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Research article

Factorial Validity and Internal Consistency of the Motivational Climate in Physical Education Scale

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Abstract

The aim of the study was to examine the construct validity and internal consistency of the Motivational Climate in Physical Education Scale (MCPES). A key element of the development process of the scale was establishing a theoretical framework that integrated the dimensions of task- and ego involving climates in conjunction with autonomy, and social relatedness supporting climates. These constructs were adopted from the self-determination and achievement goal theories. A sample of Finnish Grade 9 students, comprising 2,594 girls and 1,803 boys, completed the 18-item MCPES during one physical education class. The results of the study demonstrated that participants had highest mean in task-involving climate and the lowest in autonomy climate and ego-involving climate. Additionally, autonomy, social relatedness, and task-involving climates were significantly and strongly correlated with each other, whereas the ego-involving climate had low or negligible correlations with the other climate dimensions. The construct validity of the MCPES was analyzed using confirmatory factor analysis. The statistical fit of the four-factor model consisting of motivational climate factors supporting perceived autonomy, social relatedness, task-involvement, and ego-involvement was satisfactory. The results of the reliability analysis showed acceptable internal consistencies for all four dimensions. The Motivational Climate in Physical Education Scale can be considered as psychometrically valid tool to measure motivational climate in Finnish Grade 9 students.

Key words: Students, self-determination, goal orientation, psychometric properties.

Introduction

Motivation is recognized to be one of the most important factors related to engagement in physical activity during childhood and adolescence (Hagger and Chatzisarantis, 2007; Malina et al., 2004; Sallis et al., 2000). School physical education (PE) plays an important role in the socialization process to motivate students towards a physically active lifestyle because it has the potential to provide positive physical activity experiences to the whole student population (O'Sullivan, 2004). Furthermore, PE teachers have an important role in the development of motivation toward PA through creation and maintenance of the social and psychological climate perceived by students through teachers' use of different pedagogical and didactical methods.

Research on children's motivation toward physical activity has utilized two main theories namely the self-determination theory (Deci and Ryan, 1985) and the

achievement goal theory (Nicholls, 1989) both representative of modern social-cognitive theories of motivation. The self-determination theory constitutes an important approach in studying human motivation, particularly in achievement and participation contexts (Standage et al., 2007; Vallerand, 2001).

The self-determination theory suggests that autonomy, competence, and relatedness are the key constructs of psychological well-being and optimal functioning. Environments which satisfy these three needs positively affect well-being. In contrast, environments that limit or restrict the attainment of these needs can negatively influence human functioning and well-being. All three needs are essential, and if anyone is unable to be met there is likely to be a detrimental motivational outcome (Deci and Ryan, 1985; 2000). Previous research has shown that the role of environment in satisfying these three psychological needs is important determinant of intrinsic motivation in PA context (Hagger and Chatzisarantis, 2007; Ntoumanis, 2012), and persistence in physical activity within school PE and leisure time (e.g., Digelidis et al., 2003; Jaakkola et al., 2013; Papaioannou et al., 2006; Yli-Piipari et al., 2009; 2012; Zhang et al., 2011).

Perceived autonomy is considered as the opportunity to affect one's own behavior. If an action is regulated externally or controlled by a person not directly involved in it, the interest toward the task can decrease (Deci and Ryan, 1985). Strong perception of autonomy in PE has been found to increase physical activity not only during the class, but also during leisure time (Hagger et al., 2003). Social relatedness is a natural need by human beings to belong to a group, be accepted and feel positive emotions while acting as a group member (Deci and Ryan, 2000). Social relatedness has been reported as demonstrating positive associations with perceived engagement in physical activity (Prochaska et al., 2002). Perceived competence is related to an individual's perceptions of their own abilities in interacting with the social environment (Deci and Ryan, 1985). Satisfaction with perceptions of competence leads to enhanced intrinsic motivation and consequently participation in physical activities (Deci and Ryan, 2000; Ntoumanis, 2005).

