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Influence of Perceived Motivational Climate on Achievement Goals in Physical Education: A Structural Equation Mixture Modeling Analysis

John C. K. Wang, Woon Chia Liu, Nikos L. D. Chatzisarantis, and Coral B. S. Lim
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The purpose of the current study was to examine the influence of perceived motivational climate on achievement goals in physical education using a structural equation mixture modeling (SEMM) analysis. Within one analysis, we identified groups of students with homogenous profiles in perceptions of motivational climate and examined the relationships between motivational climate, $2 \times 2$ achievement goals, and affect, concurrently. The findings of the current study showed that there were at least two distinct groups of students with differing perceptions of motivational climate: one group of students had much higher perceptions in both climates compared with the other group. Regardless of their grouping, the relationships between motivational climate, achievement goals, and enjoyment seemed to be invariant. Mastery climate predicted the adoption of mastery-approach and mastery-avoidance goals; performance climate was related to performance-approach and performance-avoidance goals. Mastery-approach goal had a strong positive effect while performance-avoidance had a small negative effect on enjoyment. Overall, it was concluded that only perception of a mastery motivational climate in physical education may foster intrinsic interest in physical education through adoption of mastery-approach goals.

Keywords: achievement goals, motivational climate, latent profile analysis, SEM mixture model

What energizes and directs human behavior? This has been the key question in guiding the study of motivation since the inception of motivational research. Over the past two decades, contemporary achievement motivation theorists (Ames, 1992a, 1992b; Dweck & Leggett, 1988; Elliot, 1997; Nicholls, 1989) have adopted...
a social cognitive approach to the study of motivation and behavior in individuals. Specifically, it has been shown that achievement goal theory can explain and predict beliefs, responses, and behavior in achievement settings, and there are personal and situational factors that influence goal adoption. Previous work has focused primarily on personal dispositions rather than on situational or contextual aspects of goals.

Within the achievement goals theory research, different labels or forms of achievement goals have been identified by different researchers, such as Ames (1992a, 1992b), Dweck (1986; Dweck & Leggett, 1988), Maehr (Maehr & Braskamp, 1986; Maehr & Nicholls, 1980), and Nicholls (1989). There are similarities and differences in their conceptual approaches to the study of achievement motivation.

In each of these theories, a common assumption is that the goal of action is the demonstration of competence and therefore the perception of ability becomes a central variable (Duda & Whitehead, 1998). In addition, although different labels have been used in the achievement goal theory research, there is a common agreement that two major achievement goals operate in achievement settings. The first goal perspective focuses on self-referenced mastery or learning how to do the task and is labeled by terms such as “learning,” “mastery,” or “task-involved” goals. The second perspective emphasizes normative comparison of ability or performance relative to others and is labeled by terms such as “performance,” “ability,” or “ego-involved” goals (Pintrich, 2000). We will use these terms interchangeably. Furthermore, variations in these goal perspectives are linked to different cognitive, affective and behavioral outcomes. Specifically, a more motivationally adaptive pattern is predicted by mastery goals and a less motivationally adaptive pattern is associated with performance goals, depending on various factors (Ames, 1992a; Dweck & Leggett, 1988; Nicholls, 1989).

Although the different goal perspectives share the above similarities, there are some theoretical distinctions. For example, Nicholls (1989) linked achievement goals to the development of conception of ability. When task involvement prevails, perceived ability is evaluated in a self-referenced manner and the focus is on achieving mastery, effort investment and progress in learning. On the other hand, when ego involvement prevails, individuals conceive of ability as capacity that limits the effect of effort on performance. Success is other-referenced and the focus is on outperforming others or winning with less effort. Depending on the levels of perceived ability, the two goal involvement states predict different behavioral outcomes in achievement domains. At the dispositional level, these goals are termed goal orientations. Nicholls maintains that the two dispositional achievement goals are related in an orthogonal way and thus individuals can have different combinations of levels.

