This is a post-print version of the paper published

Diloy-Peña, S., García-González, L., Burgueño, R., Tilga, H., Koka, A., y Abós, A. (2024) A Cross-Cultural Examination of the Role of (De-)Motivating Teaching Styles in Predicting Students' Basic Psychological Needs in Physical Education: A Circumplex Approach. *Journal of Teaching in Physical Education.* Ahead of print. https://doi.org/10.1123/jtpe.2023-0036

A cross-cultural examination of the role of (de-)motivating teaching styles in predicting students' basic psychological needs in physical education: A circumplex approach

Abstract

Purpose: Guided by self-determination theory, this research examined cross-cultural differences in associations of students' perceptions of teachers' (de-)motivating approaches on Estonian and Spanish students' need satisfaction from a circumplex model. **Method**: The participants were 601 Estonian (56% girls) and 669 Spanish (52% girls) secondary students. **Results:** Multi-group single-indicator structural equation modelling analysis revealed that participative, attuning, guiding, clarifying, and demanding predicted the satisfaction of each basic psychological need (BPN), according to the Estonian and Spanish students' perspective. Domineering approach negatively predicted autonomy satisfaction in the eyes of Estonian students, while abandoning approach predicted the satisfaction of each BPN negatively as perceived by Estonian and Spanish students. **Conclusion:** Results underscore the cross-cultural relevance in explaining the role of teachers' (de-)motivating approaches in the eyes of students, supporting/undermining students' need satisfaction in physical education. Hence, these findings set the scene for development of effective guidance for teaching training adapted to culture, aimed at providing teachers with the strategies they need to apply the most optimal motivating teaching styles in their PE lessons.

Keywords: circumplex model; need–supportive teaching; need–thwarting teaching; basic psychological needs.

Introduction

One of the main curricular goals for physical education (PE) is to develop physically literate students who are able to demonstrate both positive peer interactions, and autonomy and competence in a wide array of motor activities and movement patterns (SHAPE America—Society of Health and Physical Educators, 2014). A substantial basis of research on PE has evidenced that teachers take a central position in the social classroom environment to guide students in their learning process (Vasconcellos et al., 2020). Building upon self–determination theory (SDT; Ryan & Deci, 2017), Aelterman et al. (2019) forwarded a more fine–grained conceptualization of (de-)motivating teaching styles by differentiating among eight approaches that draw a circular structure in terms of teacher directiveness and need–supportiveness. Although the circumplex model represents a meaningful advance in the study of PE teachers' (de-)motivating practices (Escriva-Boulley et al., 2021), very little is, currently, known about the influence of students' perceptions of eight (de-)motivating teaching approaches on their psychological experiences in PE. Furthermore, it is important to deem the premise that PE may vary across countries due to the cultural characteristics and their own variability (Walton-Fisette et al., 2018). Therefore, there is a need to investigate whether the cross-cultural differences influence how students' perceptions of (de)motivating approaches from the teacher might yield specific motivational outcomes. To overcome this existing cross-cultural gap and to extend evidence on the circumplex model in PE, this study aimed to test cross-cultural differences in the associations of Spanish and Estonian students' perceptions of (de-)motivating approaches from PE teachers with their satisfaction of the three basic psychological needs (BPN).

From demotivating to motivating teaching styles: the Circumplex model

(De-)motivating styles are the particular way in which the teacher interacts, relates, and communicates with students during classroom practice. Following the circumplex model

(Aelterman et al., 2019; Escriva-Boulley et al., 2021), the level of directiveness (i.e., the degree in which the teacher takes the lead in student learning) and need-supportiveness (i.e., the degree to which the teacher supports or thwarts BPN) are used to interact with the students. Considering intersections among two dimensions, two motivating and two demotivating styles are differentiated (see Figure 1) (Aelterman et al., 2019).

<PLEASE, INSERT FIGURE 1 ABOUT HERE>

Under the circumplex model, Aelterman et al. (2019) propose that autonomy support and structure are identified as motivating styles inasmuch as both are need-supportive and qualitatively different given that the first is low in teacher directiveness and the second is high on this dimension. Autonomy-supportive style (i.e., the teacher understands students' interests and preferences) can be expressed in participative and attuning approaches. Particularly, a participative teaching approach wants to find out students' personal interests to open a dialogue and invite them to make suggestions and comments. An attuning teaching approach tries to identify different choices for more attractive and enjoyable tasks, allowing students to work at their own pace (Aelterman et al., 2019). Structuring style (i.e., the teacher provides students with suitable assignments to their abilities level to facilitate their perceived competence in classroom) can be expressed through guiding and clarifying approaches. A guiding teaching approach assists students to progress through the provision of help when needed, the decomposition step by step for the task accomplishment, so students can continue learning on their own. A clarifying teaching approach provides an overview of the students' expectations of the lesson, as well as communicates guidelines in a clear and transparent way to guide their learning (Aelterman et al., 2019).

The other half of the circumflex stands two demotivating styles, which are need-thwarting but qualitatively different as control is high in directiveness and chaos is low on this dimension (Aelterman et al., 2019). A controlling style (i.e., the teacher obliges students

to adopt his/her viewpoint to behave in classroom) can be adopted by demanding and domineering approaches. A demanding teaching approach imposes discipline on students by using coercive and commanding language to make it clear what students must do and not tolerating any disagreement. A domineering teaching approach exerts their power on students to make demands, inducing feelings of guilt and shame, if they do not follow his/her commands. It turns into a personal attack on students in some situations (Aelterman et al., 2019). Finally, a chaotic style (i.e., the teacher leaves students alone, making it confusing for them to find out without help what to do and how to behave) can be differentiated into abandoning and awaiting approaches. An abandoning teaching approach takes no responsibility for students, as well as allowing them to learn to take responsibility for their own behavior. An awaiting teaching approach gives all the initiative to students, so the teacher does not make often the lesson plans because he/she prefers to wait to see how things develop (Aelterman et al., 2019).

(De-)motivating styles and need satisfaction in physical education

SDT-based research on PE has well documented that the students' satisfaction of the BPN for autonomy (i.e., sense of initiative and choice for the task development), competence (i.e., sense of effectiveness and mastery in the ongoing task accomplishment), and relatedness (i.e., sense of belonging and connection with classmates in the PE lesson) led to a wide range of adaptive learning outcomes (Vasconcellos et al., 2020). In the PE lesson, teachers, via their (de-)motivating teaching style, have a central position within the social classroom environment which allow them either to support or thwart students' need satisfaction (Vasconcellos et al., 2020).

Previous PE research has shown the tendency that the students' perception of motivating styles (i.e., autonomy-supportive and structuring styles) were positively associated with their need satisfaction and adaptive outcomes (Vasconcellos et al., 2020). More

particularly, perceived autonomy-supportive and structuring teaching styles were positively associated with the students' satisfaction of the three BPN, albeit emphasizing that autonomy-supportive style was more strongly related to autonomy satisfaction just as structuring style was more highly associated with competence satisfaction among students (Curran & Standage, 2017; Vasconcellos et al., 2020). While evidence on motivating styles is consistent in the PE setting, the small basis of research examining perceived demotivating styles (i.e., control and chaos) reported inconsistent results in PE. Concerning control, although much of the previous PE research found negative associations of perceived controlling style from the teacher with autonomy, competence and relatedness satisfaction in the eyes of students (e.g., Burgueño et al., 2022; Leo et al., 2022; Vasconcellos et al., 2020), fewer studies also revealed non-significant relationships between students' perceptions of controlling teaching style and their need satisfaction in PE (Behzadnia et al., 2018; Cronin et al., 2019; Tilga et al., 2020). Regarding chaos, little research to date found negative associations of the students' perception of chaotic teaching style with their satisfaction of the three BPNs, albeit some studies reported a non-significant relationship between both variables (Burgueño & Medina-Casaubón, 2021; Leo et al., 2022). More research is, thus, needed to shed light on how the students' perception of the different (de-) motivating teaching approaches may differentially yield specific motivational processes in PE.

