What factors are associated with physical education teachers' (de)motivating teaching style? A circumplex approach

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Abstract

Building upon the circumplex approach to (de)motivating styles defined by self-determination theory, this research aimed: 1) to analyse the extent to which physical education (PE) teachers' (de)motivating teaching approaches differ across gender, school level, and years of teaching experience, and 2) to test paths from PE teachers' need-based experiences to their (de)motivating teaching approaches, via motivation quality. A purposive and cross-sectional sample of 667 Spanish PE teachers (63.7% male; 54.7% primary; mean teaching experience=10.77 years) participated. The overall results found that male, secondary school, and more experienced teachers scored lower on autonomy-supportive approaches, and higher on controlling and chaotic approaches. The findings also showed that, after controlling for gender, school level, and teaching experience, need satisfaction showed a direct significant effect on autonomous motivation and an indirect effect on participative, attuning, guiding, and clarifying approaches via autonomous motivation. Need frustration showed a direct significant effect on controlled motivation and amotivation and an indirect effect on demanding, domineering, abandoning, and awaiting approaches via controlled motivation and amotivation. Another noteworthy result is the positive relationship between need satisfaction and controlled motivation. Our results underscore the role that PE teachers' personal traits play in the adaptive motivational mechanisms underlying their variety of (de)motivating approaches to PE teaching.

Keywords

Introduction

Self-determination theory (SDT; Ryan and Deci, 2017) constitutes a broad theoretical structure for analysing motivation and behaviour. Growing attention is being given to exploring the associations between physical education (PE) teachers' motivational processes and their teaching behaviour. Recently, Aelterman et al. (2019) proposed an SDT-based circumplex approach to more holistically conceptualising (de)motivating styles by introducing the styles of autonomy support (i.e. participative and attuning approaches), structure (i.e. guiding and clarifying approaches), control (i.e. demanding and domineering approaches), and chaos (i.e. abandoning and awaiting approaches) within a circular structure according to their level of need-supportiveness and teacher directiveness. Previous SDT-grounded research, conducted with in-service generalist teachers (i.e. not specialist PE teachers), has provided clues on how differentiated motivational processes contribute to explaining a specific (de)motivating style (Abós et al., 2018, 2019; Cheon et al., 2020). However, very little is currently known about the role that PE teachers' need-based experiences and motivation could play in the variety of (de)motivating approaches for effective classroom management. Further, there is a need to explore to what extent the use of PE teachers' (de)motivating styles would depend on their personal traits (e.g. gender, school level, and years of teaching experience). Guided by the SDT-based circumplex approach, the present research aspires to expand previous evidence by analysing if there is an association between PE teachers' perceptions of need-based experiences and their (de)motivating teaching approaches (via motivation quality), considering the potential differences in their personal traits.

Self-determination theory: basic psychological needs and motivation

Central to SDT is the assumption of three basic psychological needs (BPNs) (i.e. autonomy, competence, and relatedness) which are universal psychological nutrients for

growth, adjustment, and wellness. Indeed, it is suggested that individuals' varying perceptions of these BPNs are influenced by how they interpret the contextual, motivational, and social factors in their environment (Bartholomew et al., 2014; Pelletier et al., 2002). SDT distinguishes between a bright side of functioning based on BPN satisfaction, and a dark side based on BPN frustration (Vansteenkiste et al., 2020). Autonomy satisfaction refers to PE teachers' perceptions of making their own decisions and having a feeling of willingness in their work, while autonomy frustration concerns a feeling of obligation and pressure in work-related tasks. Competence satisfaction refers to PE teachers' perceptions of success and effectiveness in the actions to be developed, while competence frustration concerns when they experience feelings of ineffectiveness and failure in work-related tasks. Relatedness satisfaction refers to PE teachers' perceptions of being connected and integrated with the people they work with, while relatedness frustration concerns when they feel socially rejected and excluded in their working environment (Vansteenkiste et al., 2020).

SDT argues that BPN satisfaction and frustration can occur simultaneously in PE, with each contributing to a specific quality of motivation (Abós et al., 2018, 2019; Bartholomew et al., 2014). Three motivational qualities are differentiated along a self-determination continuum depending on the relative autonomy level present in each of them (Ryan and Deci, 2020). At one end of the continuum lies autonomous motivation, which refers to undertaking a behaviour for inherent pleasure, interest, and curiosity (i.e. intrinsic motivation), and personal value and recognition of the benefits that it brings (i.e. identified regulation). In the centre of the continuum stands controlled motivation, which refers to undertaking a behaviour to comply with self-imposed pressures and self-esteem contingencies (i.e. introjected regulation) and social environment pressures based on rewards and punishments (i.e. external regulation). At the opposite end of the continuum

lies amotivation, which expresses the total absence of intention toward the target behaviour (Ryan and Deci, 2017). Prior research has shown that BPN satisfaction is positively related to autonomous motivation (Abós et al., 2018, 2019), while BPN frustration is positively related to controlled motivation and amotivation (Collie et al., 2016; Van den Berghe et al., 2014).

