

Review

Motivational climate interventions in physical education: A meta-analysis

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ABSTRACT

Objective: The purpose of this study was to synthesize findings from motivational climate interventions employing Ames (1992a, 1992b) and Epstein's (1988, 1989) TARGET framework within school-based physical education contexts.

Design: The present study employed a quantitative research synthesis design. Meta-analysis uses empirical studies to summarize past research by drawing overall conclusions from separate investigations. This research design highlights important and unsolved issues related to motivational climate interventions within physical education.

Methods: Standard meta-analytic procedures incorporating inclusion and exclusion criteria, literature search, coding procedures, and statistical methods were used to identify and synthesize 22 studies with 24 independent samples. Cohen's (1988) criteria for effect sizes were used to interpret and evaluate results.

Results: There was an overall small positive treatment effect ($g = 0.103$) for groups exposed to mastery motivational climates. Outcome analyses identified the most consistent and largest overall treatment effects for behavioral outcomes ($g = 0.39$ – 0.49) followed by affective outcomes ($g = -0.27$ to 0.59) and cognitive outcomes ($g = -0.25$ to 0.32). Moderator analyses were directed by study heterogeneity and identified several trends in intervention features and study features with the most substantial trend for participant features as elementary students had the largest overall treatment effect ($g = 0.41$).

Conclusions: Outcome and moderator analyses identified several trends in methodological features, participant features, and study features that should be addressed in future physical education motivational climate interventions.

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The study of motivational processes in achievement contexts has been evident in psychological literature for many decades (Elliot & Dweck, 2005). Prominent in this area of inquiry is achievement goal theory (AGT; Ames, 1992a, 1992b; Dweck, 1986, 1999; Elliot, 1999; Nicholls, 1989). This approach places competence at the heart of achievement striving and stresses that competence can be viewed by individuals in different ways. These differences arise from individual and situational factors and lead to cognitive, affective and behavioral outcomes. Although the roots of AGT lie in education, a significant body of work has examined key tenets in physical activity settings, notably sport and school physical education (PE). This paper sets out to synthesize the extant literature on the influence of situational factors in such settings. Specifically, we aimed to quantitatively summarize the effects of

motivational climate interventions on specific outcomes, examine potential moderators of effects, and identify good practice in future research into climate interventions.

Motivational climate

Within AGT, the term 'motivational climate' has been adopted to encompass the study of environmental factors that lead individuals to construe competence in different ways and pursue different goals. One way to define one's competence is through the perception of self improvement and mastery of skills, whereas a second perspective entails the comparison of one's own ability with that of others in a salient reference group. Logically, individuals who employ the first definition pursue goals centered on striving to improve and master tasks; on the other hand, those individuals who choose to adopt the second definition pursue goals focused on doing better than others (Nicholls, 1989). Although different frameworks and perspectives exist under the broad umbrella term

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of AGT (Ames, 1992a, 1992b; Elliot, 1999; Nicholls, 1989), all theorists agree that, in addition to or in combination with intrapsychic factors, goal adoption can be determined by environmental features (i.e., the motivational climate).

Motivational climates in the physical domain that emphasize effort and personal improvement have been termed task or mastery climates, whereas climates emphasizing normative comparison and doing better than others have been referred to as ego or performance climates (for reviews, see Duda & Whitehead, 1998; Harwood, Spray, & Keegan, 2008). Drawing from the classroom-based work of Ames (1992a), research in sport and PE has been particularly concerned with identifying the motivational ramifications or correlates of *perceived* mastery and performance climates. That is, it has been considered important to understand the consequences of the situational goals held to be salient through the behaviors of key social agents. In PE and sport, the key agents that have received the most research attention are teachers and coaches, although some studies have examined parents and peers. These agents thus ‘create’ a motivational climate based on the way they relate to sport and PE participants.

One means by which the specific behaviors of sports coaches and PE teachers can be understood in terms of emphasizing the salience of particular goals is through the TARGET framework (Ames, 1992a, 1992b; Epstein, 1989). The acronym TARGET refers to Task (design of activities), Authority (location of decision-making), Recognition (manner of distributing rewards such as praise), Grouping (criteria for selecting working groups), Evaluation (standards of performance considered important), and Time (pace of learning). A mastery climate is more likely to be perceived when tasks are challenging, participants are provided with choices and opportunities to exercise leadership, recognition is provided privately to individuals, participants work in mixed ability groupings, positive evaluation for personal improvement is emphasized, and variability in pace of learning is accommodated. A performance climate is more likely to be reported by sports and PE participants when coaches and teachers organize repetitive and uniform tasks, control all aspects of decision-making, provide praise publicly, arrange groupings reflective of rank order of ability, praise and reward only the more able in the class or team, and do not allow slower learners extra time to master skills. Because the TARGET framework provides guidance as to specific environmental structures that emphasize different achievement goals, it has proved a useful model for researchers interested in manipulating the motivational climate in the physical domain.

Motivational climate interventions

Reviews of motivational climate research in physical activity highlight the prevalence of cross-sectional studies that seek to identify the correlates of perceived mastery and performance climates (see Duda & Whitehead, 1998; Harwood et al., 2008; Ntoumanis & Biddle, 1999). This comprehensive body of work provides support for the positive or adaptive correlates (e.g., confidence, enjoyment, task orientation) associated with mastery climate, whereas performance climate is often not associated with such outcomes, instead being linked with negative or maladaptive consequences (e.g., anxiety, boredom, ego orientation). Therefore, on the basis of theory (Ames, 1992a, 1992b; Epstein, 1989) and substantial correlational research in physical activity settings, it has been proposed that interventions should seek to promote mastery climates in order to enhance motivation (Duda, 1996; Harwood et al., 2008).

Ntoumanis and Biddle (1999), in their review of motivational climate, identified four short-term and three long-term interventions that sought to manipulate the psychological environment of participants engaged in a variety of physical activities.

Only one study (Theeboom, De Knop, & Weiss, 1995) adopted the TARGET framework and found support for the hypothesized benefits of creating a mastery climate i.e., higher levels of enjoyment and motor skills among the mastery group compared to the traditional group. Narrative reviews of achievement goal research in physical activity reveal that, since 1999, correlational research has continued to flourish, and authors have called for stronger designs that facilitate the inference of cause and effect (Duda, 2001; Duda & Whitehead, 1998; Harwood et al., 2008; Roberts, 2001). Although not as prevalent as cross-sectional investigations, a number of intervention studies have been conducted into the effects of manipulating mastery climate on cognitive, affective and behavioral outcomes. We argue that, over a decade later, there is a requirement to examine the collective empirical yield. Thus, the purpose of the present paper was to examine effect sizes across studies on different outcomes, to provide some indication of a summary effect for both positive and negative outcomes, and to identify the influence of moderating variables. In undertaking this research endeavor, we hoped to provide a critique of this area to assist researchers in the planning, delivery and reporting of future interventions. Moreover, in responding to the interests of practitioners working in sports and PE settings, we wanted to address the question: ‘Do interventions work and what determines their effectiveness?’ We expected that mastery climate interventions would result in significant positive effects on adaptive affective, behavioral, and cognitive motivational outcomes and significant negative effects on maladaptive outcomes. Where analyses revealed heterogeneity among effect sizes (i.e., results across studies were inconsistent), we analyzed the influence of a number of moderators. However, we did not set, a priori, hypotheses in relation to potential moderating influences. Instead, coding methods established by Brown, Upchurch, and Acton (2003) were used to extract descriptive information listing characteristics of interest. Based on the descriptive information collected, three categories were established including methodological features, participant features, and study features. Information regarding the specific features can be found in the [Methods](#) section.

