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ABSTRACT

Background: Consistent with self-determination theory (SDT), teachers may differ in the motivating style used to motivate students in physical education (PE). When relying on need-supportive behaviors, teachers attempt to provide students with opportunities for choices and initiative (autonomy support), valuable information and feedback (competence support), and an emotional and affective environment (relatedness support). Alternatively, teachers relying on need-thwarting behaviors tend to adopt a controlling language (autonomy thwarting), unclear goals toward the task (competence thwarting), and cold links with students (relatedness thwarting). While competence, autonomy, and relatedness supportive and thwarting behaviors are theoretically distinct in the instructional practice, every teaching behavior may co-occur to different degrees. Grounded in SDT, the only existing person-centered study in PE showed that PE teachers' autonomy-supportive and controlling teaching behaviors can be combined through the students' eyes, being associated with different motivational outcomes.

Purpose: Adopting a person-centered approach, this research aimed to extend previous knowledge by examining how different combinations of students' perceptions of autonomy, competence, and relatedness supportive and thwarting teaching behaviors are associated with students' need satisfaction, need frustration, and motivation in PE.

Method: A sample of 478 middle school students (53.97% girls) participated in the study. First, a two-step cluster analysis using autonomy, competence, and relatedness supportive and thwarting behaviors was run to identify different motivating teaching profiles. Subsequently, a multivariate analysis of covariance was conducted to examine differences between the retained clusters and students' need-based experiences and motivational regulations.

Results: Two of these profiles were characterized by the dominant presence either of need-supportive (i.e. 'high need-support – low need-thwarting') or need-thwarting behaviors (i.e. 'low need-support – high need-thwarting'), while they were found to be similarly present in the two remaining profiles (i.e. 'moderate need-support – need-thwarting', and 'moderate need-support – high need-thwarting'). The 'high need-support – low need-thwarting' profile obtained the highest scores on need satisfaction and autonomous forms of motivation, accompanied

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by the lowest levels of need frustration and amotivation. The 'moderate need-support – need-thwarting' profile reflected low scores on need frustration, introjected and external regulation, and amotivation. The 'moderate need-support – need-thwarting' and the 'low need-support – high need-thwarting' profiles showed the highest scores on need frustration, introjected and external regulation, and amotivation.

Conclusions: This research underscores that teachers may combine need-supportive and need-thwarting behaviors in their instructional practice. Results revealed that the 'high need-support – low need-thwarting' profile showed the most optimal outcomes, while the 'low need-support – high need thwarting' profile yielded the least optimal outcomes. Given that the 'high need-support – low need-thwarting' profile showed a more optimal pattern of outcomes than the 'moderate need-support – high need-thwarting' profile and the 'moderate need-support – need-thwarting', results suggest that students' perception of need-thwarting teaching behaviors is detrimental even when the instructor is additionally perceived to be need-supportive. PE teachers are recommended not only to develop a motivating teaching style characterized by high levels of need-supportive behaviors, but also to avoid need-thwarting behaviors in their instructional practice, in order to enhance students' motivational experiences.

Introduction

Teachers play a fundamental role in motivating students in physical education (PE) (Vasconcellos et al. 2020). Consistent with self-determination theory (SDT) (Ryan and Deci 2017), students reported more positive motivational experiences in PE when the teacher provides autonomy, competence, and relatedness support (i.e. need-supportive behaviors). Nevertheless, these experiences can also be hindered whether the PE teacher uses autonomy, competence, and relatedness-thwarting behaviors (i.e. need-thwarting behaviors). The few existing studies in PE have examined the relationship of need-supportive and/or need-thwarting teaching behaviors with different students' motivational outcomes, using a variable-centered approach (e.g. structural equation modeling, regression and/or correlational analyses, etc.) (Vasconcellos et al. 2020). However, a growing body of research has suggested that PE teachers rely on a wide range of teaching behaviors in their daily instructional practice. The only existing person-centered study in PE only examined the combination of students' perceptions of autonomy-supportive and controlling teaching behaviors and their association with different motivational outcomes (Haerens et al. 2018). Therefore, further studies should investigate the extent to which perceived autonomy, competence, and relatedness supportive and thwarting teaching behaviors can be combined and which motivating teaching profile yields the most and least optimal pattern of outcomes among students. Given the recent empirical distinction between the six specific types of teaching behaviors (Rocchi et al. 2017), the present research aims to extend previous knowledge by examining how students' perceptions of autonomy, competence, and relatedness need-supportive and need-thwarting behaviors may be combined in PE teachers and which motivating style yields the most and least optimal pattern of outcomes in terms of basic psychological needs (BPN) and motivation among students in PE.

Need-supportive teaching behaviors in PE

SDT is one of the most commonly used motivational theories for the study of the influence of social agents (e.g. teacher's behaviors) on students' motivation in PE (Vasconcellos et al. 2020). SDT postulates that the satisfaction of the BPN for autonomy (i.e. feelings of ownership of one' behaviors), competence (i.e. feelings of efficacy in interactions with the one' environment), and relatedness (i.e.

feelings of strong connections with significant others) is required to energize internalization and wellbeing (Vansteenkiste, Ryan, and Soenens 2020). Given the positive outcomes associated with students' BPN satisfaction in PE, great attention has been paid to need-supportive behaviors among PE teachers (Vasconcellos et al. 2020; White et al. 2021).

Autonomy-supportive behaviors include providing students with opportunities for choice, dialogue, and construction (e.g. material, tasks, assessment criteria, etc.), identifying their interests and preferences, recognizing their opinions, providing meaningful rationale for in-class activities and behind them or encouraging self-initiated behaviors (Reeve et al. 2022; Rocchi et al. 2017). Competence-supportive behaviors (also called structure) include strategies such as providing students with constructive, clear, and self-oriented feedback and helpful strategies to guide them, clarifying expectations (e.g. learning objectives, assessment methods, and criteria, etc.), or creating a well-structured learning environment with different levels of difficulty and enough time for task completion (Aelterman et al. 2019; Reeve et al. 2022; Rocchi et al. 2017). Relatedness-supportive behaviors include strategies such as providing students with emotional support and care, using empathic listening, acknowledge and respect different perspectives and feelings, demonstrating interest in students, encouraging the cooperation or showing an affective bond with them (Reeve et al. 2022; Rocchi et al. 2017).

