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Towards a refined insight into physical education teachers' autonomy-supportive, structuring, and controlling style to the importance of student motivation: a person-centered approach

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ABSTRACT

Background: Physical education (PE) teachers face the challenge of managing their classroom and directing students' learning in a way that engages students in a motivating manner. For this reason, numerous studies have examined the impact of PE teachers' autonomy-supportive, structuring, and controlling style. Most research relied on a variable-centered approach, but a person-centered approach is warranted as in reality these styles co-occur. Prior person-centered research examined the combinations of autonomy support and structure, autonomy support and control, and structure and control. In the current study we take the next step by examining combinations of the three most prevalent styles in PE teachers. This investigation is particularly relevant as many PE teachers believe that being perceived as controlling might not be detrimental if they are also seen as autonomy-supportive and/or structuring.

Purpose: To further understand the interplay of an autonomy-supportive, structuring, and controlling style, this study simultaneously investigated all three styles using a person-centred approach. The first aim was to examine how students perceive PE teachers' combined use of an autonomy-supportive, structuring, and controlling style. The second aim was to investigate whether students' motivation differed according to the profile they perceived their teacher to be in.

Method: A sample of 673 secondary school students (M age = 13.82, SD = 1.25 years) reported on their PE teachers' autonomy-supportive, structuring, and controlling style, and their motivation for PE. Hierarchical K-Means Cluster analyses and MANCOVA tests were performed.

Findings: Results showed that in the eyes of the students, PE teachers employed different combinations of autonomy support, structure, and control to different degrees, as six different profiles were found. Students who perceived their teacher as more need-supportive displayed higher levels of intrinsic motivation, integrated, and identified regulation, particularly when students perceived their teacher as high on both autonomy support and structure. In contrast, students who perceived their teacher as more controlling displayed more extrinsic regulation and amotivation, even when students simultaneously

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perceived their teacher as need-supportive. Students who perceived their teacher as higher on all three styles displayed higher levels of introjected regulation, suggesting that this mixture of styles elicits internal pressure. **Conclusion:** In conclusion, according to the students, PE teachers can combine certain autonomy-supportive, structuring, and controlling behaviors to different degrees, indicating that classifying PE teachers as either need-supportive or controlling may be inaccurate. Students who perceived their PE teacher as highly autonomy-supportive and structuring and lowly controlling reported the most optimal motivational outcomes. The detrimental effect of a perceived controlling style was evident, even when the teacher was additionally perceived as autonomy-supportive and structuring. This finding challenges the common belief among PE teachers that being perceived as controlling is not harmful when simultaneously being perceived as autonomy-supportive and controlling. Interestingly, both need-supportive and controlling styles were positively related to students' introjected regulation.

Introduction

Self-Determination Theory (SDT; Deci and Ryan 2000) and empirical research starting from this theory (Vasconcellos et al. 2020), suggest that when students perceive their physical education (PE) teacher as highly autonomy-supportive and structuring, they report greater autonomous motivation for PE. In contrast, when students indicate that their PE teacher adopts a controlling style more controlled forms of motivation are promoted (De Meyer et al. 2014; Deci and Ryan 2000). The relations between students' perception of their PE teachers' autonomy support, structure and control and their motivation are well-documented (e.g. Bartholomew et al. 2018; Koka and Hein 2005). However, comparatively less attention has been paid to the question of whether students perceive teachers as using these three styles differently, and how this affects their motivation. This question is highly relevant as many teachers believe that it may not be detrimental to be perceived as controlling, as long as they are also perceived as motivating (e.g. autonomy-supportive and structuring) (Reeve 2009).

The few available studies that examined combinations of students' perceived styles revealed that an autonomy-supportive style and structuring style should preferably be combined (Vansteenkiste et al. 2012) and that the provision of structure (García-González et al. 2023) or autonomy support (Haerens et al. 2017) is particularly beneficial when students also perceive an absence of a controlling style. Therefore, the present study examines students' perceptions of their PE teachers' combined use of an autonomy-supportive, structuring, and controlling style, and how their motivation differs according to these combinations of styles.

Student motivation

SDT (Deci and Ryan 2000), one of the most researched theories on human motivation, distinguishes six qualitatively different types of motivation, which vary in the degree to which they are volitional. These six types can be depicted on a continuum. Amotivation (i.e. a complete absence of motivation) is situated at the far left of the continuum, followed by two controlled forms of motivation: external regulation (i.e. avoiding punishment or criticism, obtaining rewards or appreciation, or meeting external expectations) and introjected regulation (i.e. avoiding feelings of guilt or shame, or obtaining feelings of pride) (Deci and Ryan 2000). Moving along the continuum, the next motivation types are considered autonomous forms of motivation: identified regulation (i.e. understanding the personal relevance), integrated regulation (i.e. harmonization with personal values and ideals), and intrinsic motivation (i.e. finding the activity fun). Students'

amotivation and controlled forms of motivation are related to maladaptive outcomes, such as fear of failure, challenge avoidance (Bartholomew et al. 2018), and less physical activity outside class (Koka et al. 2019). In contrast, students' autonomous forms of motivation are associated with adaptive outcomes, such as more engagement and higher physical activity levels during (Aelterman et al. 2012) and outside class (Haerens et al. 2010).

