Physical Education Motivational Climate, on the Achievement Goals, and Intrinsic Motivation of Students: A Multilevel approach

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Word count: 7096 (including Tables, Figures, and references)

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This study examined whether the perceived motivational climate was associated with students' achievement goals and intrinsic motivation, from a multilevel (i.e., individual- and school-level) perspective within the Physical Education context. The sample was composed of 9855 students aged 10-18 (M_{age} = 13.96 years; SD_{age} = 1.97 years) who belong to 237 different teachers from seven European countries. We used measures for teacher's motivational climate, achievement goals, and intrinsic motivation. After testing for cross-country invariance, results from the mediated structural equation model showed that partial mediation was the most suitable solution. Predictions from the accepted model supported theoretical predictions, suggesting a strong positive mediating role of task orientation between achievement goals and intrinsic motivation, while the role of ego orientation remained more ambiguous. Our findings also highlight the relevance of students' individual experiences in shaping their perception of the emphasized motivational climate, as well as reveal an additive effect in the prediction from task orientation to intrinsic motivation due to cluster belongingness. We discuss these results with other variables that might affect students' perceptions such as teacher-student relationship and motivational contagion and encourage future research to keep studying the construction of the students' perception of the teacher's emphasized motivational climate from a multilevel perspective.

Keywords: achievement goal theory, school; motivational contagion; structural equation model; teacher-student relationship

Introduction

Physical Education (PE) plays a key role in the development of children and adolescents, encompassing aspects such as body development, body expression, sports learning and positive peers interactions (Bailey, 2006; García-Hermoso et al., 2020; Kerner et al., 2018). Furthermore, PE is thought to have a role in improving activity rates (Alcaraz et al., 2017; Slingerland & Borghouts, 2011). Notably, fostering an intrinsic interest and enjoyment towards PE is linked to higher physical activity levels (e.g., Hutmacher et al., 2020; Kalajas-Tilga et al., 2022).

According to the Achievement Goal Theory (AGT), the environment in which a given student is embedded is thought to influence students' intrinsic motivation through the adoption of achievement goals. (Ames, 1992; Deci & Ryan, 2000; Elliot, 1999; Nicholls, 1989). This social environment is mainly shaped by teachers and shared across students (e.g., Duda, 2007). As such, the educational context is characterized by an inherent multilevel structure, as students are clustered in classes with different teachers and peers. Moreover, these nested groups are usually not randomly composed, with students of the same group (e.g., class, school) typically being more similar between them compared to students from other groups (e.g., Marsh et al., 2012; Morin et al., 2014). Considering the importance of accounting for the nested structure in the academic context, this study aims at examining the relationship between the perceived motivational climate by students, their achievement goals, and their intrinsic motivation from a multilevel perspective.

Achievement goals are conceptualized as the mental representations that guide students to perceive themselves as competent (Elliot, 1999). Students can orient their achievement goals towards two directions. The use of self-referenced criteria (e.g., individual improvement, invested effort) to construct one’s perception of competence corresponds to task orientation. A focus on social comparison (e.g., achieving or surpassing the standard, seeking higher performance than other schoolmates) is usually indicative of adopting an ego orientation (Nicholls, 1989). Empirical evidence has shown that PE students with higher task-oriented goals exhibit higher intrinsic motivation levels towards PE lessons than those with ego-oriented goals (e.g., Franco et al., 2020).

Achievement goals in academic contexts have been shown to depend on the climate instigated by the teacher (e.g., Duda, 2007; Fernández-Espínola et al., 2020). From the AGT perspective, the motivational climate is defined as the conjunction of signals by which an environment defines its keys to success or failure (Ames, 1992; Nicholls, 1989). In PE, the climate adopted by the teacher can either be mastery-oriented (i.e., when the emphasis is on personal progress, learning achievements and effort) or performance-oriented (i.e., when the definition of success is related to performance achievements and comparison with others). This classification was complemented by Papaioannou et al. (2007), who suggested a trichotomous model by dividing performance climate using Elliot's and Church's (1997) approach/avoidance distinction (i.e., whether teachers encourage students either to pursue the attainment of competence; or to avoid situations with potential unfavourable judgements of competence). In terms of achievement goals, mastery orientation is usually related to positive outcomes, and performance-avoidance goals tend to be associated with less adaptive outcomes (Bardach et al., 2020). Conversely, being performance-approach oriented is paired with more ambivalent associations (see also, Urdan & Kaplan, 2020). However, limited studies have used this classification to relate motivational climate and achievement goals.