Previous studies in PE have showed that teachers' need-supportive teaching behaviors were primarily associated with adaptive consequences by satisfying BPN among students (Vasconcellos et al. 2020). Specifically, BPN satisfaction inherently fosters both the optimal behavioral internalization reflected in integrated regulation (i.e. behavior is congruent with their personal goals, needs, and values), and identified regulation (i.e. benefits associated with this behavior), and intrinsic motivation (i.e. adopting a behavior for its own sake, interest, and enjoyment), in PE (Vasconcellos et al. 2020; White et al. 2021). Therefore, if students can choose, perceive progress in their learning and feel connected to their peers, it is more likely that their source of motivation will be more internal. Likewise, autonomous motivation (i.e. intrinsic, integrated, and identified regulations) lead to adaptive affective, cognitive, and behavioral outcomes (Vasconcellos et al. 2020; White et al. 2021).

Need-thwarting teaching behaviors in PE

PE teachers' need-thwarting and need-supportive behaviors have long been conceived as conceptually opposite dimensions (Reeve 2009). However, as the absence of need-supportive behaviors does not automatically imply the presence of need-thwarting behaviors and vice-versa, both dimensions may co-occur to different degrees, thereby constituting distinct motivating teaching styles (Vansteenkiste, Ryan, and Soenens 2020).

Previous literature in PE has traditionally conceptualized need-thwarting behaviors as controlling practices used by teachers to pressure students to think, feel, or behave in a prescribed manner (Reeve 2009). Rocchi et al. (2017) more recently provided a more fine-grained picture of teachers' need-thwarting behaviors. Autonomy-thwarting behaviors refer to using coercive and intimidating language, making demands without rationales, and adopting strategies that induce feelings of shame and guilt (Rocchi et al. 2017). Competence-thwarting behaviors refer to discouraging students from attempting difficult and challenging activities, making them doubt their skills and emphasizing their faults. Relatedness-thwarting behaviors refer to being distant with students, not listening to them, and excluding them from activities. De Meyer et al. (2014) have referred to these need-thwarting behaviors as controlling, chaotic, and cold practices, respectively.

An emerging body of studies in PE has found that all three types of need-thwarting behaviors were positively related to students' maladaptive outcomes through experiences of autonomy frustration (i.e. perceived coercion and obligation), competence frustration (i.e. perceived inefficacy and failure), and relatedness frustration (i.e. perceived rejection, exclusion, and loneliness) (Leo et al. 2020). Students' BPN frustration, in turn, has been positively related to introjected regulation

(i.e. student is guided by internal pressure either to enhance one's self-worth or to avoid shame and guilt), external regulation (i.e. student undertakes a behavior to obtain rewards or to avoid punishments), amotivation (i.e. the complete lack of self-determination towards the target behavior) (Vasconcellos et al. 2020). Accordingly, controlled motivation (i.e. introjected and external regulation) or amotivation drives to maladaptive affective, cognitive, and behavioral consequences (Vasconcellos et al. 2020).

Motivating teaching profiles in PE

Although most studies indicated that need-supportive behaviors are more common among PE teachers, need-thwarting behaviors are also often among some teachers (De Meyer et al. 2016; De Meyer et al. 2014). For instance, teachers who pressure students to strictly meet their requests and demands (i.e. autonomy-thwarting behaviors) may also provide them with valuable instructions and feedback for the task (competence-supportive behaviors). Thus, it might be inaccurate to classify teachers as either need-supportive or need-thwarting in their instructional practice. Indeed, previous observational studies have found that students may be quite sensitive to need-thwarting teaching behaviors (De Meyer et al. 2014). However, most previous SDT-based studies have examined the relationship between need-supportive and/or need-thwarting behaviors and students' motivational outcomes in PE, using variable-centered approaches (Vasconcellos et al. 2020). These variable-centered approaches rely on the premise that the associations between variables are similar across the population studied (Bergman and Andersson 2010). Conversely, person-centered approaches are based on the assumption that the relationships between variables are not necessarily the same for everyone in the population (Bergman and Andersson 2010). This approach makes it possible to classify profiles or groups of students who perceive similar characteristics (e.g. need-supportive and need-thwarting teaching behaviors).

From a theoretical viewpoint, a person-centered approach would, therefore, contribute to shed light on the question of whether need-supportive and need-thwarting behaviors would represent opposite ends of the same need-nurturing continuum or might instead be conceptualized as distinguishable but correlated dimensions. Additionally, the identification of distinct profiles characterized by different combinations of autonomy-, competence, and relatedness-supportive behaviors contributes to providing a better understanding of how the presence of perceived need-thwarting behaviors may be associated with maladaptive consequences. Finally, from an applied perspective, gaining insight into students' perceptions of motivational teaching profiles can be used to individualize intervention for each particular group of teachers.

Although person-centered approaches have been relatively used in SDT-based research for the study of motivation in PE, to the best of our knowledge, the only existing SDT-based study in PE examined, at the situational level (i.e. after a specific lesson), whether PE teachers' autonomy-supportive and controlling teaching behaviors (also called autonomy-thwarting behaviors) can be combined and their association with different students' motivational outcomes (Haerens et al. 2018). Four motivating teachers' profiles were identified in this mentioned study. Two of these profiles were characterized by the dominant presence of either autonomy-supportive (i.e. 'high-autonomy support') or control (i.e. 'high controlling behaviors'). In contrast, autonomy and controlling behaviors were found to be equally present in the two remaining profiles (i.e. 'high autonomy – high control' or 'low autonomy – low control'). Results revealed that the high-autonomy support profile reported the most optimal pattern of outcomes (e.g. need satisfaction and autonomous motivation), while the high-control profile reported the least optimal pattern of outcomes. The results further showed that the use of controlling practices was detrimental to students' motivational outcomes, even when the teachers were additionally perceived to be autonomy-supportive. Therefore, further studies at the contextual level (i.e. refer to PE classes) that examine how

autonomy, competence, and relatedness supportive and thwarting behaviors combine in PE teachers and their consequences on students' motivational outcomes are required.

