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6 Motivational Climate Interventions in Physical Education: A Meta-Analysis

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1 **Abstract**

2 **Objective**

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

6 **Design**

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

11 **Methods**

12 Standard meta-analytic procedures incorporating inclusion and exclusion criteria,  
13 literature search, coding procedures, and statistical methods were used to identify and synthesise  
14 22 studies with 24 independent samples. Cohen's (1988) criteria for effect sizes were used to  
15 interpret and evaluate results.

16 **Results**

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

24

**1 Conclusions**

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

**5 Keywords**

6 *Motivational Climate, Interventions, Physical Education, Meta-Analysis*

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## 1           **Motivational Climate Interventions in Physical Education: A Meta-Analysis**

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

### 14           **Motivational Climate**

15           Within AGT, the term ‘motivational climate’ has been adopted to encompass the study of  
16 environmental factors that lead individuals to construe competence in different ways and pursue  
17 different goals. One way to define one’s competence is through the perception of self  
18 improvement and mastery of skills, whereas a second perspective entails the comparison of one’s  
19 own ability with that of others in a salient reference group. Logically, individuals who employ  
20 the first definition pursue goals centered on striving to improve and master tasks; on the other  
21 hand, those individuals who choose to adopt the second definition pursue goals focused on doing  
22 better than others (Nicholls, 1989). Although different frameworks and perspectives exist under  
23 the broad umbrella term of AGT (Ames, 1992a, b; Elliot, 1999; Nicholls, 1989), all theorists

1 agree that, in addition to or in combination with intrapsychic factors, goal adoption can be  
2 determined by environmental features (i.e., the motivational climate).

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

14         One means by which the specific behaviors of sports coaches and PE teachers can be  
15 understood in terms of emphasizing the salience of particular goals is through the TARGET  
16 framework (Ames, 1992a,b; Epstein, 1989). The acronym TARGET refers to Task (design of  
17 activities), Authority (location of decision-making), Recognition (manner of distributing rewards  
18 such as praise), Grouping (criteria for selecting working groups), Evaluation (standards of  
19 performance considered important), and Time (pace of learning). A mastery climate is more  
20 likely to be perceived when tasks are challenging, participants are provided with choices and  
21 opportunities to exercise leadership, recognition is provided privately to individuals, participants  
22 work in mixed ability groupings, positive evaluation for personal improvement is emphasized,  
23 and variability in pace of learning is accommodated. A performance climate is more likely to be  
24 reported by sports and PE participants when coaches and teachers organize repetitive and

1 uniform tasks, control all aspects of decision-making, provide praise publicly, arrange groupings  
2 reflective of rank order of ability, praise and reward only the more able in the class or team, and  
3 do not allow slower learners extra time to master skills. Because the TARGET framework  
4 provides guidance as to specific environmental structures that emphasize different achievement  
5 goals, it has proved a useful model for researchers interested in manipulating the motivational  
6 climate in the physical domain.

### 7 **Motivational Climate Interventions**

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

18       Ntoumanis and Biddle (1999), in their review of motivational climate, identified four  
19 short-term and three long-term interventions that sought to manipulate the psychological  
20 environment of participants engaged in a variety of physical activities. Only one study  
21 (Theeboom, De Knop & Weiss, 1995) adopted the TARGET framework and found support for  
22 the hypothesized benefits of creating a mastery climate i.e., higher levels of enjoyment and  
23 motor skills among the mastery group compared to the traditional group. Narrative reviews of  
24 achievement goal research in physical activity reveal that, since 1999, correlational research has

1 continued to flourish, and authors have called for stronger designs that facilitate the inference of  
2 cause and effect (Duda, 2001; Duda & Whitehead, 1998; Harwood et al., 2008; Roberts, 2001).  
3 Although not as prevalent as cross-sectional investigations, a number of intervention studies  
4 have been conducted into the effects of manipulating mastery climate on cognitive, affective and  
5 behavioral outcomes. We argue that, over a decade later, there is a requirement to examine the  
6 collective empirical yield. Thus, the purpose of the present paper was to examine effect sizes  
7 across studies on different outcomes, to provide some indication of a summary effect for both  
8 positive and negative outcomes, and to identify the influence of moderating variables. In  
9 undertaking this research endeavor, we hoped to provide a critique of this area to assist  
10 researchers in the planning, delivery and reporting of future interventions. Moreover, in  
11 responding to the interests of practitioners working in sports and PE settings, we wanted to  
12 address the question: ‘Do interventions work and what determines their effectiveness?’ We  
13 expected that mastery climate interventions would result in significant positive effects on  
14 adaptive affective, behavioral, and cognitive motivational outcomes and significant negative  
15 effects on maladaptive outcomes. Where analyses revealed heterogeneity among effect sizes  
16 (i.e., results across studies were inconsistent), we analysed the influence of a number of  
17 moderators. However, we did not set, *a priori*, hypotheses in relation to potential moderating  
18 influences. Instead, coding methods established by Brown, Upchurch, & Acton (2003) were used  
19 to extract descriptive information listing characteristics of interest. Based on the descriptive  
20 information collected, three categories were established including methodological features,  
21 participant features, and study features. Information regarding the specific features can be found  
22 in the methods section.

## 23 **Methods**

### 24 **Literature Search & Inclusion Criteria**



1           A literature search was conducted in three phases that included a) an electronic database  
2 search, b) a search for review articles and c) a search of the reference sections in articles  
3 determined to be relevant from the previous searches (a & b). Electronic database searches were  
4 performed in Academic Search Elite, ArticleFirst, ERIC, Medline, OmniFile, Physical Education  
5 Index, Proquest Dissertations and Theses, PsychINFO, PsychARTICLES, and SportDiscus using  
6 variations of the keywords *intervention*, *achievement motivation*, *achievement goal theory*,  
7 *motivational climate*, *mastery climate*, *performance climate*, and *TARGET*. Articles retained for  
8 the current meta-analysis met the following inclusion criteria: (a) Published and unpublished  
9 literature in the English language from January 1, 1992 to August 1, 2010; (b) use of a  
10 motivational climate intervention following the TARGET structure established by Ames (1992b)  
11 and Epstein (1988, 1999); (c) interventions conducted in school-based physical education settings  
12 and reporting measurements for student outcomes as a result of the intervention; (d) studies using  
13 a control group or control measure, (e) articles reporting quantitative descriptive and/or  
14 inferential statistics that would allow for calculation or estimation of an effect size, and (f)  
15 studies reporting reliability (e.g., Cronbach Alpha's) and validity (e.g., confirmatory factor  
16 analysis results [CFA] or the use of previously established measures that have used CFA)  
17 coefficients of motivational climate instruments.