Cross-Cultural Research in Physical Education

Central to SDT is the fact that the three BPNs are essential for all individuals, irrespective of their cultural backgrounds (Ryan & Deci, 2017). Nevertheless, a growing body of research has called into question the cross-cultural SDT validity (Chen et al., 2015; Chirkov et al., 2005) suggesting an uniformity rather than universality of BPNs and a little more diffuse way of understanding autonomy varying between choice and independence in non-Western cultures (Chirkov et al., 2005; Chirkov & Ryan, 2001; Vlachopoulos et al.,

2013). Indeed, autonomy is thought to represent a core ideal to be learnt in Western cultures where individualist values prevailed over collectivist ones (Chirkov, 2011). In contrast, autonomy is believed to have less importance in Eastern cultures and it could therefrom perform a more secondary role in Eastern people who prioritized more collectivist over individualist values (Chirkov, 2011).

Consistent with previous research in PE, there is a myriad of factors that may vary across cultures, such as including workplace, education system, curriculum, or teacher education. These cultural characteristics can somehow determine the specific way in which students perceived their teacher as interacting with them in not only directing the classroom, but also facilitating their psychological experiences in the lesson. Regarding initial PE secondary teacher education, both countries (i.e., Spain and Estonia) follow the European University System, which consists of the fulfilment of 300 ECTS (i.e., European Credit Transfer System; one credit represents a total of 25 hours of study and work for the student). In addition, these countries have a consecutive model with studies of Bachelor's Degree first and a specific Physical Education Teacher Education (PETE) programs (i.e., master's degree). However, they have some differences in analyzing the structure of this PE secondary teacher education. Spain follows a 4-year Bachelor's Degree and 1-year PETE, whereas Estonia follows a 3-year Bachelor's Degree and 2-year PETE. Overall, this structure of PE secondary teacher education might have some influence on student motivation. For this reason, it is essential to combine a well-designed teacher education programs, practical experience, and specialized knowledge, to be more likely to positively impact student motivation in PE. Concerning the amount of the proportions of pedagogy and PE teaching subjects in the Bachelor's Degree. In Estonia, the proportion of pedagogy and PE teaching subjects is 12 ECTS, out of total 180 ECTS (7%). In Spain, on the other hand, the proportion of pedagogy and PE teaching subjects is 48 ECTS, out of total 240 ECTS (20%). Also, there are some

differences in the amount of the proportion of theoretical and practical subjects in the PETE programs. In Estonia, the proportion of theoretical and practical subjects is 120 ECTS, out of which 82 ECTS (68.3%) are theoretical subjects and 38 ECTS (31.7%) are practical subjects. In Spain, however, the percentage of theoretical and practical subjects is 60 ECTS, including 50 ECTS (83%) in theoretical subjects and 10 ECTS (17%) in practical subjects. While the proportions of pedagogy and PE teaching-related subjects are meaningful, they are just one aspect of a teacher's overall preparation. The quality of instruction, the integration of theoretical knowledge into practical teaching experiences, and individual teaching styles also play critical roles in motivating secondary school students.

Concerning professional development programs, while Estonian PE teachers must complete 160 hours of continuous education in five years, Spanish PE teachers are not required to undertake continuous education. With respect to the PE curriculum, although the curricular goals for PE (e.g., PA promotion) are common in both countries (i.e., Spain and Estonia), different perspectives were adopted in content and assessment. Specifically, the Estonian curriculum takes a more sports view for PE in content development with students who are usually engaged in team sports (e.g., basketball, volleyball, and football), winter sports (e.g., cross-country skiing and skating), track and field athletics, while Spanish curriculum adopts a more varied perspective for PE with students who are typically engaged in a wide range of physical activities, including individual activities, inter-individual opposition, cooperative activities, cooperation and opposition, nature activities, and expressive activities (López-Pastor et al., 2016). It is important to consider that the curriculum is meaningful factor of the overall PE experience. Creating a supportive and inclusive learning environment that recognizes and values student interests and provides opportunities for success is crucial for enhancing motivation in PE.

The present research

Recently, research under the circumplex model has shown that different (de-) motivating approaches contributed to differentially predicting autonomy, competence and relatedness satisfaction in different domains (Delrue et al., 2019; Escriva-Boulley et al., 2021). To the best of our knowledge, no previous studies so far were found to examine the predictive associations of the students' perception of the eight (de-)motivating teaching approaches proposed in the circumplex model with their autonomy, competence, and relatedness satisfaction in PE. Furthermore, little is, currently, known about the potential role that a chaotic style (i.e., abandoning and awaiting approaches) from the teacher may play in fostering or hampering students' motivational outcomes in the PE lesson. Besides, it is worth underscoring the great absence of cross-cultural research in PE analyzing the role that the students' perceptions of (de-)motivating behaviors from the teacher might have in their motivational outcomes. Indeed, there are no evidence to date examining the predictive associations of students' perceptions of (de-)motivating approaches from the teacher on their need satisfaction, considering the potential cross-cultural differences between students from Estonia (a more collectivist culture) and Spain (a more individualist culture). As societies are becoming increasingly multicultural, the research could be helpful for PE teachers to raise awareness of which (de-)motivating approaches may be the most and least effective in developing their students' experiences of autonomy, competence and relatedness in the PE lesson.

Building upon the circumplex model from SDT, the objective of this study was to examine to what extent are there cross-cultural differences based on students' perceptions of (de-)motivating teaching style from PE teachers. Specifically, the potential cross-cultural differences in the predictive associations of (de-)motivating approaches from the teacher with autonomy, competence, and relatedness satisfaction in the eyes of Estonian and Spanish

205 secondary school students who participated in PE lessons. According to previous literature, a
206 theoretical model was hypothesized to analyse all these relationships (see Figure 1).
207 <PLEASE, INSERT FIGURE 2 ABOUT HERE>
208 Consistent with previous SDT-based research in PE (Burgueño et al., 2022; Curran &
209 Standage, 2017; Vasconcellos et al., 2020) and cross-cultural studies (Chirkov, 2011;
210 Vlachopoulos et al., 2013), we hypothesized that Spanish students (as members of a more
211 individualist culture) would obtained higher scores in the two perceived autonomy-supportive
212 and structuring approaches, as well as lower scores in the two perceived controlling and
213 chaotic approaches. We also expected that students' perceptions of motivating teaching
214 approaches would positively predict autonomy, competence and relatedness satisfaction and
215 that demotivating teaching approaches would negatively predict autonomy, competence and
216 relatedness satisfaction.
217 **Methods**
218 **Participants and Setting**
219 A convenience sample of 1278 secondary school students from two secondary schools
220 in Estonia (Region of Tartu) and four secondary schools in Spain (Region of Aragon) were
221 invited to voluntarily participate in this cross-sectional study. After removing invalid data
222 (valid response rate: 99%), the final sample consisted of 1270 secondary school students
223 (M_{age}=14.62, *SD*=1.68; 54% girls) from Estonia (n=601, M_{age}=14.59, *SD*=1.90; 56% girls)
224 and Spain (n=669, M_{age}=14.65, *SD*=1.47; 52% girls) who completed different validated
225 questionnaires regarding PE during the period between May 2021 and February 2022. Before
226 to fill the questionnaire, the researchers obtained parent-signed written informed consent of
227 every student and the students themselves. A paper-and-pencil survey was administered by
228 the researchers from each country during 25 minutes in a quiet classroom environment
229 without the presence of the PE teacher. In Spain, students received two 50-minutes PE lessons

per week, whereas Estonian students received two 45-minutes PE lessons per week. Generally, the PE teacher's annual program consists of different teaching units per year. These teaching units correspond to different types of motor content (e.g., individual sports, cooperative games, first aid, etc.) following the national curriculum of each country. Ethical approval for this study was obtained from the Ethics Committee for Clinical Research of Aragon (PI22/363).

Variables and Instruments

Motivating and demotivating teaching approaches

Spanish students' perceptions of (de-)motivating approaches from PE teachers was assessed using the Spanish version (Burgueño et al., 2024) of the Situations-in-School Questionnaire (SIS-PE; Escriva-Boulley et al., 2021), while Estonian students' perceptions of (de-)motivating approaches from PE teachers was assessed using an Estonian version (Tilga et al., 2023) of the Situations in School Questionnaire modified for the PE context (SIS; Aelterman et al., 2019). These questionnaires present some situations alongside with four different reactions (i.e., items) for each situation that commonly occur in PE lesson. Each presented reaction correspond to one of the four (de-)motivating teaching style (i.e., autonomy support, structure, control, and chaos), each of which, in turn, is divided into two teaching approaches (i.e., in total of eight teaching approaches; for further information, please see Aelterman et al., 2019). Students were asked to indicate the extent to which each response reflects their PE teacher's way of teaching on a 7-point Likert scale ranging from one "does not describe my PE teacher at all" to seven "describes my PE teacher extremely well".