The current research

The question of how need-supportive and need-thwarting teaching behaviors can be simultaneously adopted by PE teachers, has not received previous attention. Given that some teachers frequently use need-thwarting behaviors in PE lessons and students felt very sensitive to this type of teaching behaviors (De Meyer et al. 2016; De Meyer et al. 2014), the first aim was to examine if different configurations of PE teachers' need-supportive and need-thwarting behaviors would differentially be associated with students' motivational outcomes. Through a person-centered approach based on students' perceptions, the first aim of the study was to identify a set of naturally occurring groups of PE teachers' motivating profiles, characterized by different levels of autonomy, competence, and relatedness -supportive and -thwarting behaviors. According to a previous study in PE (Haerens et al. 2018), at least two opposite PE teachers' motivating profiles were expected to be found (i.e. 'high need-support – low need-thwarting' and 'low need-support – high need-thwarting'). In line with this previously mentioned study in PE (Haerens et al. 2018), two other profiles of PE teachers that combined students' perception of both dimensions as either relative high (i.e. 'high need-support – high need-thwarting') or low (i.e. 'low need-support – low need-thwarting') were also expected to be found.

The second aim was to examine the extent to which the retained motivating teaching profiles differed from each other in terms of students' need-based experiences and self-determined motivation. Consistent with prior SDT-based research in PE (Haerens et al. 2018), the motivating teaching profiles characterized by a predominant presence of the three need-supportive practices were expected to yield the most adaptive outcomes among students (i.e. greater BPN satisfaction and autonomous forms of motivation), while profiles characterized by a predominant presence of the three need-thwarting behaviors were expected to yield the most maladaptive outcomes (i.e. greater BPN frustration, controlled forms of motivation, and amotivation). Finally, grounded in SDT (Ryan and Deci 2017) and a previous study in PE (Haerens et al. 2018), the profile characterized exclusively by the three need-supportive behaviors was expected to yield a more optimal pattern of outcomes than the other potential profiles characterized by a high or moderate presence of both the three need-supportive and need-thwarting behaviors.

Method

Participants and setting

After removing invalid data (97% valid responses), the final sample included 478 middle school students (53.97% girls and 2.30% ethnic minority members), aged between 13 and 17 years ($M = 14.56$, $SD = 1.06$), who received two 60-min compulsory and coeducational PE lessons per week. The students were enrolled in four different public schools in a medium-sized city in southern Spain.

Students' responses regarding need-supportive and need-thwarting behaviors were based on eight different PE teachers (50% women and $M_{experience} = 15.25$, SD = 3.06) who each were directly supervising approximately 60 students (2 classes of 30 students). Generally, PE teachers have between six and eight teaching units of 8–12 sessions in their annual programs. These teaching units correspond to different types of content (i.e. individual, cooperative, and interactive sports and games, as well as body expression, health-related fitness, and outdoor activities), which are collected in the PE curriculum. Although the PE curriculum promotes the increased use both of productive teaching styles and a more student-centered approach, Spanish PE teachers most frequently used reproductive styles followed by the guided discovery style, divergent discovery style, and reciprocal style (Espada-Mateos and Pineño 2020).

Instruments

Need-supportive and need-thwarting behaviors from PE teachers

Students' perceptions of autonomy, competence, and relatedness supportive and thwarting teaching behaviors were assessed by the Interpersonal Behaviors Questionnaire adapted to the Spanish PE context (Burgueño and Medina-Casaubón 2021). The scale begins with the stem 'My PE teacher … ' followed by 24 items (four items per factor) that measure autonomy, competence, relatedness supportive and thwarting behaviors. In this study, confirmatory factor analysis (CFA) showed an adequate fit: $\chi^2(237) = 553.25$, $p < .001$, $\chi^2/df = 2.33$; CFI = .92; TLI = .91; SRMR = .048; RMSEA = .053(90%CI = .047–.059).

BPN satisfaction in PE

Students' perceptions of autonomy, competence, and relatedness satisfaction were measured through the BPN in PE Scale adapted to the Spanish PE context (Menéndez-Santurio and Fernández-Río 2018). The scale is preceded by the stem 'In my PE classes … ' and includes 12 items (four items per factor) that assess the satisfaction of each need. In this study, CFA revealed a good fit: $\chi^2(51) = 99.52$, $p < .001$, $\chi^2/df = 1.95$; CFI = .97; TLI = .96; SRMR = .042; RMSEA = .045(90%CI = .031–.058).

BPN frustration in PE

Students' perceptions of autonomy, competence, and relatedness frustration were assessed by Psychological Need Thwarting Scale adapted to the Spanish PE context (Burgueño et al. 2019) The scale begins with the stem 'In my PE classes … ' and consists of 11 items that assess the frustration of the need for autonomy (four items), competence (four items), and relatedness (three items). In this study, CFA displayed satisfactory goodness-of-fit measures: $\chi^2(41) = 149.87$, $p < .001$, $\chi^2/df = 3.66$; CFI = .96; TLI = .94; SRMR = .040; RMSEA = .075(90%CI = .062–.088).

Motivation in PE

Students' perceptions of different behavioral regulations were assessed by the Perceived Locus of Causality Scale adapted to the Spanish PE context (Ferriz, González-Cutre, and Sicilia 2015). The instrument is preceded by the stem 'I participate in PE … ' and followed by 24 items (four items per factor) that measure intrinsic motivation, integrated, identified introjected, and external regulation, and amotivation. In this study, CFA found acceptable fit indexes: $\chi^2(234) = 754.62$, $p < .001$, $\chi^2/df = 3.23$; CFI = .91; TLI = .90; SRMR = .057; RMSEA = .068 (90%CI = .063–.074).

All instruments were measured using a 7-point Likert scale, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), except the BPN in PE Scale which ranged from 1 (*I do not agree at all*) to 5 (*I completely agree*).