Circumplex approach: (de)motivating teaching styles in PE

SDT-based studies (Abós et al., 2018; Vermote et al., 2020) have shown the interplay between teachers' need-based experiences and motivation and their (de)motivating styles in PE lessons. To study teachers' (de)motivating styles from a more integrative and holistic perspective, Aelterman et al. (2019) put forward an SDT-based circumplex model (see Figure 1) that combines need-supportiveness (on the x-axis, i.e. the degree to which teachers support/thwart students' needs) with directiveness (on the y-axis, i.e. the extent to which teachers take the lead in learning interactions). According to the intersection of these two dimensions, autonomy support and structure constitute motivating styles, given that both are need-supportive practices, with autonomy support being low in directiveness and structure being highly directive. Control and chaos represent demotivating styles since both are need-thwarting practices, with control being high in directiveness and chaos being low on this dimension.

[Insert Figure 1 near here, please]

The circumplex model allows for a more refined vision of the overarching (de) motivating styles of teachers' autonomy support, structure, control, and chaos, as each style can be implemented in two more specific teaching approaches (Aelterman et al., 2019). Regarding motivating styles, autonomy support is characterised by understanding attitudes toward students (Reeve and Cheon, 2021). When PE teachers are autonomy-supportive, they offer decision-making power to their students in terms of learning (i.e.

participative approach). They also underline the relevance of tasks, aligning them with students' interests and preferences, and validating their views (i.e. attuning approach) (Burgueño et al., 2024). Structure encompasses students' progress and process, aiming for alignment with their ability levels, strengths, and learning potential (Skinner et al., 1998). When structuring, PE teachers display confidence in students' skills for task accomplishment and provide them with useful and adjusted information and feedback to support their progress (i.e. guiding approach). They also communicate learning goals and expectations clearly, and consistently monitor their progress (i.e. clarifying approach) (Escriva-Boulley et al., 2021).

Concerning demotivating styles, control refers to a pressuring attitude toward students (Bartholomew et al., 2009). When they are controlling, PE teachers take a tunnel-perspective in which their agenda and way of achieving task completion become prioritised by using either explicit behaviour-focused strategies, such as strict commands, coercive language, contingent rewards, and threats of sanctions (i.e. demanding approach), or manipulative person-targeted strategies such as guilt-induction, public shaming, expressions of disapproval, and withdrawal of attention (i.e. domineering approach) (Burgueño et al., 2024). Chaos is characterised by a laissez-faire attitude toward students (Jang et al., 2010). When they are chaotic, PE teachers leave students to their own devices, giving up after repeatedly intervening in the classroom (i.e. abandoning approach), or waiting to see how things unravel when directions are required so that students take the initiative themselves (i.e. awaiting approach) (Escriva-Boulley et al., 2021).

A growing body of SDT-grounded research with teachers has shown that autonomous motivation is positively associated with autonomy support (Abós et al., 2018), and with the two autonomy-supportive and structuring approaches (Escriva-

Boulley et al., 2021; Vermote et al., 2020). A negative relationship between teachers' autonomous motivation and the abandoning approach was also found (Escriva-Boulley et al., 2021; Vermote et al., 2020). Teachers' controlled motivation was positively associated with demanding and abandoning approaches, but not with the awaiting approach (Escriva-Boulley et al., 2021; Vermote et al., 2020). However, the relationship between controlled motivation and the domineering approach remains unclear given that Escriva-Boulley et al. (2021) revealed a negative relationship, while Vermote et al. (2020) reported that both variables were unrelated. It is important to note that cross-relationships between controlled motivation and need-supportive styles were inconsistent, since Escriva-Boulley et al. (2021) found non-significant associations, whereas Vermote et al. (2020) showed a negative association of controlled motivation with both autonomy-supportive approaches. Moreover, teachers' amotivation was positively related to demanding, domineering, and abandoning approaches (Escriva-Boulley et al., 2021; Vermote et al., 2020), while being negatively associated with the autonomy-supportive style and the guiding approach (Abós et al., 2018; Vermote et al., 2020). Therefore, there is a need for further research to deepen insight into the interplay between PE teachers' quality of motivation and their (de)motivating style, via the circumplex lens.

Socio-demographic and/or personal influencing factors

Previous research has suggested that teachers' socio-demographic and personal traits are associated not only with their motivational processes for teaching, but also with their variety of (de)motivating styles and approaches used for effective classroom management (Escriva-Boulley et al., 2021; Hellebaut et al., 2023). Despite little attention being given to the distinctive role that socio-demographic and personal variables could have in teachers' motivational processes and behaviour, it seems that gender, school level, and

years of teaching experience have been identified as the strongest determinants of their teaching style (Hellebaut et al., 2023; Vermote et al., 2022).