Basic psychological need satisfaction

Students' perceptions of autonomy, competence, and relatedness satisfaction in PE were assessed using the Spanish version of the Basic Psychological Needs in Exercise Scale (Moreno-Murcia et al., 2008) and the Estonian version of the Basic Psychological Need

Satisfaction and Frustration Scale (BPNSFS) adapted to PE (Tilga et al., 2020), for Spanish and Estonian students, respectively. Following the stem: "In/during my PE lessons ..." both scales includes 12 items (four items per need) assessing autonomy satisfaction (e.g., "I feel that the activities I do in PE fit in with my interests" or "I felt that the exercises reflect what I really want"), competence satisfaction (e.g., "I feel that in PE I perform the activities effectively" or "I felt capable at what I did"), and relatedness satisfaction (e.g., "I feel that in PE lessons I can communicate openly with my classmates" or "I felt that the class members I care about also cared about me"). Items were rated on a 5-point scale ranging from one ("strongly disagree") to five ("strongly agree").

Data Analysis

To estimate the statistical power for the structural equation modelling (SEM) model, the *Free Statistics Calculator* v.4.0 (Soper, 2024) was used. With nine predictors (eight de-motivating approach and a covariate, this is, the school), a probability level of .05 and a sample size of 1278, a statistical power of 1.00 was estimated. Descriptive statistics (means and standard deviations), McDonald's omega (ω) reliability coefficient, and Pearson's correlations were estimated for all study variables in the Spanish and Estonian samples. For the SEM and considering the differentiated number of items comprising the Spanish and Estonian SIS's versions, variables were specified by a computed averaged score and their respective error variance computed using the formula: (1 – reliability) * sample variance (Byrne, 2010). Next, the SEM model was tested for invariance across the Spanish and Estonian samples. Following a methodological proposal by Byrne (2010), we successively tested configural invariance (i.e., no equality constraints), structural weight invariance (i.e., equal structural weights), covariances invariance (i.e., equal structural weights and structural covariances, concurrently), structural residuals invariance (i.e., equal structural weights, structural covariances, and structural residuals, concurrently), and measurement residual

invariance (i.e., equal structural weights, structural covariances, structural residuals and measurement residuals, concurrently). The difference between two progressively constrained models was assessed by the difference of CFA and RMSEA value. A score equal to or less than .010 in CFI in conjunction with a value equal to lower than .015 in RMSEA indicate no practical differences among models and, hence, tenability of equality constraints (Byrne, 2010; Kline, 2016). Once invariance was explored, a SEM was performed to examine cross-cultural differences in relationships between students' perceptions of the eight (de-)motivating approaches from the PE teacher and students' autonomy, competence, and relatedness satisfaction. For this purpose, multi-group model for Spanish and Estonian samples were specified within the overall model. Following the Kline's (2016) methodological approach, the first step consisted of identifying non-significant structural paths in both samples, which were proposed for elimination. The second step tested cross-cultural differences in the relationships of the trimmed model, where all structural paths were freely estimated (i.e., unconstrained model) and compared to the model in which all structural paths were constrained to be equal across samples. To verify which paths were variant across countries, one at a time path was constrained to be equal across countries. Each partially constrained model was compared with an unconstrained model. Next, the χ^2 difference test was used to evaluate the difference between models. A significant χ^2 difference would indicate that the partially constrained model does not fit equally well for both countries and the magnitude of the path coefficient is significantly different across countries, indicating that country moderates this path in the model. Reversely, a non-significant χ^2 difference test would indicate that the partially constrained model fit equally well for both countries and the path coefficient did not vary significantly in magnitude across countries, indicating thus that the country does not moderate this pathway in the model. Prior this analysis, we tested the

possibility to control either for the hierarchical nature of the data at the school level or for introducing school as a covariate in the model.

The model's fit was assessed by taking acceptable cut-off scores above .90 in Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI), and up to .08 in Root Mean Square Error of Approximation (RMSEA) (Kline, 2016). As the multivariant normality assumption was violated (a Mardia's coefficient=22.65 p<.01), the maximum-likelihood method and the 5000-re-sampling bootstrapping technique were conjointly used. Analyses were conducted using the statistical programs SPSS (version 29, Chicago, IL) and AMOS (version 29, IBM SPSS, Chicago, IL).

Results

Preliminary Results

The confirmatory factor analysis (CFA) showed a good fit to the data for Spanish (χ^2(df=1074) = 3945.46, p< .001; CFI = .906; TLI = .901; RMSEA = .064), and Estonian samples (χ^2(df=1074) = 6703.34, p< .001; CFI = .929; TLI = .926; RMSEA = .070) concerning (de-)motivating teaching approaches. Regarding BPN satisfaction, CFA showed a good fit to the data for Spanish (χ^2(df=51) = 323.44, p< .001; CFI = .944; TLI = .932; RMSEA = .077) and Estonian samples (χ^2(df=51) = 179,97, p< .001; CFI = .979; TLI = .973; RMSEA = .065). In addition, the reliability values obtained were appropriate for (de-)motivating teaching approaches ($\omega_{Spanish}$ = .71 to .86) and ($\omega_{Estonian}$ = .89 to .92) and the satisfaction of each BPN ($\omega_{Spanish}$ = .72 to .83) and ($\omega_{Estonian}$ = .88 to .93).

Table 1 presents correlations from .25 (i.e., guiding and abandoning approaches) to .86 (i.e., clarifying and attuning approaches) in Estonian and Spanish student samples. Perceived participative, attuning, guiding, and clarifying approaches were positively correlated with autonomy, competence and relatedness satisfaction in Spanish and Estonian students. In Spanish students, a positive correlation was also found between perceived

329 demanding approach and the satisfaction of each BPNs. In Estonian students, perceived
330 demanding approach only was positively correlated with competence satisfaction, whereas
331 perceived domineering approach was positively correlated with autonomy satisfaction.
332 Finally, there were negative correlations of perceived abandoning approach with the
333 satisfaction of each BPN in Estonian and Spanish students.

334 <PLEASE, INSER TABLE 1 ABOUT HERE>

335 **Cross-cultural differences in the associations of (de-)motivating approaches on students'**
336 **need satisfaction**

337 ***Initial insights: fit indexes, hierarchical nature, and covariate impact in cross-cultural***
338 ***results***

339 Table 2 reports differences in fit indexes for the different progressively constrained
340 models tested. While configural invariance, covariance invariance, structural residuals, and
341 measurement invariance were, respectively, supported for values below .010 in CFA and .015
342 in RMSEA, structural invariance was not met by obtaining differences of .019 in CFI and of
343 .039 in RMSEA. These results implied that the paths from perceived PE teachers' (de-
344)motivating approaches to autonomy, competence and relatedness satisfaction were different
345 between Spanish and Estonian student samples.

346 <PLEASE, INSER TABLE 2 ABOUT HERE>

347 Prior to SEM, the examination of the hierarchical nature of data at the school level
348 showed that there was not the need to control for the data in its multilevel nature because the
349 results from school-level variance (autonomy satisfaction: ICC_{Spain}=.17; p>.05 and
350 $ICC_{Estonia}$=.22; p>.05; competence satisfaction: ICC_{Spain}=.37; p>.05 and $ICC_{Estonia}$=.33; p>.05;
351 and relatedness satisfaction: ICC_{Spain}=.28; p>.05 and $ICC_{Estonia}$=.30; p>.05) were not
352 statistically significant for the target variables. Alternatively, school was introduced as a

covariate in the multi-group SEM given that a significant multivariate effect (Wilks' λ=0.36, $F(17, 96)=77.75$, $p<.001$, $\eta^2_p=.14$) was found for the totality of variables across school.