PE teachers' autonomy support and structure: a motivating cocktail

The need-supportive style that has received the most attention is the autonomy-supportive style (Vansteenkiste et al. 2019). When being autonomy-supportive, teachers try to identify students' interests and preferences (Reeve 2009), by providing choice (Patall, Cooper, and Wynn 2010), using inviting language (Ryan 1982), and accepting students' input (Jang, Reeve, and Halusic 2016). Teachers' structuring style comparably received far less attention (Vasconcellos et al. 2020). When relying on a structuring style, teachers give students clear information about what to do and how to do it (Reeve and Cheon 2014), by giving clear instructions (Jang, Reeve, and Deci 2010), using positive and constructive feedback (Koka and Hein 2005), and offering guidelines (Jang, Reeve, and Deci 2010). Previous variable-centered research has shown that PE teachers' autonomy-supportive and structuring styles are positively related to students' intrinsic motivation, identified and introjected regulation, and although less strong, are also negatively related to external regulation and amotivation (see Vasconcellos et al. 2020 for a review).

PE teachers' controlling style: the most prevalent need-thwarting style

PE teachers can also rely on a need-thwarting style, of which a controlling style is most frequently examined (Vasconcellos et al. 2020). Furthermore, according to research relying on observations during PE lessons, a controlling style is the most prevalent need-thwarting style used in practice (Van den Berghe et al. 2013). When adopting a controlling style, teachers put pressure on students to behave in a prescribed way (Reeve 2009), by yelling, using sanctions and rewards, and inducing feelings of guilt and shame (Bartholomew et al. 2011). Previous research has shown that PE teachers' controlling style is negatively related to students' identified regulation, while it is positively and more strongly related to students' introjected regulation, external regulation, and amotivation (see Vasconcellos et al. 2020 for a review), even if the controlling behavior does not occur frequently (De Meyer et al. 2014; Van den Berghe et al. 2013).

Combinations of PE teachers' need-supportive and need-thwarting styles

The fact that teachers can simultaneously rely on autonomy support, structure and control when teaching their classes (Van den Berghe et al. 2016) has received far less attention. To investigate how students perceive their PE teacher combining these styles to varying degrees, a person-centered approach is warranted. While most SDT research adopts a variable-centered approach, which assumes homogeneity in the population and describes average associations between individual constructs, a person-centered approach considers the possibility of multiple subpopulations within the population and focuses on the individual characterized by many co-occurring constructs. For example, a PE teacher who is perceived as using punishments to pressure students (i.e. controlling behavior) may also be perceived as providing students with choices (i.e. autonomy-supportive behavior). Therefore, categorizing PE teachers as either autonomy-supportive or controlling may be inaccurate. A person-centered approach not only identifies subpopulations within a sample, but also reveals the prevalence of each subpopulation. This approach is crucial for assessing the current population and informing future interventions.

Despite the clear advantages of a person-centered approach, only a handful of studies adopted this approach. These studies have shown that students' perceptions of an autonomy-supportive

style and structuring style should preferably be combined (Vansteenkiste et al. 2012), while each need-supportive style is particularly beneficial when students simultaneously perceive an absence of a controlling style (García-González et al. 2023; Haerens et al. 2017). A higher-order approach combining intrinsic and identified regulation into autonomous motivation and introjected and external regulation into controlled motivation was applied in all three studies. However, this approach is not well supported from either a theoretical or empirical perspective (Howard et al. 2021), as relations between PE teachers' autonomy-supportive, structuring (Taylor and Ntoumanis 2007), and controlling styles (Koka et al. 2019) and introjected and external regulation appear to be demonstrably different. Similarly, it is important to assess intrinsic motivation, integrated, and identified regulation separately (Howard et al. 2021).

There are some studies available that examined combinations of more than three student perceived styles (Burgueño et al. 2024; Leo et al. 2022), hereby providing a more comprehensive picture of styles being assessed. Both studies included six styles (three need-supportive and three need-thwarting styles). These studies identified four profiles (i.e. predominantly need-supportive, predominantly need-thwarting, moderate to high need-supportive and need-thwarting, and moderate to low need-supportive and need-thwarting). Interestingly, while Burgueño et al. (2024) did not find a profile with a 'contrasting' perceived autonomy-supportive and structuring style, Leo et al. (2022) found a profile characterized by low perceived autonomy support and moderate to high perceived structure (and high control). In general, students who perceived their PE teacher as more need-supportive reported higher intrinsic motivation, integrated, identified, and introjected regulation (Burgueño et al. 2024). In contrast, students who perceived their PE teacher as more need-thwarting reported higher introjected, external regulation, and amotivation (Burgueño et al. 2024). While student motivational outcomes were not assessed in the study of Leo et al. (2022), it showed that students displayed more behavioral and emotional engagement when they perceived their PE teacher as highly autonomy-supportive and structuring and lowly controlling, compared to perceiving their teacher as structuring and controlling. Because six styles were combined to different degrees in four profiles, it is challenging to disentangle the role of specific styles from these results. Hereto more profiles would need to be identified.

In summary, previous research on students' perceptions of PE teachers' combined use of different styles, assessed only two styles (i.e. García-González et al. 2023; Haerens et al. 2017) or all six styles (i.e. Burgueño et al. 2024; Leo et al. 2022). The latter studies, albeit providing a full picture, were inconclusive so far in relation to different profiles being found (e.g. 'contrasting' autonomy support and structure) and the role of specific styles. A logical next step therefore is to examine autonomy support, structure, and control simultaneously and look beyond more than four potential clusters. This investigation is crucial, as these three styles are highly prevalent among PE teachers, with the controlling style being the most commonly used need-thwarting style (Van den Berghe et al. 2013). Moreover, despite evidence showing that being perceived as controlling is detrimental (Bartholomew et al. 2018), many teachers believe that employing a controlling style is sometimes necessary (Reeve 2009), and that its detrimental effects mitigate particularly when teachers are also perceived as autonomy-supportive and structuring. As such, the present study aims to achieve two key objectives. First, it examines how students perceive their PE teachers' combined use of an autonomy-supportive, structuring, and controlling styles (Aim 1). This aim explores whether need-supportive and controlling styles are seen as mutually exclusive by students, whether teachers can be seen as providing structure in a non-controlling manner, and whether students perceive there teachers as consistently combining autonomy support with structure. Aim 1 thus addresses the theoretical distinction between these styles, clarifying how students perceive them. Second, this study investigated how students' motivation differs according to these perceived combinations (Aim 2). By examining each type of motivation separately, this approach allows for a detailed analysis of how students' motivational regulations differ based on their perceptions of their teachers combined styles.