Methods

Literature search & inclusion criteria

A literature search was conducted in three phases that included a) an electronic database search, b) a search for review articles and c) a search of the reference sections in articles determined to be relevant from the previous searches (a & b). Electronic database searches were performed in Academic Search Elite, ArticleFirst, ERIC, Medline, OmniFile, Physical Education Index, Proquest Dissertations and Theses, PsychINFO, PsychARTICLES, and Sport-Discus using variations of the keywords *intervention*, *achievement motivation*, *achievement goal theory*, *motivational climate*, *mastery climate*, *performance climate*, and *TARGET*. Articles retained for the current meta-analysis met the following inclusion criteria: (a) Published and unpublished literature in the English language from January 1, 1992 to August 1, 2010; (b) use of a motivational climate intervention following the TARGET structure established by Ames (1992b) and Epstein (1988, 1989); (c) interventions conducted in school-based physical education settings and reporting measurements for student outcomes as a result of the intervention; (d) studies using a control group or control measure, (e) articles reporting quantitative descriptive and/or inferential statistics that would allow for calculation or estimation of an effect size, and (f) studies reporting reliability (e.g., Cronbach alpha's) and validity (e.g., confirmatory factor analysis results [CFA] or the use of

previously established measures that have used CFA) coefficients of motivational climate instruments.

Search procedures generated 2190 potential studies for evaluation and initial decisions regarding article retrieval were based on review of abstracts. After the abstract screening process, a total of 57 studies were identified as potential sources for data collection and retrieved for detailed analysis. The search process also produced dissertations and theses that were later published in refereed journals, therefore, journal articles were used to extract data and prevent redundancy. A total of 22 studies with 24 independent samples were included in the meta-analysis.

Data extraction forms following established meta-analytic procedures were then used to code data relevant to the current study (Brown et al., 2003; Wilson & Lippy, 2001). Two coders reviewed and evaluated articles on 12 characteristics that were classified into three sections (a) methodological features, (b) participant features, and (c) study features. Methodological features provided details concerning methods used during the intervention and included: 1) Training of teachers or instructors to deliver intervention (reported hours spent training individuals to conduct intervention, Not Reported (NR)-did not report training procedures; 2) Duration in weeks marked the overall intervention time period and in cases with year-long interventions time in school was approximated at 40 weeks; 3) The use of a follow-up measure (yes or no) examining outcomes after intervention; 4) The use of a manipulation check of motivational climate (yes or no) prior to start of intervention; 5) TARGET intervention was conducted using all (full) or some of the components (partial) of a mastery motivational climate; 6) Intervention intensity examined how frequently students (R = reported and NR = not reported) were involved in the mastery climate intervention. Participant features provided information concerning 7) Overall sample size; 8) Participant mean age in years; 9) Participants grade level in school (E = Elementary ages 5–11.99 years, M = Middle School ages 12–14.99 years, and H = High School ages 15–18 years) when the intervention was conducted; and 10) Country represented geographical location of participants involved in intervention. Study features included: 11) Publication status (published or unpublished); 12) Outcome measures regarding data collection (self-report and/or teacher report, objective measure, or combination); and 13) Overall study effect size.

Effect size calculations

Data were entered into Comprehensive Meta Analysis (CMA) version-2 software (Borenstein, Hedges, Higgins, & Rothstein, 2005) which was used to compute all effect sizes. CMA provides many (more than 100) data entry options allowing flexibility during analysis to overcome insufficient information not provided in the literature. Data entry formats used in this study to calculate effect sizes included variations of both matched and unmatched designs across post-test, pre–post contrasts, and gain scores. When descriptive data such as means and standard deviations were not available, estimates of effect size calculations were based on F , t , r , or p -values (Rosenthal, 1994). Each study was the unit of analysis and contributed one independent effect size to the meta-analysis. If a study contained more than one relevant effect size (multiple outcomes per study) the standard procedure was to average those scores providing one overall (combined) calculation (Borenstein, Hedges, Higgins, & Rothstein, 2009; Cooper, 1998). Additionally, outcome analyses were used to determine summary effects of a single outcome and the summary treatment effect for that outcome was the mean calculation across studies measuring that outcome (Cooper, 1998). For example, several studies reported information on situational outcomes (mastery and performance

climate perceptions) and dispositional outcomes (ego and task orientation). The overall treatment effect was an average of both dispositional and situational variables and the outcome analyses provided a summary effect for each dispositional and situational outcome variable. Hedges g was selected as the measure of effect size to provide a conservative estimate of effect due to small sample sizes ($k < 20$) (Hedges & Olkin, 1985) and was calculated by CMA with the following formula:

$$g = d \left[1 - \frac{3}{4(n_1 + n_2) - 9} \right]$$

There are two primary models that can be employed to determine statistical assumptions of error when conducting a meta-analysis (Hedges & Vevea, 1998). A fixed effects model suggests that all studies in the meta-analysis share a common effect and differences are a result of within study error (sampling error), whereas a random effects model makes the assumption that there are both within study error and between-study variance (Borenstein et al., 2009). A random effects model (Field, 2003; Hedges & Olkin, 1985; Hedges & Vevea, 1998) was selected for the analysis due to variation between intervention methods, potential sampling error, and the possibility of random unexplained variance between studies. Standardized mean differences were adjusted by the inverse weight of the variance to prevent sample size from inflating study weights and allowing for a more accurate calculation of the overall effect size (Borenstein et al., 2009; Hedges & Olkin, 1985; Shadish & Haddock, 1994). An a priori power analysis determined that there were sufficient studies in the meta-analysis to detect moderate to large effects.

Heterogeneity of variance

When using a random effects model there is an assumption that the true effect size will vary between studies, therefore, several indicators were used to assess heterogeneity of variance. The Q -test serves as a significance test and is based on critical values for a chi-square (χ^2) distribution. Significant Q -values indicate heterogeneity, or that variability across the effect sizes is greater than what would have resulted from chance. Effect size distributions that are heterogeneous indicate a large variability and allow for study of moderator variables to provide a more accurate estimate of study dispersion. The computations produced from a moderator analysis compartmentalize the total Q_T -value variance by calculating between (Q_B) and within (Q_W) values. Significant Q_B values indicate moderator variance that can be attributed to systematic between-study differences and require t -test or an analysis of variance technique described by Hedges and Olkin (1985) to identify between group differences. When interpreting the Q -statistics (Q_{Total} and Q_{Between}) and corresponding p -values, all heterogeneity statistics (τ^2 and I^2 , see next paragraph for descriptions) should be considered for interpretation, as significant p -values only indicate that true effects vary between studies but do not provide information on the magnitude of dispersion (Borenstein et al., 2009). The final consideration was the influence of a random effects model on moderating variables when model assumptions are violated as there is a potential to overestimate error (Overton, 1998) when sample sizes are small (Field, 2001). To prevent type I errors we set a conservative alpha level ($\alpha < 0.01$) when interpreting significant moderators.