Procedure

The present study has the approval of the Human Research Ethics Committee of the University of Almeria (Ref: UALBIO2020/029), the authorization by the management team of each participating school, and the informed consent from the students' parents/legal guardians. Data collection was conducted using a paper-and-pencil questionnaire in a quiet classroom, in the absence of PE teachers, in an average time of approximately 20 min. Since there was a new PE teacher in each class group, the questionnaire was administrated between May and June 2019, to give students time to perceive nee-supportive and/or need-thwarting teaching behaviors for at least one academic year. Before completing the questionnaire, the research team explained to the students that their participation was anonymous and voluntary.

Data analysis

Preliminary data analyses

The standardized scores for autonomy, competence, and relatedness supportive and thwarting teaching behaviors were calculated to detect potential univariate and multivariate outliers. The normality assumption was analyzed using the standardized skewness and kurtosis coefficients, suggesting that absolute values below 1.96 indicate a normal distribution (Field 2017). Multicollinearity was examined through Pearson's correlation analysis, indicating that values as high as .80 would underpin the lack of multicollinearity among variables (Hair et al. 2018). Descriptive statistics were calculated for the study variables.

Aim 1. Identification of need-supportive and need-thwarting teaching profiles

A two-step cluster analysis approach (Hair et al. 2018) was performed to identify need-supportive and need-thwarting teaching behaviors profiles. Previous to this analysis, every clustering variable was transformed into *z*-scores. Hodge and Petlichkoff (2000) propose that *z*-scores below −.50 are considered low, *z*-scores between −.50 and .50 moderate, and *z*-scores above .50 high. The first step consisted of hierarchical cluster analysis, using Ward's method based on squared Euclidean distances (Hair et al. 2018). To identify the number of profiles, a univariate analysis of variance was conducted to examine the explanatory power of the cluster solution for each clustering variable. Hair et al. (2018) recommend an explained variance greater than 50% for each clustering variable as a minimally suitable cut-off point. The second step included a non-hierarchical cluster analysis (*k*-means) using the initial cluster centers that emerged from the hierarchical cluster analysis as non-random starting points. Differences between profiles for each clustering variable were analyzed by an analysis of variance. Next, double-split cross-validation was applied to analyze the stability of the cluster solution. The sample was randomly split into halves, and the full procedure (i.e. hierarchical and non-hierarchical analysis) was rerun for each subsample. The two new cluster solutions were averaged and Cohen's kappa coefficient (κ) was estimated to assess the level of agreement between both solutions and the original cluster solution. This coefficient is suitable with values above .60 (Hair et al. 2018). Finally, Chi-square tests were calculated as a function of sex and age to explore the need to include them as covariates in subsequent analyses.

Aim 2: differences in students' motivational experiences in PE according to cluster membership.

To examine differences in students' need-based experiences and self-determined motivation in retained profiles, a multivariate analysis of covariance was performed. Pillai's Trace was used as a test statistic, given the violation of homogeneity of covariance assumption (Box's $M = 378.35$, F [234, 298,513.63] = 1.54, $p < .001$). *Post-hoc* multiple comparisons with Bonferroni adjustment for those variables in which there was a statistically significant difference. Effect sizes were considered small (<0.01), moderate (<0.06), or large (<0.14) (Field 2017). IBM® SPSS® (version 25.00) was utilized to perform all the analyses described.

Results

Preliminary results

There were 10 cases identified as univariate outliers (i.e. *z*-scores >|3|), while seven were multivariate outliers (i.e. Mahalanobis distance [D^2] at $p < .001$). All these cases were removed. Table 1 displays the standardized skewness and kurtosis coefficients, descriptive statistics and reliability coefficients for the study variables.

Positive correlations were found between the three need-supportive behaviors and satisfaction of each BPN and autonomous forms of motivation, while there were negative correlations between each need-supportive behavior and frustration of each BPN, controlled forms of motivation, and

Table 1. Descriptive statistics and correlations among variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. ASB		.72***	.71***	−.35***	−.25***	−.41***	.50***	.18***	.15***	−.24***	−.15***	−.05***	.30***	.21***	.23***	.13**	−.11*	−.09
2. CSB			.73***	−.29***	−.28***	−.47***	.19***	.45***	.16***	−.13***	−.23**	−.07	.35***	.24***	.31***	.08	−.11*	−.19***
3. RSB				−.21***	−.20***	−.50***	.12**	.17***	.47***	−.09*	−.19***	−.24***	.26***	.23***	.23***	.11*	−.10*	−.11*
4. ATB					.54***	.41***	−.18***	.03	−.05	.35***	.22***	.18***	−.17***	−.03	−.10*	.10*	.26***	.19***
5. CTB						.48***	−.01	−.10*	−.08	.25***	.38***	.23***	−.17***	−.07	−.12**	.11*	.20***	.29***
6. RTB							−.07	−.03	−−.24***	.28***	.20***	.34***	−.23***	−.14**	−.24***	.02	.21***	.28***
7. ANS								.37***	.29***	−.30***	−.26***	−.13**	.49***	.43***	.40***	.20***	−.21***	−.15***
8. CNS									.30***	−.18***	−.27***	−.13**	.37***	.45***	.37***	.18***	−.06	−.17***
9. RNS										−.34***	−.34***	−.46***	.34***	.31***	.29***	.03	−.13**	−.19***
10. ANF											.72***	−.68***	−.31***	−.23***	−.30***	.11*	.32***	.37***
11. CNF												.69***	−.27***	−.30***	−.26***	.08	.27***	.33***
12. RNF													−.26***	−.21***	−.26***	.14***	.23***	.33***
13. IM														.73***	.76***	.26***	−.22***	−.33***
14. IntR															.75***	.35***	−.16***	−.27***
15. IdR																.36***	−.12**	−.42***
16. IntrR																	.40***	.11*
17. ER																		.45***
18. Amot																		
M	5.62	4.82	4.76	2.28	3.30	2.43	3.05	3.18	3.81	2.46	2.66	2.28	5.19	4.94	5.43	3.64	3.30	2.28
SD	1.12	1.25	1.36	1.09	1.29	1.28	0.90	0.98	0.81	1.30	1.54	1.33	1.35	1.58	1.32	1.45	1.46	1.40
γ_1	−0.86	−0.41	−0.49	0.84	0.15	0.82	0.01	0.71	−0.65	0.75	0.85	1.03	−0.53	−0.51	−0.85	−0.09	0.24	1.01
γ_2	0.44	−0.34	−0.17	0.46	−0.57	0.27	−0.56	0.66	0.43	−0.23	−0.11	0.21	−0.35	−0.59	0.36	−0.55	−0.60	0.09
α (Cronbach)	.76	.77	.81	.85	.75	.74	.73	.72	.71	.74	.84	.84	.77	.87	.79	.70	.71	.74