Method

Participants and procedure

Students aged between 11 and 17 years ($M = 13.82$; $SD = 1.25$) were recruited from four different public secondary schools in Spain. The sample was selected based on the number of secondary schools that agreed to participate in the study (non-probabilistic). After removing invalid data (2.80%), the final sample consisted of 673 students, of which 307 were men (45.60%), 349 were women (51.90%), and 17 preferred not to say (2.50%). In total, 137 (20.50%) were first graders, 190 were second graders (28%), 239 were third graders (35.50%), and 107 were fourth graders (16%). Each class had around 26 students ($M = 25.82$; $SD = 5.54$). Five different PE teachers were involved (four men and one woman). Teachers were on average 37 years old ($SD = 5.83$, range = 30–46), and had an average of 7.80 years of teaching experience ($SD = 6.14$, range = 3 −15).

To collect the data, the school administrators, school boards, and parents or legal guardians were informed, and the necessary written consent forms were obtained. Paper-and-pencil questionnaires were distributed during the final term of the school year during school hours in the presence of a member of the research group, who explained to the students how to respond, reminded them that participation was anonymous and voluntary, and requested honesty in their answers. Students took around 15 minutes to complete the questionnaires. The study was approved by the Andalusian Ethics Committee of Biomedical Research (TD-OCME-2018) and was conducted following the ethical principles of the American Psychological Association (2020).

Measures

Students' perceived PE teachers' need-supportive styles

To determine students' perceptions of their PE teacher's autonomy-supportive and structuring style, students filled in the corresponding subscales of the teacher support for basic psychological needs scale (Sánchez-Oliva et al. 2013). Each dimension consisted of four items (e.g. autonomy support: 'often asks us about the activities we want to do'; structure: 'encourages us to trust our ability to complete the tasks well'), preceded by the stem 'In my PE class, the teacher … '. Students rated their agreement with the statements on a 5-point scale (1 = totally disagree to 5 = totally agree). Evidence for the reliability and validity of this questionnaire has been provided in the PE context (e.g. Sevil-Serrano et al. 2020). Present Cronbach's Alpha and McDonald's Omega values were α = .80 and ω = .81 for autonomy support; α = .70 and ω = .71 for structure. The results of the confirmatory factor analysis offered acceptable fit indices ($\chi2$ (19) = 92.38 $p < .01$, *CFI* = .958, *TLI* = .938, *SRMR* = .037, *RMSEA* = .076).

Students' perceived PE teachers' controlling style

The Spanish version (Trigueros et al. 2019) of the Psychologically Controlling Teaching scale (Soenens et al. 2012) was used to determine students' perceptions of their PE teacher's controlling style. This scale consists of 7 items (e.g. 'My PE teacher made me feel guilty when I dissatisfied him/her'. The items were answered on a 5-point scale (1 = strongly disagree to 5 = strongly agree). Evidence for the reliability and validity of this questionnaire has been previously provided (e.g. Trigueros-Ramos et al. 2019). Present Cronbach's Alpha and McDonald's Omega value were α = .72 and ω = .73. Confirmatory factor analysis showed acceptable fit indices ($\chi2$ (14) = 43.97; $p < .01$, *CFI* = .963, *TLI* = .944, *SRMR* = .034, *RMSEA* = .056).

Students' motivation

Students' motivation towards the PE lesson was assessed using the Spanish version (Ferriz, González-Cutre, and Sicilia 2015) of the Perceived Locus of Causality Scale (Goudas, Biddle, and Fox 1994). The scale consists of 24 items, grouped into four items per factor: intrinsic motivation (e.g.

'because PE is fun'), integrated regulation (e.g. 'because it fits with my way of life'), identified regulation (e.g. 'because I want to learn sports skills'), introjected regulation (e.g. 'because I would feel bad about myself if I didn't do it'), external regulation (e.g. 'because I'll get in trouble if I don't'), and amotivation (e.g. 'but I really feel like I'm wasting my time in PE.'). The scale begins with the stem 'I take part in PE … '. The items were answered on a 7-point Likert scale (1 = totally disagree to 7 = totally agree). Previous studies have tested this instrument's reliability and validity (e.g. González-Cutre et al. 2018). Present Cronbach's Alpha and McDonald's Omega value were $\alpha = .84$ and $\omega = .84$ for intrinsic motivation, $\alpha = .87$ and $\omega = .88$ for integrated regulation, $\alpha = .81$ and $\omega = .82$ for identified regulation, $\alpha = .72$ and $\omega = .73$ for introjected regulation, $\alpha = .75$ and $\omega = .75$ for external regulation, and $\alpha = .77$ and $\omega = .78$ for amotivation. Confirmatory factor analysis gave acceptable fit indices ($\chi2$ (237) = 814.92, $p < .01$, $CFI = .919$, $TLI = .906$, $SRMR = .054$, $RMSEA = .060$).

Data analysis

Preliminary analysis

First, internal consistency was examined using Cronbach's Alpha and McDonald Omega. Additionally, to assess the nested structure of the data, Intraclass Correlation Coefficients (ICCs) were determined for each item, considering both the class and the teacher (Muthén 1991). ICCs below 0.05 suggest that multilevel analysis is not required (Muthén 1994; Stapleton, McNeish, and Yang 2016). Finally, a confirmatory factor analysis was performed using MLR as an estimator (Hu and Bentler 1999) for each instrument used. Second, descriptive statistics (i.e. mean, standard deviation, skewness, and kurtosis coefficients) were calculated. Afterward, Pearson correlations were used to determine the univariate relations between the variables.