Research relating motivational climate, achievement goals and intrinsic motivations has been extensively developed. For example, the work by Marjanović et al. (2019) examined the relations between PE teachers' created motivational climate and achievement goals, revealing that mastery climate, but not performance-avoidance climate positively predicted task orientation. Also, Jaakkola and colleagues (2017) tested the interrelations between motivational climate and intrinsic motivation and found that task-oriented, but not performance-oriented climate, predicted students' intrinsic motivation toward PE lessons. Previous research has also related achievement goals and intrinsic motivation, suggesting that, relative to ego orientation, task orientation usually predicted higher levels of intrinsic motivation (Halvari et al., 2011). Limited research exists to support the mediating role of achievement goals between motivational climate and intrinsic motivation. Cury and cols. (1996) found that mastery climate had both a direct and indirect effect on intrinsic motivation through mastery goals. Similarly, Ferrer-Caja and Weiss (2000), observed that both task and ego orientation mediated the relationship between mastery climate and intrinsic motivation. However, Sproule et al. (2007) reported different findings, with performance climate positively predicting intrinsic motivation through ego orientation. Therefore, further research is needed to clarify the interrelations between motivational climate, achievement goals and intrinsic motivations. Considering the individual perspective of the previous studies, we aim to complement the existing evidence by adopting a multilevel perspective.

Researchers have emphasized the importance of adopting a multilevel perspective in the educational context (see Wang & Degol, 2016) to disentangle students' unique perceptions (individual level) and the shared perceptions about the climate generated at the teacher level (e.g., Marsh et al., 2012; Morin et al., 2014). This approach provides a more accurate decomposition of the variance when there are different levels of analysis (Papaioannou et al., 2004). Previous studies have supported the use of a multilevel approach when addressing motivation research within the PE context (Escriva-Boulley et al., 2018; Leo et al., 2022, 2023; Papaioannou et al., 2004; Vasconcellos et al., 2020). However, to our knowledge, only the work of Papaioannou et al. (2004) has previously addressed the interplay between AGT constructs from a multilevel perspective. Although they did not examine the full mediating pattern, Papaioannou et al. (2004) found that task-involving teacher climate positively predicted intrinsic motivations (effort and enjoyment) both at the group (i.e., class-average scores) and the individual (i.e., singular perceptions not shared by the rest of the group) levels; and that ego orientation predicted intrinsic motivation neither at the student nor the class level. Following advances in multilevel modelling (Marsh et al., 2012; Morin et al., 2014), and considering the need to further explore the mediational role of achievement goals in AGT, our study aims to use a doubly-latent structural equation model to examine the mediating role of students' achievement goals in the relationship between perceived motivational climate and intrinsic motivation.

Materials and methods

Pilot phase

This study is part of the project "Identifying and Motivating youth who mostly need Physical Activity" (IMPACT), which was developed in seven European countries. Before launching the main study, questionnaires were translated into different languages using the back-translation process. A pilot study was developed to test the validity of the translated versions and the adequacy of the whole data collection procedure. This phase indicated that students took longer to respond than anticipated, so the project consortium decided to shorten the survey length to ensure the quality of the response process. The results from the pilot test revealed that, when accounted for the variance explained by the ego and performance avoidance dimensions on intrinsic motivation, the performance-approach subscale did not add explanatory power in the prediction of intrinsic motivation. Therefore, the project consortium concluded that motivational climate was sufficiently covered by the mastery approach and performance-avoidance subscales and decided to exclude the performance-approach subscale from the main study.

Participants

The initial sample of this study was composed of 13359 students and their corresponding 361 PE teachers. Following previous recommendations on multilevel research designs (Meuleman & Billiet, 2009), only cases with at least 20 students per teacher (irrespective of whether they were from the same class or not) were included. The final sample resulted in 9855 secondary students with ages ranging between 10 and 18 years (M_{age} = 13.96; SD_{age} = 1.97) coming from seven countries (Turkey = 28.2%, Greece = 23.3%, Italy = 21.5%, Spain = 9.0%, Portugal = 7.8%, France = 5.2%, and the United Kingdom = 5.0%). Students were clustered according to their PE teachers, with 237 different teachers (M_{age} = 42.00 years; SD_{age} = 19.92 years).