Another prevailing theory in the field of the study associated with the motivation characteristics that influence children and adolescents is the achievement goal theory (Nicholls, 1989). It also includes cognitive and social factors both affecting motivation. Goal orientations in the theory represent cognitive factors and

two goal perspectives namely task (self-referenced) and ego (other-referenced), and are considered to be dominant in performance settings. These orientations refer to how success is perceived and competence evaluated (Nicholls, 1989), and relate to important differences in behavior. It is expected that when a student focuses on task-involving goals, a more adaptive motivational pattern should result, regardless of whether she or he has a high or low perception of competence (Nicholls, 1989). It has also been proposed that children should not experience motivational problems when ego-involving goals are emphasized, as long as they are confident in their physical ability. Maladaptive motivational patterns result when a student has adopted ego-involving goals but have doubts about the adequacy of their competence to undertake the task at hand (Roberts, 2001). Previous findings indicate that task orientation is associated with intrinsic motivation (Standage et al., 2003), enjoyment and lower levels of boredom (Barkoukis et al., 2010), self-reported engagement in PA (Papaioannou et al., 2006; Zan et al., 2008), and objectively assessed PA levels (Jaakkola et al., 2008). Alternatively, several empirical findings examining relationships between ego orientation and PA related outcomes have been inconsistent (see review by Roberts et al., 2007).

Motivational climate is another key element in the achievement goal theory and it refers to a situational psychological perception of the activity that directs the goals of action (Ames, 1992). The motivational climate in school PE affects students' self-experience, motivation, and attitudes toward physical activity. The social situation created by significant others varies in terms of the achievement goals emphasized (Duda and Balaguer, 2007). From the achievement goal orientation approach, the motivational climate has two perspectives, namely a task-involving and an ego-involving climate. An ego-involving climate stresses performance outcomes and social comparison between students. This leads to increased external motivation and anxiety, as well as decreased interest (Duda and Whitehead, 1998). In a task-involving climate, students reflect their performance to their personal development, are rewarded for trying and effort, and set their personal goals themselves (Ames, 1992). A task-involving climate is created if the didactical solutions of the teacher support the development of the students' task orientation. Correlational and intervention based studies in PE have revealed that a task-involving climate is positively associated with task orientation (Bakirtzoglou and Ioannou, 2011; Moreno-Murcia et al., 2011), intrinsic motivation (Bryan and Solmon, 2012; Spittle and Byrne, 2009; Standage et al., 2007), and physical activity (Christodoulidis et al., 2001; Wallhead and Ntoumanis, 2004). An ego-involving motivational climate is found to be associated with ego orientation (Bakirtzoglou and Ioannou, 2011; Spittle and Byrne, 2009) and lowered intrinsic motivation (Ferrer-Caja and Weiss, 2000).

Previous studies have shown integration of achievement goal (Nicholls, 1989) and self-determination theories (Deci and Ryan, 1985) to be useful in understanding students' intra-individual motivation (Ciani et

al., 2011; Ommundsen and Kvalø, 2007). When exploring the theories of achievement goals and self-determination simultaneously, we notice that they include similar elements, both involving social and cognitive factors. The major difference between the two models is that the achievement goal theory operates only with perceived competence, which is divided into task- and ego-oriented approaches. Although the self-determination theory also involves the perception of competence it includes perceptions of autonomy and social relatedness as additional elements. Deci and Ryan (1985), however, did not divide the perception of competence into task and ego orientation, which are crucial elements of motivation in achievement settings, such as school PE (Nicholls, 1989; Roberts, 2001). For example, teaching process in PE is often evaluative in nature, and can be considered as an outcome-oriented activity, the goals being primarily defined in terms of success and failure.