Note: ASB = Autonomy-supportive behaviors; CSB = Competence-supportive behaviors; RSB = Relatedness-supportive behaviors; ATB = Autonomy-thwarting behaviors; CTB = Competence-thwarting behaviors; RTB = Relatedness-thwarting behaviors; ANS = Autonomy need satisfaction; CNS = Competence need satisfaction; RNS = Relatedness need satisfaction; ANF = Autonomy need frustration; CNF = Competence need frustration; RNF = Relatedness need frustration; IM = Intrinsic motivation; IntR = Integrated regulation; IdR = Identified regulation; IntrR = Introjected regulation; ER = External regulation; Amot = Amotivation.
*** $p < .001$, ** $p < .01$; * $p < .05$.

amotivation. Alternatively, each need-thwarting behavior was positively correlated with frustration of each BPN, introjected and external regulation, and amotivation, and negatively with autonomy, competence, and relatedness satisfaction, and autonomous forms of motivation.

Aim 1. Identification of need-supportive and need-thwarting teaching profiles

To identify the possible number of clusters, the dendrogram and the agglomeration coefficient that emerged from the hierarchical cluster analysis were examined, respectively, showing that the percentage changes in the movements between five, four, and three were 13.05%, 15.01%, and 31.66%. These coefficients increased substantially when the solution moved from four clusters to three clusters, suggesting that the four-cluster solution should be selected. The four-cluster solution also explained a level of variance higher than 50% for each clustering variable. The average Cohen's kappa value for the four-cluster solution was $\kappa = .84$, suggesting an adequate level of agreement. The graphical results for the four-cluster solution are represented in Table 2 and Figure 1. Cluster 1 ($n = 167$, 34.94%), named 'high need-support – low need-thwarting' profile, was characterized by the highest z-scores on need-supportive behaviors, along with the lowest scores on need-thwarting behaviors. Cluster 2 ($n = 138$, 28.87%), termed 'moderate need-support – need-thwarting' profile, was characterized by moderate z-scores (i.e. between −.50 and .50) in need-supportive and need-thwarting. Cluster 3 ($n = 84$, 17.57%), denominated as 'moderate need-support – high need-thwarting' profile, was characterized by moderate z-scores (i.e. between −.50 and .50) in need-supportive behaviors, and high z-scores (i.e. > .50) in need-thwarting behaviors. Cluster 4 ($n = 89$, 18.62%), labeled 'low need-support – high need-thwarting' profile, was characterized by the lowest z-scores in need-supportive behaviors together with high z-scores (i.e. > .50) in need-thwarting behaviors.

Male and female students were almost equally distributed across the four retained profiles. Chi-square test revealed a non-significant cluster assignment by gender (χ^2 [3, $N = 578$] = 8.39, $p = .060$). However, the chi-square test showed that the number of younger and older students was not well-distributed across the four profiles (χ^2 [3, $N = 578$] = 32.81, $p < .001$). Thus, age was introduced as a covariate in the following analyses.

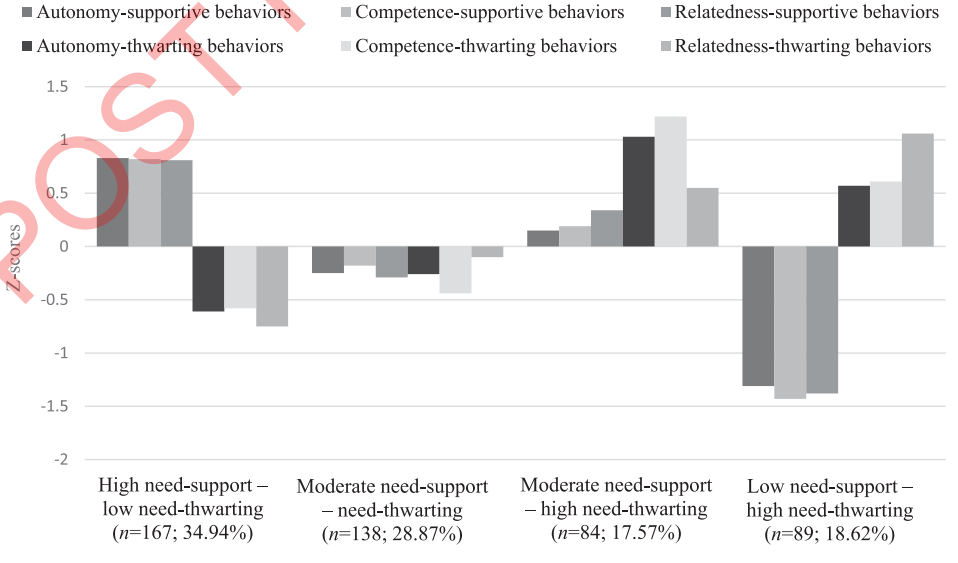

Figure 1. Four-cluster solution based on *Z*-scores of students' perception of autonomy, competence and relatedness supportive and thwarting behaviors.

Table 2. Differences in students' motivational experiences in PE according to cluster membership.