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

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

### 23 **Effect Size Calculations**

1 Data were entered into Comprehensive Meta Analysis (CMA) version-2 software  
2 (Borenstein, Hedges, Higgins, & Rothstein, 2005) which was used to compute all effect sizes.  
3 CMA provides many (more than 100) data entry options allowing flexibility during analysis to  
4 overcome insufficient information not provided in the literature. Data entry formats used in this  
5 study to calculate effect sizes included variations of both matched and unmatched designs across  
6 posttest, pre-post contrasts, and gain scores. When descriptive data such as means and standard  
7 deviations were not available, estimates of effect size calculations were based on  $F$ ,  $t$ ,  $r$ , or  $p$ -  
8 values (Rosenthal, 1994). Each study was the unit of analysis and contributed one independent  
9 effect size to the meta-analysis. If a study contained more than one relevant effect size (multiple  
10 outcomes per study) the standard procedure was to average those scores providing one overall  
11 (combined) calculation (Borenstein et al., 2009; Cooper, 1998). Additionally, outcome analyses  
12 were used to determine summary effects of a single outcome and the summary treatment effect  
13 for that outcome was the mean calculation across studies measuring that outcome (Cooper,  
14 1998). For example, several studies reported information on situational outcomes (mastery and  
15 performance climate perceptions) and dispositional outcomes (ego and task orientation). The  
16 overall treatment effect was an average of both dispositional and situational variables and the  
17 outcome analyses provided a summary effect for each dispositional and situational outcome  
18 variable. Hedges  $g$  was selected as the measure of effect size to provide a conservative estimate  
19 of effect due to small sample sizes ( $k < 20$ ) (Hedges & Olkin, 1985) and was calculated by CMA  
20 with the following formula:

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

21 There are two primary models that can be employed to determine statistical assumptions of error  
22 when conducting a meta-analysis (Hedges & Vevea, 1998). A fixed effects model suggests that

1 all studies in the meta-analysis share a common effect and differences are a result of within study  
2 error (sampling error), whereas a random effects model makes the assumption that there are both  
3 within study error and between study variance (Borenstein et al., 2009). A random effects model  
4 (Hedges & Olkin, 1985; Hedges & Vevea, 1998; Field, 2003) was selected for the analysis due  
5 to variation between intervention methods, potential sampling error, and the possibility of  
6 random unexplained variance between studies. Standardized mean differences were adjusted by  
7 the inverse weight of the variance to prevent sample size from inflating study weights and  
8 allowing for a more accurate calculation of the overall effect size (Borenstein, Hedges, Higgins,  
9 & Rothstein, 2009; Hedges & Olkin, 1985; Shaddish & Haddock, 1994). An a priori power  
10 analysis determined that there were sufficient studies in the meta-analysis to detect moderate to  
11 large effects.

## 12 **Heterogeneity of Variance**

13 When using a random effects model there is an assumption that the true effect size will  
14 vary between studies, therefore, several indicators were used to assess heterogeneity of variance.  
15 The  $Q$ -test serves as a significance test and is based on critical values for a chi-square ( $\chi^2$ )  
16 distribution. Significant  $Q$ -values indicate heterogeneity, or that variability across the effect sizes  
17 is greater than what would have resulted from chance. Effect size distributions that are  
18 heterogeneous indicate a large variability and allow for study of moderator variables to provide a  
19 more accurate estimate of study dispersion. The computations produced from a moderator  
20 analysis compartmentalize the total  $Q_T$ -value variance by calculating between ( $Q_B$ ) and within  
21 ( $Q_W$ ) values. Significant  $Q_B$  values indicate moderator variance that can be attributed to  
22 systematic between-study differences and require t-test or an analysis of variance technique  
23 described by Hedges & Olkin (1985) to identify between group differences. When interpreting  
24 the  $Q$ -statistics ( $Q_{Total}$  and  $Q_{Between}$ ) and corresponding  $p$ -values, all heterogeneity statistics ( $\tau^2$ )

1 and  $I^2$ , see next paragraph for descriptions) should be considered for interpretation, as significant  
2  $p$ -values only indicate that true effects vary between studies but do not provide information on  
3 the magnitude of dispersion (Borenstein et al., 2009). The final consideration was the influence of  
4 a random effects model on moderating variables when model assumptions are violated as there is  
5 a potential to overestimate error (Overton, 1998) when sample sizes are small (Field, 2001). To  
6 prevent type I errors we set a conservative alpha level ( $\alpha < .01$ ) when interpreting significant  
7 moderators.

8 CMA version-2 software provides four statistics ( $Q$ ,  $\tau^2$ ,  $\tau$ , and  $I^2$ ) to assess sub-group  
9 differences. Besides the  $Q_T$ -value there were two additional statistics that were used to interpret  
10 heterogeneity that included tau-squared ( $\tau^2$ ) and I-squared ( $I^2$ ). The  $\tau^2$  statistic is used by CMA to  
11 calculate weights and yields an estimate of total variance between studies in a random effects  
12 model. Larger  $\tau^2$  values reflect the proportion of variance that can be attributed to real  
13 differences between studies. When the number of effect sizes in a sub-group was small ( $k \leq 5$ )  
14 estimates of  $\tau^2$  are likely to be imprecise and the standard procedure was to use a pooled estimate  
15 of variance for all calculations of moderators (Borenstein et al., 2009). The  $I^2$  statistic is the ratio  
16 of excess dispersion to total dispersion and can be interpreted as the overlap of confidence  
17 intervals explaining the total variance attributed to the covariates (Higgins, Thompson, Deeks, &  
18 Altman, 2003). Values closer to zero represent random error and values that move away from  
19 zero provide an opportunity to analyse variance by covariates. Interpretation of the  $I^2$  statistic  
20 indicates low (25%), moderate (50%), and high (75%) relative variance with higher values  
21 requiring techniques (i.e., moderator analysis or meta-regression) to provide explanations  
22 (Borenstein et al., 2009; Higgins et al., 2003).

### 23 **Outlier Analysis & Publication Bias**

1           Outlier analysis was examined by interpretation of relative residuals and by a “one-study  
2 removed” procedure that is available in CMA. Any study that was identified as an outlier (a large  
3 residual value  $z \leq$  or  $\geq 1.96$ ) was examined in a “one study removed” analysis, studies were not  
4 removed if they did not substantially impact the effect size  $g$  and results were within or near the  
5 95<sup>th</sup> confidence interval. Publication bias was controlled for by visual inspection of a funnel plot,  
6 the Trim and Fill procedure (Duval & Tweedie, 2000) and Fail Safe- $N$  calculation (Rosenthal,  
7 1979). The funnel plot provided a visual representation of publication bias that was based on a  
8 symmetrical distribution of data points about the mean effect size. A funnel plot graphs studies  
9 according to standard error (y-axis) and effect size (x-axis) with larger studies appearing toward  
10 the top of the plot (less error) and smaller studies (more error) toward the bottom. Symmetrical  
11 plots can be interpreted as a lack of publication bias, however, asymmetrical data are adjusted by  
12 using Duval and Tweedie’s (2000a) Trim and Fill procedure on a precision plot. The Trim and  
13 Fill procedure is an iterative process that adjusts overall effect size by identifying the number of  
14 missing studies (with negative effects) that would balance the plot to provide an unbiased  
15 estimate of effect size (Duval & Tweedie, 2000b). “Fail safe  $N$ ” was used as an additional  
16 precaution and determines the number of non-significant missing studies that would be needed to  
17 nullify significant results (Rosenthal, 1979).

