation: 3.3; explained variance: 2.3%; factor loadings ranged from .76 to .52).

Because Achievement Goal Theory research (Newton et al., 2000) predicted different mastery and performance climates sub-factors, two confirmatory factor analyses were performed in LISREL in order to test the psychometric attributes of the MCSQ in relation to achievement goals measures at Time 1. Due to the high number of items in relation to the sample size we tested first a measurement model for items in the three mastery climate sub-factors and the mastery goal. Second, we tested the measurement model for the items reflecting the three performance climate sub-factors, the performance-approach, and the performance-avoidance goals. Model fit indices used were the chi-square likelihood ratio (X^2), the chi-square degree of freedom ratio (X^2/df), the Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI), and the standardized root-mean-square residual (SRMR). Researchers recommend the use of these different indices in order to evaluate model fit (Bollen, 1989; Hoyle & Panter, 1995; Hu & Bentler, 1999). For evaluating the adequacy of model fit the following cut-off values were used: $X^2/df \leq 3.0$ (Kline, 2005), $CFI \geq .90$, $RMSEA \leq .08$ (Browne & Cudeck, 1993), and $SRMR \leq .10$ (Hu & Bentler, 1999). In the evaluation of model fit we relied more on the values for X^2/df , SRMR and CFI than on the RMSEA because the latter tends to over-reject true-population models at small sample sizes (< 250) and thus is less preferable here (Hu & Bentler, 1999).

The *a priori* models with all items in the two models did not yield an acceptable fit. However, there was room for improvement. In the process to reduce the number of items to include about three items for each motivational climate sub-factor and each achievement goal we examined the modification indices and looked for items with high error uniqueness correlations. We started to omit indicators which had the highest error values and at the same time had the lowest factor loadings. Next, we continued to omit other items with sizable error correlation magnitudes and low factor loadings, until about three items remained for each variable. In this procedure we omitted 5 “stars” items except one, which was confirmed together with “normative praise” items, 2 “helping each other” items, 1 “improvement” item, and 1 “belief that all can succeed” item. The final model for three mastery climate sub-factors (“helping each other” with factor loadings = .81, .87, .88, and .60; “improvement” with factor loadings = .57, .65, and .64; and the “belief that all can succeed” with factor loadings = .70, .56, .66, and .64) and the mastery goal (with factor loadings = .76, .78, and .81) yielded a good fit (see Table 2). In addition, the final model for two performance climate sub-factors (“normative praise/stars” with factor loadings = .58, .73, and .90 and “negative emotional tune” with factor loadings = .73, .72, and .84), the performance-approach goal (with factor loadings = .87, .77, and .85) and the performance-avoidance goal (with factor loadings = .68, .67, and .87) also yielded a good fit (see Table 2).

Correlations Among Variables at Times 1 and 2

Correlations among Times 1 and 2 measures are presented in Table 3. We expected that perceived mastery climate in physical education classes would be positively correlated with pupils' mastery goals, which, in turn, would be positively associated with physical education outcomes (Hypothesis 1). Next, perceived performance climate in physical education classes was expected to be positively correlated with students' performance-approach and performance-avoidance goals. In turn, the performance-approach goal was expected to be positively correlated with physical education outcomes (Hypothesis 2), whereas the performance-avoidance goal was hypothesized to be negatively correlated with physical education outcomes (Hypothesis 3). It is a positive and significant correlation between mastery climate at T1 and mastery goals at T1, and both yield positive and significant correlations with all physical education outcomes at T2, except the non-significant correlation between mastery climate and physical education attendance. In addition, a perceived performance climate at T1 and performance-avoidance goals at T1 are not significantly correlated with any of the physical education outcomes at T2. For performance-approach goals at T1, significant positive correlations are present for T2 measures of intrinsic motivation, attitude toward daily physical activity, and for perceived physical education competence. Thus, these zero-order correlations between perceived mastery climate and mastery goals at Time 1 and physical education outcomes at Time 2 indicate support of hypothesis 1. The correlations presented between Time 1 and Time 2 measures do not indicate support to hypotheses 2 and 3, that performance climate would affect physical education outcomes through performance-approach and performance-avoidance goals. However, final conclusions will await further analyses of change in motivational climates and achievement goals in relation to physical education outcomes after one year.