CMA version-2 software provides four statistics (Q , τ^2 , τ , and I^2) to assess sub-group differences. Besides the Q_T -value there were two additional statistics that were used to interpret heterogeneity that included tau-squared (τ^2) and I -squared (I^2). The τ^2 statistic is used by CMA to calculate weights and yields an estimate of total

variance between studies in a random effects model. Larger τ^2 values reflect the proportion of variance that can be attributed to real differences between studies. When the number of effect sizes in a sub-group was small ($k \leq 5$) estimates of τ^2 are likely to be imprecise and the standard procedure was to use a pooled estimate of variance for all calculations of moderators (Borenstein et al., 2009). The I^2 statistic is the ratio of excess dispersion to total dispersion and can be interpreted as the overlap of confidence intervals explaining the total variance attributed to the covariates (Higgins, Thompson, Deeks, & Altman, 2003). Values closer to zero represent random error and values that move away from zero provide an opportunity to analyze variance by covariates. Interpretation of the I^2 statistic indicates low (25%), moderate (50%), and high (75%) relative variance with higher values requiring techniques (i.e., moderator analysis or meta-regression) to provide explanations (Borenstein et al., 2009; Higgins et al., 2003).

Outlier analysis & publication bias

Outlier analysis was examined by interpretation of relative residuals and by a “one-study removed” procedure that is available in CMA. Any study that was identified as an outlier (a large residual value $z \leq$ or ≥ 1.96) was examined in a “one-study removed” analysis, studies were not removed if they did not substantially impact the effect size g and results were within or near the 95th confidence interval. Publication bias was controlled for by visual inspection of a funnel plot, the Trim and Fill procedure (Duval & Tweedie, 2000a, 2000b) and Fail Safe N calculation (Rosenthal, 1979). The funnel plot provided a visual representation of publication bias that was based on a symmetrical distribution of data points about the mean effect size. A funnel plot graphs studies according to standard error (y -axis) and effect size (x -axis) with larger studies appearing toward the top of the plot (less error) and smaller studies (more error) toward the bottom. Symmetrical plots can be interpreted as a lack of publication bias, however, asymmetrical data are adjusted by using Duval and Tweedie’s (2000a) Trim and Fill procedure on a precision plot. The Trim and Fill procedure is an iterative process that adjusts overall effect size by identifying the number of missing studies (with negative effects) that would balance the plot to provide an unbiased estimate of effect size (Duval & Tweedie, 2000b). “Fail Safe N ” was used as an additional precaution and determines the number of non-significant missing studies that would be needed to nullify significant results (Rosenthal, 1979).

Outcome analyses

Due to the large number of student outcome variables and relatively few studies for each outcome, an approach resembling methods employed by Biddle, Wang, Kavussanu, and Spray (2003) and Ntoumanis and Biddle (1999) were used to condense and summarize findings that represented affective, behavioral, and/or cognitive outcomes. The process used to define and sort outcome variables included gathering information on instruments used to collect data from studies meeting inclusion criteria. Outcomes that were measured by an instrument, subscale, or a few items were then grouped according to the construct. For example, there were five separate measures used to collect information on competence and confidence. These measures included the Intrinsic Motivation Inventory (IMI; McAuley, Duncan, & Tammen, 1989), Competitive State Anxiety Inventory-2 (CSAI-2; Martens, Vealey, & Burton, 1990), Physical Self-Perception Profile (PSP; Fox & Corbin, 1989), Pictorial Scale of Perceived Competence and Social Acceptance (PSPCSA; Harter, 1982), and the Physical Education Teachers’ Emphasis on Achievement Goals Questionnaire (PETEAGQ;

Papaioannou, Milosis, Kosmidou, & Tsigilis, 2007). Field’s (2001, 2005) Monte Carlo simulations of meta-analytic approaches found that using Hedges and Olkin’s (1985) and Hedges and Vevea’s (1998) random effects approach when data were heterogeneous did not control for type I errors with fewer than 15 studies. Based on Field’s (2001, 2005) findings, in addition to Borenstein et al.’s (2009) suggestions on reporting standards, we have provided summary effects for each outcome where there were a critical number (three or four studies) of studies measuring a specific outcome, along with a conservative interpretation.

Affective outcomes measured included attitudes (Ajzen, 1988; Carlson, 1995; Christodoulidis, Papaioannou, & Digelidis, 2001; Treasure, 1993, 1997), boredom (Duda & Nicholls, 1992a, 1992b; Treasure, 1997), commitment/dedication (Cecchini et al., 2001; Papaioannou & Theodorakis, 1996; Theodorakis, 1994), and enjoyment/satisfaction (Duda, Fox, Biddle, & Armstrong, 1992; Duda & Nicholls, 1992a, 1992b; McAuley et al., 1989; Treasure, 1997). Behavioral outcomes measured were health/fitness related variables (Bowler, 2009; Christodoulidis et al., 2001; Cramer, 2000; Digelidis, Papaioannou, Lapidis, & Christodoulidis, 2003) and skills (Boone, 1995; Cramer, 2000; Martin, Rudisill, & Hastie, 2009; Solmon, 1996; Valentini & Rudisill, 2004a, 2004b). Cognitive outcomes measured included achievement goal (task/ego) orientations (Duda & Nicholls, 1992a, 1992b; Roberts, Treasure, & Balague, 1998; Treasure & Roberts, 1994; Walling & Duda, 1995), anxiety (Barkoukis, Tsorbatzoudis, & Grouis, 2008; Martens et al., 1990; Papaioannou, 1994), competence/confidence (Fox & Corbin, 1989; Harter & Pike, 1984; Martens et al., 1990; McAuley et al., 1989; Morgan & Kingston, 2008; Papaioannou, 1994; Papaioannou et al., 2007; Weigand & Burton, 2002), competitive and learning strategies (Morgan & Carpenter, 2002; Papaioannou, 1994; Solmon & Boone, 1993), motivational climate (mastery and performance) perceptions (Papaioannou, 1994; Papaioannou et al., 2007; Seifritz, Duda, & Chi, 1992), perceptions of ability (Duda & Nicholls, 1992a, 1992b; McAuley et al., 1989), and perceptions of effort (Duda & Nicholls, 1992a, 1992b; McAuley et al., 1989).