Dweck and her colleagues (Dweck, 1986; Dweck & Leggett, 1988) took a similar perspective to the study of achievement goals as Nicholls (1989). For example, Dweck (1986, 1999; Dweck & Leggett, 1988) also identifies two goals—learning and performance goals—that resemble task and ego involvement. Learning goals operate when individuals seek to increase their competence and/or learning new skills, or understanding new things. In comparison, performance goals are defined in terms of winning positive judgments of one’s competence and avoiding negative ones. However, the two goals are viewed as bipolar rather than independent dimensions in Dweck's approach. In addition, the more and less
differentiated conceptions of ability do not play any role in the prediction of goals in Dweck’s approach. Instead, Dweck proposes that two clusters of beliefs underpin the adoption of achievement goals. These beliefs center on the way people view the malleability of intelligence. Specifically, those who subscribe to the view that intelligence is fixed and relatively stable hold an “entity” view or theory, whereas those who perceive intelligence as malleable and open to development hold an “incremental” view or theory. The main concerns of the entity theorists are how much intelligence they have compared with others, and how to look “smart” and not “dumb” at all costs (Dweck, 1999). To them, looking smart means easy, low-effort success and outperforming others. Looking smart has a different meaning to the incremental theorists. For them, focusing on effort to increase their intelligence, as well as learning and mastery of new challenging tasks, make them feel smart.

More recently, Elliot and his colleagues (Elliot, 1999; Elliot & McGregor, 2001; Wang, Biddle, & Elliot, 2007) propose an approach-avoidance dimension of achievement goal to be added to the mastery-performance dimension. The approach-avoidance distinction has a rich history in the literature of achievement motivation but previous achievement goal researchers focused only on the approach forms of motivation (Elliot, 2005). In this framework, perceived competence is seen as the antecedent of four achievement goals (mastery-approach, mastery-avoidance, performance-approach, and performance-avoidance) and not as a moderator as in Nicholls and Dweck’s approach. In this model, competence can be defined as the standard for evaluating either mastery of the task itself in a self-referenced way (mastery) or when comparing against others’ performance (performance). It can also encompass the valency, that is, whether the focus is on a positive possibility (approach) or a negative possibility (avoidance).

The mastery-approach goal is indicated when one focuses on task-based or intrapersonal competence—for example, “I want to completely master the skills taught in this Physical Education [PE] class”; performance-approach goals occur when one aims to achieve normative competence, such as in, “my goal in this PE class is to perform better than others”; mastery-avoidance goals focus on task-based or intrapersonal incompetence, as in, for example, “I worry that I may not learn all that I possibly could in this PE class”; and finally, performance-avoidance goals focus on normative incompetence, as in, “my goal in this PE class is to avoid performing poorly.”

Studies in the new 2 × 2 achievement goal framework provide the evidence that each achievement goal predicts a different pattern of achievement-relevant process and outcomes. For example, Elliot and his colleagues (Elliot & McGregor, 2001; McGregor & Elliot, 2002) found that mastery-approach and performance-approach goals contributed to positive effects and consequences, whereas mastery-avoidance and performance-avoidance goals predicted and produced less adaptive motivational patterns.

Another line of achievement goal research that warrants highlighting is the work of Ames (Ames, 1992a, 1992b). Her work on examining the situational aspects of achievement goals in the classroom focuses on the situational antecedents of goal involvement and the resulting motivation patterns in the classroom. The main focus was the motivational climate made salient by the teachers and how to manipulate the structure to influence achievement goal orientations and enhance pupils’ cognitive and affective responses (Morgan & Carpenter, 2002; Solmon, 1996; Todorovich &
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Two main motivational climates have been identified. They are “performance” (ego-involving) and “mastery” (task-involving) motivational climates. In essence, students are more likely to perceive a performance climate when interpersonal competition is emphasized, mistakes are punished, and high normative ability is rewarded. On the other hand, they are more likely to perceive a mastery climate when the situational cues emphasize learning and improvement, effort is rewarded, mistakes are seen as part of learning, and choice is provided (Ames, 1992a, 1992b).