Measures

Students' perceptions of their teacher's motivational climate. We used the mastery (e.g., "My teacher is very happy when I learn new skills and games") and performance-avoidance (e.g., My teacher often makes me worry about how others view my athletic abilities") subscales of the Perceptions of Teacher's Emphasis on Goals Questionnaire (PTEGQ; Papaioannou et al., 2007). This measure consisted of 12 items capturing the perceived motivational climate created in PE lessons using the stem "My Physical Education teacher…". Participants answered a 5-point Likert scale to indicate the degree of agreement (1 = *strongly disagree* to 5 = *strongly agree*) with each of the statements. Internal consistency indices suggested good psychometric properties for both subscales (mastery: α = .85; performance-avoidance: α = .79). Multilevel confirmatory factor analysis showed an acceptable model fit (CFI = .949, TLI = .935, and RMSEA = .058).

Students' achievement goal orientations. We used the Task and Ego Orientation in Physical Education Questionnaire (TEOPEQ; Walling & Duda, 1995). This is a 13-item questionnaire that measures students' achievement orientations toward PE lessons. Following the stem "I feel the most successful in PE when", this questionnaire measures orientation toward the task (e.g., "I learn a new skill by trying hard") and toward ego (e.g., "I am the only one who can do the skill"). Participants were asked to answer a 5-point Likert scale to indicate their degree of agreement (1 = *strongly disagree* to 5 = *strongly agree*) with each statement. Internal consistency indices suggested good psychometric properties for both subscales (task orientation: α = .89; ego orientation: α = .89). Multilevel confirmatory factor analysis showed an acceptable model fit (CFI = .969, TLI = .961, and RMSEA = .063).

Intrinsic motivation. We used the intrinsic motivation subscale of the Behavioural Regulation in Exercise Questionnaire (BREQ; Lonsdale et al., 2008). Following the stem, "I actively participate in PE lessons because…", participants completed four items that addressed intrinsic reasons to get involved in PE lessons (e.g., "because I enjoy it"). Participants answered on a 5-point Likert scale to indicate their degree of agreement (1 = *strongly disagree* to 5 = *strongly agree*) with each statement. Internal consistency indices suggested good psychometric properties of this subscale (intrinsic motivation α = .88). Multilevel confirmatory factor analysis showed values close to an acceptable model fit (CFI = .996, TLI = .998, and RMSEA = .096).

Procedure

Following approval from the ethics committee, researchers contacted their educational partners and national secondary schools in their country and invited them to participate in the data collection. The data collection was developed using Limesurvey®, an online and secured survey platform. This platform was used to collect and store all the information of the data collection. Participants completed an online survey using computers or tablets under teacher supervision. Participants received concrete instructions and were informed of the possibility to withdraw from the study at any moment and of the confidentiality of their answers. Written consent from parents or legal response was required for participation in the study. The data collection was developed during the first semester of 2019. On average, participants answered the questionnaire in approximately 30 minutes.

Data analysis

All analyses were conducted using the Mplus (version 8.0) software. The first step of the data analysis consisted of the description of the data and the exploration of the multilevel nature of the measured variables by using the intraclass correlation coefficient (ICC). As suggested by previous research in the educational context (Cheon et al., 2016), we adopted the criteria of ICC values greater than .10 as being indicative of multilevel effects. Second, we conducted a confirmatory factor analysis for the baseline model. At this step, we also tested measurement invariance between countries to ensure the comparability of our data. To determine if the models could be considered invariant, we followed Chen's (2007) cut-off criteria of a change in CFI of less than -.01 or a change in RMSEA of less than .015, when sequentially assessing configural, metric and scalar invariance. Third, we tested a mediated multilevel structural equation model at both the student (Level 1; L1) and teacher levels (Level 2; L2), including age and gender as moderators at L1. Level-1 variables were computed based on individual scores, and level-2 variables were computed aggregating such scores according to cluster belongingness. Following Marsh et al (2012) nomenclature, the tested model included two climate variables (e.g., mastery and performance-avoidance motivational climates) and three contextual variables (task and ego orientations and intrinsic motivation). Relying upon a component approach (i.e., testing the respective significance of the different paths of indirect effect), mediation analyses were computed by testing two nested models: one model for partial mediation and another model for total mediation. The accepted model was selected following parsimony and model fit criteria (Mackinnon, 2008). Values of CFI > .90, TLI > .90 and RMSEA < .08 were considered indicators of an acceptable model, while values of CFI > .95 and CFI > .95 and RMSEA < .05 were considered indicators of excellent fit (Hu & Bentler, 1999).