Results

The primary purpose of the current study was to determine the overall effectiveness across all outcomes of motivational climate interventions and the secondary purpose was to determine the effect of motivational climate interventions (TARGET) on specific affective, behavioral, and cognitive outcomes in school-based physical education. There were a total of 22 studies with 24 independent samples that included 4932 participants meeting inclusion criteria. The overall inter-rater agreement between two coders was 92.3% and ranged from 75% to 100% across the 12 characteristics coded and extraction of descriptive and inferential statistics. There were a total of 23 disagreements and of those disagreements seven were factual disagreements that were corrected and 16 interpretation disagreements that were uncorrected. An objective third coder evaluated each of the interpretations disagreements and the coding value or data extraction value used was based on the simple majority (two coders). Fig. 1 provides an overall presentation of the search strategy and Table 1 displays the coded methodological, participant, and study features as well as each study’s overall treatment effect. When interpreting the treatment effects Cohen’s (1988) criteria were used for interpretation of standardized mean differences and summarized effect sizes as small (≤ 0.20), medium (0.50), and large (≥ 0.80). Positive effect sizes are interpreted as treatment groups (mastery motivational climate) having stronger results than control groups or groups exposed to performance climate manipulations. Negative treatment effects indicated

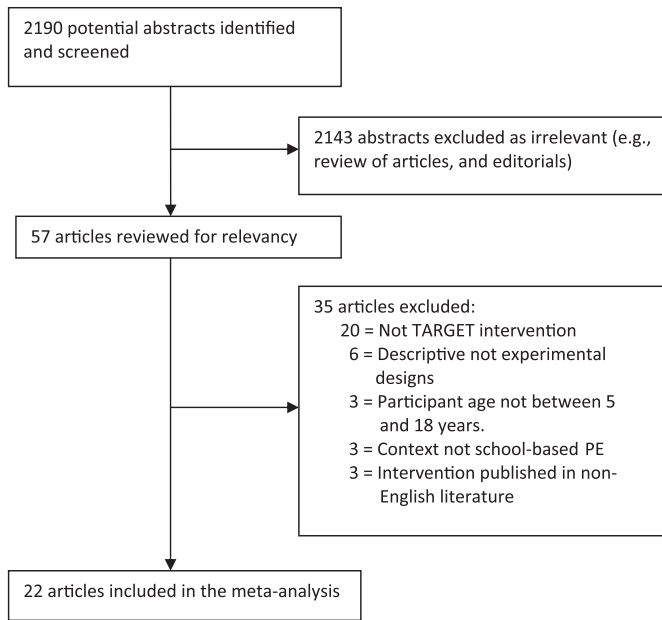


Fig. 1. Selection of TARGET framework intervention manuscripts within physical education contexts.

that the control group or performance climate group produced larger outcome results than the mastery climate group.

Random effects model results

The average treatment effect for all TARGET intervention studies was small ($g = 0.103$; $SE = 0.035$; 95% *C.I.* = 0.034, .171; $p = 0.003$)

and represented about one tenth a standard deviation advantage for treatment groups over control groups. Table 2 presents an overview of the relevant statistics used when evaluating the overall effect. Review of the homogeneity statistics revealed a significant heterogeneous distribution ($Q_T = 38.59$, $p = 0.022$; $I^2 = 40.40$) making it necessary to explain between-study variation though moderator analyses of characteristics coded for studies. In addition, an outlier analysis was conducted through evaluation of residual values and found one independent sample (Valentini & Rudisill, 2004b) to be an outlier ($z = 2.09$), therefore, a “one-study removed” procedure was performed. The single effect size was retained in the analysis as results indicated a small change (-0.006) in the effect size ($g = 0.097$) remaining within the 95% confidence interval. Publication bias was deemed marginal as a result of a symmetrical funnel plot, no studies being added during the Trim and Fill procedure, and a Fail Safe *N* value calculation of 98 studies that would be needed to nullify a significant α -level ($p < 0.05$).

Outcome analyses

In summary, outcome analyses generated positive and negative effects ranging from a low of -0.274 to a high of 0.599 . The diversity of outcomes and limited number of studies meeting inclusion criteria compelled the authors to employ procedures (see Biddle et al., 2003) combining measures with similar constructs and having at least three effect sizes for each outcome. Results were consistent with Achievement Goal Theory literature producing positive findings for adaptive outcomes and negative results for maladaptive outcomes (Biddle et al., 2003; Harwood et al., 2008). Maladaptive outcomes such as anxiety, boredom, competitive strategies, ego orientation, and perceptions of a performance climate were largest for control groups or groups exposed to performance climate conditions. Adaptive outcomes that were

Table 1
Study characteristics meeting inclusion criteria.

| Study | Intervention characteristics | | | | | | Participant characteristics | | | | Study characteristics | | |
|--|------------------------------|------------------|-----------|---------|--------------------|-----------|-----------------------------|-------------|-------|---------|-----------------------|-----------------|---------------------|
| | Training | Duration (weeks) | Follow-up | TARGET | Manipulation check | Intensity | <i>N</i> | Age (years) | Level | Country | Type | Outcome measure | Effect (<i>g</i>) |
| Barkoukis et al., 2008 | R | 28 | No | Full | Yes | R | 374 | 13.8 | MS | Greece | P | 1 | 0.07 |
| Boone, 1995 | R | 3 | No | Full | Yes | R | 268 | NR | MS | US | U | 2 | 0.24 |
| Bowler, 2009 | R | 2 | No | Full | Yes | R | 32 | 13.5 | MS | UK | U | 2 | 0.50 |
| Cecchini et al., 2001 | NR | 4 | No | Full | No | R | 115 | 11.7 | MS | Spain | P | 1 | -0.08 |
| Christodoulidis et al., 2001 | R | 40 | Yes | Partial | Yes | R | 634 | 15.0 | HS | Greece | P | 1 | 0.11 |
| Cramer, 2000 | R | 12 | No | Full | Yes | R | 65 | 15.0 | HS | US | U | 2 | 0.19 |
| Digelidis et al., 2003 | R | 40 | Yes | Full | Yes | R | 782 | 12.0 | MS | Greece | P | 1 | 0.24 |
| Jaakkola & Liukkonen, 2006 | R | 40 | No | Full | No | R | 333 | 15.0 | HS | Finland | P | 1 | -0.01 |
| Martin et al., 2009 | R | 6 | No | Full | Yes | R | 64 | 5.58 | E | US | P | 2 | 0.46 |
| Morgan & Carpenter, 2002 | R | 7 | No | Full | Yes | R | 153 | 13.6 | MS | UK | P | 1 | 0.03 |
| Morgan, Kingston, & Sproule, 2005 | R | 4 | No | Full | Yes | R | 92 | 12.9 | MS | UK | P | 2 | 0.00 |
| Morgan & Kingston, 2008 | R | 3 | No | Full | Yes | R | 80 | 13.7 | MS | UK | P | 2 | 0.14 |
| Papaioannou & Kouli, 1999 | R | 2 | No | Partial | Yes | R | 239 | 13.0 | MS | Greece | P | 1 | -0.10 |
| Papaioannou et al., 2007 | NR | 1 | No | Partial | Yes | NR | 580 | 12.5 | MS | Greece | P | 1 | -0.12 |
| Papaioannou et al., 2007 | NR | 1 | No | Partial | Yes | R | 351 | 13.0 | MS | Greece | P | 1 | 0.12 |
| Solmon, 1996 | R | 1 | No | Partial | Yes | R | 109 | NR | MS | US | P | 2 | -0.01 |
| Todorovich & Curtner-Smith, 2002 | NR | 2 | No | Full | Yes | R | 72 | 11.0 | E | US | P | 1 | 0.28 |
| Todorovich & Curtner-Smith, 2003 | NR | 2 | No | Full | Yes | R | 80 | NR | E | US | P | 1 | 0.06 |
| Valentini & Rudisill, 2004a | R | 12 | Yes | Full | Yes | R | 39 | 5.43 | E | US | P | 2 | 0.59 |
| Valentini & Rudisill, 2004a | R | 12 | Yes | Full | Yes | R | 56 | 5.10 | E | US | P | 2 | 0.56 |
| Valentini & Rudisill, 2004b | R | 12 | No | Full | No | R | 104 | 7.80 | E | Brazil | P | 2 | 0.56 |
| Viciano, Cervelló, & Ramírez-Lechuga, 2007 | R | 7 | No | Partial | Yes | R | 95 | 15.0 | HS | Spain | P | 1 | -0.10 |
| Wallhead & Ntoumanis, 2004 | NR | 8 | No | Partial | Yes | R | 51 | 14.3 | MS | UK | P | 2 | 0.39 |
| Weigand & Burton, 2002 | NR | 5 | No | Full | No | R | 40 | 15.9 | HS | UK | P | 1 | 0.44 |