	Profile 1 ($n = 167$) High need-support –low need-thwarting	Profile 2 ($n = 138$) Moderate need-support – need-thwarting	Profile 3 ($n = 84$) Moderate need-support – high need-thwarting	Profile 4 ($n = 89$) Low need-support – high need-thwarting	F	P	η_p^2	R^2
Autonomy-supportive behaviors								
Z-scores	0.83(0.56)^{2,3,4}	−0.25(0.72)^{1,3,4}	0.15(0.66)^{1,2,4}	−1.31(0.68)^{1,2,3}	218.73	<.001	.58	.64
Raw scores (1-7)	5.86(0.70)^{2,3,4}	4.50(0.90)^{1,3,4}	5.01(0.83)^{1,2,4}	3.18(1.25)^{1,2,3}				
Competence-supportive behaviors								
Z-scores	0.82(0.43)^{2,3,4}	−0.18(0.70)^{1,3,4}	0.19(0.56)^{1,2,4}	−1.43(0.76)^{1,2,3}	275.23	<.001	.64	.58
Raw scores (1-7)	6.54(0.48)^{2,3,4}	5.41(0.78)^{1,3,4}	5.83(0.62)^{1,2,4}	4.01(0.85)^{1,2,3}				
Relatedness-supportive behaviors								
Z-scores	0.81(0.57)^{2,3,4}	−0.29(0.62)^{1,3,4}	0.34(0.56)^{1,2,4}	−1.38(0.70)^{1,2,3}	267.32	<.001	.63	.63
Raw scores (1-7)	5.86(0.78)^{2,3,4}	4.36(0.84)^{1,3,4}	5.22(0.77)^{1,2,4}	2.88(0.96)^{1,2,3}				
Autonomy-thwarting behaviors								
Z-scores	−0.61(0.82)^{2,3,4}	−0.26(0.75)^{1,3,4}	1.03(0.65)^{1,2,4}	0.57(0.83)^{1,2,3}	106.78	<.001	.40	.51
Raw scores (1-7)	2.51(1.05)^{2,3,4}	2.98(0.97)^{1,3,4}	4.64(0.84)^{1,2,4}	4.04(1.07)^{1,2,3}				
Competence-thwarting behaviors								
Z-scores	−0.58(0.65)^{2,3,4}	−0.44(0.58)^{1,3,4}	1.22(0.86)^{1,2,4}	0.61(0.81)^{1,2,3}	159.86	<.001	.50	.60
Raw scores (1-7)	1.65(0.71)^{2,3,4}	1.80(0.64)^{1,3,4}	3.60(0.94)^{1,2,4}	2.95(0.88)^{1,2,3}				
Relatedness-thwarting behaviors								
Z-scores	−0.75(0.51)^{2,3,4}	−0.10(0.75)^{1,3,4}	0.55(0.91)^{1,2,4}	1.06(0.88)^{1,2,3}	135.52	<.001	.46	.54
Raw scores (1-7)	1.47(0.66)^{2,3,4}	2.29(0.96)^{1,3,4}	3.12(1.16)^{1,2,4}	3.77(1.12)^{1,2,3}				
Need satisfaction								
Autonomy	3.55(0.79)^{2,3,4}	2.79(0.78)^{1,3,4}	3.18(0.74)^{1,2,4}	2.39(0.82)^{1,2,3}	49.19	<.001	.24	
Competence	3.41(0.92)^{2,4}	2.96(0.93)^{1}	3.31(0.74)	2.98(1.25)^{1}	7.37	<.001	.05	
Relatedness	3.99(0.91)	3.71(0.80)	3.80(0.63)	3.67(0.75)	4.54	.004	.03	
Need frustration								
Autonomy	1.92(1.15)^{2,3,4}	2.38(1.20)^{1,3,4}	3.03(1.36)^{1,2}	3.07(1.23)^{1,2}	24.57	<.001	.14	
Competence	2.16(1.44)^{2,3,4}	2.70(1.52)^{1}	3.13(1.63)^{1}	3.10(1.40)	11.68	<.001	.07	
Relatedness	2.05(1.38)^{3,4}	2.13(1.16)^{3,4}	2.64(1.43)^{1,2}	2.60(1.24)^{1,2}	6.73	<.001	.04	
Motivation								
Intrinsic motivation	5.74(1.28)^{2,3,4}	5.06(1.18)^{1,4}	5.12(1.27)^{1,4}	4.42(1.39)^{1,2,3}	21.81	<.001	.12	
Integrated regulation	5.42(1.59)^{1,2,4}	4.66(1.43)^{1,3,4}	5.09(1.50)^{1,2,4}	4.36(1.63)^{1,2,3}	11.43	<.001	.07	
Identified regulation	5.86(1.22)$^{1,2.,4}$	5.35(1.16)^{1,4}	5.49(1.21)^{1,4}	4.70(1.51)^{1,2,3}	16.73	<.001	.10	
Introjected regulation	3.73(1.52)	3.36(1.24)^{3}	4.11(1.56)^{2,4}	3.45(1.40)^{3}	5.58	.001	.03	
External regulation	2.94(1.53)^{3,4}	3.13(1.38)^{3,4}	3.85(1.35)^{1,2}	3.76(1.33)^{1,2}	11.42	<.001	.07	
Amotivation	1.83(1.15)^{2,3,4}	2.21(1.29)^{1,3,4}	2.87(1.59)^{1,2}	2.69(1.49)^{1,2}	14.58	<.001	.08	

Note: Standard errors are reported in parenthesis; Numbers in superscript refer to significantly different groups ($p \leq .001$).

Aim 2. Differences in students' motivational experience according to cluster membership

The multivariate effect of cluster membership on students' motivational experiences was significant with a high effect size (Pillai's Trace = .43, F[36, 1395.00] = 6.45, $p < .001$, $\eta_p^2 = .15$). Although age

was introduced as a covariate, there were no significant multivariate effects across it (Pillai's Trace = .03, F[12, 461.00] = 1.33, p = .198, η_p^2 = .03).