However, the two theories consider competence from different perspectives. In the achievement goal theory, demonstration of competence constitutes one of the driving forces of behavior (Nicholls, 1989), whereas in the self-determination theory, the need for competence influences subsequent beliefs, affects, and behavior (Deci and Ryan, 1985; 2000). The need for competence as an element of the self-determination theory has been found to positively affect both controlling and autonomous motivation (Hagger and Chatzisarantis, 2007). This could be representative of the differential effect that environmental cues (task vs ego climate) may have on the need for competence.

In order to analyze the motivational climate in PE, it is important to develop valid and reliable inventories. Physical education teachers, therefore, could benefit from scales to evaluate changes in motivational climate as result of their pedagogical actions. Although there has been advancements in the measurement of key achievement goal constructs in the PE domain, there is need for the refinement and further development of existing measures and creating new assessment tools (Duda and Balaguer, 2007). Motivational climate scales (e.g., LAPOPEQ; Papaioannou, 1994; PMCSQ; Seifriz et al., 1992; PMCSQ II; Walling et al., 1993) are typically based on the goal orientation model (Nicholls, 1989), according to which perception of competence as motivational factor is based on two independent criteria. The two other cornerstones of the self-determination theory, perceived autonomy and perceived social relatedness, are neglected or included in task and ego involving climate sub-dimensions (see Perceived Motivational Climate in Sports Questionnaire-2; Walling et al., 1993). Another issue with these scales is that the task-involving climate has been operationalized according to various pedagogically positive variables, whereas the ego-involving climate has been operationalized according to negative items.

Suggestions for future research proposed by Duda and Balaguer (2007) were a stimulus for the current decision to integrate the theoretical frameworks of both self-determination and achievement goal approach in the development of a new questionnaire to evaluate a broader

interpretation of the motivational climate construct.

Due to the continuing need to improve the quality of PE, and further develop associated theoretical perspectives, we thought it important to be able to assess the perceptions of the motivational climate within the PE context. In this study, the purpose was the examination of the factorial validity and internal consistency of the Motivational Climate in Physical Education Scale (MCPES). During the development process of the scale, we aimed at enhancing the theoretical framework using four dimensions relevant to the environment to satisfy three psychological needs (Table 1). We hypothesized that a four-factor structure of the MCPES would emerge (Liukkonen et al., 2010; Standage et al., 2003) representing social relatedness, perceived autonomy, and task- and ego-involving climate, with the last two reflecting the perception of competence.

Table 1. Theoretical contents of the dimensions of motivational climate.

Dimension	Contents of the dimensions
Task-involving climate	trying one's best, mistakes are seen as part of the learning process, learning new things, progress in one's own skills (1, 2, 4)
Ego-involving climate	competing in relation to others, comparison in relation to others, showing superiority in relation to others, importance of succeeding more than others, normative comparison (1, 2, 3, 4)
Autonomy support	freedom to make choices, possibility to make choices, possibility to affect the way PE lessons are run, possibility to affect common issues (5)
Social relatedness support	working together as a team, cohesion during classes, pulling together, class is united when practicing (6)

1) Ames and Archer (1989), 2) Epstein (1988), 3) Papaioannou (1994), 4) Newton and Duda (1993), 5) Deci and Ryan (1985), 6) Deci and Ryan (2000).

Methods

Participants

The data for this study was collected from a sample of Finnish secondary school students ($n = 4,397$). Participants were drawn from 62 schools and 268 classes comprising both girls ($n = 2,594$) and boys ($n = 1,803$) at the Grade 9 level (14 to 15-year-old). Grade 9 students were selected because in Finland, the students' PE teacher remains the same during the secondary school years (Grades 7 to 9), which improves the likelihood that they have a good awareness and positive experiences of the pedagogical climate of PE classes by the Grade 9.