Key findings: cross-cultural variances in (de-)motivating approaches and students' need satisfaction

Results from the multi-group SEM indicated that paths from each perceived (de-) motivating teaching approaches to autonomy, competence and relatedness satisfaction were, overall, statistically significant among Estonian and Spanish students. Standardized path coefficients for both countries are presented in Figure 3. Then, equality constraints were specified to all structural paths to test cross-cultural differences in relationships between each perceived (de-)motivating approach and the satisfaction of each BPN. In consequence, a significant change in the χ^2 test was observed (see Table 2) suggesting that at least one or more structural paths differed across countries.

<PLEASE, INSER TABLE 3 ABOUT HERE>

Table 3 show that a total of 19 additional models were run to examine which structural paths were variant across countries by constraining paths one at a time to be equal across the Estonian and Spanish samples, suggesting that these paths were moderated by the country. Figure 3 shows that Estonian and Spanish students' perceptions of the participative approach positively predicted autonomy ($\beta_{Estonian}$=.82; B=.75, CI_{95}=.67, .82 vs $\beta_{Spanish}$=.70; B=.41, CI_{95}=.35, .46), competence ($\beta_{Estonian}$=.64; B=.64, CI_{95}=.55, .72 vs $\beta_{Spanish}$=.33; B=.22, CI_{95}=.15, .28), and relatedness satisfaction ($\beta_{Estonian}$=.61; B=.63, CI_{95}=.54, .72 vs $\beta_{Spanish}$=.27; B=.18, CI_{95}=.11, .24), being all this paths moderated by country. Results also display that the attuning approach positively predicted the satisfaction of autonomy ($\beta_{Estonian}$=.79; B=.65, CI_{95}=.60, .71 vs $\beta_{Spanish}$=.74; B=.48, CI_{95}=.43, .54), competence ($\beta_{Estonian}$=.62; B=.56, CI_{95}=.50, .63 vs $\beta_{Spanish}$=.40; B=.30, CI_{95}=.23, .36), and relatedness ($\beta_{Estonian}$=.59; B=.56, CI_{95}=.49, .63 vs $\beta_{Spanish}$=.36; B=.26, CI_{95}=.19, .32) as perceived by both Estonian and Spanish

students, being all this paths moderated by country. Regarding the two structuring approaches, the guiding approach positively predicted autonomy ($\beta_{Estonian}$=.77; B=.65, CI_{95}=.60, .71 vs $\beta_{Spanish}$=.67; B=.47, CI_{95}=.40, .53), competence ($\beta_{Estonian}$=.62; B=.58, CI_{95}=.51, .65 vs $\beta_{Spanish}$=.37; B=.29, CI_{95}=.22, .37), and relatedness ($\beta_{Estonian}$=.56; B=.55, CI_{95}=.48, .63 vs $\beta_{Spanish}$=.36; B=.27, CI_{95}=.20, .35) satisfaction both as perceived by Estonian and Spanish students. The clarifying approach predicted the satisfaction of autonomy ($\beta_{Estonian}$=.52; B=.53, CI_{95}=.44, .62 vs $\beta_{Spanish}$=.56; B=.46, CI_{95}=.37, .55), competence ($\beta_{Estonian}$=.42; B=.48, CI_{95}=.38, .57 vs $\beta_{Spanish}$=.25; B=.24, CI_{95}=.15, .34), and relatedness ($\beta_{Estonian}$=.39; B=.46, CI_{95}=.36, .56 vs $\beta_{Spanish}$=.33; B=.31, CI_{95}=.22, .40) as perceived by Estonian and Spanish students, being this paths moderated by country except autonomy satisfaction. Concerning the two controlling approaches, demanding approach positively and significantly predicted competence ($\beta_{Estonian}$=.14; B=.15, CI_{95}=.09, .21 vs $\beta_{Spanish}$=.23; B=.26, CI_{95}=.15, .36) and relatedness ($\beta_{Estonian}$=.13; B=.14, CI_{95}=.07, .20 vs $\beta_{Spanish}$=.18; B=.20, CI_{95}=.09, .30) satisfaction for both Estonian and Spanish, autonomy satisfaction was positively and significantly predicted only in the eyes of Spanish students ($\beta_{Estonian}$=.06; B=.05, CI_{95}=-.01, .12 vs $\beta_{Spanish}$=.49; B=.47, CI_{95}=.37, .58), being only the autonomy satisfaction path moderated by country. The domineering approach only negatively and significantly predicted autonomy satisfaction in Estonian students' perception autonomy ($\beta_{Estonian}$=-.11; B=-.09, CI_{95}=-.13, -.04 vs $\beta_{Spanish}$=.09; B=.07, CI_{95}=-.00, .15). About the two chaotic approaches, the abandoning approach negatively predicted autonomy ($\beta_{Estonian}$=-.27; B=-.21, CI_{95}=-.26, -.16 vs $\beta_{Spanish}$=-.14; B=-.09, CI_{95}=-.14, -.04), competence ($\beta_{Estonian}$=-.16; B=-.14, CI_{95}=-.19, -.09 vs $\beta_{Spanish}$=-.18; B=-.14, CI_{95}=-.19, -.08), and relatedness ($\beta_{Estonian}$=-.11; B=-.10, CI_{95}=-.15, -.05 vs $\beta_{Spanish}$=-.20; B=-.14, CI_{95}=-.19, -.09) satisfaction both in the eyes of Estonian and Spanish students, being only the autonomy satisfaction path moderated by country. The awaiting approach did not predict the satisfaction of any BPN in students from both cultures.

<PLEASE, INSERT FIGURE 3 ABOUT HERE>

Discussion

Grounded on the circumplex model from SDT, the main objective of this study was to examine the potential cross-cultural differences in the predictive associations of the Estonian and Spanish students' perception of (de-)motivating approaches from the teacher with their autonomy, competence, and relatedness satisfaction in PE. The main results revealed that: a) participative, attuning, guiding, clarifying, and demanding approaches predicted the satisfaction of each BPN in general in the eyes of Estonian and Spanish students; b) Estonian students' perceptions of domineering approach negatively predicted their autonomy satisfaction; and c) abandoning approach negatively predicted the satisfaction of each BPN as perceived by Estonian and Spanish students.

The results from the two autonomy-supportive approaches showed that perceived participative and attuning approaches predicted positively and significantly autonomy, competence, and relatedness satisfaction in both Spanish and Estonian students. Aligned with SDT-based research in PE (Vasconcellos et al., 2020), these results suggest that providing students with opportunities for choice or asks them for their opinions (i.e., participative approach) and students can choose both the most-liked variant and the most-loved classmates to do it (i.e., attuning approach) may facilitate autonomy satisfaction in particular, but also competence and relatedness satisfaction.

In line with our research hypotheses, both participative and attuning approaches positively predicted autonomy, competence, and relatedness satisfaction. Contrasted with our expectations, the predictive effect was significantly higher in Estonian than Spanish students' perceptions. A possible explanation would rest on the differences in the education context, where students from individualistic or collectivist countries could experience autonomy support differently (Awang-Hashim et al., 2017). These results obtained in the two autonomy-

supportive approaches contrasted both with Chirkov and Ryan's (2001) study reporting students from collectivist cultures perceived lower values of PE teachers' autonomy support, and the Vasconcellos et al. (2020) systematic review showing the absence of cross-cultural differences in perceived autonomy support. These findings may be due to the changing nature of young people's cultural orientations in Eastern European countries. Previous research has suggested that socio-political evolution and modernization in these countries may change the balance between individualistic and cultural values (Allik & Realo, 2004). In particular, Realo (2003) stated that Estonian people tended to self-stereotype themselves as individualists whereas the scientific literature tends to conceptualize Estonia as a collectivist culture.

The results of the two structuring approaches showed that perceived guiding and clarifying approaches predicted positively autonomy, competence, and relatedness satisfaction in both Estonian and Spanish students. Consistent with SDT assumptions and the circumplex model (Vansteenkiste et al., 2019), these results indicated that perceived guiding approach could predict BPNs satisfaction because it supports the students' progress by providing them with help and assistance when needed. This would imply that when students can decompose the target activity into different steps to complete it, receiving useful feedback to guide them in their improvement of the teaching-learning process (i.e., guiding approach), they are prone to satisfy their autonomy, competence and relatedness. Moreover, perceived clarifying approach characterized by strategies for teachers to communicate their expectations to their students in a clear and transparent way and offering an overview of the learning to be achieved could satisfy the three BPNs in line with the SDT (Ryan & Deci, 2017) in Spanish and Estonian students.