Note. Training: R = reported; NR = not reported. Duration (weeks): NR = not reported. Intensity: R = reported; NR = not reported. Level: E = elementary; MS = middle school; HS = high school. Type: P = published; U = unpublished. Outcome measures: 1 = self-report; 2 = combination (self-report and objective measure). The effect size reported for study characteristics is a summary effect across all outcome variables per study. Papaioannou et al. (2007) is a single study with two independent samples.

Table 2
Outcome analysis.

| Variable | Effect size statistics | | | | | Null test Z | Heterogeneity statistics | | | Publication bias Fail safe N |
|----------------------------|------------------------|--------|-------|----------------|-----------------|----------------|--------------------------|----------------|----------------|---------------------------------|
| | k | g | SE | s ² | 95% C.I. | | Q | τ ² | I ² | |
| <i>Affective outcomes</i> | | | | | | | | | | |
| Attitude | 4 | 0.599 | 0.238 | 0.057 | (0.133, 1.07) | 2.518* | 48.311* | 0.205 | 93.79 | 125 |
| Boredom | 3 | -0.274 | 0.268 | 0.072 | (-0.801, .252) | -1.022 | 8.665* | 0.162 | 76.92 | 1 |
| Enjoyment | 11 | 0.149 | 0.054 | 0.003 | (0.043, .255) | 2.750* | 22.64* | 0.015 | 55.83 | 45 |
| <i>Behavioral outcomes</i> | | | | | | | | | | |
| Health/fitness | 4 | 0.492 | 0.110 | 0.012 | (0.277, .706) | 4.486* | 6.365 | 0.022 | 52.87 | 52 |
| Skills | 7 | 0.395 | 0.107 | 0.011 | (0.185, .605) | 3.692* | 9.510 | 0.028 | 36.91 | 35 |
| <i>Cognitive outcomes</i> | | | | | | | | | | |
| Anxiety | 3 | -0.246 | 0.072 | 0.005 | (-0.387, -.104) | -3.406* | 2.970 | 0.005 | 28.324 | 10 |
| Commitment | 3 | 0.183 | 0.122 | 0.015 | (-0.055, .422) | 1.508 | 5.515 | 0.026 | 63.74 | 4 |
| Competence/confidence | 9 | 0.118 | 0.133 | 0.018 | (-0.143, .378) | 0.883 | 75.61* | 0.121 | 89.42 | 3 |
| Competitive strategies | 4 | -0.074 | 0.073 | 0.005 | (-0.216, .069) | -1.016 | 6.639 | 0.011 | 54.81 | 0 |
| Learning strategies | 3 | 0.285 | 0.084 | 0.007 | (0.121, .448) | 3.409* | 2.154 | 0.002 | 7.147 | 5 |
| Ego orientation | 14 | -0.065 | 0.078 | 0.006 | (-0.217, .087) | -0.834 | 63.93* | 0.057 | 79.67 | 12 |
| Task orientation | 14 | 0.181 | 0.057 | 0.003 | (0.069, .292) | 3.172* | 44.46* | 0.027 | 70.76 | 114 |
| Mastery climate | 13 | 0.318 | 0.053 | 0.003 | (0.215, .422) | 6.006* | 34.28* | 0.020 | 64.99 | 224 |
| Performance climate | 12 | -0.239 | 0.102 | 0.010 | (-0.438, -.039) | -2.344* | 78.63* | 0.093 | 86.01 | 110 |
| Perceptions of ability | 6 | 0.078 | 0.163 | 0.027 | (-0.242, .398) | 0.479 | 36.88* | 0.123 | 86.44 | 0 |
| Perceptions of effort | 5 | 0.082 | 0.051 | 0.003 | (-0.018, .182) | 1.608 | 2.525 | 0.000 | 0.000 | 0 |

Note. *k* = Number of effect sizes. *g* = Effect size (Hedges *g*). *SE* = Standard error. *s*² = Variance. 95% C.I. = Confidence intervals (lower limit, upper limit). *Z* = Test of the null hypothesis. τ^2 = Between-study variance in random effects model. *I*² = Total variance explained by moderators. *Indicates a significant *Q*_{Total} value, $p \leq 0.05$.

positive for groups experiencing a mastery climate treatment included attitude, commitment, enjoyment, competence/confidence, mastery climate perceptions, perceptions of effort, and task orientation. The largest positive treatment effects were found for attitude ($N = 1634$, $k = 4$, $g = 0.599$), health/fitness ($N = 1513$, $k = 4$, $g = 0.492$), and skills ($N = 705$, $k = 7$, $g = 0.395$) with the most negative effect sizes found for the outcomes boredom ($N = 288$, $k = 3$, $g = -0.274$), anxiety ($N = 728$, $k = 3$, $g = -0.246$), and perceptions of a performance climate ($N = 3012$, $k = 13$, $g = -0.239$). Moderator analyses were needed for most outcome variables ($Q_B \leq 0.01$), however, there were insufficient data for some outcomes to perform moderator analyses that would generate a precise estimate of the combined effect (Borenstein et al., 2009). Therefore, we chose only to report the summary effect for each outcome and not to perform moderator analyses.

Affective outcomes

Mastery climate interventions produced small to moderate negative and positive treatment effects for affective outcomes. Interpretation of these results suggest that TARGET interventions produce between one seventh ($g = 0.149$) to greater than one half ($g = 0.599$) a standard deviations advantage on adaptive outcomes for groups exposed to mastery climate conditions. Outlier analyses for all affective outcomes produced no large residual values, however, publication bias statistics (Fail Safe *N*) indicated low tolerance suggesting caution when interpreting affective outcome results for boredom.