## 18 **Outcome Analyses**

19           Due to the large number of student outcome variables and relatively few studies for each  
20 outcome, an approach resembling methods employed by Biddle, Wang, Kavussanu, & Spray  
21 (2003) and Ntoumanis & Biddle (1999) were used to condense and summarize findings that  
22 represented affective, behavioral, and/or cognitive outcomes. The process used to define and sort  
23 outcome variables included gathering information on instruments used to collect data from  
24 studies meeting inclusion criteria. Outcomes that were measured by an instrument, subscale, or a

1 few items were then grouped according to the construct. For example, there were five separate  
2 measures used to collect information on competence and confidence. These measures included  
3 the Intrinsic Motivation Inventory (IMI; McAuley, Duncan, & Tammen, 1989), Competitive  
4 State Anxiety Inventory-2 (CSAI-2; Martens, Vealey, & Burton, 1990), Physical Self-Perception  
5 Profile (PSPP; Fox & Corbin, 1989), Pictorial Scale of Perceived Competence and Social  
6 Acceptance (PSPCSA; Harter, 1982), and the Physical Education Teachers' Emphasis on  
7 Achievement Goals Questionnaire (PETEAGQ; Papaioannou, Milosis, Kosmidou, & Tsigilis,  
8 2007). Field's (2001, 2005) Monte Carlo simulations of meta-analytic approaches found that  
9 using Hedges and Olkin's (1985) and Hedges and Vevea's (1998) random effects approach when  
10 data were heterogeneous did not control for type I errors with fewer than 15 studies. Based on  
11 Field's (2001, 2005) findings, in addition to Borenstein and colleagues' (2009) suggestions on  
12 reporting standards, we have provided summary effects for each outcome where there were a  
13 critical number (three or four studies) of studies measuring a specific outcome, along with a  
14 conservative interpretation.

15 Affective outcomes measured included attitudes (Ajzen, 1988; Carlson, 1995;  
16 Christodoulidis, Papaioannou, & Digidelidis, 2001; Treasure, 1993, 1997), boredom (Duda &  
17 Nicholls, 1992; Treasure, 1997), commitment/ dedication (Cecchini, Gonzalez, Carmona,  
18 Arruza, Escarti, & Balague, 2001; Papaioannou & Theodorakis, 1996; Theodorakis, 1994), and  
19 enjoyment/satisfaction (Duda & Nicholls, 1992; Duda, Fox, Biddle, & Armstrong, 1992;  
20 McAuley, Duncan, & Tammen, 1989; Treasure, 1997). Behavioral outcomes measured were  
21 health/fitness related variables (Bowler, 2009; Christodoulidis et al. 1992; Cramer, 2000;  
22 Digidelidis, 2003) and skills (Boone, 1995; Cramer, 2000; Martin, Hastie, & Rudisell, 2009;  
23 Solmon, 1996; Valentini & Rudisell, 2004a, 2004b). Cognitive outcomes measured included  
24 achievement goal (task/ego) orientations (Ballague & Roberts, 1991; Duda & Nicholls, 1992;

1 Roberts, Treasure, & Balague 1998; Walling & Duda, 1995; Treasure & Roberts, 1994), anxiety  
2 (Barkoukis, 2004; Martens, Burton, Vealey, Smith, & Bump, 1990; Papaioannou, 1994),  
3 competence/confidence (Fox & Corbin, 1989; Harter & Pike, 1984; Martins et al., 1990;  
4 McAuley, Duncan, & Tammen, 1989; Morgan & Kingston, 2008; Papaioannou, 1994, 2007;  
5 Weigand & Burton, 2002), competitive and learning strategies (Morgan & Carpenter, 2002;  
6 Papaioannou, 1994; Solmon & Boone, 1993), motivational climate (mastery and performance)  
7 perceptions (Papaioannou, 1994, 1998, 2007; Seifritz, Duda, & Chi, 1992), perceptions of ability  
8 (Duda & Nicholls, 1992; McAuley, Duncan, & Tammen, 1989), and perceptions of effort (Duda  
9 & Nicholls, 1992; McAuley, Duncan, & Tammen, 1989).

10

### Results

11 The primary purpose of the current study was to determine the overall effectiveness  
12 across all outcomes of motivational climate interventions and the secondary purpose was to  
13 determine the effect of motivational climate interventions (TARGET) on specific affective,  
14 behavioral, and cognitive outcomes in school-based physical education. There were a total of 22  
15 studies with 24 independent samples that included 4932 participants meeting inclusion criteria.  
16 The overall inter-rater agreement between two coders was 92.3% and ranged from 75% to 100 %  
17 across the 12 characteristics coded and extraction of descriptive and inferential statistics. There  
18 were a total of 23 disagreements and of those disagreements seven were factual disagreements  
19 that were corrected and 16 interpretation disagreements that were uncorrected. An objective third  
20 coder evaluated each of the interpretations disagreements and the coding value or data extraction  
21 value used was based on the simple majority (two coders). Figure 1 provides an overall  
22 presentation of the search strategy and Table 1 displays the coded methodological, participant,  
23 and study features as well as each study's overall treatment effect. When interpreting the  
24 treatment effects Cohen's (1988) criteria were used for interpretation of standardized mean



1 differences and summarized effect sizes as small ( $\leq .20$ ), medium (.50), and large ( $\geq .80$ ). Positive  
2 effect sizes are interpreted as treatment groups (mastery motivational climate) having stronger  
3 results than control groups or groups exposed to performance climate manipulations. Negative  
4 treatment effects indicated that the control group or performance climate group produced larger  
5 outcome results than the mastery climate group.

6 INSERT TABLE 1 AND FIGURE 1 ABOUT HERE

### 7 **Random Effects Model Results**

8 The average treatment effect for all TARGET intervention studies was small ( $g = 0.103$ ;  
9  $SE = 0.035$ ; 95% C.I. = 0.034, 0.171;  $p = 0.003$ ) and represented about one tenth a standard  
10 deviation advantage for treatment groups over control groups. Table 2 presents an overview of  
11 the relevant statistics used when evaluating the overall effect. Review of the homogeneity  
12 statistics revealed a significant heterogeneous distribution ( $Q_T=38.59$ ,  $p = 0.022$ ;  $I^2 = 40.40$ )  
13 making it necessary to explain between study variation through moderator analyses of  
14 characteristics coded for studies. In addition, an outlier analysis was conducted through  
15 evaluation of residual values and found one independent sample (Valentini & Rudisell., 2004b)  
16 to be an outlier ( $z = 2.09$ ), therefore, a “one study removed” procedure was performed. The  
17 single effect size was retained in the analysis as results indicated a small change ( $-.006$ ) in the  
18 effect size ( $g = 0.097$ ) remaining within the 95% confidence interval. Publication bias was  
19 deemed marginal as a result of a symmetrical funnel plot, no studies being added during the Trim  
20 and Fill procedure, and a Fail Safe N value calculation of 98 studies that would be needed to  
21 nullify a significant  $\alpha$ -level ( $p < .05$ ).