Measure

Relevant items were selected from previous motivational climate scales representing the three cornerstones of self-determination theory, namely perceived competence (including ego- and task-involvement), perceived autonomy and perceived social relatedness. The draft version of the scale consisted of 45 items. Items were selected from the Learning and Performance Orientations in Physical Education Classes Questionnaire (LAPOPEQ; Papaioannou,

1994), Perceived Motivational Climate in Sport Questionnaire (PMCSQ; Seifriz et al., 1992), and Perceived Motivational Climate in Sport Questionnaire -2 (PMCSQ-2; Walling et al., 1993). The items selected were translated using the back-translation method. In addition, a panel of experts evaluated and separated items reflecting each climate dimension in order to capture the theoretical definitions of the dimensions of autonomy, perceived competence and social relatedness. Finally, we modified the items so that they were relevant for Finnish PE, reflecting the motivational climate perceived by students.

A pilot study was conducted with Grade 9 students ($n = 317$) prior to the commencement of the main study (Soini, 2006). The data of the pilot study were analyzed using the principal axis method and promax rotation. The loading criteria for accepting the items in the factor model was set at .60, and simultaneously, set for a maximum of 0.30 loading on competing factors in order to apply later confirmatory factor models with a single loading structure. Also, the criterion for the acceptability for the internal reliability of the factors was set at 0.70 (Tabachnick and Fidell, 2006). After this process, 18 items were left for the MCPES, five of which were in the autonomy factor, four in the social relatedness factor, five in the task-involving climate factor and four in the ego-involving climate factor (Table 2).

Table 2. Items of the Motivational Climate in Physical Education Scale (MCPES).

1. It is important for the students to try their best during PE lessons (3)
2. Learning new things makes me want to learn more (3)
3. What's most important is that we progress every year in our own skills (3)
4. Our PE class has a good sense of unity (2)
5. It is important for students to show that they are better in PE than others (4)
6. Students have a significant role in decision making in PE lessons (1)
7. Our PE class is united when practicing during PE lessons (2)
8. During PE lessons students compare their performance mainly to that of others (4)
9. Students really "work together" as a team (2)
10. It is important for the students to try to improve their own skills (3)
11. Students are given the opportunity to affect the way PE lessons are run (1)
12. During PE lessons the students 'pull together' (2)
13. It is important to keep trying even though you make mistakes (3)
14. It is important for the students to succeed better than the others (4)
15. Students have significant freedom to make choices during PE lessons (1)
16. During PE lessons the students compete with each other in their performance (4)
17. Students are given the opportunity to select activities according to their own interests (1)
18. Students can affect the course of PE lessons (1)

(1) = Perceived autonomy supporting dimension, (2) = Perceived social relatedness supporting dimension, (3) = Perceived task-involvement supporting dimension, (4) = Perceived ego-involvement supporting dimension

The items in the autonomy dimension represent a

chance to choose among different activities in a PE lesson. The task-involvement items represent effort and self-improvement, and the ego-involvement items represent normative comparison. The items in the social relatedness dimension represent the students' unity in PE classes. Each item was rated on a five-point Likert scale anchored by 1 = strongly disagree and 5 = strongly agree. The MCPES had the individual item stem of "In my PE class ...".

Procedure

Following approval from the ethics committee of the local university, teachers of Grade 9 students were invited to be involved in the study via an e-mail message sent to randomized members of the Finnish Association of Physical Education ($n = 437$). Those who replied positively received the questionnaire with information about data collection procedures. The geographical distribution of the participating teachers represented all regional districts of Finland.

The questionnaire was administered to students prior to PE classes. The participants were informed that their involvement in the study was voluntary and that their scores would be kept anonymous. The students were considered of an age to approve their anonymous involvement in the study. In addition, they were informed that if for any reason they were unable to finish the inventory they were free to end their involvement in the task. The participants were also invited to ask for help if confused about the instructions or the clarity of a particular item. No problems were reported during the data collection process.

Data analysis

Descriptive analyses were completed to generate subscale means and standard deviations for the sample. Pearson product moment correlations and Cronbach's alpha coefficients were calculated to examine the pattern of associations and internal consistency of the subscales.