Regarding teachers' gender, Vermote et al. (2020, 2022) revealed that male teachers scored higher than female teachers on the autonomy-supportive style and the two chaotic approaches. Conversely, Escriva-Boulley et al. (2018) and Burel et al. (2021) reported that teachers' gender non-significantly predicted their autonomy-supportive and structuring styles. In addition, Burel et al. (2021) found that teachers' gender was unrelated to control, while it positively predicted relatedness support. Although the research by Escriva-Boulley et al. (2018) did not consider controlling and chaotic styles, and Burel et al. (2021) failed to operationalise (de)motivating teaching styles from a circumplex approach, both shed some light on the differentiated nature of teachers' gender in the associations with their (de)motivating style in lessons.

Moreover, only two previous studies examined the differences by school level in (de)motivating styles and approaches. While Vermote et al. (2022) reported that primary and secondary school teachers did not differ in autonomy support, structure, control, and chaos, Vermote et al., (2020) revealed that university teachers scored lower in the participative approach than secondary school teachers.

Concerning teaching experience, less experienced teachers scored lower than more experienced teachers in guiding, clarifying, and demanding approaches (Hellebaut et al., 2023). Similarly, more experienced teachers were more autonomy-supportive and structuring (Vermote et al., 2022), in addition to obtaining higher values in demanding, domineering, and abandoning approaches than less experienced ones (Hellebaut et al., 2023; Vermote et al., 2020). However, much of the research reported that years of teaching experience are not significantly associated with teachers' autonomy support (Burel et al., 2021; Escriva-Boulley et al., 2018; Hellebaut et al., 2023; Vermote et al.,

2020), while a few studies showed that teaching experience was unrelated to structure (Vermote et al., 2020), control (Burel et al., 2021), and chaos (Vermote et al., 2020).

In light of the unclear and inconclusive results from previous studies conducted with generalist teachers, there is a need to gain a better understanding of the potential role that gender, school level, and teaching experience may play in the adoption of each (de) motivating approach used by teachers in PE lessons. This may allow us to gather a substantial basis of evidence that could help to develop training programs to assist PE teachers in improving the quality of their motivational process and teaching behaviour by considering their personal and working characteristics.

The present study

Little is currently known about the underlying motivational mechanisms that lead PE teachers to rely on a variety of (de)motivating approaches to achieve optimal PE classroom management. Much of SDT-based research conducted to date with generalist teachers has considered teacher behaviour from a categorical and black-and-white viewpoint (i.e. need-supportive *versus* need-thwarting practices), while the SDT-based circumplex approach to (de)motivating styles relies on a gradual and holistic perspective where the differences between teaching approaches are more progressive. These differences are reflected in the extent to which they are need-supportive or need-thwarting, and in the teacher's degree of directiveness (Burgueño et al., 2024). Indeed, this gradual vision of teacher behaviour may shed light on how differentiated motivational mechanisms make PE teachers shift from one approach to another along the circumplex, depending on obstacles and facilitators found in the PE classroom. Among these obstacles and facilitators, previous SDT-grounded studies have suggested that generalist teachers' personal traits might be associated with their teaching behaviour (e.g. Vermote et al., 2020, 2022). However, regarding PE teachers, there is still a lack of evidence regarding

the specific role that these personal traits may play in the motivational mechanisms and teaching behaviours underlying their practice.

Therefore, the present research had two objectives. The first objective was to analyse the extent to which PE teachers' (de)motivating teaching approaches differ across gender, school level, and years of teaching experience. Given the unclear and inconclusive results from previous studies with generalist teachers, we did not formulate any hypotheses about this objective. The second objective was to test paths from PE teachers' need-based experiences to their own (de)motivating teaching approaches, via motivation quality. Guided by SDT and previous research (Abós et al., 2018, 2019; Collie et al., 2016; Van den Berghe et al., 2014), we hypothesised that PE teachers' BPN satisfaction would positively predict autonomous motivation, while their BPN frustration would positively predict controlled motivation and amotivation. We also hypothesised that autonomous motivation would positively predict the two autonomy-supportive and structuring approaches. Given the differences found in controlled motivation and its relationship to (de)motivating approaches (Escriva-Boulley et al., 2021; Vermote et al., 2020), it is difficult to establish a clear and precise hypothesis. In contrast, the results for amotivation are quite clear (Escriva-Boulley et al., 2021; Vermote et al., 2020), as it is very likely that amotivation will positively predict control and chaos.