Results

Descriptive results

Information about means, standard deviations, ICC and correlations both at the individual and teacher levels can be found in Table 1. Most ICC were equal to or above .10, suggesting the presence of multilevel effects. The visual inspection of the correlations showed some differences between L1 (student level) and L2 (teacher level). Mastery and performance-avoidance climates were not significantly correlated at the student level (r = .005; p = .809), while a low-to-medium correlation was observed at the teacher level (r = -.276; p = .004). Similarly, mastery climate showed not being significantly related to ego orientation at the student level (r = .065; p < .001), while a moderate negative correlation was observed at the teacher level (r = -.403; p = .001). Also, task orientation was positively correlated with ego orientation at the student level (r = .266; p < .001), but this correlation was not significant at the teacher level (r = -.097; p = .655). The magnitude of the correlation between performance-avoidance climate and ego orientation was weak at the student level (r = .175; p < .001), but strong at the teacher level (r = .806; p < .001). Finally, the correlation between ego orientation and intrinsic motivation showed similar magnitude, but the opposite sign (student level: $r = .195$; $p < .001$; and teacher level: $r = -.107$; $p = .506$).

<<<< INSERT TABLE 1 HERE >>>>

Measurement Model and Invariance Analysis

The baseline measurement model obtained acceptable fit indices, with $\chi 2$ (367) = 15712.028, CFI = .946, TLI = 940, and RMSEA = .065. Further exploration using modification indices and correlation network analysis identified two problematic items that prevented the model to have an excellent fit (performance avoidance climate: "My PE teacher makes me avoid questions in the lesson that could make others laugh at me", and ego orientation: "I feel most successful in Physical Education when I score the most points/goals etc."). These two indicators showed high correlations with similar items and negatively contributed to model fit. We opted to remove these two items from further analysis to ensure proper model specification in the following steps of the data analysis. The modified measurement model increased model fit, achieving excellent cut-off criteria ($\chi 2$ (314) = 8799.210, CFI = .968, TLI = .965 and RMSEA = .052).

After having accepted the baseline measurement model, we tested cross-country invariance analysis to ensure comparability among measures from different countries. The nested models showed similar fit indices between them (see Table 2) and, when sequentially constraining factor loadings and intercepts across countries, the cut-off criteria for invariance were met, suggesting that the measurement model was invariant at configural, metric, and scalar levels (i.e., ΔCFI < .01 and ΔRMESEA < .015). Therefore, the scalar invariance model was accepted. Next, we tested the multilevel measurement model by specifying the baseline model at both the student- and teacher levels. This model also showed excellent model fit with $\chi 2$ (628) = 5113.130, CFI = .955, TLI = .950, and RMSEA = .027.

Having accepted the multilevel measurement model, the last step consisted of testing a multilevel structural equation model. To do so, we tested two different nested models testing the partial and total mediating role of achievement goals between motivational climate and intrinsic motivation. The results showed similar fit indices for both models (see Table 2), with the partial mediation model showing slightly better fit indices and revealing direct significant associations between motivational climate and intrinsic motivation. As such, we decided to accept the partial mediation model as the reference model for this study. Fit indices of the accepted structural equation model showed excellent values, with $\chi2$ (675) = 5974.701, CFI = .947, TLI = .940, and RMSEA = .028.