22 INSERT TABLE 2 ABOUT HERE

### 23 **Outcome Analyses**

1           In summary, outcome analyses generated positive and negative effects ranging from a  
2 low of -.274 to a high of 0.599. The diversity of outcomes and limited number of studies meeting  
3 inclusion criteria compelled the authors to employ procedures (see Biddle et al., 2003)  
4 combining measures with similar constructs and having at least three effect sizes for each  
5 outcome. Results were consistent with Achievement Goal Theory literature producing positive  
6 findings for adaptive outcomes and negative results for maladaptive outcomes (Biddle et al.  
7 2003; Hardwood et al., 2009). Maladaptive outcomes such as anxiety, boredom, competitive  
8 strategies, ego orientation, and perceptions of a performance climate were largest for control  
9 groups or groups exposed to performance climate conditions. Adaptive outcomes that were  
10 positive for groups experiencing a mastery climate treatment included attitude, commitment,  
11 enjoyment, competence/confidence, mastery climate perceptions, perceptions of effort, and task  
12 orientation. The largest positive treatment effects were found for attitude ( $N = 1634$ ,  $k = 4$ ,  $g =$   
13  $0.599$ ), health/fitness ( $N = 1513$ ,  $k = 4$ ,  $g = 0.492$ ), and skills ( $N = 705$ ,  $k = 7$ ,  $g = 0.395$ ) with the  
14 most negative effect sizes found for the outcomes boredom ( $N = 288$ ,  $k = 3$ ,  $g = -0.274$ ), anxiety  
15 ( $N = 728$ ,  $k = 3$ ,  $g = -0.246$ ), and perceptions of a performance climate ( $N = 3012$ ,  $k = 13$ ,  $g = -$   
16  $0.239$ ). Moderator analyses were needed for most outcome variables ( $Q_B \leq .01$ ), however, there  
17 were insufficient data for some outcomes to perform moderator analyses that would generate a  
18 precise estimate of the combined effect (Borenstein et al, 2009). Therefore, we chose only to  
19 report the summary effect for each outcome and not to perform moderator analyses.

20           **Affective outcomes.** Mastery climate interventions produced small to moderate negative  
21 and positive treatment effects for affective outcomes. Interpretation of these results suggest that  
22 TARGET interventions produce between one seventh ( $g = 0.149$ ) to greater than one half ( $g =$   
23  $0.599$ ) a standard deviations advantage on adaptive outcomes for groups exposed to mastery  
24 climate conditions. Outlier analyses for all affective outcomes produced no large residual values,

1 however, publication bias statistics (Fail-Safe  $N$ ) indicated low tolerance for suggesting caution  
2 when interpreting affective outcome results for boredom.

3       **Behavioral outcomes.** The largest overall outcome advantage for groups exposed to  
4 mastery climate TARGET manipulations were found in behavioral outcomes. Health and fitness  
5 outcomes (i.e., heart rate, cardiovascular fitness, exercise frequency, nutrition behaviors) as well  
6 as skill-based outcomes (badminton, basketball, juggling, and practice conditions) produced  
7 treatment effect sizes ( $g=0.395$  and  $g=0.492$ ) that were small to moderate. Observation of  
8 heterogeneity statistics revealed that distributions were homogeneous (non-significant  $Q_T$ -values,  
9  $p > .05$ ) or that studies measuring health/fitness and skill outcomes produced similar findings and  
10 no moderator analyses were needed to explain variance between studies. Publication bias was  
11 unlikely as Fail Safe  $N$  calculations for both health/fitness (52 studies) and skills (35 studies)  
12 indicated several studies were needed to produce non-significant results.

13       **Cognitive outcomes.** Cognitive outcomes were most frequently measured in studies and  
14 included treatment effects on student variables such as confidence/competence ( $k=9$ ), ego  
15 orientation ( $k=14$ ), mastery climate perceptions ( $k=13$ ), performance climate perceptions ( $k=12$ ),  
16 and task orientation ( $k=14$ ). Desired treatment effects were positive small gains in mastery  
17 climate groups for the adaptive outcomes commitment ( $g=.183$ ), confidence/ competence  
18 ( $g=.118$ ), learning strategies ( $g=.285$ ), perceptions of a mastery climate ( $g=.315$ ), and task  
19 orientation ( $g=.181$ ). In summary, the maladaptive cognitive outcomes anxiety, competitive  
20 strategies, ego orientation, and perceptions of a performance climate produced small negative  
21 effects ranging from  $-0.065$  to  $-0.246$  with homogeneity statistics indicating heterogeneous ( $Q_T <$   
22  $.05$ ) distributions and large portions of variance ( $I^2 > 70$ ) that could be explained by moderator  
23 analyses. The only cognitive outcomes that could be interpreted with confidence that publication  
24 bias was not present were task-orientation and perceptions of a mastery and performance

1 climates. These results indicated that overall summary effects for maladaptive outcomes were  
2 not robust and further study is needed to provide an accurate estimate of effect size for most  
3 cognitive outcomes.

#### 4 **Moderator Analyses**

5 Heterogeneity statistics for the random effects model confirmed that there was a  
6 heterogeneous ( $Q_T = 38.59, p < .05$ ) distribution and that a moderate level ( $I^2 = 40.40$ ) of between  
7 study variation existed to justify conducting subgroup analyses for coding characteristics. Tables  
8 2 and 3 present the results from moderator analyses on intervention characteristics (Table 2),  
9 participant characteristics (Table 3), and study characteristics (Table 3). While all analyses  
10 produced overall trends (treatment groups > control groups,  $p < .05$ ) for specific moderators,  
11 there were no statistically significant differences ( $p < .01$ ) between moderators.

12 **Methodological features.** While no significant differences within methodological  
13 moderators were present, there were several methodological trends including reported training  
14 time ( $g = .112, Z = 2.639, p < .05$ ) for individuals (teacher/researchers) delivering TARGET  
15 interventions, motivational climate interventions longer than eight weeks ( $g = .178, Z = 2.434, p <$   
16  $.05$ ), and TARGET interventions employing all the characteristics ( $g = .150, Z = 3.500, p < .05$ ) of  
17 a mastery motivational climate intervention. Studies conducting follow-up intervention measures  
18 ( $g = .231, Z = 2.838, p < .05$ ) and employing a manipulation check ( $g = .165, Z = 2.462, p < .05$ )  
19 produced larger treatment effects than interventions not conducting follow-up measures ( $g =$   
20  $.072, Z = 2.028, p < .05$ ) or using manipulation checks. ( $g = .095, Z = 1.664, p < .05$ ). Overall,  
21 there were small positive treatment effects.

22 INSERT TABLE 3 ABOUT HERE

23 **Participant features.** Level in school (Elementary School, Middle School, or High  
24 School) and country (Brazil, Finland, Greece, Spain, UK, or US) were the primary categories for

1 participant analysis There was a significant treatment effect ( $Z \leq .05$ ) for students at the  
2 Elementary School level ( $g = 0.407$ ,  $Z = 3.710$ ,  $p < .05$ ), however, there were no moderator  
3 differences ( $Q_B=8.840$ ,  $p > .01$ ) when compared to Middle School ( $g = 0.068$ ,  $Z = 0.940$ ,  $p > .05$ )  
4 or High School students ( $g = 0.066$ ,  $Z = 1.896$ ,  $p > .05$ ). The moderator trends for country had  
5 the largest treatment effects for participants in Brazil ( $g = 0.563$ ,  $Z = 2.610$ ,  $p < .05$ ) and the US  
6 ( $g = 0.239$ ,  $Z = 2.962$ ,  $p < .05$ ) than for participants in Finland ( $g = -0.005$ ,  $Z = -0.039$ ,  $p > .05$ ),  
7 Greece ( $g = 0.058$ ,  $Z = 1.238$ ,  $p > .05$ ), Spain ( $g = -0.084$ ,  $Z = -0.480$ ,  $p > .05$ ), or the UK ( $g =$   
8  $0.089$ ,  $Z = 1.378$ ,  $p > .05$ ). Results from both participant and study characteristics can be found in  
9 Table 3 and Table 4.