Correlational studies (e.g., Carpenter & Morgan, 1999; Goudas & Biddle, 1994; Papaioannou, 1995; Wang et al., 2008) have consistently shown that perceptions of a mastery climate are related to adaptive motivational responses, such as beliefs that success is due to effort, high satisfaction, low boredom, high intrinsic motivation, the choice of challenging tasks, and a positive attitude toward the activity. A performance climate, on the other hand, has been linked to maladaptive motivational responses, such as beliefs that success is the result of ability and deceptive strategies (such as cheating), choice of nonchallenging tasks, low perceived ability, and a negative attitude.

Ames’s research integrates very well with Nicholls and Dweck’s work (Elliot, 2005). However, very few studies have examined the effects of perceived motivational climate with the new addition of the approach-avoidance dimension to the achievement goal theory. To our knowledge, only one recent study from Morris and Kavussanu (2008) examined these relationships in sport and found that the two types of climate did not differentially predict achievement goals based on the valence of competence (in terms of approach-avoidance dimension). Nonetheless, the resultant achievement goals had differential effects on the level of enjoyment. Since this is the only study conducted in examining the relationships between climate and $2 \times 2$ achievement goals, there is a need to validate these findings.

There are typically two analytical techniques in examining the relationship between motivational climate and achievement goals. One is a variable-oriented approach, which essentially groups variables on common underlying dimensions or factors, such as structural equation modeling or multiple regressions (e.g., Morris & Kavussanu, 2008). The other is a person-centered approach, in which people are grouped together based on their responses to variables. For example, the variable-centered approach would examine what type of motivational climate would predict mastery goal adoption, while the person-centered approach would use the responses to goals and motivational climate to group individuals into distinct groups with homogenous characteristics (Hair, Anderson, Tatham, & Black, 1998). Marsh and his colleagues (Marsh, Luedtke, Trautwein, & Morin, 2009) recently showed that the two methods should be seen as complementary and not competing methods. They demonstrated that a latent profile analysis (LPA) can be used to identify homogenous groups within the total sample and a variety of correlates can be used to validate the relationships between the different profiles and correlates.

One other approach that has not been used in the sport and exercise psychology literature is the combination of both methods concurrently. In this study, we combined LPA with structural equation modeling (SEM) in one single analysis. This method is called full SEM Mixture Model (SEMM), and it is possible with Mplus (Muthén & Muthén, 2004), Latent Gold (Vermunt & Magidson, 2000), and GLLAMM (Rabe-Hesketh & Skrondal, 2008). To put it simply, the LPA was used...
to identify groups of individuals with qualitatively distinct perceptions of motivational profiles and SEM was used to examine the relationship between motivational climate, achievement goals, and outcome variables.

In this study, we demonstrated the application of the full SEMM Model with Mplus. We used LPA to identify groups of students with homogenous profiles in perceptions of motivational climate. We also used SEM to examine concurrently the relationships between motivational climate, $2 \times 2$ achievement goals, and affect. We used enjoyment in physical activity as the outcome variable, as there is a vast amount of literature supporting this theoretical link within the theory (e.g., see Biddle, Wang, Kavussanu, & Spray, 2003; Morris & Kavussanu, 2008; Wang & Biddle, 2001).

**Methods**

**Participants and Procedure**

Eight hundred school students (257 males, 524 females, 19 missing) from five secondary schools in Singapore took part in this study. The age range of the participants was between 12 and 20 years ($M = 15.24$, $SD = 1.45$). Permission for the study was granted by the principals and heads of physical education department, and no pupil refused to take part. Questionnaires were administered in quiet classroom conditions with the presence of research assistants. When completing the questionnaire, participants were informed that there were no right or wrong answers. They were assured of the confidentiality of their responses, and were encouraged to ask questions if necessary. Research procedures for the study were cleared by the Ethical Review Committee of the university.