The results from perceived guiding and clarifying approaches are totally consistent with our hypotheses, such that they positively predicted autonomy, competence and relatedness satisfaction. In addition, the predictive effect was overall higher in Estonian than

Spanish students' perceptions, although this difference was not significant between clarifying approach and autonomy satisfaction across countries. These results may be explained by the change in the Estonian young people's mentality from collectivist to individualist values which may show less cross-cultural variability in the psychological variables than expected (Realo, 2003).

Unlike the SDT-based PE research (Behzadnia et al., 2018; Cronin et al., 2019) and the circumplex model (Aelterman et al., 2019; Escriva-Boulley et al., 2021), the results of the two controlling approaches showed that perceived demanding approach positively predicted the satisfaction of each BPN in general. These results may be explained by some features of the demanding approach, which is part of the controlling style and characterized by high directivity and moderate need thwarting levels (e.g., the PE teacher requires discipline from the students by using a clear language to specify what students have to do), may be interpreted by students as features of a clarifying approach, which is part of the structuring style. This clarifying approach also stands for high directivity but with moderate levels of need support (e.g., the PE teacher communicates expectations and the desired attitude to students in a clear and transparent way) (Aelterman et al. 2019; Vansteenkiste et al. 2019). Perceived domineering approach negatively and significantly predicted autonomy satisfaction only in Estonian students. In line with the SDT assumptions (Ryan & Deci, 2017), these results suggest that when a PE teacher pressures their students to complete the task in question according to his/her requests using intrusive and manipulative tactics (i.e., domineering approach), students would feel that they are not free to decide how to behave during the task. Shortly, it is plausible to think that controlling and structuring practices are high in teacher directiveness, specific demanding practices might be understood by students as clarifying strategies and, in consequence, feel their BPNs as satisfied. Hence, more research is required to shed light on which may be the optimal level of perceived control to

contribute to adaptive outcomes in the PE lesson, since it broadly yields maladaptive outcomes in the long-term (Vasconcellos et al., 2020). In addition, it would be beneficial to examine the effects of the combination of structure and control, to explore if there is a need to study profiles where it can be seen if there were combinations of both teaching approaches that would have positive effects.

In contrast to our hypothesis, the predictive effect of demanding approach was overall higher in Spanish than Estonian students' perceptions, although this difference was only significant between demanding approach and autonomy satisfaction across countries. This result could be explained by the lower magnitude of the relationship with demanding compared to clarifying approaches, and the relationship between demanding and clarifying (e.g., correlation values) is very different between Spain and Estonia. Otherwise, perceived domineering approach had a higher prediction on autonomy satisfaction in Estonian than Spanish students, in line with our hypothesis. A possible explanation would rest on the fact that Estonian and Spanish students would differentially interpret controlling approaches from their teacher. For instance, Spanish students may be more inclined to normalize controlling approaches in response to their behavior in PE lessons. This could be attributed to a social acceptance for this controlling style, as they understand that their PE teacher is concerned about their learning (Abós et al., 2022).

The results of the two chaotic approaches revealed that perceived abandoning approach negatively predicted autonomy, competence, and relatedness satisfaction in students from both cultures. Consistent with SDT assumptions (Ryan & Deci, 2017), our findings suggest that when a PE teacher gives up and leave students to their fate in the classroom, they would tend to actively undermine need satisfaction by not knowing what they have to do, how they should act and how they are able to develop their skills. Following with our hypotheses, it was expected a negative prediction from perceived awaiting approach to BPN satisfaction.

However, the results of this teaching approach did not significantly predict the satisfaction of any BPN. According to Aelterman et al. (2019), these findings would raise that awaiting approach does not actively undermine need satisfaction, but rather it might create the conditions for which students might deprive the opportunities to support their need satisfaction in the PE lesson.

In contrast to our hypothesis, the results displayed that, while non-significant cross-cultural differences were found for perceived awaiting approach, there were greater predictions of perceived abandoning approach on the satisfaction of each BPN. Nevertheless, this difference was only significant between abandoning approach and autonomy satisfaction across countries A plausible rationale would lie in the change in the Estonian young people's mentality to denominate themselves as individualists against the scientific literature to date tending to identify them as a collectivist culture (Realo, 2003). Our results also contrasted with previous research (Chirkov & Ryan, 2001), in the sense that students from collectivist cultures reported lower perceptions of less directive behaviors, including chaotic teaching style.

Limitations and Future Directions

Although this research meaningfully contributed to the PE existing literature and practice, various limitations should be considered. Firstly, although the same SDT-based variables were assessed in the two target samples, slightly different questionnaire versions were used to measure such variables, which might entail some distinctiveness in analyzing cross-cultural differences. Future studies should consider the use of the same questionnaire form to obtain a more rigorous insight into students' motivational processes in different countries. Secondly, the adoption of a cross-sectional design does not allow us to estimate causal effects between study variables. Additional longitudinal research is needed to further examine the direction of the relationships and to shed light on the effects of (de-)motivating

teaching approaches on students' need satisfaction in PE. Thirdly, although the statistical approach followed is commonly used for measurement invariance, it is important to manifest that there may be other more robust proposals to test measurement invariance in general, and at the item level in particular. Hence, additional research is needed to explore if the differences are true for moderation and not due to measurement differences. Fourthly, in the present study, only need satisfaction was included. More research should expand the evidence on the associations of the eight (de-)motivating approaches with other adaptive and maladaptive outcomes such as need frustration or the quality of motivation in PE. This would allow us to gain a better understanding of the beneficial and detrimental effects of (de-)motivating approaches from teachers in instructional practice. Fifthly, the eight (de-)motivating approaches were assessed by self-reported measures in eyes of students. Further studies could complement these self-reported measures both with observational instruments and teachers' perceptions of their own (de-)motivating approaches for an effective data triangulation.

Conclusions

The present study underscores cross-cultural differences in the associations of students' perceptions of (de-)motivating approaches on their need satisfaction, as well as it strengthens the SDT assumptions regarding cross-cultural validity. Our results highlight the cross-cultural variability in the determinant role played by the Estonian and Spanish students' perception of (de-)motivating approaches from the teacher in the satisfaction of their autonomy, competence and relatedness. Firstly, autonomy support and structure through perceived participative, attuning, guiding, and clarifying approaches may be relevant for students to satisfy their three BPNs. Moreover, control, and in special, perceived demanding approach was positively related to autonomy, competence, and relatedness satisfaction, which make us suggest the need for further research to expound on the relationship between this

type of demotivating approach and BPNs satisfaction in students. Finally, chaos and, more particularly, perceived abandoning approach was negatively associated with need satisfaction, which could trigger maladaptive outcomes over time in PE. Thus, these results underline the need to include a specific education in initial and continuous teacher education programs, in which PE teachers are trained not only to maximize motivating approaches (i.e., participative, attuning, guiding, and clarifying), but also to minimize demotivating approaches (i.e., domineering and abandoning) as much as possible in their classroom practice.