10 INSERT TABLE 4 ABOUT HERE

11 **Study features.** The moderator analysis for type of study found that unpublished ( $g =$   
12  $0.251$ ,  $Z = 2.145$ ,  $p < .05$ ) reports had larger treatment effects than unpublished ( $g = 0.087$ ,  $Z =$   
13  $2.423$ ,  $p < .05$ ), however, no significant differences were present ( $Q_B=1.794$ ,  $p > .01$ ). Results  
14 from the outcome measures analysis determined studies using both (combination) self-report and  
15 objective methods in data collection had larger treatment effects ( $Z = 3.169$ ,  $p < .05$ ) than studies  
16 only using self-report measures with no significant differences between either moderator  
17 ( $Q_B=3.242$ ,  $p > .01$ ). Overall results from study feature moderators found small to marginal  
18 treatment effects

## 19 Discussion

20 The purpose of our literature synthesis was twofold and focused on the effectiveness of  
21 motivational climate interventions and moderating factors that contributed to positive or negative  
22 results in physical education contexts. Our results found an overall positive treatment effect for  
23 groups and participants exposed to a mastery motivational climate and negative effects for  
24 untreated control groups or performance climate conditions. More specifically, TARGET

1 strategies used to manipulate an environment to favor mastery conditions have small to moderate  
2 treatment effects for affective, behavioral, and cognitive outcomes. These findings support our  
3 hypotheses and are consistent with motivational climate literature that shows positive effects for  
4 adaptive outcomes and negative effects for maladaptive outcomes across affective, behavioral,  
5 and cognitive variables. Consequently, there are several factors that should be considered when  
6 designing and implementing future motivational climate interventions. If motivational processes  
7 underpin student participation in activity and learning, future interventions should provide more  
8 empirical evidence to support instructional strategies that facilitate adaptive motivational  
9 processes.

10 Outcome measures provided information concerning how data were collected from the  
11 participants. Nine studies selected to use self-report measures while the other 15 studies used a  
12 combination of self-report and objective measures. The difference in overall effectiveness across  
13 all outcomes between the two methods used to collect data from students was non-significant ( $p$   
14  $>.01$ ), favoring a combination ( $g = .189$ ) over self-report ( $g = .057$ ) methods. Analysis of the types  
15 of outcome variables that were intended for measurement were insightful concerning the  
16 outcome measure and outcome focus for future research. In the current study, all interventions  
17 measured some type of cognitive outcome, nine studies investigated behavioral outcomes, and 13  
18 studies collected data on affective variables. Research on AGT connects situational processes to  
19 several affective, behavioral, and cognitive outcomes but to date there is a shortage of data  
20 concerning the influence of motivational climate interventions on affective and behavioral  
21 variables. Equally important is the effect of situational achievement goals on learning, as most  
22 educational research on competence-based goals has expectations attached to student  
23 achievement in learning contexts (Chen & Ennis, 2004). Student learning can be measured in  
24 affective, cognitive, and psychomotor domains but in the current review there were only five

1 studies (Cramer, 2000; Solmon 1996; Valentini & Rudisell, 2004a, b) that directly measured  
2 psychomotor learning as a result of employing a mastery climate intervention. Physical  
3 education promotes lifetime involvement in physical activity and AGT research has enhanced  
4 our understanding of student perceptions that are attached to specific situational influences that  
5 engage students in a learning context. However, what remains unclear is how students use  
6 competence based information received from their motivational climate perceptions in physical  
7 education to influence participation in lifetime physical activity.

### 8 **Recommendations for Future Intervention Research**

9 **Methodological features.** Several substantive features were explored in an attempt to  
10 explain the current findings and provide suggestions for future motivational climate  
11 interventions. With regard to the methodological features, an important factor that underpins  
12 successful manipulation of motivational climate is the training of teachers or those providing  
13 instruction to students in physical education. All studies provided some detail concerning  
14 TARGET framework training, however, only five of the 24 studies provided detailed information  
15 on time spent and specific methods in preparing teachers to deliver the TARGET framework.  
16 These methods included training seminars, pre-designed units or lessons, video analysis or  
17 systematic coding, or combinations of the various strategies. Nevertheless, absent from most of  
18 the studies are descriptions concerning teacher attitudes, beliefs, and teaching practice before and  
19 after interventions as these teacher variables directly influence student outcomes (Biddle, 2001;  
20 Ennis, 2003). More information is needed regarding the amount of time involved in training as  
21 well as the specific strategies that reinforce the delivery of a TARGET framework in future  
22 research to fully assess the effect of mastery climate interventions on student motivation.

23 The link between training and the intervention delivery process (intervention duration  
24 and intervention intensity) is critical to maximize both teacher and student outcomes. Analysis of

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

12       Taking baseline measurements during an experiment constitutes an important  
13 methodological feature and motivational climate manipulation checks provide information on  
14 student perceptions prior to an intervention being conducted. Without a climate manipulation  
15 check, student outcomes cannot be directly attributed to the treatment being applied. Our review  
16 found five studies that did not report a climate manipulation check, therefore, results concerning  
17 student outcomes may or may not be attributed to exposure (or lack thereof) to a mastery  
18 motivational climate. Equally important to research on motivation climate are the long term  
19 effects on student motivation as a result of being exposed to a TARGET intervention. To date,  
20 only three studies (four independent samples) used follow-up measures to determine treatment  
21 effectiveness. Results were mixed with two studies (Christoloudis et al., 2001; Digidelidis et al.,  
22 2003) finding no long term effects and one study (Valentini & Rudisell, 2004) producing  
23 significant treatment effects. The authors encourage future intervention studies to collect these



1 pre-test, post-test, and follow-up measures to further our understanding of TARGET  
2 interventions.

3         When analyzing the use of the TARGET structure to conduct interventions, 17 of the  
4 studies meeting inclusion criteria employed a full (all components) TARGET module when  
5 implementing mastery climate interventions as compared to seven studies using a partial (some  
6 of the components) module during mastery climate interventions. Ames (1992a, b) and Epstein  
7 (1988, 1989) provide specific strategies which can be used when employing the TARGET  
8 framework to improve the motivational climate and these strategies appear to be connected to the  
9 literature on the effective teaching principles in physical education (Rink, 2003). Both full and  
10 partial interventions produced positive outcomes for mastery climates with full TARGET models  
11 producing the strongest results in treatment groups. Additional studies using interventions to  
12 promote mastery motivational climates would benefit by connecting process and product  
13 research to specific pedagogical principles of effective teaching (process) to adaptive outcomes  
14 (products).