Regarding students' BPN satisfaction, the 'high need-support – low need-thwarting' and the 'low need-support – high need-thwarting' profiles showed the highest and the lowest values in autonomy satisfaction, respectively. In addition, the 'moderate need-support – high need-thwarting' profile showed higher autonomy satisfaction than the 'moderate need-support – need-thwarting' profile. However, as seen in Table 2, these differences were much less clear for competence satisfaction and non-significant for relatedness satisfaction. Regarding students' BPN frustration, the 'high need-support – low need-thwarting' profile showed the lowest values of autonomy, competence, and relatedness frustration, although the latter profile did not differ significantly from the 'moderate need-support – need-thwarting' profile. Further, the profiles with a greater presence of need-thwarting behaviors (i.e. the 'moderate need-support – high need-thwarting' and the 'low need-support – high need-thwarting' profiles), showed higher values of autonomy, competence, and relatedness frustration when compared to the profiles with a low (i.e. the 'high need-support – low need-thwarting' profile) and moderate presence (i.e. the 'moderate need-support – need-thwarting' profile) of need-thwarting behaviors.

Regarding autonomous motivation, the 'high need-support – low need-thwarting' profile showed the highest values of intrinsic motivation, integrated, and identified regulation, whereas the opposite was true for the 'low need-support – high need-thwarting' profile. The differences in controlled motivation were less clear, but in general, the profiles with a greater presence of need-thwarting behaviors (i.e. 'moderate need-support – high need-thwarting' and 'low need-support – high need-thwarting'), showed lower values of introjected and external regulation when compared to the profiles with a low (i.e. the 'high need-support – low need-thwarting' profile) and moderate presence (i.e. the 'moderate need-support – need-thwarting' profile) of need-thwarting behaviors. Finally, the 'high need-support – low need-thwarting' profile showed the lowest values of amotivation. Moreover, the 'moderate need-support – high need-thwarting' and the 'low need-support – high need-thwarting' profiles revealed higher amotivation values than the 'moderate need-support – need-thwarting' profile.

Discussion

Within the last decade, variable-centered research on SDT has focused on examining how PE teachers' need-supportive and need-thwarting teaching behaviors related to students' motivational outcomes (Haerens et al. 2018; Leo et al. 2020). The present study aimed to expand prior evidence by examining the co-occurrence of students' perceptions of need-supportive (i.e. autonomy, competence, and relatedness support) and need-thwarting behaviors (i.e. autonomy, competence, and relatedness thwarting) from their PE teachers, which has not been explored to date. In addition, this person-centered perspective allowed us to investigate how the different motivating teaching profiles might be related to need-based experiences and motivation among students and design future interventions according to each profile.

Regarding the first aim, four PE teachers' motivating profiles were identified based on students' reports. In line with a previous person-centered study in PE, based on the combination of PE teachers' autonomy-supportive and controlling behaviors (Haerens et al. 2018), and consistent with our hypothesis, a 'high need-support – low need-thwarting' profile and a 'low need-support – high need-thwarting' profile emerged. Consistent with the notion that need-supportive and need-thwarting behaviors may represent two clearly distant motivating styles (Vansteenkiste, Ryan, and Soenens 2020), these two groups seem to indicate that at least some students would barely perceive need-thwarting behaviors when they perceive a high use of need-supportive behaviors from their PE teachers and vice-versa. However, these two profiles represented only half of the student sample in the present study (i.e. 53%).

According to the previous study by Haerens et al. (2018) in PE and following our hypotheses, a combination of PE teachers' need-supportive and need-thwarting behaviors was also found in the other two profiles identified (i.e. 47%). That is, according to the students' perception, some PE teachers tend to use both need-supportive and need-thwarting behaviors (i.e. the 'moderate need-support – need-thwarting' and the 'moderate need-support – high need-thwarting' profiles). Thus, it seems that PE teachers might facilitate decision-making, value effort and progress, and group cohesion (i.e. need-supportive behaviors) among students but also, at times, try to demand discipline, highlight their failures, and do not care about them (need-thwarting behaviors). The correlations result also showed that the three need-supportive behaviors were negatively and moderately related to three need-thwarting behaviors ($r = -.20$ to $-.50$, $p < .01$). These findings suggest that it may be inaccurate to classify PE teachers as being exclusively need-supportive or need-thwarting in their instructional practice. Therefore, perceived need-supportive and need-thwarting behaviors are not necessarily two poles of the same need-nurturing continuum. In addition, it should be noted that it seems that PE teachers could combine need-supportive and need-thwarting behaviors, as long as neither of the two behaviors is excessively predominant compared to the other. One possible explanation for these results could be due to the fact that, although the Spanish PE curriculum promotes the increased use of productive teaching styles and more student-centered approaches, Spanish PE teachers use both reproductive styles and productive styles (Espada-Mateos and Pineño 2020).

With regard to the second aim, consistent with a previous study in PE (Haerens et al. 2018) and our hypotheses, the profiles characterized by a predominant use of need-thwarting behaviors (i.e. the 'moderate need-support – high need-thwarting' and the 'low need-support – high need-thwarting' profiles), yielded the least optimal pattern of outcomes. It should also be pointed that the 'low need-support – high need-thwarting' profile was particularly the most maladaptive in terms of autonomous forms of motivation, external regulation and amotivation. These findings are in line with previous studies in PE and sport context (Haerens et al. 2018), thereby highlighting the strong association of need-thwarting behaviors with students' maladaptive outcomes, even when teachers are additionally perceived to be need-supportive. This means that PE teachers who predominantly adopt need-thwarting behaviors, even if often accompanied by need-supportive strategies, lead students to feel coerced into carrying out the instructional activity in a prescriptive way (autonomy need frustration), along with feelings of inefficacy and failure (competence need frustration), and rejection of their teacher (relatedness need frustration). In addition, this could result in students having no autonomous or controlled reason to participate in PE (amotivation) or being based on contingencies associated with external incentives such as the avoidance of punishments (external regulation). In this regard, the results from this research highlight that more need-thwarting and less need-supportive motivating styles from PE teachers may be related to negative motivational experiences among students.