References

Abós, Á., Burgueño, R., García-González, L., & Sevil-Serrano, J. (2022). Influence of internal and external controlling teaching behaviors on students' motivational outcomes in Physical Education: Is There a Gender Difference? *Journal of Teaching in Physical Education*, *41*(3), 502–512. https://doi.org/10.1123/jtpe.2020-0316

Aelterman, N., Vansteenkiste, M., Haerens, L., Soenens, B., Fontaine, J. R., & Reeve, J. (2019). Toward an integrative and fine-grained insight in motivating and demotivating teaching styles: The merits of a circumplex approach. *Journal of Educational Psychology*, *111*(3), 497–521. https://doi.org/10.1037/edu0000293

Allik, J., & Realo, A. (2004). Individualism-collectivism and social capital. *Journal of Cross-Cultural Psychology*, *35*(1), 29–49. https://doi.org/10.1177/0022022103260381

Awang-Hashim, R., Thaliah, R., & Kaur, A. (2017). A cultural insight into the development of teacher autonomy support scale: A self-determination theory perspective. *Journal for Multicultural Education*, *11*(4), 287–305. https://doi.org/10.1108/JME-09-2016-0050/FULL/HTML

Behzadnia, B., Adachi, P. J., Deci, E. L., & Mohammadzadeh, H. (2018). Associations between students' perceptions of physical education teachers' interpersonal styles and students' wellness, knowledge, and performance. *Psychology of Sport and Exercise*, *39*,

10–19. https://doi.org/https://doi.org/10.1016/j.psychsport.2018.07.003

Burgueño, R., Abós, Á., Sevil-Serrano, J., Haerens, L., De Cocker, K., & García-González, L. (2024). A Circumplex approach to (de)motivating styles in Physical Education: situations-in-school–physical-education questionnaire in spanish students, pre-service, and in-service teachers. *Measurement in Physical Education and Exercise Science*, *28*(1), 86–108. https://doi.org/10.1080/1091367X.2023.2248098

Burgueño, R., García-González, L., Abós, Á., & Sevil-Serrano, J. (2024). Students' motivational experiences across profiles of perceived need-supportive and need-thwarting teaching behaviors in physical education. *Physical Education and Sport Pedagogy*, *29*(1), 82-96. https://doi.org/10.1080/17408989.2022.2028757

Burgueño, R., & Medina-Casaubón, J. (2021). Validity and reliability of the interpersonal behaviors questionnaire in physical education with spanish secondary school students. *Perceptual and Motor Skills*, *128*(1), 522–545. https://doi.org/10.1177/0031512520948286

Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van der Kaap-Deeder, J., Duriez, B., Lens, W., Matos, L., Mouratidis, A., Ryan, R. M., Sheldon, K. M., Soenens, B., Van Petegem, S., & Verstuyf, J. (2015). Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion*, *39*(2), 216–236. https://doi.org/10.1007/s11031-014-9450-1

Chirkov, V. I. (2011). Dialectical relationships among human autonomy, the brain, and culture. In L. Z. Turiel, D. K. Hymes, & P. G. Miller (Eds.), *Human autonomy in cross-cultural context* (pp. 65–91). Springer. https://doi.org/10.1007/978-90-481-9667-8_4

Chirkov, V. I., & Ryan, R. M. (2001). Parent and teacher autonomy-support in Russian and U.S. Adolescents. *Journal of Cross-Cultural Psychology*, *32*(5), 618–635. https://doi.org/10.1177/0022022101032005006

603 Chirkov, V. I., Ryan, R. M., & Willness, C. (2005). Cultural context and psychological needs
604 in Canada and Brazil. *Journal of Cross-Cultural Psychology*, *36*(4), 423–443.
605 https://doi.org/10.1177/0022022105275960
606 Cronin, L., Marchant, D., Allen, J., Mulvenna, C., Cullen, D., Williams, G., & Ellison, P.
607 (2019). Students' perceptions of autonomy-supportive versus controlling teaching and
608 basic need satisfaction versus frustration in relation to life skills development in PE.
609 *Psychology of Sport and Exercise*, *44*, 79–89.
610 https://doi.org/10.1016/J.PSYCHSPORT.2019.05.003
611 Curran, T., & Standage, M. (2017). Psychological Needs and the Quality of Student
612 Engagement in Physical Education: Teachers as Key Facilitators. *Journal of Teaching in*
613 *Physical Education*, *36*(3), 262–276. https://doi.org/10.1123/jtpe.2017-0065
614 Delrue, J., Reynders, B., Broek, G. V., Aelterman, N., De Backer, M., Decroos, S., De
615 Muynck, G. J., Fontaine, J., Fransen, K., van Puyenbroeck, S., Haerens, L., &
616 Vansteenkiste, M. (2019). Adopting a helicopter-perspective towards motivating and
617 demotivating coaching: A circumplex approach. *Psychology of Sport and Exercise*, *40*,
618 110–126. https://doi.org/10.1016/j.psychsport.2018.08.008
619 Escriva-Boulley, G., Guillet-Descas, E., Aelterman, N., Vansteenkiste, M., Van Doren, N.,
620 Lentillon-Kaestner, V., & Haerens, L. (2021). Adopting the situation in school
621 questionnaire to examine Physical Education teachers' motivating and demotivating
622 styles using a circumplex approach. *International Journal of Environmental Research*
623 *and Public Health*, *18*(14), 7342. https://doi.org/10.3390/ijerph18147342
624 Kline, R. B. (2016). *Principles and practice of structural equation modeling*. Guilford Press.
625 Leo, F. M., Mouratidis, A., Pulido, J. J., López-Gajardo, M. A., & Sánchez-Oliva, D. (2022).
626 Perceived teachers' behavior and students' engagement in physical education: the
627 mediating role of basic psychological needs and self-determined motivation. *Physical*

628 *Education and Sport Pedagogy*, *27*(1), 59–76.
629 https://doi.org/10.1080/17408989.2020.1850667
630 López-Pastor, V. M., Ruano, C., Hernangómez, Á., María, A., Dimas, C., Hernández-
631 Sánchez, B., Sánchez-García, B., Marcos, G., Fuentetaja, R., Herrero, J., Barrios-Martín,
632 J., Plaza, J., Ruanes, J., Laguna, J., Romano, L., Arranz, A., Jesús, M., Molina, M.,
633 Ángel, M., … Otero, D.-. (2016). Veinte años de formación permanente del profesorado,
634 investigación-acción y programación por dominios de acción motriz. *RETOS. Nuevas*
635 *Tendencias En Educación Física, Deporte y Recreación*, *29*, 270–279.
636 https://doi.org/https://doi.org/10.47197/retos.v0i29.42494
637 Moreno-Murcia, J. A., González-Cutre, D., Chillón, M., & Parra, N. (2008). Adaptación a la
638 educación física de la escala de las necesidades psicológicas básicas en el ejercicio.
639 *Revista Mexicana de Psicología*, *25*(2), 295–303.
640 Realo, A. (2003). Comparison of public and academic discourses: Estonian individualism and
641 collectivism revisited. *Culture & Psychology*, *9*(1), 47–77.
642 https://doi.org/10.1177/1354067X03009001004
643 Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in*
644 *motivation, development, and wellness* (Guilford Press).
645 https://doi.org/https://doi.org/10.1521/978.14625/28806
646 SHAPE America—Society of Health and Physical Educators. (2014). *National standards &*
647 *grade-level outcomes for K-12 physical education*. Human Kinetics.
648 Tilga, H., Hein, V., Koka, A., & Hagger, M. S. (2020). How Physical Education teachers'
649 interpersonal behaviour is related to students' health-related quality of life. *Scandinavian*
650 *Journal of Educational Research*, *64*(5), 661–676.
651 https://doi.org/10.1080/00313831.2019.1595718
652 Tilga, H., Vahtra, K., & Koka, A. (2023). The role of teachers (de-)motivational styles on

students' autonomous motivation in physical education and leisure time. *Baltic Journal of Health and Physical Activity*, *15*(4). https://doi.org/10.29359/BJHPA.15.4.05

Vansteenkiste, M., Aelterman, N., Haerens, L., & Soenens, B. (2019). Seeking stability in stormy educational times: A need-based perspective on (de)motivating teaching grounded in self-determination theory. *Advances in Motivation and Achievement*, *20*, 53–80. https://doi.org/10.1108/S0749-742320190000020004

Vasconcellos, D., Parker, P. D., Hilland, T., Cinelli, R., Owen, K. B., Kapsal, N., Lee, J., Antczak, D., & Ntoumanis, N. (2020). Self-Determination theory applied to physical education: A systematic review and meta-analysis. *Journal of Educational Psychology*, *112*(7), 1444–1469. https://doi.org/10.1037/edu0000420

Vlachopoulos, S. P., Asci, F. H., Cid, L., Ersoz, G., González-Cutre, D., Moreno-Murcia, J. A., & Moutão, J. (2013). Cross-cultural invariance of the basic psychological needs in exercise scale and need satisfaction latent mean differences among Greek, Spanish, Portuguese and Turkish samples. *Psychology of Sport and Exercise*, *14*(5), 622–631. https://doi.org/10.1016/j.psychsport.2013.03.002

669 Table 1. *Descriptive statistics, and correlations between study variables in the eyes of Estonian and Spanish students*