**Measures**

*The 2 × 2 Achievement Goal in Physical Education Questionnaire (AGPEQ).* The AGPEQ (Wang et al., 2007) was used to measure four achievement goals in the physical education context. There were 12 items, with 3 items measuring each achievement goal. The four achievement goals were mastery-approach (e.g., “I want to learn as much as possible from this PE class”), mastery-avoidance (e.g., “I am often concerned that I may not learn all that there is to learn in this PE class”), performance-approach (e.g., “It is important for me to do better than other students in this PE class”), and performance-avoidance (e.g., “My fear of performing poorly in this PE class is often what motivates me”). A 7-point Likert scale was used ($1 = \text{strongly disagree}$ to $7 = \text{strongly agree}$).

*Perceived Mastery and Performance Climates.* The perceptions of the motivational climate were measured with a short version of the Learning and Performance Orientations in Physical Education Classes Questionnaire (LAPOPECQ; Marsh, Papaioannou, Martin, & Theodorakis, 2006; Papaioannou, 1994). The Perceived Motivational Climate in Sport Questionnaire-2 (Newton, Duda, & Yin, 2000) was alternative measure of climate, but it was developed in the sport context rather than the physical education context. There were 7 items measuring mastery climate, and 6 items measuring performance climate. One example of an item measuring mastery climate was, “In my PE class, my PE teacher
pays special attention to whether my skills are improving” and for performance climate was, “In my PE class, my PE teacher praises the students only when they are better than their schoolmates.” Answers were given on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree).

**Enjoyment.** The enjoyment subscales of the Intrinsic Motivation Inventory (IMI, McAuley, Duncan, & Tammen, 1989) were adapted to assess enjoyment (6 items; e.g., “I enjoy PE very much”). The items were measured on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree).

**Data Analysis**

In a typical analysis, a confirmatory factor analysis (CFA) would be conducted to examine the factor structure of the measures, followed by a latent profile analysis to establish the different clusters, and a regression analysis to examine the relationships between the predictor variables and the outcome variables. With Mplus (Muthén & Muthén, 2004), it is possible to combine these three analyses into one full SEMM analysis. This model consists of (a) a CFA linking all the subscale items to their respective factors, (b) a LPA identifying clusters of individuals having different profiles on the motivational climate factor means, and (c) a regression in which the outcomes of the four achievement goals, enjoyment, was regressed onto the latent profile variables.

In the main analysis, a series of SEMM analysis was conducted to identify the best solution for the climate profile of the students. The SEMM was conducted with all the items of the perceived motivational climate, achievement goals, and enjoyment measures. We examined the fit of the solutions from one to five clusters. All the observed variables are specified as continuous because analysis involving categorical data with many latent factors can result in overly high-dimensional numerical integration. The algorithm used was integration and the number of initial stage random starts at 500 with 20 stages of final stage optimizations. The number of integration points was 15. The estimator used was MLR (multivariate linear regression).

We used Akaike’s information criterion, or AIC (Akaike, 1987); the Bayesian information criterion, or BIC (Schwarz, 1978); sample-size adjusted BIC; and the Lo-Mendell-Rubin (LMR) likelihood ratio test to decide on the fit of the model. The AIC and BIC are general fit indexes that are used for model comparison within the same data set (Hox, 2002). Both are based on the likelihood function and take into account both the measure of fit and model complexity. Lower values of both AIC and BIC are indicators of better model fit. The LMR test (Lo, Mendell, & Rubin, 2001) is used to compare the estimated model with a model with one less class than the estimated model. A small \( p \)-value associated with the LMR test supports the retention of a more complex solution with \( k \) clusters (Pastor, Barron, Miller, & Davis, 2007).