15         **Participant features.** Analyses of the participant features produced the largest effect  
16 sizes within the current investigation. The moderator analyses of grade in school (level)  
17 produced significant results for elementary students (ages 5 to 11) and marginal treatment effects  
18 for middle school (ages 12 to14), and high school (ages 15 to18) students. Elementary and high  
19 school students were the least studied subgroups ( $k=6$ ) as compared to middle school ( $k=12$ ).  
20 When analyzing the motives behind youth's declining interest in physical education, and in  
21 general physical activity participation, understanding the spectrum of changes that occur during  
22 each transitional time period from youth to adolescence is an important consideration. Additional  
23 information is also needed concerning the gender and cultural contexts for physical education to  
24 explore variance in outcome variables related to motivational climate. Given that our analysis

1 found trends in country as a moderator of climate perceptions, we would suggest future studies  
2 attempt to explore cultural, gender, and contextual factors of physical education. Results from  
3 our study suggest that Brazil and the US produced strong treatment effects when compared to  
4 other countries in which TARGET interventions were conducted. Information on contextual  
5 factors such as curriculum and instructional delivery might provide an additional perspective on  
6 participants concerning motivational climate perceptions in physical education. What is also  
7 beginning to emerge from the literature is that, not only are teachers considered to be a pivotal  
8 figure in determining motivational climate in physical education, but peers' influence can impact  
9 climate perceptions especially during adolescence (Harwood & Swain, 2001; Vazou, Ntoumanis  
10 & Duda, 2006). The developmental aspects related to motivational climate provide a compelling  
11 argument on how students begin to conceptualize success (Nicholls, 1989) in physical education,  
12 but equally important are changes related to health-related outcomes (i.e., decline in physical  
13 activity and increase in sedentary behaviors) that occur during middle school years and beyond  
14 (United States Department of Health and Human Services, 2008, 2010; United Kingdom  
15 Department of Health, 2004). Future research might direct the focus on transitional periods, both  
16 before and after, on a variety of affective, behavioral, and cognitive outcomes that the literature  
17 has established as relevant.

18 **Study features.** Study characteristics that were analyzed as a part of the moderator  
19 analyses included publication type (published or unpublished) and type of outcome measure (self  
20 report and/or objective) that were used to collect information from the students. There were  
21 seven studies (one conference presentation and six dissertations) identified in literature searches  
22 meeting inclusion criteria, and of those studies, four were later published in peer reviewed  
23 journals. Analysis of this moderator produced larger effects for unpublished ( $g = .246$ ) than  
24 published ( $g = .089$ ). The authors are unsure of the rationale concerning the decision not to

1 publish, however, these studies did produce small to moderate positive treatment effects. The  
2 outcome measure moderator for study features produced a noticeable difference between  
3 TARGET interventions that used a combination approach (self-report and objective measures)  
4 when compared to self-report approaches in data collection. Additionally, there has been a  
5 precedent set that research conducted on motivational climate use interventions to provide  
6 information that advances our knowledge and understanding on the influence of motivational  
7 climate on outcome variables (Duda, 1993; Harwood et al. 2009). We would echo those  
8 suggestions and in addition advocate for future studies to used combinations of measures to  
9 collect data from participants being exposed to motivational climate manipulations.

## 10 **Conclusions**

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

21 The overall summary of meta-analytic findings indicated that factors such as the lack of a  
22 validated and reliable measurement tool for each component of TARGET, different measurement  
23 tools for perceptions of climate, lack of standardized training policies and procedures for those  
24 administering interventions, and inequity and inconsistent evidence for many affective,

1 behavioral, and cognitive outcomes limit drawing firm conclusions on the positive effects of  
2 motivational climate interventions. Additional methodological factors such as the unit of analysis  
3 (class or individual) debate, conducting a priori power calculations, and employing balanced  
4 group designs and (to the extent possible) randomized controlled trials could all improve the  
5 effectiveness of motivational climate interventions. Clearly, more TARGET intervention studies  
6 are requisite in physical education contexts. Interventions should be conducted with different  
7 populations using specific strategies that address the unique demands of different environments  
8 to provide a substantive review of the effectiveness of TARGET structures on student cognitions,  
9 affect and behavior in physical education.

10

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Appendix A

**Meta Analysis Reporting Standards**

<b>Paper Section/Topic</b>	<b>Description</b>	<b>Completed</b>
<b>Title</b>	1. Make it clear that the report describes a research synthesis ad include “meta-analysis”, if applicable	Page 1,2
	2. Footnote funding sources	N/A
<b>Abstract</b>		
	1. The problem or relation(s) under investigation	Page 2
	2. Study eligibility criteria	Page 2
	3. Type(s) participants included in primary analysis	Page 2
	4. Meta-analysis methods (fixed or random effects model)	Page 2
	5. Main results (including important effect sizes and any important moderators of these effect sizes).	Page 2
	6. Conclusions (including limitations)	Page 2,3
	7. Implications for theory, policy, and/or practice	Page 2,3
<b>Introduction</b>		
	1. Clear statement of the question or relation(s) under investigation	Page 7
	2. Historical background	Pages 4-7
	3. Theoretical, policy, and/or practical issues related to the question or relation(s) of interest	Pages 4-7
	4. Rationale for the selection and coding of potential moderators and mediators of results	Page 9, 13-15
	5. Types of study designs used in the primary research, their strengths and weaknesses	Pages 8-9
	6. Types of predictor and outcome measures used , their psychometric characteristics	Pages 8-9, 13-15
	7. Populations to which the question or relation is relevant	Page 8-9
	8. Hypotheses, if any	Page 7
<b>Method</b>		
<b>Inclusion/Exclusion Criteria</b>	1. Operational characteristics of independent (predictor) and dependent (outcome) variable(s)	Page 9, 13-15
	2. Eligible participant populations	Page 8-9
	3. Eligible research design features (e.g., random assignment, minimal sample size)	Page 8
	4. Time period in which studies needed to be conducted	Page 8
	5. Geographical and/or cultural restrictions	Page 8
<b>Moderator/Mediator Analyses</b>	1. Definition of all coding categories used to test moderators or mediators of the relation(s) of interest.	Page 9
<b>Search Strategies</b>	1. Reference and citation of databases searched	Page 8
	2. Registries (including prospective registries) searched	Page 8
	a. Keywords used to enter databases and registries	Page 8
	b. Search software used and version	Page 10
	3. Time period in which studies needed to be conducted if applicable	Page 8
	4. Other efforts to retrieve all available studies	Page 8
	a. Listservs	N/A
	b. Contacts made with authors (and how many authors were selected).	N/A
	c. Reference lists of reports examined	Page 13
	5. Methods of addressing reports in languages other than English	Page 8
	6. Process for determining study eligibility	Page 8
	7. Aspects of reports examined (i.e., title, abstract, and/or full text)	Page 8
	a. Number and qualifications or relevance judges	Page 15
	b. Indication of agreement	Page 15
	c. How disagreements were resolved	Page 15