Testing the links between: (1) motivational climates at T1 and achievement goals at T2 controlling for goals at T1 and (2) achievement goals at T1 and physical education outcomes at T2 controlling for outcomes at T1. Cole and Maxwell (2003) propose a way to test a mediator model with two data waves. They recommend a pair of longitudinal tests: (1) estimate the path a in the regression of the achievement goal mediator at T2 onto the motivational climate independent variable at T1 controlling for the achievement goal mediator at T1; and (2) estimate path b in the regression of the dependent physical education outcome variable at T2 onto the achievement goal mediator at T1 controlling for the dependent outcome variable at T1. If we can assume that the relationships do not change in magnitude over time, the paths between the mediator at T1 and the dependent variable at T2 would be equal to the path between the mediator at T2 and a hypothetical dependent variable at T3. Under this assumption, the product ab provides an estimate of the mediational link. In the present study, we used LISREL in estimating the paths. Before testing structural models, it is recommended that the measurement model should have an acceptable fit (Cole & Maxwell, 2003). Due to the high number of indicators per latent construct in relation to the sample size, two measurement models were tested: one that included mastery climate, mastery goals and the five physical education outcomes at T1 and T2, and a second model, which included performance climate, performance approach and avoidance goals, and the five physical education outcomes at T1 and T2. For the same reason, the number of items per latent construct was reduced for achievement goals (see factor analysis above). The number of items for latent physical education outcomes was reduced to the three indicators

Table 3
Pearson Correlations Among Measures at Times 1 and 2, and Their Non-Parametric Correlations with Gender and Age (n = 152)

Measure and time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1 Gender	–																				
2 Age	.03	–																			
3 Mastery climate, T1	–.09	–.06	–																		
4 Perf. climate, T1	–.08	–.05	–.18	–																	
5 Mastery goal, T1	.04	.11	.50	–.08	–																
6 PAp goal, T1	.12	.21	.07	.36	.47	–															
7 PAv goal, T1	–.24	.19	–.13	.34	.13	.33	–														
8 IM in PE, T1	.10	.14	.40	–.27	.60	.32	–.10	–													
9 PC in PE, T1	.18	.07	.26	–.05	.43	.49	–.13	.74	–												
10 PE exertion, T1	.05	.20	.33	–.05	.34	.33	.13	.31	.31	–											
11 PE attendance, T1	.20	.13	.09	.02	.28	.17	.12	.16	.18	.25	–										
12 Mastery climate, T2	–.05	–.24	.51	–.19	.38	–.09	–.06	.42	.25	.21	.01	–									
13 Perf. climate, T2	–.03	.08	–.01	.44	.04	.19	.18	.03	.05	.09	.18	–.20	–								
14 Mastery goal, T2	–.07	–.15	.32	–.04	.58	.30	.16	.47	.38	.16	.13	.57	–.02	–							
15 PAp goal, T2	.08	.06	.10	.28	.28	.61	.22	.32	.39	.15	.14	.01	.38	.45	–						
16 PAv goal, T2	–.20	.21	–.09	.25	.06	.19	.53	–.09	–.11	.00	.06	–.18	.33	.11	.33	–					
17 IM in PE, T2	.16	–.12	.28	–.12	.46	.21	.03	.65	.52	.18	.11	.53	–.12	.67	.24	–.17	–				
18 PA attitude, T2	.26	–.07	.24	–.08	.30	.15	–.10	.43	.39	.21	.08	.44	.05	.48	.25	–.02	.59	–			
19 PC in PE, T2	.20	–.10	.24	–.10	.38	.34	–.12	.55	.58	.16	.05	.41	–.03	.61	.42	–.25	.71	.56	–		
20 PE exertion, T2	.14	–.24	.16	–.05	.29	.11	.04	.24	.21	.10	.19	.40	.04	.50	.25	–.02	.45	.42	.40	–	
21 PE attendance, T2	.01	–.22	.05	.02	.21	.05	.08	.15	.08	–.08	.04	.12	.06	.32	.25	–.03	.30	.05	.27	.37	–

Note: A correlation of .15 is significant at $p < .05$ (two-tailed test). Correlations between gender, age, and other variables are non-parametric (Spearman's point biserial correlation). PAp = Performance-approach goals; PAv = Performance-avoidance goals; PA attitude = attitude toward daily physical activity; IM = Intrinsic motivation; PC = Perceived competence. Gender: (1) Females; (2) Males.

having the highest factor loadings, and, because the three mastery and the two performance climate sub-factors, respectively, were highly correlated, we used them as indicators of mastery and performance climates. To achieve this, we inspected the modification indices and looked for items with high error values and low factor loadings. The trimmed measurement models yielded an acceptable fit for the first mastery goal model ($X^2 [df = 200, N = 152] = 554, p < .001$; CFI = .94; IFI = .94; RMSEA = .099; SRMR = .059), and the same was the case for the second model with performance goals ($X^2 [df = 116, N = 152] = 335, p < .001$; CFI = .92; IFI = .92; RMSEA = .099; SRMR = .048). In the evaluation of model fit we relied more on the values for SRMR and CFI than the RMSEA because the latter tends to over-reject true-population models at small sample size (< 250) and thus is less preferable for the sample size of 152 in the present study (Hu & Bentler, 1999).