Unlike profiles characterized by students' perceptions of high use of PE teachers' need-thwarting behaviors, the 'moderate need-support – need-thwarting' profile could minimize, to a lesser degree than the two previous profiles, students' motivational outcomes related to BPN frustration, controlled forms of motivation, and amotivation. This would imply that some students may think that the combination of moderate to low levels of need-supportive and need-thwarting behaviors would be justified by understanding that the teacher's underlying intentions are to enhance their academic learning or to address the misbehavior of some students (Cothran and Kulinna 2006). It may also be possible that some students prefer their teachers to use controlling behaviors, accompanied by a range of need-supportive strategies, because they do not like to think or choose (Cothran and Kulinna 2006). For example, they may, on occasions, prefer to be told by their teachers 'you have to do this' rather than 'what could you do to solve this problem?'. This combination seems to be for this student group the best way to avoid the presence of negative motivational experiences, although this seems to imply a lower level of BPN satisfaction and autonomous motivation.

Moreover, the 'high need-support – low need-thwarting' profile displayed the most adaptive pattern of outcomes with the highest scores in BPN satisfaction and the three autonomous forms of motivation. These findings are consistent with a previous person-centered study in PE (Haerens et al. 2018), which found that the 'high autonomy-support – low control' profile reported more positive motivational experiences among students at the end of a PE lesson. These results imply that PE teachers who primarily rely their motivating style on behaviors that include strategies such as providing students with choice (i.e. autonomy support), constructive, clear, and relevant feedback to improve their skills (i.e. competence support), and interest in the person's thoughts and perceptions (i.e. relatedness support), enhance the students' satisfaction of BPN and, consequently, the reasons to participate in PE lessons are based on experiences of volition, enjoyment, and self-endorsement (Vasconcellos et al. 2020). Additionally, this motivating teaching profile showed the lowest levels in the frustration of the three BPN and amotivation, aligning with the previously mentioned study in PE (Haerens et al. 2018). These findings suggest that motivating styles used by PE teachers characterized by high levels of need-supportive behaviors, together with low levels of need-thwarting behaviors, could play a buffering role against the appearance of maladaptive motivational consequences on students in PE.

Implications for practice

The results suggest the need to use motivating styles characterized by high levels of need-supportive behaviors and low levels of need-thwarting behaviors to enhance students' positive motivational experiences in PE lessons. In this sense, there is a need for PE teachers to use instructional strategies focused on the provision of choice, initiative, and a meaningful rationale (i.e. autonomy-supportive behaviors), the provision of helpful instructions and valuable feedback to guide students toward the tasks, as well as clear information of the expectations of the lessons (i.e. competence-supportive behaviors), and the creation of a supportive socio-emotional environment (i.e. relatedness-supportive behaviors). In addition, these results suggest that PE teachers should avoid the moderate or high use of need-thwarting behaviors since they can be very detrimental to students' motivational outcomes, even when teachers are additionally perceived to be need-supportive. Therefore, it is recommended to avoid or, at least, reduce the use of controlling language and behaviorally contingent rewards that generate a strong sense of duty through expressions such as 'you must' or 'you have to', and strategies focused on yellow and guilt-induction (i.e. autonomy-thwarting behaviors), the lack of clear instructions and contradictory information for tasks, together with messages that can make them feel inefficacy (i.e. competence-thwarting behaviors), and the creation of a cold environment between the students themselves and between the teacher and the students (i.e. relatedness-thwarting behaviors) (De Meyer et al. 2014). Thus, the results highlight that different SDT-intervention programs may be designed to train PE teachers to become less thwarting, more supportive, or less thwarting and more supportive in their daily instructional practice depending on their (de)motivating style profile. However, it seems that these must be particularly focused on avoiding or at least reducing need-thwarting behaviors among PE teachers. In Spain particularly, it is recommended that teachers make greater use of productive styles such as guided discovery and problem-solving, as well as the use of questioning and self-oriented feedback, and formative and shared assessment (i.e. self-assessment and peer-assessment) to involve students in their own learning, being able to progress, and interact with their peers. In addition, they should reduce the use of more reproductive styles to prevent students from reproducing their cues or movements, as well as not being able to progress at their own pace and interact with others (Espada-Mateos and Pineño 2020).

Limitations and future directions

Some limitations and future avenues of research should be identified. Firstly, the cross-sectional design adopted only represents a snapshot view of the combination of PE teachers' need-supportive

and need-thwarting behaviors. Indeed, although this study used a person-centered approach, it also does not allow us to establish causal relationships between the resulting profiles and students' motivational outcomes. Therefore, longitudinal research is needed to capture the dynamic nature of teachers' (de)motivating behaviors on motivational experiences displayed by students in PE lessons. Secondly, given a non-probabilistic method was used to recruit participants, results from this study should be interpreted with caution. Further studies should consider more representative samples based on their educational level (e.g. primary education), type of school (e.g. private) or social, and cultural features. Thirdly, this research only included need satisfaction and frustration, and different types of motivational regulations as dependent variables. Additional studies are needed to consider other adaptive and maladaptive affective, behavioral, and cognitive outcomes to obtain a deeper insight into how different configurations of teacher's need-supportive and need-thwarting behaviors influence students' outcomes in PE. Finally, PE teachers' need-supportive and need-thwarting behaviors were based exclusively on self-reported questionnaires. In future studies, it would be interesting to complement these measures with systematic observation instruments and teachers' perceptions of their own (de)motivating style to triangulate the three viewpoints.

Conclusions

The results found in two of the four identified motivating teaching profiles suggest, in the eyes of students, that need-supportive and need-thwarting behaviors, although they are distant constructs, might co-occur in some PE teachers from low to moderate degrees, thereby constituting different teaching (de)motivating styles. In addition, the findings suggest that teaching (de)motivating styles have been differentially related to need-based experiences and self-determined motivation among students in PE lessons. Students who perceived their PE teachers as being primarily need-supportive or need-thwarting yielded the most and least adaptive patterns of outcomes, respectively. Likewise, the results showed that PE teachers need-thwarting behaviors were related to students' maladaptive outcomes, even when students perceived need-supportive behaviors from their PE teachers simultaneously. Overall, our results indicate that while it seems important for PE teachers to adopt a motivating style based on need-supportive behaviors, it seems even more important to avoid need-thwarting behaviors, so that students have positive motivational experiences in PE lessons.

Disclosure statement

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