Method

Participants and procedures

There were 667 participants (422 male, 63.3%), all PE teachers, aged between 22 and 67 years old (M_{age}=37.86; SD=8.11), from different mixed schools located in the northeastern part of Spain. They worked both in primary (n=365, 54.7%) and secondary (n=302, 45.3%) schools, and self-reported teaching experience ranging from 1 to 35 years ($M_{experience}$=10.77; SD=8.52). Primary PE teachers are required to deliver 25 hours of

teaching per week, whereas secondary PE teachers are expected to teach between 18 and 21 hours per week.

Participants were recruited by a non-probabilistic purposive method. Specifically, short and direct messages were disseminated in different online forums related to PE (e.g. WhatsApp, Facebook, and Twitter) aimed at capturing the PE teachers' attention. These messages included a weblink providing access to the online-based questionnaire where PE teachers could find a brief explanation of the study's objectives and the main researcher's contact details. This online-based questionnaire, which took approximately 25 minutes to complete, was available for 30 days. Participation was voluntary and anonymous. The study was approved by the Ethics Committee of the University of Extremadura (code: 153/2022) and followed all ethical procedures established in the Helsinki Declaration.

Instruments

Socio-demographic variables: data related to gender (i.e. male/female), school level (i.e. primary school/secondary school), and years of experience as PE teachers were collected. Years of experience, consistent with prior educational research (e.g. Gutiérrez-Díaz del Campo et al., 2016) were categorised as low (i.e. 0-9 years), medium (i.e. 10-19 years), high (i.e. 20-29 years), and very high (i.e. +29 years).

BPN satisfaction and frustration: To assess PE teachers' perception of their BPN satisfaction and frustration, the Spanish version of the Basic Psychological Need Satisfaction and Frustration Scale (Chen et al., 2015) was used. This instrument includes 24 items (four items per dimension) and taps into autonomy satisfaction (e.g. "I can make my own decisions"), autonomy frustration (e.g. "I feel forced to do a lot of things"), competence satisfaction (e.g. "I feel competent in my job"), competence frustration (e.g. "I feel disappointed with many of my job performances"), relatedness satisfaction (e.g.

"When I am with colleagues at work, I feel they listen to me"), and relatedness frustration (e.g. "I feel that colleagues dislike me"). Items were rated on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Consistent with SDT-based research (e.g. Moè and Katz, 2020), composite scores for BPN satisfaction and frustration were estimated by using autonomy, competence, and relatedness satisfaction and frustration, respectively. In the current study, Cronbach's alphas were .83 and .75 for BPN satisfaction and frustration, respectively. The hierarchical confirmatory factorial analysis (CFA) models for BPN satisfaction (χ^2(df=2) =2.965, p=.227, χ^2/df=1.48; comparative fit index (CFI)=.99; Tucker-Lewis index (TLI)=.99; standardised root mean squared residual (SRMR)=.008; root mean square error of approximation (RMSEA)=.027 (90%CI=.001–.086)) and BPN frustration (χ^2(df=2)=3.439, p=0.179, χ^2/df=1.72; CFI=.99; TLI=.99; SRMR=.011; RMSEA=.033 (90%CI=.001–.090)) indicated a good fit.

Motivation for teaching: To assess PE teachers' perception of their motivation for teaching, the Spanish version of the Motivation for Teaching in Secondary Education (Abós et al., 2018) was used. The scale starts with the stem "I get involved in teaching because…" followed by 19 items measuring intrinsic motivation (four items; e.g. "Teaching is fun"), identified regulation (four items; e.g. "This is an important personal choice for me"), introjected regulation (four items; e.g. "I want to give others the impression that I am a good teacher"), external regulation (four items; e.g. "Otherwise, I would be disappointed in myself"), and amotivation (three items; e.g. "I don't know, I feel like I am wasting my time when I teach"). Responses were provided on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Following previous SDT-based research (e.g. Abós et al., 2019; Van den Berghe et al., 2014), composite scores both for autonomous motivation (including intrinsic motivation and identified regulation) and controlled motivation (including introjected and external regulation) were computed.

In this study, Cronbach's alphas for autonomous and controlled motivation, and amotivation were .83, .74, and .52, respectively. The five-factor model obtained a good fit: χ^2(*df*=135) =369.373, *p*<.001, χ^2/*df*=2.74; CFI=.91; TLI=.90; SRMR=.059; RMSEA=.051 (90%CI=.045–.057).