<<<< INSERT TABLE 2 HERE>>>>

Multilevel Structural Equation Modeling

The results of the accepted model are summarized in Figure 1 and Table 3. Moreover, Table 4 includes the direct and indirect effects at the student and teacher levels. At the student level, residual individual perceptions of the teacher's motivational climate were associated with students' achievement goals. Mastery climate positively predicted task orientation (β = .569; p < .001) and had a weak positive prediction on ego orientation (β = .096; p < .001). Similarly, performance-avoidance climate positively predicted ego orientation (β = .163; p < .001) and showed a weak negative but significant prediction on task orientation (β = -.061; p < .001). Regarding the relationships between achievement goals and intrinsic motivation, students' individual orientation towards task showed to strongly predict intrinsic motivation (β = .610; p < .001), while ego orientation had a low positive prediction on intrinsic motivation (β = .028; p = .013). Consistent with the partial mediating pattern, results at the student level also showed a direct prediction of motivational climate with intrinsic motivation. Thus, the residual perceptions of mastery climate showed a positive path with intrinsic motivation (β = .164; p < .001) and perceptions of performance-avoidance climate showed a low negative prediction on intrinsic motivation (β = -.056; p < .001).

<<<< INSERT FIGURE 1 HERE>>>>

<<<< INSERT TABLE 3 HERE>>>>

At the teacher level, the shared perceptions of students about their teacher's generated motivational climate showed to predict group-averaged goal orientations. Therefore, mastery climate showed to positively predict task orientation (β = .220; p < .001) but showed no significant predictions on ego orientation (β = -.029; p = .349). Performance-avoidance climate positively predicted ego orientation (β = .226; p < .001) and revealed a non-significant prediction on task orientation (β = .109; p = .114). In turn, at the teacher level, we observed an increased prediction of task orientation to intrinsic motivation due to having, on average, higher rates of achievement goals (β = .096; p < .001). This relationship turned out to be non-significant for the path from ego orientation to intrinsic motivation (β = -.017; p = .424). Direct paths showed non-significant relationships at the teacher level, with β = -.053; p = .195 for the effects of mastery climate on group-averaged intrinsic motivation, and with β = -.040; p = .344 for the effects of performance-avoidance climate on intrinsic motivation. Overall, the accepted model explained 74% of the variance of intrinsic motivation towards PE.

<<<< INSERT TABLE 4 HERE>>>>

Discussion

This study addressed the lack of evidence testing the mediating role of achievement goals between motivational climate and intrinsic motivation from a multilevel approach. Results from the accepted model confirmed previous predictions on the AGT postulates on the relevance of mastery climate and task orientation in the prediction of intrinsic motivation, and added some new insights on how students perceive their teacher's motivational climate within the PE context. Besides group-shared perceptions of the motivational climate, individual perceptions (not shared by the rest of the group) about the teacher climate showed to be strongly associated with achievement goals. Our findings also highlighted that once accounted for student predictions, group-averaged levels of task orientation positively showed an additional effect on the prediction of intrinsic motivation. This research expands previous knowledge by providing data about level-specific interactions of AGT postulates within the PE context.

Results from our model are in line with past theoretical and empirical claims. First, at the teacher level, we observed that the teacher's mastery climate positively predicted students' group-averaged task orientation and that the performance-avoidance climate positively predicted ego orientation. This is congruent with the findings from Papaioannou et al. (2004), and with the well-established body of evidence that suggests that teachers creating a motivational climate emphasizing learning and individual progress usually favour the adoption of task-focused achievement goals among students. On the contrary, inviting individuals to be focused on performance and social comparison goals usually predict an ego-oriented style (Bardach et al., Cecchini-Estrada & Méndez-Giménez, 2017; Marjanović et al., 2019). Second, at the student level, students' task (but not ego) orientations showed to predict intrinsic motivation. This finding is congruent with previous literature based on AGT postulates that show that task orientation positively (and strongly) predicts intrinsic motivation (Ilker & Demirhan, 2013; Jaakkola et al., 2015, 2017). The model also showed inconsistent predictions between ego orientation and intrinsic motivation across levels. Previous research testing similar models have also found that the influence of ego orientation on intrinsic motivations is somewhat equivocal, suggesting that the predictive role of ego orientation on intrinsic motivation is weaker and frequently moderated by basic psychological needs (Ferrer-Caja et al., 2000; Sproule et al., 2007).