		Estonian students (n=601)	Spanish students (n=669)										
	Range	*M* (*SD*)	*M* (*SD*)	1	2	3	4	5	6	7	8	9	10	11
1. Participative approach	1-7	4.40(1.24)	4.01(1.50)	-	.81**	.75**	.49**	.20**	.01	.-07	.08*	.66**	.52**	.50**
2. Attuning approach	1-7	4.49(1.22)	4.60(1.26)	.73**	-	.86**	51**	.15**	-.01	-.17**	.04	.70**	.56**	.54**
3. Guiding approach	1-7	5.06(1.18)	5.18(1.22)	.61**	.77**	-	.70**	.13**	-.06	-.25**	-.02	.67**	.55**	.51**
4. Clarifying approach	1-7	4.96(1.02)	5.22(1.08)	.52**	.70**	.51**	-	.05	-.08*	-.22**	-.09*	.44**	.36**	.35**
5. Demanding approach	1-7	3.85(1.15)	4.75(0.97)	.42**	.51**	.55**	.59**	-	.79**	.63**	.39**	.07	.17**	.06
6. Domineering approach	1-7	3.51(1.35)	3.77(1.19)	.21**	.18**	.12**	.22**	.44**	-	.74**	.42**	-.07	.06	-.05
7. Abandoning approach	1-7	3.14(1.26)	2.56(1.24)	-.06	-.24**	-.33**	-.22**	-.01	.43**	-	.60**	-.22**	-.10**	-.15**
8. Awaiting approach	1-7	3.25(1.22)	2.63(1.29)	.01	-.07	-.16**	-.11**	.04	.27**	.57**	-	.01	.01	-.04
9. Autonomy satisfaction	1-5	3.37(1.01)	3.26(0.86)	.50**	.56**	.50**	.39**	.35**	.10**	-.09*	.01	-	.71**	60**
10. Competence satisfaction	1-5	3.49(1.09)	3.76(0.92)	.26**	.34**	.31**	.21**	.19**	.05	-.16**	-.04	.53**	-	56**
11. Relatedness satisfaction	1-5	3.47(1.13)	3.77(0.91)	.22**	.31**	.29**	.26**	.16**	.06	-.16**	-.05	.44**	.58**	-

Note: These preliminary results are from the raw data.

670

671

672

673

674

675 Table 2. *Cross-cultural invariance tests for the tested model*

	$\chi^2(df)$	CFI	TLI	RMSEA(90%CI)	Models' comparison	$\Delta\chi^2(\Delta df)$	ΔCFI	ΔTLI	ΔRMSEA	Invariance
1. Configural model	19.67(10)	.999	.987	.028(.008–.046)	-	-	-	-	-	-
2. Structural weights	193.76(29)	.980	.923	.067(.058–.076)	2 *versus* 1	174.09(19)***	.019	.064	.039	No
3. Structural covariances	238.00(36)	.975	.923	.067(.059–.075)	3 *versus* 2	44.24(7)***	.005	.000	.000	Yes
4. Structural residuals	296.54(43)	.969	.920	.067(.061–.076)	4 *versus* 3	58.54(7)***	.006	.003	.001	Yes
5. Measurement residuals	367.51(71)	.961	.915	.076(.071–.082)	5 *versus* 4	70.97(28)***	.008	.005	.009	Yes

Note: ***p<.001.

676

677

678

679

680

681

682

683

684

685

686

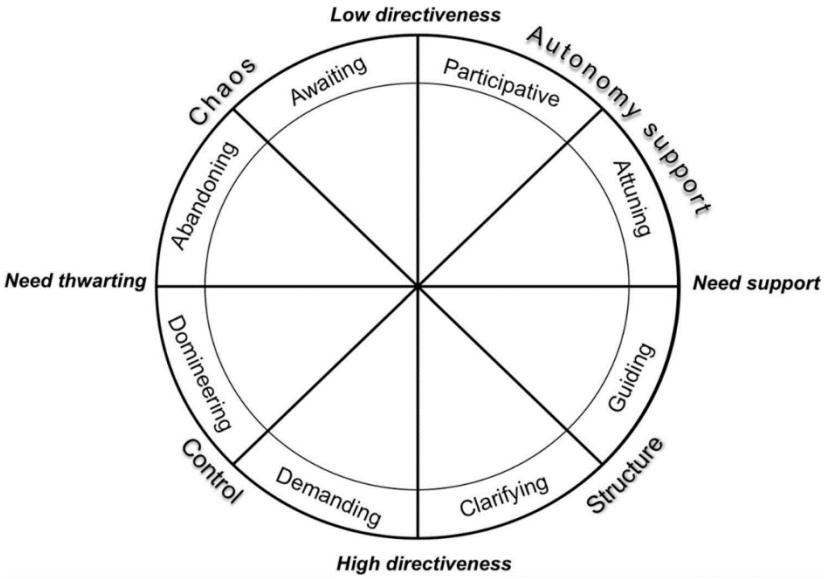
687 Table 3. *Cross-cultural invariance tests for paths from (de-)motivating teaching styles to autonomy, competence and relatedness satisfaction in students*

	Parameters constrained	$\chi^2(df)$	CFI	TLI	RMSEA(90%CI)	$\Delta\chi^2(\Delta df)$	Δp-value
Model 0	Configural model	19.67(10)	.999	.987	.028(.008–.046)	-	-
Model 1	**Participative approach → Autonomy satisfaction**	**67.76(11)**	**.999**	**.987**	**.064(.050-.079)**	**48.09(1)**	**<.001**
Model 2	**Participative approach → Competence satisfaction**	**76.26(11)**	**.993**	**.930**	**.068(.054-.083)**	**56.59(1)**	**<.001**
Model 3	**Participative approach → Relatedness satisfaction**	**82.69(11)**	**.992**	**.919**	**.072(.058-.087)**	**63.02(1)**	**<.001**
Model 4	**Attuning approach → Autonomy satisfaction**	**40.39(11)**	**.991**	**.911**	**.046(.031-.061)**	**20.72(1)**	**<.001**
Model 5	**Attuning approach → Competence satisfaction**	**50.46(11)**	**.996**	**.964**	**.053(.039-.068)**	**30.79(1)**	**<.001**
Model 6	**Attuning approach → Relatedness satisfaction**	**45.88(11)**	**.995**	**.951**	**.057(.043-.072)**	**37.01(1)**	**<.001**
Model 7	**Guiding approach → Autonomy satisfaction**	**37.51(11)**	**.994**	**.943**	**.027(.007-.044)**	**17.84(1)**	**<.001**
Model 8	**Guiding approach → Competence satisfaction**	**49.67(11)**	**.999**	**.988**	**.038(.022-.054)**	**29.99(1)**	**<.001**
Model 9	**Guiding approach → Relatedness satisfaction**	**45.31(11)**	**.998**	**.976**	**.031(.014-.047)**	**25.64(1)**	**<.001**
Model 10	Clarifying approach → Autonomy satisfaction	20.84(11)	.998	.984	.044(.029-.059)	1.17(1)	.278
Model 11	**Clarifying approach → Competence satisfaction**	**30.73(11)**	**.997**	**.967**	**.053(.038-.068)**	**11.06(1)**	**.001**
Model 12	**Clarifying approach → Relatedness satisfaction**	**24.16(11)**	**.995**	**.952**	**.050(.035-.065)**	**4.49(1)**	**.034**
Model 13	**Demanding approach → Autonomy satisfaction**	**63.31(11)**	**.996**	**.957**	**.061(.047-.076)**	**43.64(1)**	**<.001**
Model 14	Demanding approach → Competence satisfaction	22.79(11)	.994	.935	.029(.011-.046)	3.12(1)	.077
Model 15	Demanding approach → Relatedness satisfaction	20.60(11)	.999	.988	.026(.006-.044)	.94(1)	.334
Model 16	**Domineering approach → Autonomy satisfaction**	**33.54(11)**	**.999**	**.972**	**.040(.025-.056)**	**13.87(1)**	**<.001**
Model 17	**Abandoning approach → Autonomy satisfaction**	**30.53(11)**	**.997**	**.976**	**.037(.022-.054)**	**10.86(1)**	**.001**
Model 18	Abandoning approach → Competence satisfaction	19.67(11)	.998	.989	.025(.001-.042)	.01(1)	.969
Model 19	Abandoning approach → Relatedness satisfaction	21.11(11)	.999	.987	.027(.008-.044)	1.44(1)	.230