Aim 1. Identification of profiles

Hierarchical K-Means cluster analyses were performed to examine whether subgroups could be defined based on students' perception of their PE teacher's autonomy-supportive, structuring, and controlling style. We used Hierarchical K-Means clustering instead of other clustering methods (e.g. Latent Profile Analysis) for two main reasons. First, we aimed to identify clearly distinct and non-overlapping profiles. While Latent Profile Analysis assume differences in the variances of the variables by profile and thereby allowing for covariance between profiles, K-Means clustering produces profiles that do not overlap due to its geometric constraints. Second, as K-Means clustering assumes 'statistical independence' between profiles, it is unaffected by statistical problems such as multicollinearity, allowing for a an easier interpretation.

All variables were standardized. Values more than 3 SD above or below the mean were removed to reduce the impact of univariate outliers (Garson 2014). Next, using the Mahalanobis distance measure, multivariate outliers ($p < .01$) were removed as they can substantially distort cluster solutions (Garson 2014). Thereafter, a two-step clustering procedure was performed (Gore 2000). In the first step, a hierarchical cluster analysis was performed using Ward's method based on squared Euclidean distances (Hair et al. 2018). An explained variance of more than 50% for each clustering variable was considered a minimum acceptable value (Hair et al. 2018). The second step consisted of a non-hierarchical cluster analysis (K-Means) which uses the extracted initial cluster centers based on Ward's hierarchical method as non-random starting points. A comprehensive evaluation approach was employed to ensure a well-supported and appropriate final cluster solution, utilizing multiple validation metrics to assess solutions based on interpretability and parsimony (Eye and Bogat 2006). This approach integrated the within-cluster sum of squares (WCSS) to identify cluster compactness, silhouette scores to evaluate overall cluster quality and separation, a dendrogram for visual inspection of the clustering structure, and the agglomerative coefficient to measure clustering strength.

To examine the stability of the cluster solutions, the sample was randomly divided into two halves, and the full two-step procedure was applied to each half (Breckenridge 2000). Next, students in each half of the sample were assigned to new clusters based on their Euclidean distances to the cluster centers of the other half of the sample. Thereafter, the averages of both clusters were compared via Cohen's kappa (K). The two resulting K were averaged and a mean $K > .60$ was considered acceptable (Hair et al. 2018). The Chi-square test and ANOVA were calculated to see if students' sex and age needed to be included as covariates in subsequent analyses.

Aim 2. Differences in students' motivation according to cluster membership

Finally, based on the result of homogeneity covariance (Box´s test; Field 2017), Pillai's trace was used as a test statistic in the MANCOVA analyses. Cluster membership was used as the independent variable, the different motivational regulations as the dependent variables, and students' sex and age as covariates. In the univariate tests, post hoc Bonferroni tests were performed for pairwise comparison. Effect sizes (partial eta-squared; η_p^2) were considered small (< 0.01), moderate (< 0.06), or large (< 0.14) (Cohen 1988). SPSS 23.0 (IBM, Armonk, NY, USA) and JASP (Version 0.18.3; JASP Team 2024) were used for all analyses and the level of significance was $p < .05$.

Results

Preliminary results

Descriptive statistics and bivariate correlations for all variables are shown in Table 1. Pearson correlations revealed positive and significant associations between PE teachers' need-supportive styles (i.e. autonomy support and structure) and the more self-determined forms of motivation (i.e. intrinsic motivation, integrated regulation, and identified regulation), as well as introjected regulation. No significant association was found with external regulation. Additionally, a negative and significant correlation was observed with amotivation. On the other hand, PE teachers' controlling style was negatively related to intrinsic motivation and identified regulation, but no significant association was found with integrated regulation. Finally, PE teachers' controlling style showed positive and significant associations with the less self-determined forms of motivation (i.e. introjected and external regulation), as well as amotivation.

Aim 1. Identification of profiles

Eleven univariate and eight multivariate outliers were removed before conducting the cluster analysis. Cluster solutions with one to four profiles were discarded as they showed an explained variance

Table 1. Descriptive statistics and bivariate correlations.

Variables	1	2	3	4	5	6	7	8	9
1. Autonomy-supportive style	–	.65**	−.18**	.26**	.32**	.29**	.21**	−.01	−.09*
2. Structuring style		–	−.28**	.27**	.33**	.34**	.19**	−.04	−.14**
3. Controlling style			–	−.10*	−.06	−.11**	.16**	.23**	.26**
4. Intrinsic motivation				–	.50**	.62**	.10*	−.26**	−.39**
5. Integrated regulation					–	.73**	.40**	−.11**	−.23**
6. Identified regulation						–	.41**	−.09*	−.30**
7. Introjected regulation							–	.46**	.18**
8. External regulation								–	.48**
9. Amotivation									–
Range	1–5	1–5	1–5	1–7	1–7	1–7	1–7	1–7	1–7
Mean	3.75	4.33	1.48	5.12	4.88	5.38	4.23	3.55	2.61
Standard deviation	1.04	0.63	0.55	1.43	1.46	1.25	1.47	1.56	1.46
Skewness	−.64	−.85	1.21	−.80	−.47	−.92	−.12	.30	.82
Kurtosis	−.43	.07	.71	.25	−.33	.98	−.56	−.45	.05

Note. * = $p < .05$; ** = $p < .01$.