Behavioral outcomes

The largest overall outcome advantage for groups exposed to mastery climate TARGET manipulations were found in behavioral outcomes. Health and fitness outcomes (i.e., heart rate, cardiovascular fitness, exercise frequency, nutrition behaviors) as well as skill-based outcomes (badminton, basketball, juggling, and practice conditions) produced treatment effect sizes ($g = 0.395$ and $g = 0.492$) that were small to moderate. Observation of heterogeneity statistics revealed that distributions were homogeneous (non-significant Q_T -values, $p > 0.05$) or that studies measuring health/fitness and skill outcomes produced similar findings and no moderator analyses were needed to explain

variance between studies. Publication bias was unlikely as Fail Safe *N* calculations for both health/fitness (52 studies) and skills (35 studies) indicated several studies were needed to produce non-significant results.

Cognitive outcomes

Cognitive outcomes were most frequently measured in studies and included treatment effects on student variables such as confidence/competence ($k = 9$), ego orientation ($k = 14$), mastery climate perceptions ($k = 13$), performance climate perceptions ($k = 12$), and task orientation ($k = 14$). Desired treatment effects were positive small gains in mastery climate groups for the adaptive outcomes commitment ($g = 0.183$), confidence/competence ($g = 0.118$), learning strategies ($g = 0.285$), perceptions of a mastery climate ($g = 0.315$), and task orientation ($g = 0.181$). In summary, the maladaptive cognitive outcomes anxiety, competitive strategies, ego orientation, and perceptions of a performance climate produced small negative effects ranging from -0.065 to -0.246 with homogeneity statistics indicating heterogeneous ($Q_T < 0.05$) distributions and large portions of variance ($I^2 > 70$) that could be explained by moderator analyses. The only cognitive outcomes that could be interpreted with confidence that publication bias was not present were task orientation and perceptions of a mastery and performance climates. These results indicated that overall summary effects for maladaptive outcomes were not robust and further study is needed to provide an accurate estimate of effect size for most cognitive outcomes.

Moderator analyses

Heterogeneity statistics for the random effects model confirmed that there was a heterogeneous ($Q_T = 38.59$, $p < 0.05$) distribution and that a moderate level ($I^2 = 40.40$) of between-study variation existed to justify conducting sub-group analyses for coding characteristics. Tables 2 and 3 present the results from moderator analyses on intervention characteristics (Table 2), participant characteristics (Table 3), and study characteristics (Table 3). While all analyses produced overall trends (treatment groups > control groups, $p < 0.05$) for specific moderators, there were no statistically significant differences ($p < 0.01$) between moderators.

Table 3
Intervention moderator statistics.

| | Effect size descriptive statistics | | | | | Null test Z | Heterogeneity statistics | | |
|--|------------------------------------|-------|-------|----------------|----------------|----------------|--------------------------|----------------|----------------|
| | k | g | SE | s ² | 95% C.I. | | Q | τ ² | I ² |
| Random effects model ^a | 24 | 0.103 | 0.035 | 0.001 | (0.034, .171) | 2.922* | 38.59* | 0.009 | 40.40 |
| <i>Intervention features^b</i> | | | | | | | | | |
| Training | | | | | | | 0.083 ^b | | |
| Reported | 17 | 0.087 | 0.075 | 0.006 | (0.029, .195) | 2.639* | | 0.007 | 47.66 |
| Not reported | 7 | 0.112 | 0.042 | 0.002 | (-0.059, .234) | 1.169 | | 0.013 | 24.74 |
| Time period | | | | | | | 3.197 ^b | | |
| <3 Weeks | 7 | 0.023 | 0.061 | 0.004 | (-0.097, .142) | 0.375 | | 0.012 | 50.13 |
| 3–8 Weeks | 10 | 0.106 | 0.057 | 0.003 | (-0.006, .219) | 1.852 | | 0.000 | 0.000 |
| >8 Weeks | 7 | 0.178 | 0.062 | 0.004 | (0.057, .300) | 2.869* | | 0.016 | 51.22 |
| Follow-up | | | | | | | 3.410 ^b | | |
| No | 20 | 0.072 | 0.036 | 0.001 | (0.002, .142) | 2.028* | | 0.007 | 33.69 |
| Yes | 4 | 0.231 | 0.081 | 0.007 | (0.071, .390) | 2.838* | | 0.005 | 17.96 |
| TARGET | | | | | | | 3.608 ^b | | |
| Full | 17 | 0.150 | 0.043 | 0.002 | (0.066, .234) | 3.500* | | 0.007 | 29.54 |
| Partial | 7 | 0.016 | 0.056 | 0.003 | (-0.093, .126) | 0.289 | | 0.014 | 47.23 |
| Manipulation check | | | | | | | 1.822 ^b | | |
| No | 5 | 0.165 | 0.099 | 0.010 | (-0.029, .359) | 1.664* | | 0.026 | 48.65 |
| Yes | 19 | 0.095 | 0.039 | 0.001 | (0.002, .148) | 2.462* | | 0.006 | 33.24 |

Note. k = Number of effect sizes. g = Effect size (Hedges g). SE = Standard error. s² = Variance. 95% C.I. = Confidence intervals (lower limit, upper limit). Z = Test of the null hypothesis. τ² = Between-study variance in random effects model. I² = Total variance explained by moderators. *p ≤ 0.05.

^a Total Q-value used to determine heterogeneity.

^b Between Q-value used to determine significant differences (α = .01) between moderators.

Methodological features

No significant differences within methodological moderators were present, however there were several methodological trends including reported training time ($g = 0.112$, $Z = 2.639$, $p < 0.05$) for individuals (teacher/researchers) delivering TARGET interventions, motivational climate interventions longer than eight weeks ($g = 0.178$, $Z = 2.434$, $p < 0.05$), and TARGET interventions employing all the characteristics ($g = 0.150$, $Z = 3.500$, $p < 0.05$) of a mastery motivational climate intervention. Studies conducting follow-up intervention measures ($g = 0.231$, $Z = 2.838$, $p < 0.05$) and employing a manipulation check ($g = 0.165$, $Z = 2.462$, $p < 0.05$) produced larger treatment effects than interventions not conducting follow-up measures ($g = 0.072$, $Z = 2.028$, $p < 0.05$) or using manipulation checks ($g = 0.095$, $Z = 1.664$, $p < 0.05$). Overall, there were small positive treatment effects.