For the LPA, we examined the classification accuracy of the model by using the average posterior probabilities in the classification tables. The posterior probabilities are probabilities of the persons being assigned to a cluster. In the classification table, there are as many rows and columns as there are clusters. The \( k \)-th row of the classification contains \( k \) posterior probabilities, averaged across only those persons assigned to the \( k \)-th cluster. In the \( k \)-th row, the largest average posterior probabilities
will be associated with cluster k, with all other averages in that row being lower. High probabilities on the main diagonal of the classification table reflect greater accuracy in the assignment of persons to cluster. We also examined the models with number of group with less than 1% and less than 5% of the cases. Solutions with small numbers of cases may not be feasible (Marsh et al., 2009).

Results

The AICs, BICs, and the sample-size adjusted BICs for the range of cluster solutions are shown in Table 1. For the five-cluster solution, there was one group with less than 5% of the cases and another group with less than 1% of the cases. With the four-cluster solution, one group contained less than 5% of the cases. We therefore rejected the two solutions based on small number of cases. We compared the AICs, BICs, and SSA-BICs among the three- and two-cluster solutions. Although these figures were smaller for the three-cluster solution, the LMR likelihood ratio test indicated that the three-cluster solution was not statistically better than the two-cluster solution. The average posterior probabilities for the two-cluster solution are presented in Table 2. The results support the classification accuracy of the two-cluster solution. The entropy statistical value was .699. This index captures the classification utility using a single statistical value ranging from 0 to 1, with higher value indicating higher classification utility. Although there are no cutoff values for this index, values higher than 0.6 seem to be acceptable (see Pastor et al., 2007).

Table 1  AICs, BICs, and Sample-Size Adjusted BICs Values for Different Model Parameterizations

<table>
<thead>
<tr>
<th>No. Group</th>
<th>No. Parameter</th>
<th>AIC</th>
<th>BIC</th>
<th>SSA-BIC</th>
<th>pLMR</th>
<th>LT1%</th>
<th>LT5%</th>
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<tr>
<td>1</td>
<td>93</td>
<td>70,064</td>
<td>70,496</td>
<td>70,200</td>
<td>—</td>
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<td>0</td>
</tr>
<tr>
<td>2</td>
<td>103</td>
<td>69,621</td>
<td>70,099</td>
<td>69,772</td>
<td>.1982</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>113</td>
<td>69,273</td>
<td>69,797</td>
<td>69,438</td>
<td>.5456</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>123</td>
<td>69,218</td>
<td>69,789</td>
<td>69,399</td>
<td>.7541</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>133</td>
<td>69,160</td>
<td>69,777</td>
<td>69,355</td>
<td>.3342</td>
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Table 2  Average Posterior Probabilities for Most Likely Latent Class Membership by Class

<table>
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<tr>
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<tr>
<td>1.</td>
<td>.928</td>
<td>.072</td>
</tr>
<tr>
<td>2.</td>
<td>.131</td>
<td>.869</td>
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Profile of Cluster Groups

Cluster 1 consists of 72.5% of the students ($N = 557$) and is characterized by higher perceptions of mastery climate ($M = .240, S.E. = .139$) and a higher level
of performance climate ($M = .350, S.E. = .098$) compared with Cluster 2. Cluster 2 represents 27.5% of the sample ($N = 211$). The means for mastery and performance climates for this cluster were fixed at 0 by default. When we examined the other main variables of the two clusters, it was found that Cluster 1 reported consistently higher scores in all four goals, compared with Cluster 2: performance-approach ($m = 4.08 \pm 1.18$ vs. $2.18 \pm .95$), mastery-approach ($m = 5.07 \pm 1.02$ vs. $3.54 \pm 1.18$), performance-avoidance ($m = 4.46 \pm 1.10$ vs. $2.93 \pm 1.13$), and mastery-avoidance ($m = 4.51 \pm .91$ vs. $2.92 \pm .93$). They also reported higher enjoyment in physical education ($m = 5.50 \pm 1.34$ vs. $4.48 \pm 1.83$) compared with the second cluster.