lower than 50% in some variables. Finally, we decided to work with the six-cluster solution for several reasons. First, this solution showed better results in terms of interpretability and explained variance (i.e. 73% autonomy support, 73% structure, 68% control) in comparison to the five–, seven– or eight–cluster solutions. Second, the examination of a dendrogram and the agglomeration coefficient showed that for the seven– and eight–cluster solutions some of the clusters became very small (e.g. n < 30). Third, WCSS significantly decreased when increasing the number of clusters from five to six. However, the reduction in WCSS became less pronounced when moving from six to seven clusters, indicating an 'elbow' point at k = 6. This suggests that six clusters provide an optimal balance between reducing within-cluster variability and maintaining model simplicity. Fourth, the average silhouette score peaked at six clusters. This peak indicates the highest degree of intra-cluster similarity relative to inter-cluster differences, suggesting that a six-cluster solution maximizes cohesion within clusters while maintaining adequate separation between them. Lastly, the average Cohen's kappa value for the six-cluster solution was very good (K = .81; .90 and .71), indicating good stability of the clusters.

More than four profiles were found (Figure 1, Supplement A, and Table 2). More specifically, cluster 1 (n = 234; 34.80%) was characterized by students who perceived their teacher as high on autonomy support and structure, and low on control, and named 'Outspoken Need-Supportive'. In contrast, cluster 6 (n = 63; 9.40%) was labeled 'Relatively Controlling', as it displayed the opposite pattern. Similarly, cluster 2 and cluster 5 displayed contrasting styles. Cluster 2 (n = 94; 14%) was characterized by students who perceived high levels of all three styles in their PE teacher and named 'High Need-Supportive and Relatively Controlling', while cluster 5 (n = 69; 10.30%) was labeled 'Low Need-Supportive and Low Controlling'. Furthermore, one profile was characterized by 'mainly' one need-supportive style. More specifically, cluster 4 (n = 101, 15%) was characterized by students who perceived their teacher as low on autonomy support and control, and high on structure and labeled 'Relatively Structuring'. Lastly, cluster 3 (n = 112; 16.60%) included students who perceived moderate levels of autonomy support and structure and low levels of control in their PE teacher and was named 'Moderately Need-Supportive'. Most of the items showed ICCs below 0.05, both at class and teacher level, indicating multilevel analyses were not necessary. Age and sex were included as covariates, as Chi-square test and ANOVA showed that the number of

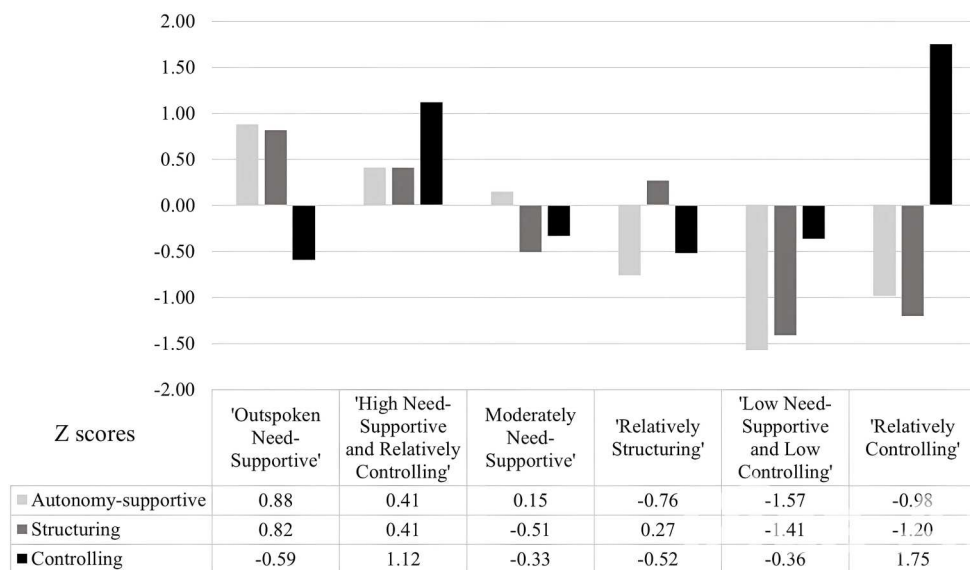| Z scores	'Outspoken Need-Supportive'	'High Need-Supportive and Relatively Controlling'	Moderately Need-Supportive'	'Relatively Structuring'	'Low Need-Supportive and Low Controlling'	'Relatively Controlling'
Autonomy-supportive	0.88	0.41	0.15	-0.76	-1.57	-0.98
Structuring	0.82	0.41	-0.51	0.27	-1.41	-1.20
Controlling	-0.59	1.12	-0.33	-0.52	-0.36	1.75

Figure 1. Six-cluster solution based on standardized scores.

Table 2. Descriptive statistics for the six-cluster solution.