The two measurement models provided a basis when we proceeded to test the paths between motivational climates, achievement goals, and physical education outcomes at T1 and T2. For the mastery goal model: (1) the estimated link between the mastery goal mediator at T2 onto the mastery climate independent variable at T1 was non-significant (standardized parameter estimate = $-.19, p > .10$), controlling for the mastery goal mediator at T1 (standardized parameter estimate = $.94, p < .001$). Based on the assumptions mentioned above, mastery goals cannot mediate the association between mastery climate and physical education outcomes. Thus, (2) we proceeded to estimate the longitudinal paths between the dependent physical education outcomes at T2 onto the mastery goal at T1 controlling for the dependent outcome variable at T1. The mastery goal at T1 predicted: (1) intrinsic motivation at T2 (standardized parameter estimate = $.35, p < .01$) controlling for intrinsic motivation at T1 (standardized parameter estimate = $.44, p < .001$); (2) perceived competence at T2 (standardized parameter estimate = $.46, p < .001$) controlling for perceived competence at T1 (standardized parameter estimate = $.47, p < .001$); (3) positive attitude toward daily physical activity at school only measured at T2 (standardized parameter estimate = $.38, p < .001$); (4) exertion at T2 (standardized parameter estimate = $.44, p < .001$) controlling for exertion at T1 (standardized parameter estimate = $.09, p > .10$); and (5) physical education attendance at T2 (standardized parameter estimate = $.34, p < .001$) controlling for physical education attendance at T1 (standardized parameter estimate = $-.05, p > .10$). In sum, the longitudinal positive paths between mastery goals and the five different physical education outcomes are supported.

For the performance goal model: (1a) the estimated link between the performance-approach goal mediator at T2 onto the performance climate independent variable at T1 was non-significant (standardized parameter estimate = $-.07, p > .10$), controlling for the performance-approach goal mediator at T1 (standardized parameter estimate = $.63, p < .001$); and (1b) the link between the performance-avoidance goal mediator at T2 onto the performance climate independent variable at T1 was also non-significant (standardized parameter estimate = $-.04, p > .10$), controlling for the performance avoidance goal mediator at T1 (standardized parameter estimate = $.84, p < .001$). Based on the assumptions mentioned above, performance goals cannot mediate the association between performance climate and physical education outcomes.

Thus, we proceeded to estimate the longitudinal paths between the dependent physical education outcomes at T2 onto the performance goal at T1 controlling for the dependent outcome variable at T1 (2). The performance-approach goal at T1: (a) did not predict intrinsic motivation at T2 (standardized parameter estimate = $.04, p > .10$), controlling for intrinsic motivation at T1 (standardized parameter estimate = $.65, p < .001$); (b) did not predict perceived competence at T2 (standardized parameter estimate = $-.03, p > .10$),

controlling for perceived competence at T1 (standardized parameter estimate = .59, $p < .001$); (c) did not predict positive attitude toward daily physical activity at school only measured at T2 (standardized parameter estimate = .17, $p > .05$); (d) did not predict exertion at T2 (standardized parameter estimate = .10, $p > .10$), controlling for exertion at T1 (standardized parameter estimate = .15, $p > .10$); and (e) did not predict physical education attendance at T2 (standardized parameter estimate = .08, $p > .10$), controlling for exertion at T1 (standardized parameter estimate = -.10, $p > .10$).

(3) The performance-avoidance goal at T1: (a) did not predict intrinsic motivation at T2 (standardized parameter estimate = -.05, $p > .10$), controlling for intrinsic motivation at T1 (standardized parameter estimate = .67, $p < .001$); (b) did not predict perceived competence at T2 (standardized parameter estimate = -.00, $p > .10$), controlling for perceived competence at T1 (standardized parameter estimate = .59, $p < .001$); (c) did not predict positive attitude toward daily physical activity at school only measured at T2 (standardized parameter estimate = -.13, $p > .10$); (d) did not predict exertion at T2 (standardized parameter estimate = -.10, $p > .10$), controlling for exertion at T1 (standardized parameter estimate = .16, $p > .10$); and (e) did not predict physical education attendance at T2 (standardized parameter estimate = -.06, $p > .10$), controlling for physical education attendance at T1 (standardized parameter estimate = -.11, $p > .10$). In sum, the hypotheses of a longitudinal positive path between performance-approach goals and the five different physical education outcomes and a longitudinal negative path between the performance-avoidance goal and the physical education outcomes were rejected.

In conclusion, the results indicate that positive changes in physical education outcomes are longitudinally positively associated with mastery goals. Mastery goals measured early in the school-year positively influenced all changes over the next year in physical education outcomes directly, whereas the measures of performance-approach and -avoidance goals were non-significant in relation to changes in outcomes. Physical education motivational climates at T1 did not influence changes in achievement goals over the school-year and, thus, was not linked to changes in physical education through achievement goals.