(De)motivating teaching approaches: To assess PE teachers' perception of their (de)motivating teaching approaches, the Spanish version of the Situations-in-School Questionnaire in Physical Education (SIS-PE; Burgueño et al., 2024) was used. The SIS-PE includes 12 typical PE-classroom situations consisting of four items each (i.e. 48 items). Autonomy-supportive items are operationalised into participative (four items; e.g. "You invite students to suggest a set of norms or rules") and attuning (eight items; e.g. "Offer enjoyable, interesting and highly attractive tasks") approaches. Structure items are operationalised into guiding (seven items: e.g. "You give them positive feedback while offering help and guidance when necessary") and clarifying (five items; e.g. "You implement an easy-to-follow and clear organisation") approaches. Control items are operationalised into demanding (seven items; e.g. "Plan a session for all students to follow. No exceptions or excuses") and domineering (five items; e.g. "You insist that they must get over it and act more maturely") approaches. Chaos items are operationalised into abandoning (eight items; e.g. "Don't worry too much about their anxiety, as it will go away on its own") and awaiting (four items; e.g. "You start the class and let it develop") approaches. Items were rated on a seven-point Likert scale from 1 (it does not define me at all) to 7 (it defines me perfectly). In this study, Cronbach's alphas were .54, .68, .67, .51, .66, .73, .74, and .66 for participative, attuning, guiding, clarifying, demanding, domineering, abandoning, and awaiting approaches, respectively. The eight-factor model had an acceptable fit: χ^2(*df*=180) =500.609, *p*<.001, χ^2/*df*=2.78; CFI=.90; TLI=.90; SRMR=.053; RMSEA=.056 (90% CI=.051–.062).

Data analysis

Firstly, descriptive statistics and Cronbach's alpha reliability were calculated for all study variables. Although there is a widespread agreement on .70 as cut-off point for an acceptable reliability level, a growing body of research suggests the need to interpret reliability as a grayscale such that scores between .90 and .95 are interpreted as excellent reliability levels, scores .80 and above as good, scores .70 and above as acceptable, scores .60 and above as reasonable, scores .50 and above as fair, and scores below .50 as unacceptable (George and Mallery, 2003; Hernaez, 2015). Secondly, Pearson's correlations were computed for continuous variables and Spearman's correlations for categorical variables. Thirdly, univariate analyses of variance (ANOVAs) with the Bonferroni correction were sequentially performed to examine mean differences in their (de)motivating approaches based on teachers' gender, school level, and teaching experience. Additionally, differences in PE teachers' need-based experiences and motivation were analysed (see Supplemental material). The statistical significance level was $p<.05$. Effect sizes were small, moderate, or large with partial eta-squared values above .01, .06, and .14 (Cohen, 2013).

Fourthly, a two-step structural equation model (SEM) (Kline, 2018) using the Robust Maximum Likelihood (MLR) estimator was run to test paths from PE teachers' need-based experiences to their (de)motivating approaches via motivation. Gender, school level, and teaching experience were included as covariates. The first step involved analysing the robustness of the measurement model, in which all target variables were freely correlated. The second step involved testing the predictive relationships between the variables within a structural model. The SEM was estimated by the MLR estimator because it provides fit and standard error rates that are robust to non-normality, and by Likert-type scales that include five or more response categories (Muthén & Muthén,

1997-2018). Values up to 5 for the χ^2/df coefficient, over .90 for CFI and TLI, and below .08 for SRMR and RMSEA represent an acceptable fit (Kline, 2018). Following Hayes (2017), an indirect effect is significant ($p<.05$) when its 95% confidence interval (95%CI) excludes zero. All analyses were conducted using SPSS 29.0 and Mplus 8.4 (Muthén & Muthén, 1997-2018).

Results

Differences by gender, school level, and teaching experience in (de)motivating teaching approaches

Table 1 shows that male PE teachers scored significantly higher on demanding and domineering approaches. Regarding school level (Table 1), primary school PE teachers scored significantly higher on the two autonomy-supportive approaches (i.e. participative and attuning). Secondary school PE teachers, on the other hand, scored significantly higher on the two controlling (i.e. demanding and domineering) and chaotic (i.e. abandoning and awaiting) approaches.

[Insert Table 1 near here, please]

Table 2 shows that PE teachers with low and medium experience scored significantly higher than those with high and very high experience in the attuning approach. PE teachers with very high experience scored the highest in demanding, domineering, and abandoning approaches. PE teachers with very high experience also scored significantly higher than those with medium experience in awaiting approach. PE teachers with high experience scored significantly higher than those with medium experience in the abandoning approach.

[Insert Table 2 near here, please]

Relationships between need-based experiences, motivation, and (de)motivating approaches

Table 3 reports descriptive statistics and correlations. Overall, correlations between most of the study variables were significant.