Confirmatory factor analysis was undertaken using AMOS 20 software and the maximum likelihood method (Arbuckle, 2011). A single model was constructed a priori for the data set and the solution evaluated using a variety of well-known fit indices. The indices used were the chi-square goodness of fit statistic, adjusted goodness of fit index (AGFI), normed fit index (NFI), parsimonious normed fit index (PNFI), Tucker-Lewis index coefficient (TLI), comparative fit index (CFI), and the root mean square error of approximation (RMSEA). These indices were selected on the basis of the examination of the literature associated with the best practice determination of model fit suggested within multivariate analysis texts, whereby, the indices used are representative of the absolute fit, incremental fit, and model parsimony categories (e.g., Hair et al., 2006; Holmes-Smith and Coote, 2002; Schreiber, 2006).

Results

Descriptive statistics, internal consistencies and correlations

Means, standard deviations, internal consistencies and Pearson's correlations for the subscale variables were examined. Descriptive statistics (Table 3) showed that the means of all motivational climate dimensions were close or above the mathematical mean. The highest means were found for the task-involving climate and the lowest for the autonomy and ego-involving climate subscales. All individual items showed a normal distribution with skewness and kurtosis values less than 2.00.

Table 3. Means, standard deviations, subscale correlations, and internal consistencies of the MCPES ($n = 4,396$).

Variable	Mean (SD)	1.	2.	3.	Alpha
1. Autonomy	2.96 (.83)				.85
2. Social relatedness	3.16 (.89)	.41**			.88
3. Task climate	3.95 (.74)	.36**	.47**		.80
4. Ego climate	3.02 (.82)	.06**	-.12**	.02	.78

** $p < 0.001$

Internal consistency reliability values for the four MCSPES sub-scales are presented in Table 3. The Cronbach alpha coefficients for the four subscales were all above 0.70 and ranged from 0.78 (ego climate) to 0.88 (social relatedness). Three subscale factors, autonomy, social relatedness, and task climate, were significantly and moderately correlated with each other, whereas the ego climate factor had low or negligible correlations with the other three factors (Table 3).

Factor structure

Resultant fit indices derived from the CFA of the four-factor model of the MCPES (18 items) were generally indicative of an acceptable model. The absolute fit index of RMSEA (.037) was below the accepted maximum fit value of .05, and AGFI (0.97) was above the expected minimum of .90. However, the normed chi-square index ($\chi^2/df = 6.883$) was above the marginal maximum of 3.00 (Hair et al., 2006). It is important to note that larger samples typically produce larger chi-squares which are more likely to be significant. The current sample could be considered as very large in relation to comparative research in measure development in this area. The incremental fit indices for this model were all well above the accepted minimum of 0.90, indicating a strong fit (NFI = 0.97; CFI = 0.97; and TLI = 0.97). Parsimonious fit of the model was evaluated using PNFI. The resultant value of 0.82 is typically smaller than incremental fit values, but within the range of accepted values (Schreiber, 2006). Review of the modification indices and standardized residual co-variances of the latent factors revealed acceptable values. Additionally, the four-factor solution of the MCPES showed viable item loading values, ranging from 0.55 to 0.82, indicating acceptable construct validity of the items and the subscales (see Figure 1).

Discussion

The purpose of the current study was to examine construct validity and internal consistency of the Motivational Climate in Physical Education Scale (MCPES) in a large sample of Finnish Grade 9 PE students. A four-factor structure of the MCPES was hypothesized to