	Cluster 1 'Outspoken Need-Supportive' n = 234 (34.80%) M (SD)	Cluster 2 'High Need-Supportive and Relatively Controlling' n = 94 (14%) M (SD)	Cluster 3 'Moderately Need-Supportive' n = 112 (16.60%) M (SD)	Cluster 4 'Relatively Structuring' n = 101 (15%) M (SD)	Cluster 5 'Low Need-Supportive and Low Controlling' n = 69 (10.30%) M (SD)	Cluster 6 'Relatively Controlling' n = 63 (9.40%) M (SD)	F-Value	p	η^2_p
Autonomy-supportive	4.65 (0.38) *	4.16 (0.58) *	3.88 (0.46) *	2.92 (0.52) [1235]	2.07 (0.62) *	2.69 (0.75) [1235]	385.38	< .01	.75
Structuring	4.87 (0.19) *	4.59 (0.33) [1356]	3.96 (0.31) *	4.49 (0.32) [1356]	3.34 (0.49) [1234]	3.48 (0.40) [1234]	410.07	< .01	.76
Controlling	1.17 (0.22) [2356]	2.17 (0.34) *	1.32 (0.29) [1246]	1.21 (0.24) [236]	1.30 (0.27) [126]	2.53 (.38) *	382.39	< .01	.75
Intrinsic R.	5.50 (1.58) [3456]	5.31 (1.32) [56]	4.91 (1.22) [15]	5.18 (1.34) [15]	4.32 (1.20) [1234]	4.62 (1.14) [12]	16.86	< .01	.11
Integrated R.	5.46 (1.32) *	5.04 (1.29) [15]	4.47 (1.40) [1]	4.66 (1.52) [1]	4.00 (1.44) [12]	4.51 (1.33) [1]	19.10	< .01	.13
Identified R.	5.84 (1.13) [3456]	5.51 (1.01) [1]	5.03 (1.25) [1]	5.38 (1.16) [15]	4.68 (1.42) [124]	4.91 (1.28) [12]	18.16	< .01	.12
Introjected R.	4.51 (1.58) [345]	4.74 (1.22) [345]	3.86 (1.38) [12]	3.84 (1.40) [12]	3.61 (1.43) [126]	4.37 (1.19) [5]	9.89	< .01	.07
External R.	3.40 (1.70) [26]	3.97 (1.26) [14]	3.61 (1.49)	3.19 (1.49) [26]	3.46 (1.53)	4.11 (1.46) [14]	5.30	< .01	.04
Amotivation	2.40 (1.51) [26]	2.90 (1.16) [14]	2.73 (1.53) [6]	2.12 (1.26) [256]	2.78 (1.39) [4]	3.40 (1.51) [134]	9.24	< .01	.07

Note: R. = regulation; 1–6 Each number shows significant difference with the comparison group; * , these values are significantly different from all groups; all analyses were controlled for students' sex and age.

students was not well-distributed across the six clusters in terms of sex ($\chi2$ (10) = 22.7, $p < .01$) and age ($F = 10.34$, $p < .01$).

Aim 2. Differences in students' motivation according to cluster membership

MANCOVA analyses revealed significant differences between clusters (Box's $M = 641.72$, F [225;307,806.01] = 2.74, $p < .01$; Pillai's Trace = .37, F (6, 660.00) = 65.40, $p < .01$, $\eta_p^2 = .37$).

Students who perceived their teacher as 'Outspoken Need-Supportive' displayed the highest values in intrinsic motivation, integrated and identified regulation (Figure 2 and Table 2), while these regulations showed the lowest values for students in the 'Low Need-Supportive and Low Controlling' and the 'Relatively Controlling' clusters. For external regulation and amotivation, the highest values were obtained for students in the 'Relatively Controlling' cluster, followed by the 'High Need-Supportive and Relatively Controlling' cluster, while the lowest values were obtained by students in the 'Relatively Structuring' cluster, followed by the 'Outspoken Need-Supportive' cluster. Altogether students in the 'Outspoken Need-Supportive' cluster displayed the most optimal pattern of outcomes, while the opposite was true for students in the 'Relatively Controlling' cluster.

Furthermore, students in the 'Relatively Structuring' cluster were somewhat in between as they displayed lower values in the most self-determined regulations compared to students in the 'Outspoken Need-Supportive' and the 'High Need-Supportive and Relatively Controlling' clusters, while they displayed higher values compared to the 'Relatively Controlling' cluster. Similarly, these students (i.e. 'Relatively Structuring') showed lower external regulation and amotivation compared to students in the 'Relatively Controlling' cluster. Students from the 'High Need-Supportive and Relatively Controlling' cluster were also somewhat in between as they displayed no differences in external regulation and amotivation compared to students from the 'Relatively Controlling' cluster but did have significantly higher intrinsic motivation and identified regulation. They also had similar levels of intrinsic motivation, integrated, and identified regulation compared to students from the 'Outspoken Need-Supportive' cluster, but displayed significantly higher external regulation and amotivation.

Lastly, regarding introjected regulation, statistically significant differences were found between students in the 'High Need-Supportive and Relatively Controlling' cluster and the 'Moderately Need-Supportive', 'Relatively Structuring', and 'Low Need-Supportive and Low Controlling'
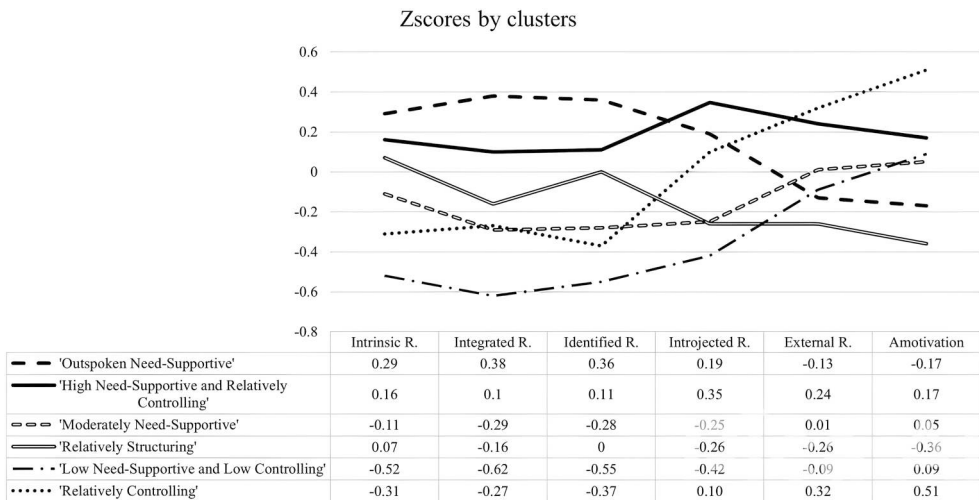