Based on the significant links between mastery goals at T1 and changes in all measured physical education outcomes over the following year we summarized these findings by the model depicted in Figure 1.¹ The measurement model yielded a good fit to the data ($X^2 [df = 79, N = 152] = 197, p < .001$; CFI = .97; IFI = .97; RMSEA = .091;

¹ Before we performed this analysis, and because zero-order correlations show significant positive correlations between mastery climate at T1 and physical education outcomes at T2 (see Table 4), we tested the hypothesis that mastery climate at T1 would be positively linked to physical education outcomes at T2, controlling for these outcomes at T1. The mastery climate at T1: (a) did not predict intrinsic motivation at T2 (standardized parameter estimate = .05, $p > .10$), controlling for intrinsic motivation at T1 (standardized parameter estimate = .69, $p < .001$); (b) did not predict perceived competence at T2 (standardized parameter estimate = -.13, $p > .10$), controlling for perceived competence at T1 (standardized parameter estimate = .65, $p < .001$); (c) did not predict positive attitude toward daily physical activity at school only measured at T2 (standardized parameter estimate = .06, $p > .10$); (d) did not predict exertion at T2 (standardized parameter estimate = .17, $p > .10$), controlling for exertion at T1 (standardized parameter estimate = .12, $p > .10$); and (e) did not predict physical education attendance at T2 (standardized parameter estimate = .10, $p > .10$), controlling for physical attendance at T1 (standardized parameter estimate = -.09, $p > .10$).

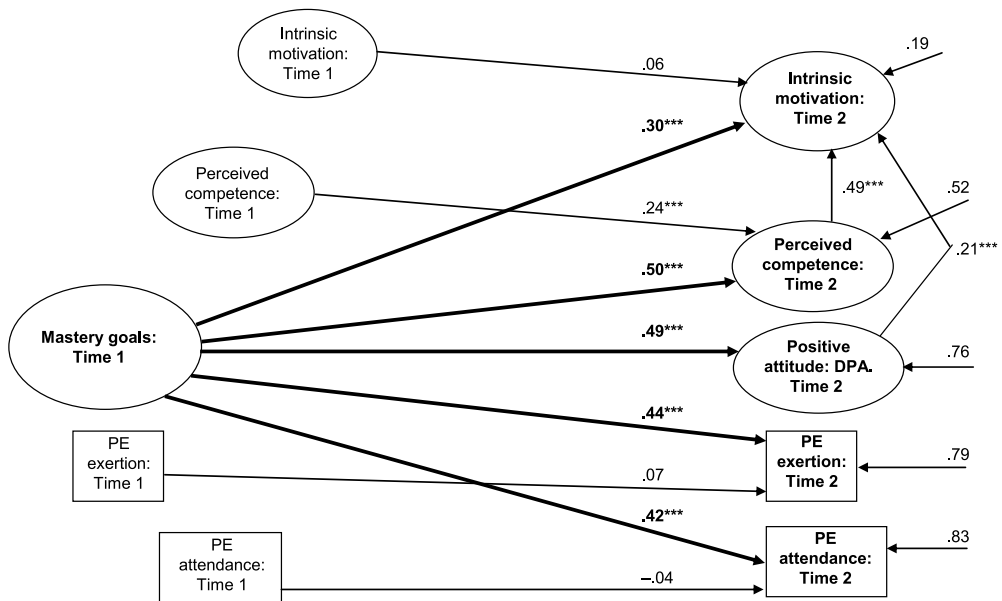


Figure 1. Standardized parameter estimates between latent variables for the longitudinal links between the mastery goal at time 1 and changes over the next school-year in five physical education outcomes ($X^2 [df = 92, N = 152] = 240, p < .001$; $X^2/df = 2.61$; CFI = .97; IFI = .97; RMSEA = .095; SRMR = .057).

DPA = daily physical activity at school; PE = physical education, indicator variables are not represented in order to simplify the presentation. They varied between .60 and .96 with an average of .81. *** $p < .001$.

SRMR = .041). Next, we proceeded by testing the structural model derived from the results presented. This structural model included all paths between mastery goals at T1 and physical education outcomes at T2 controlled for their T1 measures, and we allowed paths between T2 outcome measures to covary. This structural model (see Figure 1) did fit the data relatively well ($X^2 [df = 92, N = 152] = 240, p < .001$; CFI = .97; IFI = .97; RMSEA = .095; SRMR = .057).

Changes in Climates and Achievement Goals on PE Outcomes After One Year

Changes in perceived climates and achievement goals are important because they represent processes that are supposed to explain subsequent intrinsic motivation, behavioral attitudes, behavior, and behavioral change (Moller & Elliot, 2006). The correlations between changes in motivational climates and achievement goals, and physical education outcomes at Time 2, are presented in Table 4. They are all in line with the hypotheses, except the correlations between performance-avoidance goals and attitude toward daily physical activity and physical education exertion, respectively. The pattern of results is the same for measures with all items (below the diagonal in Table 4) and measures, with about three items each after LISREL measurement model tests (above the diagonal). These results are fully in line with hypotheses 1 and 2, and partly in line with hypothesis 3.