When comparing climate predictions at both levels, in our study, the strongest (direct and indirect) relationships between motivational climate and intrinsic motivation were found at the student level. This finding suggests that students' singular perceptions (not shared by the rest of the group) of the motivational climate generated by their teacher do have a higher role in predicting students' intrinsic motivation than the shared perceptions of the group. This extends previous results from Papaioannou et al. (2004), who already highlighted that the amount of variance explained by the motivational climate largely depended on the student level. One possible factor explaining this finding is the existence of individual differences in students' perceptions of teacher motivational climate (e.g., Li et al., 2022; Rodrigues et al., 2020). Moreover, research from the field of sports sciences similarly suggests that the coach-athlete relationship has a role in how athletes build perceptions of the climate generated by the coach (Olympiou et al., 2008; Rottensteiner et al., 2015). Accordingly, student-teacher relationships could also modulate the observed differences in students' perceptions.

At the group level, we found that once accounted for the individual effects, the fact of belonging to a group with the same teacher had an additive effect on the prediction from mastery task orientation to intrinsic motivation. Therefore, a student belonging to a group with high average task orientation ratings would be more likely to exhibit higher task orientation than one belonging to a group with lower ratings. This result is congruent with the idea of peers playing a role as social agents that influence one another's motivation (i.e., motivational contagion; Radel et al., 2010), and is supported by previous research showing that peer climate influenced students' and athletes' motivation (Hein & Jõesaar, 2015; Warburton, 2017). Interestingly, in this study, the teacher (not the class) was selected/measured as the clustering unit, so bigger effects are expected to be found in studies addressing motivational contagion within the same class. In this study, perceptions of a single teacher's motivational climate could arise from students belonging to different classes. Therefore, it is expected that group-averaged motivational scores will be even higher when using class (and not teacher) as a clustering unit. Adopting this approach would also enable measuring and controlling the motivational climate among peers.

Last, this study presents a cross-cultural design involving seven European countries. When comparing present results with other countries not included in this study such as Serbia (Marjanović et al., 2019), and Finland (Jaakkola et al., 2017), we observe similarities that drive us to think about the potential generalisability of the current findings to the European population of PE students. In any case, we encourage future researchers to test multilevel AGT effects in the PE context in further European countries to empirically test this assumption.

Limitations, and future research directions

This study has some limitations that need to be highlighted, and that open new research lines. First, the cross-sectional nature of this study should be taken into account. Therefore, no causal relationships could be inferred from our findings. Further research should address the relationships between teacher motivational climate, achievement goals and intrinsic motivation using longitudinal and experimental approaches. Second, in this study, we solely focused on collecting responses from students. Neither the teachers' motivations, nor the perception of the climate they create, nor other relevant information about their professional trajectory (e.g., years of teaching experience, university curriculum) were measured. We encourage future studies to better identify the precursors of teachers' pedagogical style in order to provide a more holistic understanding of the relationships between the motivational climate and students' intrinsic motivation. Third, the performance-approach climate subscale and two items from the measurement model were removed at different stages of the process, which hinders comparability with the limited existing literature examining the AGT postulates within the PE context from a multilevel perspective. Given this issue, future research should dedicate more efforts to testing complete measurement models when investigating relationships between similar concepts. This article also emphasizes future directions related to possible explanations of our findings. As discussed, teacher-student relationships and motivational contagion were raised as potential explanatory variables. Consequently, future studies should aim to clarify how these variables influence the perception of the motivational climate, achievement goals, and motivation within the context of PE.

Implications for practice

The findings from this study suggest that, beyond the shared perception of teachers' motivational climate, students' unique perceptions of the climate generated by their PE teacher are related to achievement goals and subsequently influence their intrinsic motivation. Accordingly, besides efforts oriented at emphasizing a proper group-based motivational climate, teachers may benefit from adopting a person-centred approach in terms of motivational climates. Therefore, teachers should pay attention to how each student perceives the motivational climate that is implemented.

Conclusion

This study was based on the AGT and aimed at testing a multilevel structural equation model testing the relationships between perceived PE teacher's motivational climate, achievement goals orientations and intrinsic motivation in a large cross-sectional sample from seven European countries. Our findings bring strong empirical support to previous theoretical predictions about the importance of emphasizing mastery climate and favouring the adoption of task-oriented goals to promote intrinsic forms of motivation. Our study also suggests that students' perceptions of their teacher's motivational climate are not only formed from common perceptions from students of the same teacher but also from individual perceptions that are not shared by the rest of the group. These perceptions showed an important association with task achievement goals and intrinsic motivation and are probably shaped by other teacher-related variables, such as teacher-student interactions. Having a deeper knowledge of how motivational climates acquire a shared and unique perception could be useful for teachers to promote higher intrinsic levels of motivation in their lessons and among each of their students.