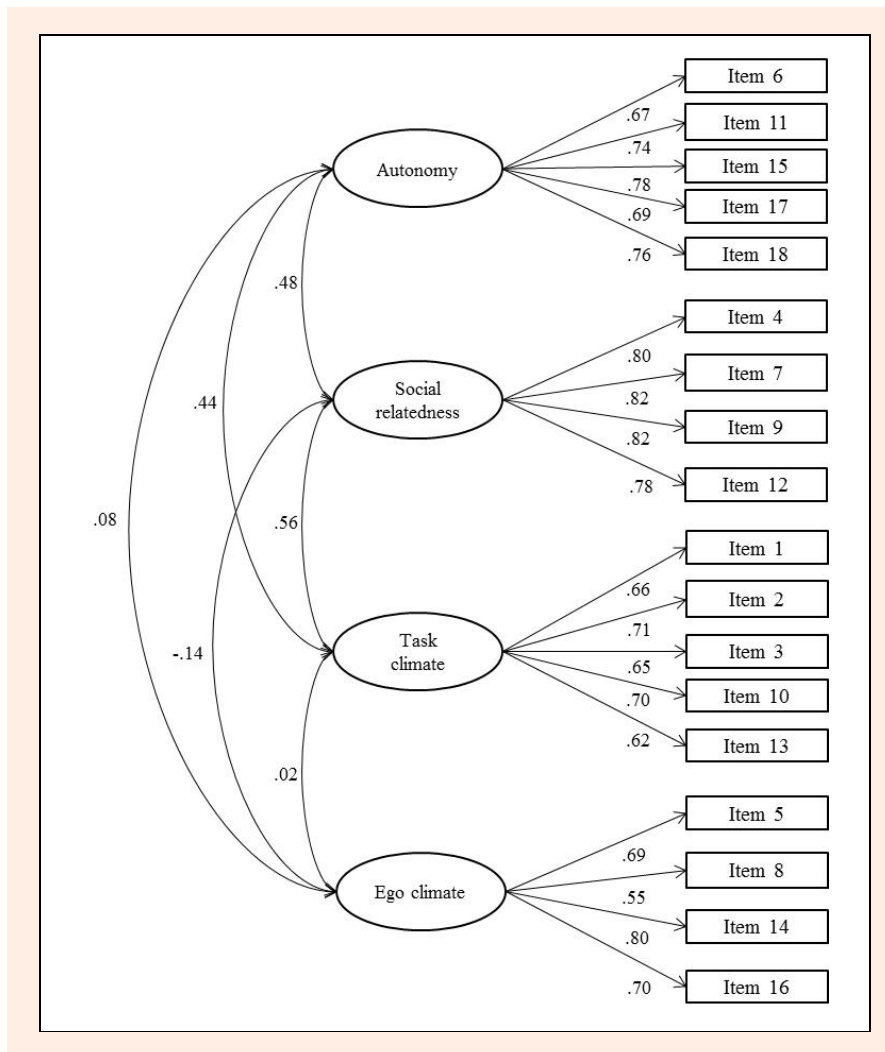


Figure 1. Measurement model (CFA) of the hypothesized four-factor structure of the MCPES.

emerge (Liukkonen et al., 2010; Standage et al., 2003) representing social relatedness, perceived autonomy, and task- and ego-involving climate.

The confirmatory factor analysis generally showed acceptable values of goodness-of-fit indices indicating satisfactory construct validity of the four-factor model of the MCPES. The only index below acceptable limits was normed chi-square index which is sensitive to large sample size (Hoyle, 2012). However, in confirmatory factor analysis there is no generally accepted agreement about the best index of overall fit used in the confirmatory analyses and, therefore, the results shall be interpreted as a whole (Boomsma et al., 2012). It should be recognized that in the current data, the index of RMSEA was satisfactory. Hair et al. (2006) suggested that the RMSEA is the index which is the most resistant to model misspecification and the least affected by a large sample size which was the case in our data.

Review of item loadings generally demonstrated high loadings indicating that each item associated with latent factor that they were hypothesized to belong. The only exception was the item eight "During PE lessons students compare their performance mainly to that of others" of the ego climate dimension which was clearly lower than the other items of ego climate subscale or

items of other subscales. The reason for this difference might be the distinct contents of the item. The other three items of ego climate subscale relate to outperforming others, whereas, item eight reflects comparing one's performances to that of others. Comparison as a action within item eight does not necessarily include a competitive element of motivational climate because it can be natural part of a sport or physical activity in the context where tasks are executed in groups. Students may, for example, look others' performances and try to learn from them. The results of the study also showed that all four subscales had acceptable internal consistencies demonstrating that the MCPES is a reliable tool in analyzing students' perception of motivational climate. Overall, the psychometric analyses of MCPES revealed satisfactory construct validity and internal consistency.