Table 4
Pearson Correlations Among Change in Motivational Variables and PE Outcomes After 1 Year: Below Diagonal: Measures With all Items. Above Diagonal: Measures With Reduced Items After LISREL Measurement Model Test (Confirmatory Factor Analysis) (n = 152)

Measure and time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 Gender	–	.03	–.06	.07	–.03	–.10	–.05	–.02	–.05	–.10	.04	–.13	.16	.26	.20	.14	.02
2 Age		–	–.27	–.19	–.32	–.12	.07	.03	.09	–.21	–.01	.17	–.12	–.07	–.10	–.24	–.22
Change measures (T1 – T2)																	
3 Mastery climate			–.33	–	.77	.71	.85	–.10	–.05	–.13	.49	.05	–.09	.33	.31	.32	.08
4 Helping others to learn			–.28	.91	–	.51	.53	–.21	–.16	–.19	.35	–.03	–.22	.33	.28	.29	.00
5 Focusing on improvement			–.34	.80	.63	–	.43	–.06	.00	–.15	.34	.07	–.09	.29	.31	.30	.06
6 Belief that all can succeed			–.12	.71	.51	.45	–	–.04	–.02	–.06	.41	.10	–.03	.34	.28	.28	.08
7 Performance climate			.06	–.26	–.28	–.18	–.17	–	.93	.75	.00	.41	.42	–.12	.07	–.04	.02
8 Normative praise			.10	.12	.10	.17	.09	.52	–	.45	.02	.40	.27	–.04	.07	.06	.13
9 Negative emotional tune			–.00	–.16	–.18	–.15	–.05	.74	.10	–	–.04	.29	.52	–.24	.01	–.20	–.12
10 Mastery goals			–.19	.56	.44	.39	.39	–.12	.06	–.14	–	.28	.02	.43	.38	.41	.23
11 Performance-approach goals			–.04	.09	–.02	.06	.12	.25	.31	.28	.36	–	.26	.15	.20	.25	.16
12 Performance-avoidance goals			.12	–.12	–.21	–.02	–.02	.20	–.04	.39	.06	.36	–	–.37	–.06	–.28	–.17
Measures after 1 year at T2																	
13 Intrinsic PE motivation			–.12	.45	.41	.31	.34	–.06	.13	–.16	.51	.12	–.21	–	.59	.71	.45
14 Positive DPA attitude			–.07	.42	.37	.28	.28	–.00	.14	.04	.39	.21	.04	.59	–	.56	.42
15 Perceived competence in PE			–.10	.36	.32	.26	.28	–.03	.15	–.11	.49	.24	–.21	.71	.56	–	.40
16 PE exertion			–.24	.38	.30	.28	.29	.03	.10	.05	.40	.19	.00	.45	.42	.40	–
17 PE attendance			–.22	.09	.04	.06	.08	.02	.02	.05	.23	.27	–.06	.30	.05	.27	.37

Note. A correlation of .15 is significant at $p < .05$ (two-tailed test). Change scores (standardized residuals) were created by regression of T2 measures onto T1 measures. Gender: (1) Females; (2) Males. DPA = positive attitude toward Daily Physical Activity at school

Structural equation modelling with latent variables. We tested the change model of motivational climates and achievement goals in relation to physical education outcomes after a year by using LISREL in testing two simple or reduced models with latent variables represented by 3–4 items having the highest factor loadings for each construct. Because all three mastery climate sub-factors were highly positively correlated we chose to use “the belief that all can succeed” to represent mastery climate in Model 1. Thus, in Model 1 we tested hypothesis 1 in which changes in mastery climate would positively predict change in mastery goals, which would positively predict three physical education outcomes at Time 2 (see Figure 2; three out of five outcomes were selected in order to simplify the models). Further, we tested hypotheses 2 and 3 in a separate Model 2 in which: (a) change in normative praise would positively predict change in performance-approach goals, which would positively predict physical education outcomes at Time 2 (hypothesis 2); and (b) that change in negative emotional tune would positively predict change in performance-avoidance goals, which would negatively predict physical education outcomes at Time 2 (hypothesis 3).