### Structural Equation Modeling

The standardized solutions for the structural equation modeling for Clusters 1 and 2 are shown in Figures 1 and 2, respectively. For both solutions, the factor loadings and error variances were almost identical. Regardless of the levels of the perceptions of mastery and/or performance climate, the results showed that perceived mastery climate resulted in mastery-approach and mastery-avoidance goals, with a stronger loading on approach goal. In addition, perceived performance climate may lead to adoption of performance-approach, with a lower loading on performance-avoidance goal. Mastery-approach goal had a strong positive effect on enjoyment. Performance-approach and mastery-avoidance goals were not related to enjoyment, whereas performance-avoidance goal negatively predicted enjoyment.

### Discussion

Previous research has established that students’ perceptions of classroom goal structures directly affect their achievement goals adoption, motivation, affect, and achievement (e.g., Ames, 1992a, 1992b; Sproule, Wang, Morgan, McNeill, & McMorris, 2007; Wang et al., 2008). With the recent additional of the approach-avoidance dimension to the achievement goal theory, the relationships between motivational climate and achievement goals require reexamination. The current study examined the relationships between perceived motivational climate and achievement goals and other correlates with a full latent SEMM analysis.

In general, the Singaporean students perceived that their physical education lessons were structured in a mastery manner rather than performance oriented. This is line with two recent studies in Singapore with secondary students (Sproule et al., 2007; Wang et al., 2008). This is indeed good news to the physical education teachers in Singapore as a mastery climate is more likely to encourage self-referenced improvement and effort. On the other hand, a performance climate is more likely to encourage normative comparisons and winning.

The use of LPA as a person-centered approach to the study of the profile of perceived motivational climate shows many advantages over the standard cluster analysis approach. Firstly, LPA is a model-based clustering method that assumed that “the data is generated by a mixture of underlying probability distributions” (Vermunt & Magidson, 2002, p. 2), whereas the traditional cluster analytic techniques are not. Secondly, fit indexes are provided in LPA for model comparisons to help researchers make informed decisions upon the final model (Marsh et al., 2009). Thirdly, LPA does not require common scaling of the observed variables.
Figure 1 — Standardized solution for the full latent SEM model for Cluster 1.
Figure 2 — Standardized solution for the full latent SEM model for Cluster 2.
Finally, traditional cluster analysis assigns people to clusters on an all-or-none fashion, whereas LPA yields a probabilistic clustering approach, which allows fractional cluster membership to be captured in the posterior probabilities (Pastor et al., 2007).

Previous research that examined the independent effects of motivational climate and achievement goals (e.g., Cury et al., 1996; Morgan & Carpenter, 2002; Papaioannou, Marsh, & Theodorakis, 2004) encouraged the promotion of mastery-oriented climate and mastery goals and downplayed the performance-oriented motivational climate and performance goals. Recently, researchers (e.g., Daniels et al., 2008; Elliot & Church, 1997) are beginning to adopt a multiple goals perspective. They suggest that people may endorse “multiple goals” in the achievement context. That is, people can have high or low achievement goals in terms of the mastery-performance dimension, as well as in the approach-avoidance dimension. For example, Wang and his colleagues (Wang et al., 2007; 2008) found that there could be at least four combinations of achievement goals in their studies: a “moderate achievement goals” profile, with scores from all four achievement goals close to a standard score of zero; a “low achievement goals” profile, in which all achievement goal scores were very low; a “high achievement goals” profile, in which scores of the four goals were all very high; and a “mastery achievement goals” profile with high mastery-approach and mastery-avoidance goal scores, and moderate performance-approach and performance-avoidance goal scores. The most adaptive group was the “high achievement goals” group, and the least adaptive group was the “low achievement goals” group, scoring low on variables such as autonomy, relatedness, and perceived competence, and high in amotivation. The students from the “low achievement goals” group also reported lowest enjoyment in physical education.