	8. Treatment of unpublished studies	Page 8
<b>Method</b>		
<b>Coding Procedures</b>	1. Number and qualification of coders (e.g. level of expertise in the area, training)	Page 15-16
	2. Intercoder reliability or agreement	Page 15
	3. Whether each report was coded by more than one coder, and if so how disagreements were resolved.	Page 15
	4. Assessment of study quality	N/A
	a. If a quality scale was employed, a description of criteria and procedures for application	N/A
	b. If study design features were coded, what these were	Page 9
	5. How missing data was handled	N/A
<b>Statistical Methods</b>	1. Effect size metric(s)	Page 10-11
	a. Effect sizes calculating formulas (e.g., means and SDs, use of univariate F-to-r transform, etc.)	Page 10-11
	b. Corrections made to effect sizes (e.g., small sample bias, correction for unequal sample sizes, etc.)	Page 10-11
	2. Effect size averaging and/or weighting method(s)	Page 10-11
	3. How effect size confidence intervals (or standard errors) were calculated	Page 10-11
	4. How effect size credibility intervals were calculated, if used	Page 10-11
	5. Whether fixed and/or random effects models were used and the model choice justification	Page 10-11
	6. How heterogeneity in effect sizes was assessed or estimated.	Page 11-12
	7. Means and SDs for measurement artifacts, if construct level relationships were the focus.	N/A
	8. Tests and any adjustments for data censoring (e.g., publication bias, selective reporting).	Page 12-13
	9. Statistical power analysis	Page 11
	10. Statistical programs or software packages used to conduct statistical analyses	Page 10, 12
<b>Results</b>		
	1. Number of citations examined for relevance	Page 8, 15
	2. List of citations included in synthesis	Page 28-37
	3. Number of citations relevant on many but NOT all included criteria excluded from the meta-analysis	Page 38 Figure 1
	4. Number of exclusions for each exclusion criteria (e.g., effect size could not be calculated), with examples.	Page 38 Figure 1
	5. Table giving descriptive information for each included study, including effect size and sample size.	Page 39 Table 1
	6. Assessment of study quality, if any	N/A
	7. Tables and/or graphic summaries	Pages
	a. Overall characteristics of the database (e.g. number of studies with different research designs)	Page 39
	b. Overall effect size estimates, including measures of uncertainty (e.g., confidence, and/or credibility intervals)	Page 39-43
	8. Results of moderator and mediator analyses (analyses of subsets of studies)	Page 19-20
	a. Number of studies and total sample sizes for each moderator analyses	Page 20, 39
	b. Assessment of intercorrelations among variables used for moderator and mediator analyses	N/A
	9. Assessment of bias including possible data censoring	N/A
<b>Discussion</b>		
	1. Statement of Major Findings	Page 20-26
	2. Consideration of alternative explanations for observed results	Page 26-27
	3. Impact of data censoring	
	4. Generalizability of conclusions (e.g. relevant populations, treatment variations, dependent variables, research designs, etc.)	Page 20-26
	5. Implications and interpretations for theory, policy, or practice	Page 26-27
	6. Guidelines for future research.	Page 26-27



Table 1

*Study Characteristics Meeting Inclusion Criteria.*

Study	Intervention Characteristics						Participant Characteristics				Study Characteristics		
	Training	Duration (Weeks)	Follow-up	TARGET	Manipulation Check	Intensity	N	Age (Years)	Level	Country	Type	Outcome Measure	Effect (g)
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 et al., 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
Christodoulis 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
Jakkola et al., 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 et al., 2002	R	7	No	Full	Yes	R	153	13.6	MS	UK	P	1	0.03
Morgan et al., 2005	R	4	No	Full	Yes	R	92	12.9	MS	UK	P	2	0.00
Morgan et al., 2008	R	3	No	Full	Yes	R	80	13.7	MS	UK	P	2	0.14
Papaioannou et al., 1999	R	2	No	Partial	Yes	R	239	13.0	MS	Greece	P	1	-0.10
Papaioannou et al., 2007a	NR	1	No	Partial	Yes	NR	580	12.5	MS	Greece	P	1	-0.12
Papaioannou et al., 2007b	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, et al., 2002	NR	2	No	Full	Yes	R	72	11.0	E	US	P	1	0.28
Todorovich et al., 2003	NR	2	No	Full	Yes	R	80	NR	E	US	P	1	0.06
Valentini et al., 2004a	R	12	Yes	Full	Yes	R	39	5.43	E	US	P	2	0.59
Valentini et al., 2004a	R	12	Yes	Full	Yes	R	56	5.10	E	US	P	2	.056
Valentini et al., 2004b	R	12	No	Full	No	R	104	7.80	E	Brazil	P	2	0.56
Viciano et al., 2007	R	7	No	Partial	Yes	R	95	15.0	HS	Spain	P	1	-0.10
Wallhead et al., 2004	NR	8	No	Partial	Yes	R	51	14.3	MS	UK	P	2	0.39
Weigand et al., 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.

Table 2

*Outcome Analysis*

VARIABLE	<i>k</i>	<i>g</i>	Effect Size Statistics			Null Test <i>Z</i>	Heterogeneity Statistics			Publication Bias Fail Safe <i>N</i>
			<i>SE</i>	<i>s</i> <sup>2</sup>	95% <i>C.I.</i>		<i>Q</i>	$\tau^2$	<i>I</i> <sup>2</sup>	
<b>Affective Outcomes</b>										
Attitude	4	0.599	0.238	0.057	.133, 1.07)	2.518*	48.311*	0.205	93.79	125
Boredom	3	-0.274	0.268	0.072	-.801, .252)	-1.022	8.665*	0.162	76.92	1
Enjoyment	11	0.149	0.054	0.003	.043, .255)	2.750*	22.64*	0.015	55.83	45
<b>Behavioural Outcomes</b>										
Health/Fitness	4	0.492	0.110	0.012	.277, .706)	4.486*	6.365	0.022	52.87	52
Skills	7	0.395	0.107	0.011	.185, .605)	3.692*	9.510	0.028	36.91	35
<b>Cognitive Outcomes</b>										
Anxiety	3	-0.246	0.072	0.005	-.387, -.104)	-3.406*	2.970	0.005	28.324	10
Commitment	3	0.183	0.122	0.015	-.055, .422)	1.508	5.515	0.026	63.74	4
Competence/Confidence	9	0.118	0.133	0.018	-.143, .378)	0.883	75.61*	0.121	89.42	3
Competitive Strategies	4	-0.074	0.073	0.005	-.216, .069)	-1.016	6.639	0.011	54.81	0
Learning Strategies	3	0.285	0.084	0.007	.121, .448)	3.409*	2.154	0.002	7.147	5
Ego Orientation	14	-0.065	0.078	0.006	-.217, .087)	-0.834	63.93*	0.057	79.67	12
Task Orientation	14	0.181	0.057	0.003	.069, .292)	3.172*	44.46*	0.027	70.76	114
Mastery Climate	13	0.318	0.053	0.003	.215, .422)	6.006*	34.28*	0.020	64.99	224
Performance Climate	12	-0.239	0.102	0.010	-.438, -.039)	-2.344*	78.63*	0.093	86.01	110
Perceptions of Ability	6	0.078	0.163	0.027	-.242, .398)	0.479	36.88*	0.123	86.44	0
Perceptions of Effort	5	0.082	0.051	0.003	-.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*<sup>2</sup> = variance. 95% *C.I.* = Confidence Intervals (lower limit, upper limit). *Z* = test of the null hypothesis.  $\tau^2$  = Between study variance in Random Effects Model. *I*<sup>2</sup> = Total variance explained by moderators. \* indicates a significant *Q*<sub>Total</sub> value,  $p \leq .05$ .