In order to obtain latent change variables of climates and achievement goals, Time 1 constructs (with the same Time 1 indicators or items as presented in the measurement models in Table 2) were modeled to predict the corresponding T2 constructs (with the

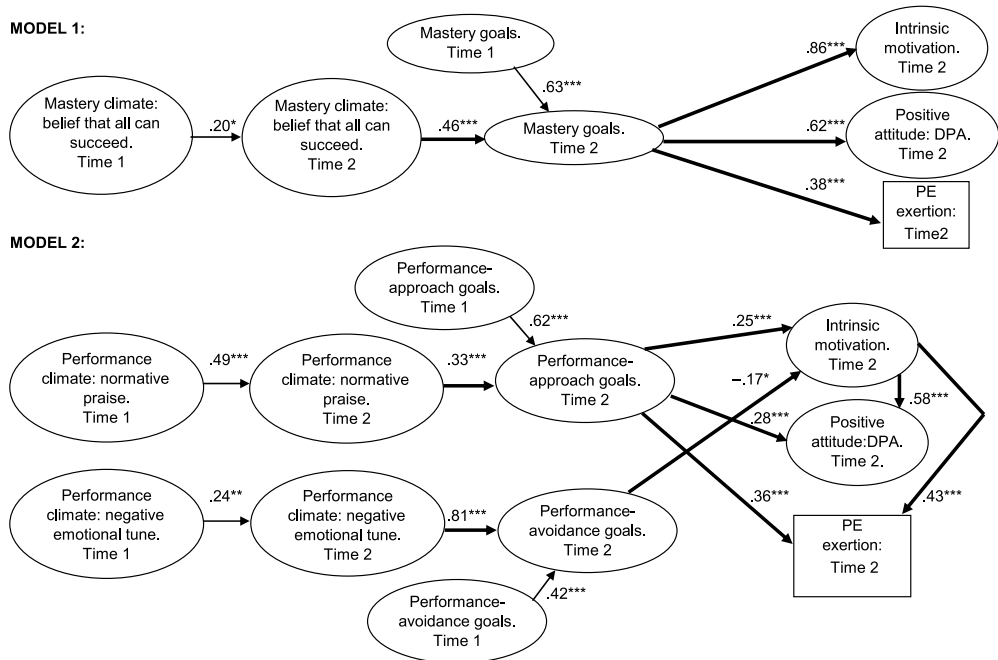


Figure 2. Standardized parameter estimates between latent variables for the hierarchical model of change in motivational climates, change in achievement goals, and outcomes after 1 year.

Model 1: ($X^2 [df = 112, N = 152] = 218.22, p < .001$; $X^2/df = 1.95$; SRMR = .089; CFI = .96; RMSEA = .073). Model 2: ($X^2 [df = 232, N = 152] = 457.78, p < .001$; $X^2/df = 1.97$; SRMR = .087; CFI = .90; RMSEA = .074). Indicator Variables and Error Variables are not represented in order to simplify the presentation. Factor loadings for indicator variables varied between .57 and .97 with an average of .77. * $p < .05$; ** $p < .01$; *** $p < .001$.

same Time 2 indicators or items), which represent the residualized change scores. Model 1 included variables in the upper part of Figure 2, that is, the mastery climate sub-factor “belief that all can succeed” at T1 and T2, the mastery goal at T1 and T2, and the physical education outcomes. The measurement model fitted the data in an acceptable way ($\chi^2[df = 99, N = 152] = 212.28, p < .001$; $\chi^2/df = 2.14$; SRMR = .058; CFI = .96; RMSEA = .080). The structural model was tested with this measurement model included and included all paths hypothesized in the theoretical model. All paths were significant and the structural model yielded a good fit ($\chi^2 [df = 112, N = 152] = 218.22, p < .001$; $\chi^2/df = 1.95$; SRMR = .089; CFI = .96; RMSEA = .073). Model 2 included variables in the lower part of Figure 2, that is, the performance climate sub-factors “normative praise” and “negative emotional tune” at T1 and T2, the performance-approach and the performance-avoidance goals at T1 and T2, and the physical education outcomes. The measurement model fitted the data in an adequate way ($\chi^2 [df = 198, N = 152] = 399.98, p < .001$; $\chi^2/df = 2.02$; SRMR = .066; CFI = .91; RMSEA = .075). The *a priori* structural model with this measurement model included all hypothesized links, and the fit was as good as the measurement model. However, in the final structural model two non-significant paths were omitted, that is, from performance-avoidance goals to both physical education exertion and positive attitude toward daily physical activity. In addition, based on modification indices suggestions, two paths were added, that is, from intrinsic motivation to both physical education exertion and positive attitude toward daily physical activity (see Figure 2). All paths were significant and the final model yielded an acceptable fit ($\chi^2 [df = 232, N = 152] = 457.78, p < .001$; $\chi^2/df = 1.97$; SRMR = .087; CFI = .90; RMSEA = .074).

Analyses of Indirect Associations

We tested indirect links of the model in Figure 2 by using the bootstrapping procedure described by Preacher and Hayes (2008). The results yielded that all indirect relations were significantly supported because the bias corrected 95% confidence intervals for these bands did not include zero or oppositely valued coefficients (see Table 5).