Participant features

Level in school (Elementary School, Middle School, or High School) and country (Brazil, Finland, Greece, Spain, UK, or US) were the primary categories for participant analysis. There was a significant treatment effect ($Z \leq 0.05$) for students at the Elementary School level ($g = 0.407$, $Z = 3.710$, $p < 0.05$), however, there were no moderator differences ($Q_B = 8.840$, $p > 0.01$) when compared to Middle School ($g = 0.068$, $Z = 0.940$, $p > 0.05$) or High School students ($g = 0.066$, $Z = 1.896$, $p > 0.05$). The moderator trends for country had the largest treatment effects for participants in Brazil ($g = 0.563$, $Z = 2.610$, $p < 0.05$) and the US ($g = 0.239$, $Z = 2.962$, $p < 0.05$) than for participants in Finland ($g = -0.005$, $Z = -0.039$, $p > 0.05$), Greece ($g = 0.058$, $Z = 1.238$, $p > 0.05$), Spain ($g = -0.084$, $Z = -0.480$, $p > 0.05$), or the UK ($g = 0.089$, $Z = 1.378$, $p > 0.05$). Results from both participant and study characteristics can be found in Tables 3 and 4.

Study features

The moderator analysis for type of study found that unpublished ($g = 0.251$, $Z = 2.145$, $p < 0.05$) reports had larger treatment effects than unpublished ($g = 0.087$, $Z = 2.423$, $p < 0.05$), however, no

significant differences were present ($Q_B = 1.794$, $p > 0.01$). Results from the outcome measures analysis determined studies using both (combination) self-report and objective methods in data collection had larger treatment effects ($Z = 3.169$, $p < 0.05$) than studies only using self-report measures with no significant differences between either moderator ($Q_B = 3.242$, $p > 0.01$). Overall results from study feature moderators found small to marginal treatment effects.

Discussion

The purpose of our literature synthesis was twofold and focused on the effectiveness of motivational climate interventions and moderating factors that contributed to positive or negative results in physical education contexts. Our results found an overall positive treatment effect for groups and participants exposed to a mastery motivational climate and negative effects for untreated control groups or performance climate conditions. More specifically, TARGET strategies used to manipulate an environment to favor mastery conditions have small to moderate treatment effects for affective, behavioral, and cognitive outcomes. These findings support our hypotheses and are consistent with motivational climate literature that shows positive effects for adaptive outcomes and negative effects for maladaptive outcomes across affective, behavioral, and cognitive variables. Consequently, there are several factors that should be considered when designing and implementing future motivational climate interventions. If motivational processes underpin student participation in activity and learning, future interventions should provide more empirical evidence to support instructional strategies that facilitate adaptive motivational processes.

Outcome measures provided information concerning how data were collected from the participants. Nine studies selected to use self-report measures while the other 15 studies used a combination of self-report and objective measures. The difference in overall effectiveness across all outcomes between the two methods used to collect data from students was non-significant ($p > 0.01$), favoring

Table 4
Participant and study moderator statistics.

| | Effect size descriptive statistics | | | | | Null test Z | Heterogeneity statistics | | |
|---|------------------------------------|--------|-------|----------------|----------------|----------------|--------------------------|----------------|----------------|
| | k | g | SE | s ² | 95% C.I. | | Q | τ ² | I ² |
| Random effects model ^a | 24 | 0.103 | 0.035 | 0.001 | (0.034, .171) | 2.922* | 38.59* | 0.009 | 40.40 |
| <i>Participant features^b</i> | | | | | | | | | |
| Level | | | | | | | 8.840 ^b | | |
| Elementary school | 6 | 0.407 | 0.105 | 0.012 | (0.192, .622) | 3.710* | | 0.000 | 0.000 |
| Middle school | 12 | 0.068 | 0.060 | 0.001 | (−0.002, .138) | 0.940 | | 0.009 | 50.75 |
| High school | 6 | 0.066 | 0.026 | 0.005 | (−0.071, .203) | 1.896 | | 0.000 | 0.000 |
| Country | | | | | | | 10.19 ^b | | |
| Brazil | 1 | 0.563 | 0.216 | 0.047 | (0.140, .986) | 2.610* | | 0.000 | 0.000 |
| Finland | 1 | −0.005 | 0.126 | 0.016 | (−0.252, .242) | −0.039 | | 0.000 | 0.000 |
| Greece | 6 | 0.058 | 0.047 | 0.002 | (−0.034, .150) | 1.238 | | 0.013 | 68.30 |
| Spain | 2 | −0.084 | 0.176 | 0.031 | (−0.429, .260) | −0.480 | | 0.000 | 0.000 |
| United Kingdom | 6 | 0.089 | 0.065 | 0.004 | (−0.038, .215) | 1.378 | | 0.002 | 9.835 |
| United States | 8 | 0.239 | 0.081 | 0.007 | (0.081, .397) | 2.962* | | 0.000 | 0.000 |
| <i>Study features^b</i> | | | | | | | | | |
| Type | | | | | | | 1.794 ^b | | |
| Published | 21 | 0.087 | 0.036 | 0.001 | (0.017, .157) | 2.423* | | 0.020 | 42.92 |
| Unpublished | 3 | 0.251 | 0.117 | 0.014 | (0.022, .479) | 2.145* | | 0.000 | 0.000 |
| Outcome measure | | | | | | | 3.242 ^b | | |
| Combination | 12 | 0.189 | 0.060 | 0.004 | (0.072, .307) | 3.169* | | 0.015 | 34.35 |
| Self-report | 12 | 0.057 | 0.043 | 0.002 | (−0.027, .141) | 1.338 | | 0.007 | 42.64 |

Note. * $p \leq 0.05$. Please refer to Table 3 footnotes for explanations regarding column headings.

^a Total Q-value used to determine heterogeneity.

^b Between Q-value used to determine significant moderator differences.

a combination ($g = 0.189$) over self-report ($g = 0.057$) methods. Analysis of the types of outcome variables that were intended for measurement were insightful concerning the outcome measure and outcome focus for future research. In the current study, all interventions measured some type of cognitive outcome, nine studies investigated behavioral outcomes, and 13 studies collected data on affective variables. Research on AGT connects situational processes to several affective, behavioral, and cognitive outcomes but to date there is a shortage of data concerning the influence of motivational climate interventions on affective and behavioral variables. Equally important is the effect of situational achievement goals on learning, as most educational research on competence-based goals has expectations attached to student achievement in learning contexts (Chen & Ennis, 2004). Student learning can be measured in affective, cognitive, and psychomotor domains but in the current review there were only five studies (Cramer, 2000; Solmon, 1996; Valentini & Rudisill, 2004a, 2004b) that directly measured psychomotor learning as a result of employing a mastery climate intervention. Physical education promotes lifetime involvement in physical activity and AGT research has enhanced our understanding of student perceptions that are attached to specific situational influences that engage students in a learning context. However, what remains unclear is how students use competence-based information received from their motivational climate perceptions in physical education to influence participation in lifetime physical activity.

Recommendations for future intervention research

Methodological features

Several substantive features were explored in an attempt to explain the current findings and provide suggestions for future motivational climate interventions. With regard to the methodological features, an important factor that underpins successful manipulation of motivational climate is the training of teachers or those providing instruction to students in physical education. All

studies provided some detail concerning TARGET framework training, however, only five of the 24 studies provided detailed information on time spent and specific methods in preparing teachers to deliver the TARGET framework. These methods included training seminars, pre-designed units or lessons, video analysis or systematic coding, or combinations of the various strategies. Nevertheless, absent from most of the studies are descriptions concerning teacher attitudes, beliefs, and teaching practice before and after interventions as these teacher variables directly influence student outcomes (Biddle & Mutrie, 2008; Ennis, 2003). More information is needed regarding the amount of time involved in training as well as the specific strategies that reinforce the delivery of a TARGET framework in future research to fully assess the effect of mastery climate interventions on student motivation.