Funding details. This work was supported by the European Education and Culture Executive Agency under Grant 579784-EPP-1-2016-2-EL-SPO-SCP.

Disclosure statement. The authors declare there are no financial or non-financial competing interests to report.

Data availability statement. The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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Tables and figures

Table 1. Descriptive statistics, internal consistency and disattenuated correlations between variables.

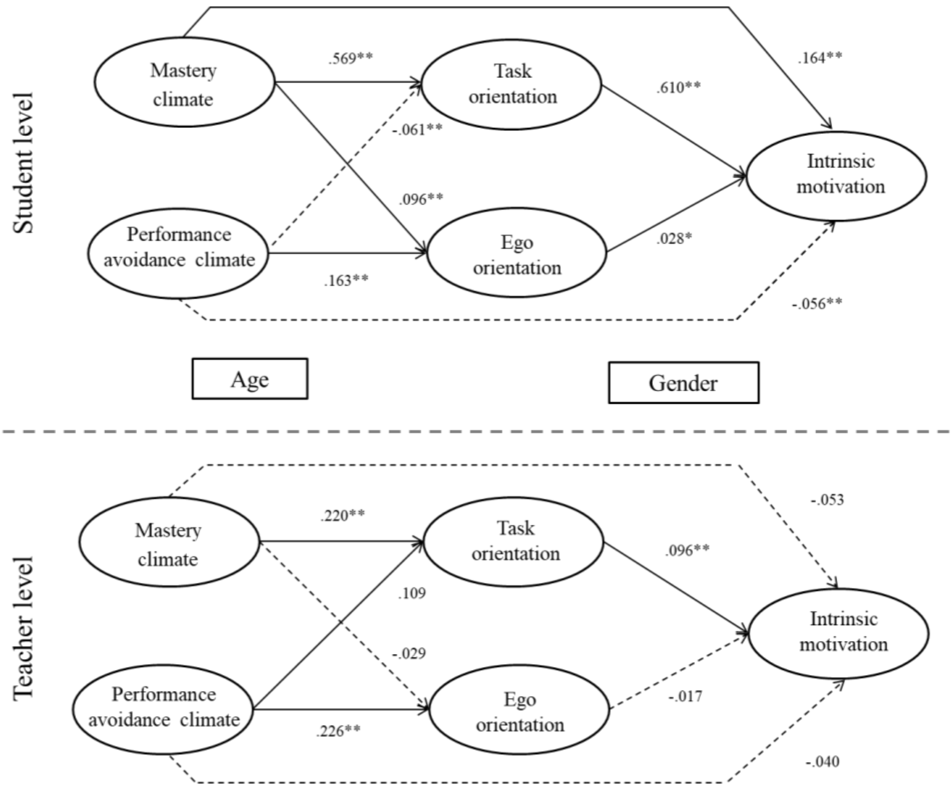
		Mean	*SD*	ICC	α	1	2	3	4	5
1.	Mastery climate	3.84	0.76	.11	.85	-	.005	.568**	.065**	.513**
2.	Performance-avoidance climate	2.35	0.85	.10	.79	-.276*	-	-.064**	.175**	-.084**
3.	Task orientation	3.93	0.75	.10	.89	.719**	-.033	-	.266**	.720**
4.	Ego orientation	2.89	1.02	.07	.89	-.403*	.806**	-.097	-	.195**
5.	Intrinsic motivation	3.94	0.91	.12	.88	.576**	-.074	.887**	-.107	-

Note. Student-level correlations are shown above the diagonal (n = 9855), and teacher-level correlations (n = 237) are shown below the diagonal. **p* < .05. ***p* < .001.

Table 2. Fit indices for the different models tested in this study

	χ^2	*df*	CFI	TLI	RMSEA
Cross-country invariance models					
Configural	6086.135	2198	.968	.964	.036
Metric	6220.774	2330	.968	.966	.035
Scalar	7328.738	2786	.963	.967	.034
Measurement models					
Baseline CFA	15712.028	367	.946	.940	.065
Baseline CFA-2items left	8799.210	314	.968	.965	.052
Multilevel CFA-2items left	5113.130	628	.955	.950	.027
Multilevel SEM models					
Total mediation	6161.063	679	.945	.939	.029
Partial mediation	5974.701	675	.947	.940	.028

Figure 1. Multilevel structural equation model at the student (L1) and teacher (L2) levels.