	Intrinsic R.	Integrated R.	Identified R.	Introjected R.	External R.	Amotivation
– – 'Outspoken Need-Supportive'	0.29	0.38	0.36	0.19	-0.13	-0.17
—— 'High Need-Supportive and Relatively Controlling'	0.16	0.1	0.11	0.35	0.24	0.17
⚊⚊⚊ 'Moderately Need-Supportive'	-0.11	-0.29	-0.28	-0.25	0.01	0.05
══ 'Relatively Structuring'	0.07	-0.16	0	-0.26	-0.26	-0.36
— · · 'Low Need-Supportive and Low Controlling'	-0.52	-0.62	-0.55	-0.42	-0.09	0.09
· · · · · 'Relatively Controlling'	-0.31	-0.27	-0.37	0.10	0.32	0.51

Figure 2. Motivational regulation by clusters (all scores are standardized).

clusters. Students in the 'High Need-Supportive and Relatively Controlling' showed the highest values, while students in the 'Low Need-Supportive and Low Controlling' cluster showed the lowest values regarding introjected regulation. Interestingly, no significant differences were found between students in the 'High Need-Supportive and Relatively Controlling' and the 'Outspoken Need-Supportive' and 'Relatively Controlling' clusters.

Discussion

Previous variable-centered SDT-based research has extensively investigated the relation between students' perceptions of PE teachers' autonomy support, structure, and control and their motivation (e.g. Bartholomew et al. 2018; Koka and Hein 2005). However, PE teachers can also be perceived as combining different styles to different degrees, whereby a person-centered approach is warranted (e.g. Burgueño et al. 2024). Despite more profile research emerging, there is a need to conduct profile studies that include more (than two) styles to get a fuller picture regarding possible combinations. Therefore, our study adds to the literature by investigating how students perceive PE teachers' combined use of an autonomy-supportive, structuring, and controlling style (Aim 1) and how students' motivational regulations differ according to their perception (Aim 2).

Concerning the first aim, six different profiles were identified, showing that in the eyes of the students, PE teachers employed various combinations of autonomy support, structure, and control to different degrees (e.g. Leo et al. 2022). Two profiles were characterized by students' perceptions of high need support and low control, and vice versa. This finding confirms that students can perceive their teacher as providing structure (and autonomy support) in a non-controlling manner. However, one could argue that such findings are consistent with the notion that teachers are either perceived as need-supportive or controlling. However, jointly these profiles represented only 44% of the sample, and correlations between students' perception of autonomy support and control (r = −.18), and between students' perceptions of structure and control (r = −.28), albeit being negative, were not strong. Moreover, three other profiles (i.e. 'High Need-Supportive and Relatively Controlling', 'Moderately Need-Supportive', and 'Low Need-Supportive and Low Controlling'), representing another 41% of the sample, displayed convergent levels of all three styles. Together these findings indicate that classifying PE teachers as either perceived as need-supportive or need-thwarting may be inaccurate, and that in the eyes of the students need support and control are not mutually exclusive.

Furthermore, although students' perceptions of autonomy support and structure tended to go hand in hand in most groups (correlations were relatively high, r = .65), 15% of the students perceived their teacher as relatively lower on autonomy support and control, and relatively high on structure, indicating a 'predominant' structuring style. Such a profile characterized by perceptions of low autonomy support and high structure (and high control) was also found in a recent profile study by Leo and colleagues (2022), yet not in Burgueño et al. (2024). Across these three studies, a student perceived profile that was predominantly autonomy-supportive and lowly structuring was not found. These findings suggest that students can see their PE teacher as providing structure without being autonomy-supportive but that students who perceive their PE teacher as autonomy-supportive will probably also perceive their PE teacher as structuring.

In summary, our results identified six distinct clusters, highlighting that students' perceptions of need-supportive and need-thwarting styles can get combined to different degrees. As at least one profile differentiated between various need-supportive styles, nuanced combination of perceived styles may exist.

The bright side of need support and the dark side of control

Regarding the second aim, the results confirmed previous research (e.g. García-González et al. 2023; Haerens et al. 2017) that students who indicated that their teacher predominantly relied on a need-

supportive style displayed the most optimal pattern of motivational outcomes. These students were thus more likely to enjoy (i.e. intrinsic motivation) and value PE (i.e. integrated and identified regulation). Importantly, these autonomous forms of motivation are related to adaptive student outcomes (i.e. Aelterman et al. 2012; Haerens et al. 2010), highlighting the bright side of adopting a need-supportive style.

In comparison, students who rated their teachers as predominately controlling reported more negative motivational experiences in PE. This finding corroborates previous findings on the detrimental effects of a controlling style (Vasconcellos et al. 2020). It is important to note, that even in this profile, in an absolute sense, the degree to which the teacher was perceived as controlling was still less prevalent than the degree to which the teacher was autonomy-supportive and structuring. It has been suggested in prior research that students seem to be more sensitive to a controlling style (De Meyer et al. 2014). Furthermore, when PE teachers were additionally perceived as need-supportive, the detrimental effect of a perceived controlling style could not be fully buffered as a mixed pattern of outcomes was found. Students' motives particularly seemed to be based more strongly on contingencies associated with internal pressures (i.e. introjected regulation) and external pressures (i.e. external regulation), or their motivation seemed to disappear altogether (i.e. amotivation). All of this is related to maladaptive student outcomes (i.e. Bartholomew et al. 2018; Koka et al. 2019), suggesting the dark side of perceived control. Our results thus contradict PE teachers' belief that being perceived as autonomy-supportive and structuring can counteract the negative effect of being perceived as controlling.