Descriptive results showed the highest mean values were for task involving motivational climate and lowest for autonomy and ego-involving climate. These results are in line with previous studies in Finnish PE context showing that students perceive more task- than ego-involving climate in their PE classes (Kalaja, 2012; Kokkonen, 2003; Liukkonen et al., 2010). These findings demonstrate that teachers tend to use more pedagogical efforts to contribute task-involving values such as own develop-

ment, trying hard, and setting own goals than efforts to advance autonomy or social relatedness in PE classes. However, it is important to recognize that higher perception of task-involving climate rather than ego-involving climate is considered to be beneficial for development of students' motivation toward physical activity (Roberts, 2001).

Examining the relationships between variables indicated that ego-involving climate had negligible association with task-involving climate. Previous studies have highlighted contradictory results regarding interrelationship between task- and ego-involving climates. Specifically, Reinboth and Duda (2006) and Horn et al. (2012) found negative association with these motivational climate dimensions, whereas in a study of Moreno-Murcia et al. (2011), the correlation was zero. The current study supports the latter finding that task- and ego-involving climate are orthogonal which is in line with achievement goal theory suggesting that task- and ego climates should have orthogonal relationship (Roberts, 2001; Roberts et al., 2007). Orthogonality in the relationship among ego- and task-involving climates means that ego-involving climate is independent from task-involving climate. As a consequence, therefore, decreasing ego-involving motivational climate does not enhance task-involving climate or other climate dimensions. A pedagogical implication of this finding is that PE teachers should focus on putting effort toward increasing task-involving climate rather than trying to affect ego-involving climate. This study also expands previous research findings showing that ego-involving climate has orthogonal relationship also with autonomy and social relatedness supporting climates.

Theoretically, the MCPES included the three cornerstones related to the social environment to satisfy three psychological needs proposed in the self-determination theory (Deci and Ryan, 2000) and achievement goal theory (Nicholls, 1989), namely perceived autonomy, social relatedness, and task-involvement. In this study, the inter-correlations between these three factors were moderate and positive. These findings support the theoretical framework of the MCPES by demonstrating that the motivational climate variables assessed represent constructs that based on theory (Deci and Ryan, 2000; Nicholls, 1989) and previous empirical findings (Bryan and Solomon, 2012; Spittle and Byrne, 2009; Standage et al., 2007) are associated with school PE environment to satisfy three psychological needs.

Conclusion

The MCPES was developed on the basis of the integration motivational elements of both the self-determination and achievement goal theories. This research has led to the construction of a psychometrically valid and reliable instrument which can be used in analyzing motivational climate in the context of school PE. In its current form the measure is applicable to the Finnish system of PE but could be easily adapted to suit a range of language and cultural contexts. In future, it would be important to analyze discriminant, construct, and predictive validity of the

MCPES to analyze more completely the psychometric properties of the scale. In addition, further research should be undertaken with a broader range of age groups and within different cultures.

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Key points

- This study developed Motivational Climate in School Physical Education Scale (MCPES). During the development process of the scale, the theoretical framework using dimensions of task- and ego involving as well as autonomy, and social relatedness supporting climates was constructed. These constructs were adopted from the self-determination and achievement goal theories.
- The statistical fit of the four-factor model of the MCPES consisting of motivational climate factors supporting perceived autonomy, social relatedness, task-involvement, and ego-involvement was satisfactory. Additionally, the results of the reliability analysis showed acceptable internal consistencies for all four dimensions.
- The results of the study demonstrated that participants had highest mean in task-involving climate and the lowest in autonomy climate.
- Autonomy, social relatedness, and task climate were significantly and strongly correlated with each other, whereas the ego climate factor had low or negligible correlations with the other three factors.

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