[Insert Table 3 near here, please]

The measurement model (χ^2[df=778]=1532.330, p<.001, χ^2/df=1.97; CFI=.92; TLI=.90; SRMR=.043; RMSEA=.038, 90%CI=.035–.041) and the structural model (χ^2[df=800]=1590.542, p<.001, χ^2/df=1.98; CFI=.91; TLI=.90; SRMR=.047; RMSEA=.038, 90%CI=.036–.041) obtained acceptable fit-indices. Figure 2 shows that, after controlling for gender, school level, and teaching experience, PE teachers' BPN satisfaction positively predicted autonomous motivation (β=.54, p<.001) and controlled motivation (β=.31, p<.001), while BPN frustration positively predicted controlled motivation (β=.48, p<.001) and amotivation (β=.55, p<.001). In addition, autonomous motivation positively predicted participative (β=.61, p<.001), attuning (β=.66, p=.001), guiding (β=.51, p=.003), and clarifying (β=.51, p=.009) approaches. Controlled motivation negatively predicted participative (β=-.19, p=.009) and attuning (β=-.17, p=.015) approaches, whereas it positively predicted demanding (β=.30, p<.001), domineering (β=.33, p<.001), and abandoning approaches (β=.17, p=.012). Finally, amotivation positively predicted demanding (β=.35, p=.014), domineering (β=.46, p<.001), abandoning (β=.64, p<.001), and awaiting (β=.78, p<.001) approaches.

[Insert Figure 2 near here, please]

Regarding indirect effects, Table 4 shows that 18 of the 48 tested indirect effects between teachers' need-based experiences and (de)motivating approaches, via motivation, were significant. In particular, positive and significant indirect effects between teachers' BPN satisfaction with participative, attuning, guiding, and clarifying

teaching approaches were found via autonomous motivation. Negative indirect effects between BPN satisfaction and frustration with participative and guiding approaches, as well as positive ones with demanding, domineering, and abandoning approaches, were found via controlled motivation. Positive indirect effects between teachers' BPN frustration with demanding, domineering, abandoning, and awaiting teaching approaches were found via amotivation.

[Insert Table 4 near here, please]

Finally, all non-significant direct effects are included in a table in Supplemental material, together with all other significant direct effects.

Discussion

Grounded in SDT, this research aimed to examine potential differences in PE teachers' (de)motivating approaches by gender, school level, and teaching experience, to explore the extent to which PE teachers' need-based experiences prospectively predict the eight (de)motivating approaches through quality of motivation. The main findings revealed that: 1) male, secondary school, and more experienced teachers scored lower on autonomy-supportive approaches, and higher on controlling and chaotic approaches; 2) PE teachers' BPNs mainly positively predicted autonomous motivation, which positively gave rise to participative, attuning, guiding, and clarifying approaches; and 3) PE teachers' BPN frustration positively explained controlled motivation and amotivation, which overall positively predicted demanding, domineering, abandoning, and awaiting approaches. These results shed new light on the role that the need-based experiences and motivational quality of PE teachers play in (de)motivating approaches, which had remained unexplored until now.

Differences in (de)motivating approaches according to gender, school level and teaching experience amongst PE teachers

Our findings show that male teachers scored higher in demanding, domineering, and abandoning approaches, while female teachers scored higher in the participative approach. These findings were partially aligned with Vermote et al. (2020, 2022), who also showed gender differences in autonomy-supportive (i.e. participative and attuning) and chaotic (i.e. abandoning and awaiting) approaches. While there were common results in terms of male teachers being more chaotic, the results differed for autonomy-supportive approaches because male generalist teachers were more autonomy-supportive (Vermote et al., 2020, 2022), whereas, in our study, female PE teachers were more participative in lessons. Unlike previous studies (Burel et al., 2021; Escriva-Boulley et al., 2018; Vermote et al., 2022), this is the first study that has shown gender differences in the two controlling approaches, suggesting that male PE teachers are more demanding and domineering than female PE teachers when directing students in PE lessons. The observed gender differences in PE teachers' approaches may be rooted in social experiences and accumulated cognitive biases. Even though both male and female teachers receive similar training, social interactions and experiences inside and outside of school may be associated with their teaching approach. Eccles and Roeser (2011) argue that schools, as developmental contexts during adolescence, may be associated with gender expectations, which might be linked to variations in teachers' teaching practices. Additionally, cognitive biases, developed throughout life due to experiences and socialisation, could affect pedagogical practice. Nosek et al. (2007) found that people may act on gender stereotypes, even unconsciously. The observed variations in past research, including the studies by Vermote et al. (2020, 2022), may be attributed to the interplay of these factors.

At the school level, our analysis showed that primary school PE teachers were more inclined towards participative and attuning approaches, whereas their counterparts in secondary schools favoured more demanding, domineering, abandoning, and awaiting

approaches. These results differed from those of Vermote et al. (2022), who reported that autonomy-supportive, structuring, controlling, and chaotic styles were similar, hardly differing in primary and secondary teachers. Notwithstanding this, our findings are partially in keeping with previous studies (Barkoukis et al., 2010; Digelidis and Papaioannou, 1999), which reported that primary teachers were more prone to practices that focussed on joint decision-making, cooperative learning among students, skill development and hard work, dimensions theoretically framed within autonomy-supportive and structuring approaches. These studies (Barkoukis et al., 2010; Digelidis and Papaioannou, 1999) also pointed out that secondary teachers tended towards coercive and guilt-induction strategies when guiding students in lessons, which conceptually fits in with the controlling style.