Table 3

*Intervention Moderator Statistics*

	<i>k</i>	<i>g</i>	<u>Effect Size Descriptive Statistics</u>			<u>Null Test</u>	<u>Heterogeneity Statistics</u>		
			<i>SE</i>	<i>s</i> <sup>2</sup>	95% <i>C.I.</i>	<i>Z</i>	<i>Q</i>	$\tau^2$	<i>I</i> <sup>2</sup>
Random Effects Model <sup>A</sup>	24	0.103	0.035	0.001	(.034, .171)	2.922*	38.59*	0.009	40.40
Intervention Features <sup>B</sup>									
Training							0.083 <sup>B</sup>		
Reported	17	0.087	0.075	0.006	(.029, .195)	2.639*		0.007	47.66
Not Reported	7	0.112	0.042	0.002	(-.059, .234)	1.169		0.013	24.74
Time Period							3.197 <sup>B</sup>		
<3 weeks	7	0.023	0.061	0.004	(-.097, .142)	0.375		0.012	50.13
3-8 weeks	10	0.106	0.057	0.003	(-.006, .219)	1.852		0.000	0.000
>8 weeks	7	0.178	0.062	0.004	(.057, .300)	2.869*		0.016	51.22
Follow-up							3.410 <sup>B</sup>		
No	20	0.072	0.036	0.001	(.002, .142)	2.028*		0.007	33.69
Yes	4	0.231	0.081	0.007	(.071, .390)	2.838*		0.005	17.96
TARGET							3.608 <sup>B</sup>		
Full	17	0.150	0.043	0.002	(.066, .234)	3.500*		0.007	29.54
Partial	7	0.016	0.056	0.003	(-.093, .126)	0.289		0.014	47.23
Manipulation Check							1.822 <sup>B</sup>		
No	5	0.165	0.099	0.010	(-.029, .359)	1.664*		0.026	48.65
Yes	19	0.095	0.039	0.001	(.002, .148)	2.462*		0.006	33.24

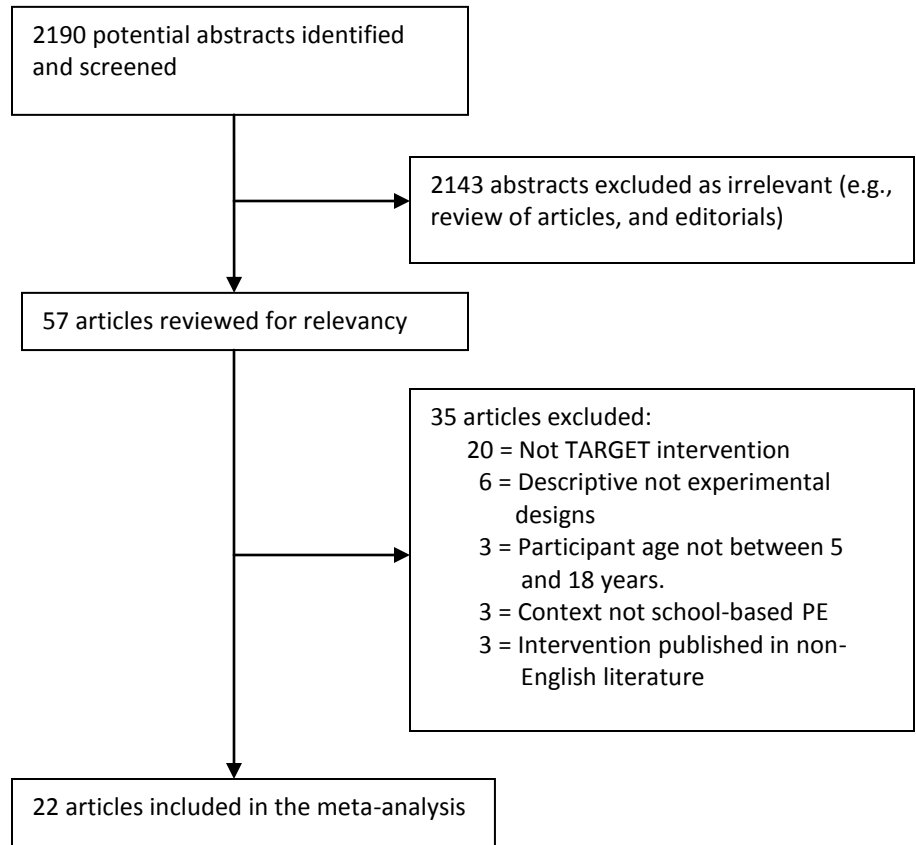
Note. A=Total Q-value used to determine heterogeneity; B=Between Q-value used to determine significant differences ( $\alpha=.01$ ) between moderators. *k* = number of effect sizes. *g* = Effect size (Hedges *g*). *SE* = Standard Error. *S*<sup>2</sup> = variance. 95% *C.I.*= Confidence Intervals (lower limit, upper limit). *Z* = test of the null hypothesis.  $\tau^2$  = Between study variance in Random Effects Model. *I*<sup>2</sup> = Total variance explained by moderators. \**p* ≤ .05.

Table 4

*Participant and Study Moderator Statistics*

	<i>k</i>	<i>g</i>	<u>Effect Size Descriptive Statistics</u>			<u>Null Test</u>	<u>Heterogeneity Statistics</u>		
			<i>SE</i>	<i>s</i> <sup>2</sup>	95% <i>C.I.</i>	<i>Z</i>	<i>Q</i>	<i>τ</i> <sup>2</sup>	<i>I</i> <sup>2</sup>
Random Effects Model <sup>A</sup>	24	0.103	0.035	0.001	(.034, .171)	2.922*	38.59*	0.009	40.40
Participant Features <sup>B</sup>									
Level							8.840 <sup>B</sup>		
Elementary School	6	0.407	0.105	0.012	(.192, .622)	3.710*		0.000	0.000
Middle School	12	0.068	0.060	0.001	(-.002, .138)	0.940		0.009	50.75
High School	6	0.066	0.026	0.005	(-.071, .203)	1.896		0.000	0.000
Country							10.19 <sup>B</sup>		
Brazil	1	0.563	0.216	0.047	(.140, .986)	2.610*		0.000	0.000
Finland	1	-0.005	0.126	0.016	(-.252, .242)	-0.039		0.000	0.000
Greece	6	0.058	0.047	0.002	(-.034, .150)	1.238		0.013	68.30
Spain	2	-0.084	0.176	0.031	(-.429, .260)	-0.480		0.000	0.000
United Kingdom	6	0.089	0.065	0.004	(-.038, .215)	1.378		0.002	9.835
United States	8	0.239	0.081	0.007	(.081, .397)	2.962*		0.000	0.000
Study Features <sup>B</sup>									
Type							1.794 <sup>B</sup>		
Published	21	0.087	0.036	0.001	(.017, .157)	2.423*		0.020	42.92
Unpublished	3	0.251	0.117	0.014	(.022, .479)	2.145*		0.000	0.000
Outcome Measure							3.242 <sup>B</sup>		
Combination	12	0.189	0.060	0.004	(.072, .307)	3.169*		0.015	34.35
Self-Report	12	0.057	0.043	0.002	(-.027, .141)	1.338		0.007	42.64

Note. \* $p \leq .05$ . A=Total Q-value used to determine heterogeneity; B=Between Q-value used to determine significant moderator differences. Please refer to Table 3 footnotes for explanations regarding column headings.



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