Note. Age and gender are included as moderators at the student level. Continuous lines indicate positive paths and dashed lines indicate negative paths. All variables were latent and no correlations among residuals were permitted. *p < .05. **p < .001.

Table 3. Estimation parameters of the accepted model at student and teacher levels

	R^2(*SE*)	Unstandardised parameter estimate (*SE*)	Standardised parameter estimate (*SE*)	*p* values
Student level				
Mastery climate → Task orientation		.633 (.028)	.569 (.016)	< .001
Perf. avoidance climate → Task orientation		-.068 (.015)	-.061 (.013)	< .001
Mastery climate → Ego orientation		.095 (.018)	.096 (.018)	< .001
Perf. avoidance climate → Ego orientation		.162 (.016)	.163 (.016)	< .001
Mastery climate → Intrinsic motivation		.195 (.020)	.164 (.017)	< .001
Perf. avoidance climate → Intrinsic motivation		-.067 (.012)	-.056 (.010)	< .001
Task orientation → Intrinsic motivation		.650 (.022)	.610 (.017)	< .001
Ego orientation → Intrinsic motivation		.034 (.013)	.028 (.011)	.013
Age → Mastery climate		-.040 (.023)	-.126 (.070)	.074
Age → Perf. avoidance climate		-.009 (.007)	-.029 (.021)	.167
Age → Task orientation		-.026 (.013)	-.074 (.036)	.043
Age → Ego orientation		.018 (.007)	.055 (.021)	.008
Age → Intrinsic motivation		-.018 (.008)	-.047 (.020)	.018
Gender → Mastery climate		.017 (.019)	.013 (.015)	.365
Gender → Perf. avoidance climate		-.056 (.017)	-.045 (.013)	.001
Gender → Task orientation		-.058 (.058)	-.041 (.011)	< .001
Gender → Ego orientation		-.196 (.016)	-.157 (.013)	< .001
Gender → Intrinsic motivation		-.197 (.017)	-.132 (.011)	< .001
Task orientation	**.344 (.025)**			**< .001**
Ego orientation	**.064 (.008)**			**< .001**
Intrinsic motivation	**.558 (.020)**			**< .001**
Teacher level (climate effects)				
Mastery climate → Task orientation		.521 (.134)	.220 (.054)	< .001
Perf. avoidance climate → Task orientation		.404 (.276)	.109 (.069)	.114
Mastery climate → Ego orientation		-.083 (.091)	-.029 (.031)	.349
Perf. avoidance climate → Ego orientation		1.028 (.197)	.226 (.028)	< .001
Mastery climate → Intrinsic motivation		-.151 (.120)	-.053 (.041)	.195
Perf. avoidance climate → Intrinsic motivation		-.179 (.192)	-.040 (.042)	.344
Task orientation	**.536 (.098)**			**< .001**
Ego orientation	**.700 (.058)**			**< .001**
Teacher level (contextual effects)				
Task orientation → Intrinsic motivation		.550 (.139)	.096 (.024)	< .001
Ego orientation → Intrinsic motivation		-.108 (.136)	-.017 (.021)	.424
Intrinsic motivation	**.744 (.125)**			**< .001**

Note. **p* < .05. ***p* < .001. Perf = Performance. Gender: 1 = male, 2 = female. Boldface indicates the amount of variance explained (R^2) by each group of variables. R^2 values at the teacher level include effects at both levels.

Table 4. Standardised effects for the accepted model at student and teacher levels

	Total	Total indirect	Specific indirect
Student level			
Mastery climate → intrinsic motivation	.514	.350	
Task orientation			.347
Ego orientation			.003
Perf. avoidance climate → intrinsic motivation	-.089	-.033	
Task orientation			-.037
Ego orientation			.005
Teacher level			
Mastery climate → intrinsic motivation	-.031	.022	
Task orientation			.021
Ego orientation			.001
Perf. avoidance climate → intrinsic motivation	-.033	.007	
Task orientation			.010
Ego orientation			-.004

Note. Perf = Performance.