Our results also displayed that less experienced teachers scored higher in the attuning approach, while more experienced teachers scored higher in the controlling and chaotic approaches. Although our results partially contrast with Hellebaut et al. (2023) on indicating that less experienced teachers scored lower on demanding approaches, they are in line with this research insofar as more experienced teachers scored higher in the abandoning approach. This could be explained because senior teachers tend to spend less time on planning their lessons and use a variety of activities that they believe work best, including competitive activities (Hall and Smith, 2006). In contrast, junior teachers often devote considerable time to meticulously organizing their lessons, prioritizing extended practice periods where learning takes precedence over outcomes (Hall and Smith, 2006). This observation is consistent with findings from the current study, where less experienced teachers demonstrated a higher propensity for attuning approaches to navigate students through their PE lessons.

Relationships between PE teachers' need-based experiences and motivation with their own (de)motivating approaches

Regarding the second objective, firstly, in line with previous research with generalist and PE teachers (Abós et al., 2018, 2019), our results show a positive and very high (.54) association of PE teachers' BPNs with their autonomous motivation for teaching. Following SDT (Ryan and Deci, 2020), a plausible explanation is that BPN satisfaction primarily energises higher-quality motivation. To illustrate this, when teachers feel free to teach as desired, efficiently and integrated into the school, they tend to enjoy and personally value the teaching profession. In contrast to previous research with teachers (Abós et al., 2018, 2019), our findings revealed a positive relationship between PE teachers' BPN satisfaction and controlled motivation, although to a lesser degree (.31) than the relationship with autonomous motivation. Despite the mitigating effect of BPN satisfaction on lower-quality motivation (Ryan and Deci, 2020), our findings are in line with those of Granero-Gallegos et al. (2023), indicating that PE teachers who feel their needs for autonomy, competence, and relatedness are met at work may also feel obligated to meet specific work demands set by the school leadership and to take on undesirable teaching tasks, in pursuit of contingent self-esteem for their achievements.

Akin to previous studies with generalist teachers (Collie et al., 2016; Van den Berghe et al., 2014), our results display positive associations of PE teachers' BPN frustration with their controlled motivation and amotivation. Although the effect size of the predictions was similar, it was higher for amotivation (.55) than for controlled motivation (.48). This could be explained because when PE teachers feel coerced to teach in a prescribed manner, inept in what they do and excluded by the school leadership team, they are prone to perform their teaching work as a means to meet the demands from students, families, and the school leadership team (i.e. controlled motivation), or they

exhibit passive commitment after fully losing social utility, personal value, and interest in teaching PE (i.e. amotivation). Building upon prior SDT-based research (Ryan and Deci, 2020; Vasconcellos et al., 2020), these findings underscore a significant association between BPN frustration and the lower-quality motivation among PE teachers.

Similar to previous research (Aelterman et al., 2019; Escriva-Boulley et al., 2021; Vermote et al., 2020) and following SDT (Ryan and Deci, 2020), the autonomous motivation of PE teachers was found to be positively and strongly linked to the two autonomy-supportive approaches, namely participative (.61) and attuning (.63). Additionally, it was positively associated, albeit to a slightly lesser extent, with structuring approaches (i.e. guiding (.51) and clarifying (.51)). A potential explanation could be that when teachers put effort into their teaching, due to their curiosity, their passion for their work, and the value they assign to their task, they could provide students with the possibility of engaging in the learning process (i.e. participative approaches), showing interest in their opinions and preferences for the PE lesson (i.e. attuning approaches). Furthermore, it is probable that an autonomously motivated teacher could also be more inclined to clearly communicate learning expectations and goals to students for good classroom development (i.e. clarifying approach), providing them with indications that adapt to their skill level, as well as positive helpful feedback for task accomplishment (i.e. guiding approach).