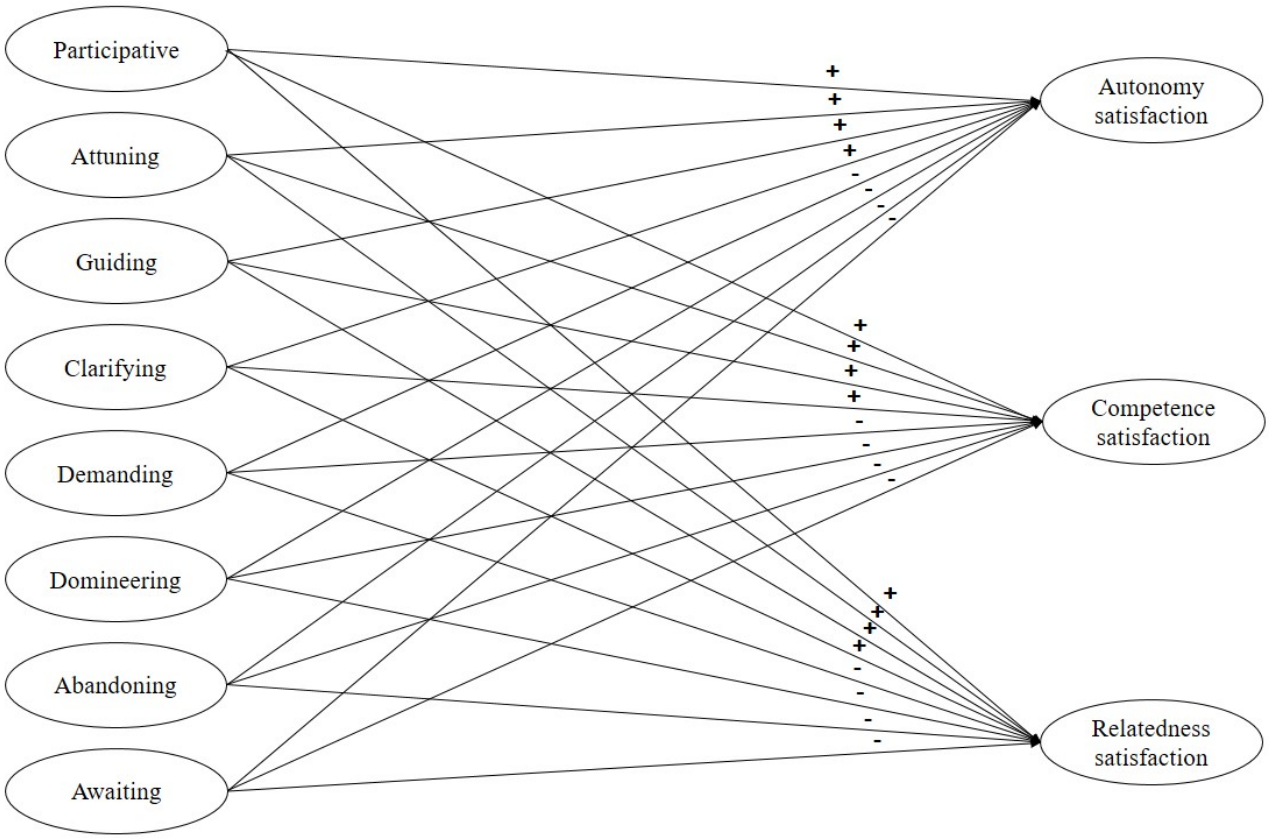
Note: Models in bold show significantly moderated relationships.

688

Figure 1. *Graphical representation of the circumplex model (Aelterman et al. 2019).*

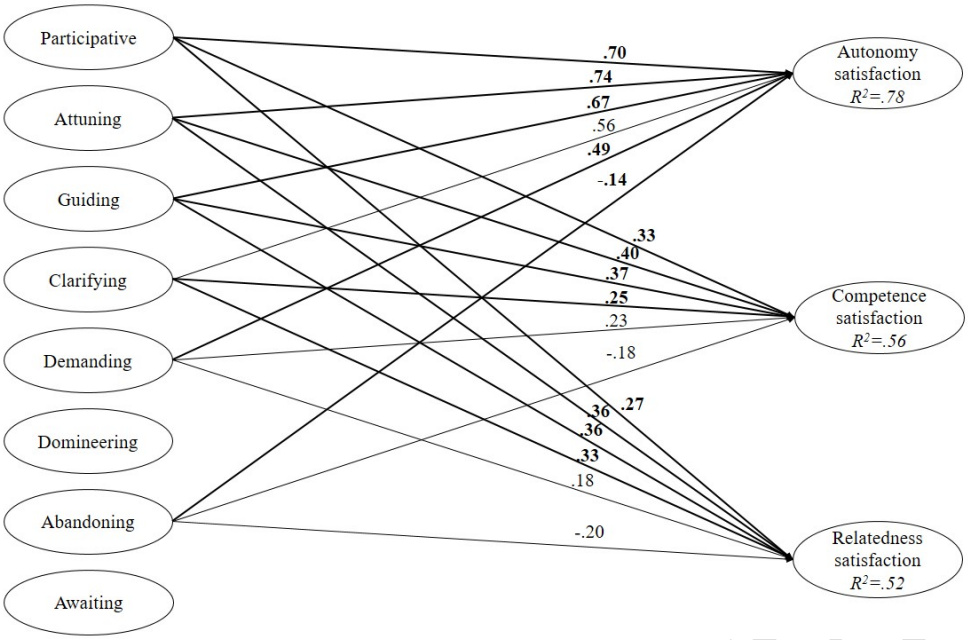


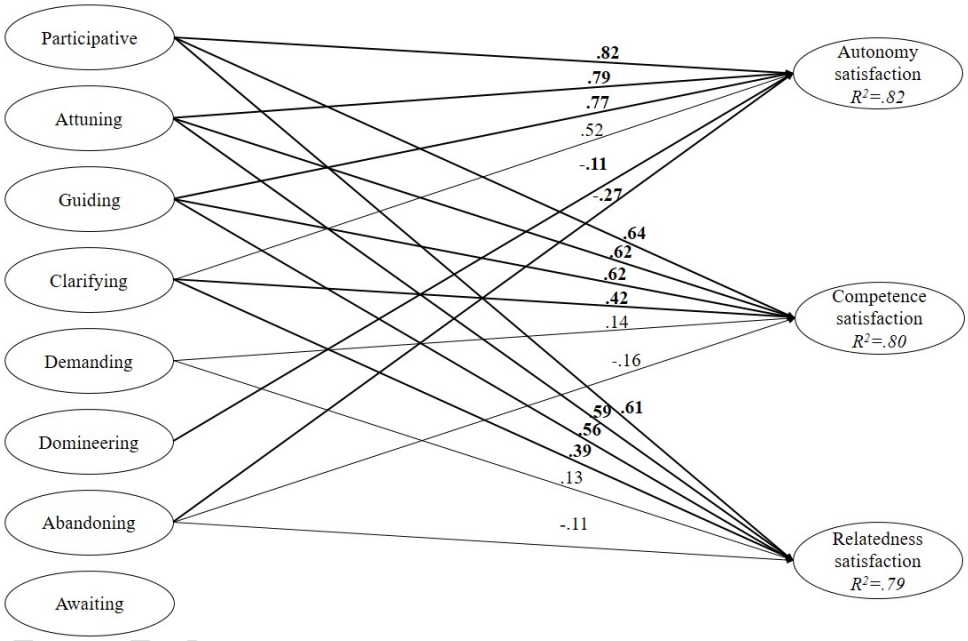
723 **Figure 2.** *Theoretical hypothesized model of relationships between the study variables*



724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740

Figure 3. *Multi-group SEM depicting relationships between perceived teachers' (de-) motivating approaches and need satisfaction between Estonian and Spanish students*





Note: Standardized estimates for Estonians are above and estimates for Spanish are below. All the paths shown in the figure are significant at p<.001. Bold paths indicate they are moderated by country.