The intermediate position of introjected regulation

One unique strength of this study was that we could examine if specific regulations were elevated with certain combinations of styles. In that respect, our results provide further insight into the theorized double-sided nature of introjected regulation (Howard et al. 2021). Students who rated their teachers as high on all three styles showed higher introjected regulation than students who rated their teachers as low on all three styles, which is in line with the findings of a recently conducted profile study (Burgueño et al. 2024). This is because students perceptions of autonomy support and structure as well as controlling teaching were positively related to students' introjected regulation. In that respect, our study confirmed prior research that found positive relations between students' perception of need-supportive (Leo et al. 2023) and need-thwarting styles (Vasconcellos et al. 2020) and introjected regulation. Introjected regulation is regulated by internal feelings of pressure, coercion, or obligation, and can be further distinguished into 'approach' (i.e. maintain or obtain feelings of high self-worth, pride, or social approval) and 'avoidance' (i.e. avoid feelings of low self-worth, shame, or guilt) components (Assor, Vansteenkiste, and Kaplan 2009). It has been argued that students' perception of PE teachers' need-supportive styles is mainly related to the 'approach' components, while students' perception of PE teachers' controlling style would be primarily correlated to the 'avoidance' components. We tested this hypothesis in additional analyses (Supplement B & C). Yet, all three student perceived styles correlated positively to both introjected regulations' 'approach' and 'avoidance' components. Consequently, students who perceived their teacher as 'Outspoken Need-Supportive' reported relatively high levels of introjected regulation, although they displayed the best possible pattern of motivational outcomes when considering all other motivational regulations. These results are intriguing. Introjected regulation, a partially internalized type of motivation that can drive behaviors through internal pressure and conflict, thus displays positive relations with both students' perceptions of need-supportive and need-thwarting styles. In prior research, introjected regulation has been positively related to both adaptive (i.e. effort, engagement, and intention to exercise) and maladaptive outcomes (i.e. negative affect and anxiety) (Howard et al. 2021; Vasconcellos et al. 2020). It thus seems to be a double-edged sword.

Practical implications

Although our results are based on students' perceptions of styles and not actual styles and students of the same teachers appear to differ in their perceptions, our results suggest that it is valuable to train PE teachers to take the students frame of reference as to identify what each students needs and if certain approaches come across as highly controlling. At the same time, it is important to note that there was substantial individual variation in students' perceptions of the same teacher. Although three teachers were primarily perceived as 'Outspoken Need-Supportive', students of each teacher were present in each of the six profiles (Supplement D). Thus, students from the same teacher can differ in their perception. One reason for this finding may be that teachers interact differently with different students within the same class and between classes (Sarrazin et al. 2006) and the quality of these interactions may differ on a day-to-day basis (Van den Berghe et al. 2013). A second explanation may be that students' characteristics color the functional significance of certain behaviors. For instance, students characterized by low actual motor competence may interpret feedback differently when compared to students with high motor competence (De Meester et al. 2020). All of this indicates it is important to identify how different students perceive the PE teacher's style differently, which PE teachers can achieve by engaging in meaningful dialogues with their students and getting to know them as a person. Yet, it also highlights we should be cautious in labeling teachers as either need-supportive or need-thwarting.

Limitations and future research

A first limitation relates to the cross-sectional design which does not allow to establish causal relations between resulting profiles and students' motivation. Future longitudinal studies may extend the current research and obtain more dynamic PE teachers' profiles, while examining situational or contextual factors that may affect PE teachers' need-supportive and need-thwarting style.

Second, this study was conducted with secondary school students in Spain, which may limit the generalizability of the findings. For instance, cultural factors can influence how students perceive autonomy support, structure, and control (Diloy-Peña et al. 2024). Future studies in diverse cultural settings are needed to determine the extent to which these findings are applicable across various contexts.

Third, this study exclusively relied on self-reported data from students and only five teachers were included. Although students' perceptions have stronger predictive power than teachers' perceptions and external observers in determining students' motivation (De Meyer et al. 2014; Haerens et al. 2013), this sole reliance on students' perceptions introduces potential biases. For instance, students' responses may be colored by their personal characteristics, which could have impacted the accuracy of the data, and consequently the study's findings. Furthermore, as both the style of the PE teacher as well as students' motivation was reported by the students, associations between these variables might be inflated (i.e. common method variance). To mitigate these limitations, future studies could incorporate a combination of data sources to triangulate the data. For instance, the inclusion of observational measures, as employed in previous studies (Fierro-Suero et al. 2020; Van Doren et al. 2023), might be fruitful. Furthermore, including a larger sample of teachers in future studies will allow for a more detailed approach to the clustering and nested nature of the data, which has been a limitation of the present work.

Fourth, it is important to note that to draw clear conclusions about the contribution of one need-supportive or need-thwarting style to student motivation, profiles should not differ significantly from each other in some styles. Unfortunately, this was rarely the case in our study.

Lastly, we chose to focus on PE teachers' autonomy-supportive and structuring styles (most motivating cocktail) in combination with a controlling style (most prevalent) to lay the groundwork before including other styles. Future research may include four or more need-supportive and need-thwarting styles to examine whether more (diverse) profiles emerge.

Conclusion

Six different profiles were identified, thereby stressing the importance of investigating multiple need-supportive and need-thwarting styles at the same time. When comparing the different profiles in terms of student motivation, students who perceived their teacher as highly autonomy-supportive and structuring and lowly controlling, had the most optimal pattern of motivational outcomes. In contrast, when students perceived their PE teacher as highly controlling, students showed higher external regulation and amotivation, even when students simultaneously perceived their teacher as need-supportive. Interestingly, both students' perceptions of need-supportive and controlling styles were positively related to students' introjected regulation.

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