The results of the LPA showed that differences in perceptions of motivational climate created different achievement goal profiles. Two distinct subgroup patterns of motivational climate were identified. One group of students perceived a “much higher mastery and performance climate” (Cluster 1) compared with the reference group (Cluster 2). Students in Cluster 1 reported a “high achievement goals” profile similar to Wang et al.’s (2007) study. This cluster also reported highest enjoyment compared with the second cluster. Students in Cluster 2 resembled Wang et al.’s (2007) “low achievement goals” profile, in which all achievement goal scores were very low, and significantly lower enjoyment in physical education was also reported by this group. The findings mirrored two previous studies done by Wang and his colleagues (Wang et al., 2007; 2008) in the Singapore context. What is clear now is that there are students who are high or low in all the four achievement goals, and these are closely related to their perceived motivational climate.

The results from the SEM part of the SEMM model highlighted that regardless of levels of perceptions of mastery and/or performance climate, the relationships between climate and achievement goals remained the same. This is the first study that can make this claim, as the full latent SEMM analysis provides the empirical support for this. This method shows that there are two distinct groups of students with a homogenous profile of perceived motivational climate. One group has significantly higher perceptions of mastery and performance climate when compared with the other group. The SEM tested the relationships between climate,
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achievement goals, and enjoyment simultaneously. The results of the current study show that the SEMM can have a powerful application in determining the different relationships between variables across different groups, together with confirmatory factor analysis. This is the true value that is added when integrating variable-centered and person-centered approaches in a single analysis.

The results of the current study also confirm the findings of Morris and Kavussanu (2008) in that perceived mastery climate predicted mastery-approach and mastery-avoidance goals, with a stronger loading on mastery-approach goal. This is also in line with the theory in that when the teachers create an environment whereby personal improvement and mastery are valued, the students are more likely to adopt mastery-approach goal. At the same time, they may be afraid that they are not able to learn or develop their skills as much as they could, and thereby trigger the adoption of mastery-avoidance goals. Morris and Kavussanu (2008) pointed out that the current motivational climate measures did not include the avoidance aspect of achievement goals and suggested that the instrument may need refinement.

In terms of the findings related to perceived performance climate in predicting performance goals, our findings also confirm the findings of previous study (Morris & Kavussanu, 2008). Perceived performance climate predicted performance-approach and performance-avoidance goals.

The findings of the current study show that there are at least two distinct groups of students with differing perceptions of motivational climate—one group of students had much higher perceptions in both climates compared with the other group. Regardless of which group they are from, the relationships between motivational climate, achievement goals, and enjoyment seemed to be invariant. Mastery climate predicted both mastery-approach and mastery-avoidance goals, and performance climate was related to both performance-approach and performance-avoidance goals. Only the mastery-approach goal had a strong positive effect whereas the performance-avoidance goal had a small negative effect on enjoyment. Overall, the findings suggest that perceptions of a mastery motivational climate in physical education may foster intrinsic interest in physical education.

There are a few limitations to the study that need to be mentioned. Firstly, the data are cross-sectional and therefore causal relationships cannot be inferred. Secondly, perceived competence was not measured and that could mask the relationships between climate and achievement goals. Thirdly, no behavioral indicators were used in the study and therefore the extent to which the adopted achievement goals or enjoyment that actually led to physical activity participation is not known. There is a need for experimental manipulation of climate, goals, perceived competence, and outcomes (success vs. failure) to confirm the causal links between motivational climate and achievement goals. Finally, the climate measure used in this study may be designed to assess perceived motivational climate based on earlier dichotomous models of mastery/performance goals in the physical education class and may be related only to the definition of the $2 \times 2$ achievement goal (mastery vs. performance) and not the valence aspect (approach vs. avoidance) of achievement goals. Therefore, the predictive power of the climate may be limited. Future studies need to develop a measure that reflects the valence-related features of the climate to increase the predictive power of the perceptions of motivational climate.
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