Discussion

The results yielded that mastery goals measured early in the school-year predicted changes over the school-year in different physical education outcomes, such as intrinsic motivation, perceived competence, physical education behavior, and positive attitudes. Regarding the *change* model of climates and goals, the results strongly supported Achievement Goal Theory (Church et al., 2001; Elliot & Church, 1997), and extended it with multiple and distinct physical education climate antecedents for each of the three goals. The importance of creating a mastery climate in physical education is positive due to its strong influence on students' mastery goal changes, which strongly positively influences physical education outcomes after one year. Conversely, the results indicate that it is equally important to de-emphasize performance climates characterized by negative emotional expressions after students' failure. This is because a negative emotional tune is strongly positively associated with students' changes in performance-avoidance goals, which negatively affect intrinsic physical education motivation after one year. In turn, reduced intrinsic physical education motivation is associated with

Table 5
Tests of Indirect Links Emerging in Figure 2

Independent variable (IV)	Mediator (M)	Dependent variable (DV)	Point est.	SE	a*b-path		Bootstrapping	
					Z	BC 95%	Lower	Upper
Change in the Belief that all can succeed (CB)	→ Change in Mastery Goal (CMG)	→ Intrinsic motivation	0.22	0.06	3.66****	0.11	0.39	
CB	→ CMG	→ Positive DPA attitude	0.19	0.06	3.22****	0.08	0.34	
CB	→ CMG	→ PE exertion	0.44	0.14	3.08****	0.20	0.80	
Change in Normative Praise (CNP)	→ Change in Performance- Approach Goals (CPAG)	→ Intrinsic motivation	0.12	0.05	2.37**	0.04	0.27	
CNP	→ CPAG	→ Positive DPA attitude	0.11	0.05	2.21**	0.03	0.25	
CNP	→ CPAG	→ PE exertion	0.17	0.10	1.61 *	0.02	0.43	
Change in Negative Emotional Tune (CNET)	→ Change in Performance Avoidance Goals (CPAVG)	→ Intrinsic motivation	-0.22	0.07	-3.15****	-0.40	-0.10	
CPAVG	→ Intrinsic motivation	→ Positive DPA attitude	-0.35	0.08	-4.59****	-0.51	-0.21	
CPAVG	→ Intrinsic motivation	→ PE exertion	-0.63	0.16	-3.83****	-0.99	-0.36	

Note. BC = bias corrected; 5000 bootstrap samples. a-path = IV → M; b-path = M → DV. * $p < .10$; ** $p < .05$; *** $p < .01$; **** $p < .001$. DPA = Daily Physical Activity.

reduced physical education exertion and reduced positive attitude toward daily physical activity.

Because this is a field study it is also important to note that these results are of great practical significance because they make clear that teachers' use of different mastery climate approaches to physical education can yield substantial changes in motivational processes and physical education behavior. This is worth considering because national statistics and research evidence emphasize declines in the population's physical activity and student physical education behavior and attendance by age (Anderssen & Andersen, 2004; Luepker, 1999; Marsh et al., 2006; MMI, 2004), whereas policy makers, schools and teachers are concerned with goals focusing on how to reverse this unfortunate development (Norwegian Ministry of Education, 2006; Norwegian Ministry of Health, 2005). Thus, we follow up with a more detailed treatment and discussion of results on perceived motivational climates, achievement goals, and physical education outcomes, and their practical implications.

Relations Between Climates and Goals at Time 1 and Changes in Physical Education Outcomes

A main aim of the present study was to examine physical education motivational climates as indirect predictors of physical education outcomes through their effects on achievement goals, which in turn are expected to be direct predictors of achievement outcomes. This hierarchical structure of physical education climates and achievement goals is consistent with the proposals in the literature that achievement motives (Elliot & Church, 1997; Elliot & Murayama, 2008) and classroom environment variables (Church et al., 2001) affect achievement outcomes indirectly by their influence on achievement goals, which are the direct predictors.

Regarding achievement goals defined as direct predictors, mastery goals at T1 positively influenced all physical education outcomes at T2, when controlling for initial measures of outcomes at T1. Performance-approach or performance-avoidance goals did not yield similar significant results. In addition, the direct influence of mastery goals on change in physical education outcomes seems robust because it predicted all five physical education outcomes positively. The hierarchical model of perceived motivational climates, achievement goals, and physical education outcomes was rejected, because motivational climates at T1 did not predict achievement goals at T2, controlling for goals at T1 and, because climates at T1 did not predict outcomes at T2, controlling for outcomes at T1. However, important consequences of mastery goals at T1 are the change in the following outcomes over one year: intrinsic motivation, positive attitudes toward daily physical activity, perceived physical education competence, physical education exertion, and attendance. These consequences of mastery goals correspond to similar findings in the literature, although none of these are conducted in the physical education domain (Church et al., 2001; Cury, Elliot, Da Fonseca, & Moller, 2002; Elliot & Church, 1997; Elliot & Harackiewicz, 1996).