The link between training and the intervention delivery process (intervention duration and intervention intensity) is critical to maximize both teacher and student outcomes. Analysis of these intervention characteristics found four studies that conducted lengthy interventions (majority of the school year) and nine studies utilized interventions that covered a unit of work (learning) in physical education settings. Also apparent was the diverse nature in intensity of delivery, as studies conducted for shorter periods of time (more mastery sessions per week) were more frequent than longer TARGET interventions (fewer mastery sessions per week). Another important consideration for future TARGET interventions is to balance quality (intervention intensity or frequency of sessions and personnel training) as well as quantity (intervention duration). Educational settings such as physical education are interested in the long-term effects and by identifying the quantity and quality of specific training strategies and the amount of time (longitudinal studies) invested in preparing teachers, research could start to isolate and enhance strategies that better facilitate the influence of TARGET structures.

Taking baseline measurements during an experiment constitutes an important methodological feature and motivational climate manipulation checks provide information on student

perceptions prior to an intervention being conducted. Without a climate manipulation check, student outcomes cannot be directly attributed to the treatment being applied. Our review found five studies that did not report a climate manipulation check, therefore, results concerning student outcomes may or may not be attributed to exposure (or lack thereof) to a mastery motivational climate. Equally important to research on motivational climate are the long-term effects on student motivation as a result of being exposed to a TARGET intervention. To date, only three studies (four independent samples) used follow-up measures to determine treatment effectiveness. Results were mixed with two studies (Christodoulidis et al., 2001; Digelidis et al., 2003) finding no long-term effects and one study (Valentini & Rudisill, 2004a, 2004b) producing significant treatment effects. The authors encourage future intervention studies to collect these pre-test, post-test, and follow-up measures to further our understanding of TARGET interventions.

When analyzing the use of the TARGET structure to conduct interventions, 17 of the studies meeting inclusion criteria employed a full (all components) TARGET module when implementing mastery climate interventions as compared to seven studies using a partial (some of the components) module during mastery climate interventions. Ames (1992a, 1992b) and Epstein (1988, 1989) provide specific strategies which can be used when employing the TARGET framework to improve the motivational climate and these strategies appear to be connected to the literature on the effective teaching principles in physical education (Rink, 2003). Both full and partial interventions produced positive outcomes for mastery climates with full TARGET models producing the strongest results in treatment groups. Additional studies using interventions to promote mastery motivational climates would benefit by connecting process and product research to specific pedagogical principles of effective teaching (process) to adaptive student outcomes (products).

Participant features

Analyses of the participant features produced the largest effect sizes within the current investigation. The moderator analyses of grade in school (level) produced significant results for elementary students (ages 5–11) and marginal treatment effects for middle school (ages 12–14), and high school (ages 15–18) students. Elementary and high school students were the least studied subgroups ($k = 6$) as compared to secondary schools ($k = 18$). When analyzing the motives behind youth's declining interest in physical education, and in general physical activity participation, understanding the spectrum of changes that occur during each transitional time period from youth to adolescence is an important consideration. Additional information is also needed concerning the gender and cultural contexts for physical education to explore variance in outcome variables related to motivational climate. Given that our analysis found trends in country as a moderator of climate perceptions, we would suggest future studies attempt to explore cultural, gender, and contextual factors of physical education. Results from our study suggest that Brazil and the US produced strong treatment effects when compared to other countries in which TARGET interventions were conducted. Information on contextual factors such as curriculum and instructional delivery might provide an additional perspective on participants concerning motivational climate perceptions in physical education. What is also beginning to emerge from the literature is that, not only are teachers considered to be a pivotal figure in determining motivational climate in physical education, but peers' influence can impact climate perceptions especially during adolescence (Harwood & Swain, 2001; Vazou, Ntoumanis, & Duda, 2006). The developmental aspects related to motivational climate provide a compelling argument on how students begin to conceptualize success

(Nicholls, 1989) in physical education, but equally important are changes related to health-related outcomes (i.e., decline in physical activity and increase in sedentary behaviors) that occur during middle school years and beyond (United Kingdom Department of Health, 2004; United States Department of Health and Human Services, 2008, 2010). Future research might direct the focus on transitional periods, both before and after, on a variety of affective, behavioral, and cognitive outcomes that the literature has established as relevant.

Study features

Study characteristics that were analyzed as a part of the moderator analyses included publication type (published or unpublished) and type of outcome measure (self-report and/or objective) that were used to collect information from the students. There were seven studies (one conference presentation and six dissertations) identified in literature searches meeting inclusion criteria, and of those studies, four were later published in peer reviewed journals. Analysis of this moderator produced larger effects for unpublished ($g = 0.246$) than published ($g = 0.089$). The authors are unsure of the rationale concerning the decision not to publish, however, these studies did produce small to moderate positive treatment effects. The outcome measure moderator for study features produced a noticeable difference between TARGET interventions that used a combination approach (self-report and objective measures) when compared to self-report approaches in data collection. Additionally, there has been a precedent set that research conducted on motivational climate use interventions to provide information that advances our knowledge and understanding on the influence of motivational climate on outcome variables (Duda, 1993; Harwood et al., 2008). We would echo those suggestions and in addition advocate for future studies to use combinations of measures to collect data from participants being exposed to motivational climate manipulations.

Conclusions

When analyzing the motivational climate literature, more data are needed from teachers and students to provide an overall perspective on what is happening within physical education settings that preempts motivational processes. The authors understand that there are several factors to consider when collecting data from students in schools, however, we would advocate that future quantitative interventions provide information on all outcomes regardless of the influence on publication merit. The most important consideration for the construct of motivation and the situational influences that exist in physical education is that more information concerning affective, behavioral, and cognitive learning outcomes is needed to provide a holistic perspective to help teachers implement methods that will enhance student participation in lifetime physical activity.

The overall summary of meta-analytic findings indicated that factors such as the lack of a validated and reliable measurement tool for each component of TARGET, different measurement tools for perceptions of climate, lack of standardized training policies and procedures for those administering interventions, and inequity and inconsistent evidence for many affective, behavioral, and cognitive outcomes limit drawing firm conclusions on the positive effects of motivational climate interventions. Additional methodological factors such as the unit of analysis (class or individual) debate, conducting a priori power calculations, and employing balanced group designs and (to the extent possible) randomized controlled trials could all improve the effectiveness of motivational climate interventions. Clearly, more TARGET intervention studies are requisite in physical education contexts. Interventions should be

conducted with different populations using specific strategies that address the unique demands of different environments to provide a substantive review of the effectiveness of TARGET structures on student cognitions, affect and behavior in physical education.

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