Changes in Climates and Goals and its Relations With Physical Education Outcomes After a Year

The results strongly supported the hierarchical model of change in perceived mastery climates, change in achievement goals and physical education outcomes after a year (see

Figure 2). Students' perceptions of a mastery climate described by an atmosphere of "the belief that all can succeed" are supposed to evoke desires that are directed toward adoption of mastery goals. Differentially, perception of performance climates described by "focuses on normative praise" and "negative emotional tune" (i.e. negative emotional expressions after students' failure) is supposed to evoke desires and concerns directed toward adoption of performance-approach goals and performance-avoidance goals, respectively. The latter link is in accordance with research indicating that performance-avoidance oriented students are vulnerable in social contexts where significant others use person-focused negative feedback as a consequence of failure (Elliot & Reis, 2003). An orientation toward negative outcomes and negative feedback and how to avoid it is posited to yield anxiety and task distraction and a helpless pattern of achievement outcomes (Elliot & Church, 1997).

Theoretically, the goals students adopt affect their self-regulation in physical education and have functional significance because they affect thoughts, feelings and behavior in physical education (Midgley, Anderman, & Hicks, 1995). The functional significance of mastery goals, and performance-approach goals pursued for the value of performance in relation to doing better than specific others or better than a norm, are supposed to be related to competence valuation and task absorption, which increases intrinsic motivation (Cury et al., 2002). This is likely to energize the use of adequate strategies, growth, performance, and subjective well-being (Deci & Ryan, 1985). Conversely, performance-avoidance goals are expected to be experienced as stressful and threatening, which will distract individuals' attention from the activity and will preclude a task-absorbed engagement in the activity. Research by Cury and colleagues (2002) yielded results supporting that performance-avoidance goals increased both state anxiety and reduced task absorption, which both, in turn, undermined intrinsic motivation. The results from the present study are to a great extent consistent with this reasoning, which means that intrinsic physical education motivation after a year was: strongly positively affected by change in mastery goals over the prior school-year; positively affected by change in performance-approach goals; and negatively affected by change in performance-avoidance goals over the prior school-year.

Perceived competence has been modeled as an antecedent of achievement goals (Cury, Elliot, Da Fonseca, & Moller, 2006; Ommundsen, 2004), whereas other research has modeled perceived competence as an outcome of goal pursuits or motivation (Deci & Ryan, 2000). Perceived competence is in the present study modeled as a physical education outcome variable and this choice is grounded in Self-Determination Theory models and research where the expected link is from motivated goal pursuits to perceived competence (Williams et al., 2006).

Limitations

Limitations of the present study may involve changes in perceived motivational climates and achievement goals. Some of these changes may have occurred close in time to the physical education outcome measures at Time 2, and may therefore have cross-sectional limitations. However, in particular the strength of the correlations between achievement goals and physical education outcomes does convey the importance of them. Regarding the correlations between motivational climates and achievement goals, the

strength of the correlations might be artificially high due to similar wording of items to assess climates and goals. Another limitation is the 21 drop-outs who displayed a marginally higher perceived performance climate in physical education and a lower physical education attendance at Time 1 than the participants. Thus, the students who dropped out from the study may have reduced the variance in perceived performance climate, which may account for its non-significant relations with physical education outcomes at Time 2, as well as reducing the sample variance in physical education attendance, which may account for the non-significant association between mastery climate perceptions at Time 1 and physical education attendance at Time 2. Another possible weakness is the measures of physical education attendance with reference to the last week, and exertion with reference to the last physical education session. We asked for their behavior last week/session because we believed this helped students to remember their behavior and exertion. However, we cannot know for sure that the measures are representative for change in attendance and exertion between T1 and T2. The correlations between T1 and T2 measures of attendance and exertion, respectively, are not significant.

Only two waves of data are included in the present study. This implies that we cannot test whether a variable completely mediates the X–Y relation, because a third data wave is not present. Thus, only partial mediation is possible to test, depending on whether the stationary assumption holds. In other words, if we can assume that the relationships do not change in magnitude over time, the paths between the mediator at T1 and the dependent variable at T2 would be equal to the path between the mediator at T2 and a hypothetical dependent variable at T3. However, this assumption may be false, and without a third wave of data it is impossible to test. Despite these shortcomings, Cole and Maxwell (2003) “suspect that failing to control for prior levels of the dependent variables creates much greater problems than does failing to take into account violations of stationarity” (p. 563).

All data are based on self-report. Self-reports have been criticized as participants would often misunderstand questions, avoid using the extremes or might try to gain the researchers’ approval instead of giving their true opinions. Further, observed associations might be artificially inflated because all provided information comes from one single informant. Based on these limitations future research should strengthen designs by including more than two longitudinal waves of data with observed dependent behavior variables instead of self-report.

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