Following previous studies based on the circumplex approach (Aelterman et al., 2019; Escriva-Boulley et al., 2021; Vermote et al., 2020) and SDT (Ryan and Deci, 2020), our results also show that PE teachers' controlled motivation, and especially amotivation, positively explained the two controlling (i.e. demanding and domineering) and chaotic (i.e. abandoning and awaiting) approaches. While it is true that controlled motivation and amotivation similarly predict demanding and domineering approaches, the difference lies

particularly in the prediction of the abandoning approach, as the prediction of amotivation (.64) is far higher than that of controlled motivation (.17). Therefore, it must be considered that, although both have a strong association with a controlling style (i.e. demanding and domineering approaches), amotivation is the one that has greater prediction on a chaotic style. These findings would suggest that when PE teachers are driven by self-imposed and external pressures and chiefly by a passive commitment to teaching PE, they are mainly prone to ignore their students' opinions in favour of prioritising their own viewpoint, using both overt and behaviour-centred strategies (i.e. demanding approach), and covert and guilt-induction practices (i.e. domineering approach). Likewise, controllingly motivated and, especially, amotivated PE teachers also tend to leave students to their own devices by not intervening (i.e. abandoning approach) and take wait-and-see attitudes in the classroom (i.e. awaiting approach). Furthermore, there were values over .60 and .70 for the effect size, suggesting a potential over-similarity among variables and jeopardizing the obtained findings. However, it is important to consider that great effect sizes may be obtained when the variables under study share a similar theoretical and empirical framework (Dominguez-Lara, 2017). This point is particularly important considering the theoretical closeness of general (de)motivating approaches, and more so for those approaches that differ significantly in their level of directiveness (high versus low) and in their orientation towards supporting versus thwarting needs. As the differences between the eight approaches become more subtle and less pronounced, there is a possibility that they overlap in how they account for the observed variance. This means that, despite being distinct, the approaches might share underlying factors that explain the behaviour or outcomes being studied.

Interestingly, this research has also revealed negative cross-paths from controlled motivation to participative and guiding approaches. These findings contrast with previous

studies (Aelterman et al., 2019; Escriva-Boulley et al., 2018), which found the relationships between the variables in question to be non-significant. However, our findings are partially consistent with the studies by Abós et al. (2018) and Vermote et al. (2020), indicating that controlled motivation generally shows a negative correlation with an autonomy-supportive style and, more specifically, with a participative approach. This implies that PE teachers, driven by internal and external pressures to conduct PE classes, might be less likely to offer students opportunities to choose certain aspects of learning (i.e. participative approach) and may also refrain from providing direction and feedback (i.e. guiding approach) during PE lessons.

Therefore, it is tenable that the use of need-supportive or need-thwarting approaches by PE teachers is influenced by their controlled motivation. Akin to Escriva-Boulley et al. (2021), controlled-motivated teachers tended not only to adopt need-thwarting styles, but also to avoid need-supportive styles. In a relatively similar way, Vermote et al. (2020) reported that teachers' controlled motivation was negatively associated with their need-supportive styles. This dual pathway sheds light on both previous and current scientific evidence, highlighting that the origin of controlled motivation in PE teachers (i.e. BPN satisfaction or BPN frustration) is associated with their classroom performance in distinct ways (i.e. need supportive and need thwarting teaching approaches).

Limitations and future research avenues

Firstly, the present research relied on self-reports, which, despite being the standard measures of (de)motivating teaching approaches, leave room for exploration of alternative instruments in future studies. Such tools could include interviews, observations by external evaluators, and analysis of students' perceptions regarding their teacher's (de)motivating approaches to enhance data triangulation. Secondly, this

research took a cross-sectional design, making it impossible to establish causal relationships between the target variables. Longitudinal studies could shed more light on the reciprocal associations between PE teachers' need-based experiences and motivation, and their own (de)motivating approaches over time. Thirdly, and akin to previous SIS-based research with teachers (Aelterman et al., 2019; Burgueño et al., 2024; Escriva-Boulley et al., 2021), low reliability scores were obtained in various (de)motivating approaches in the sample of PE teachers. These results should therefore be treated with caution. Fourthly, only the motivational process of PE teachers and their behaviours during classes were considered, without accounting for certain social and/or motivational antecedents that can determine this process. Therefore, for future studies, it would be advisable to consider some of these antecedents (e.g. pressure from above (school leaders), within (teachers themselves), and below (students)). In addition, although relatedness-supportive and relatedness-thwarting styles are part of the variety of (de)motivating styles to be used by teachers in the PE lesson, they do not fit well into the two axes of teachers' need-supportiveness and directiveness and, therefore, both were not included in the circumplex approach to (de)motivating styles proposed by Aelterman et al. (2019). Another potential limitation could have been the use of item parceling. Although some shortcomings could be emerged from the use of item parcels (e.g. item one-dimensionality within each item parcel), they also offer advantages in terms of reduced bias, improved parsimony, and model satiability (see Kline, 2010). Our study, indeed, gathered evidence for the trustworthiness of the item dimensionality via CFAs with individual items for the measures of (de)motivating approaches, need-based experiences, and quality of motivation. In addition to these psychometric advantages and consistent with Haerens et al. (2015), the approach followed in the study demonstrates

the usefulness and effectiveness of item parcels in educational research in general, and in examining structural relationships between variables in particular.

Conclusions

The present research, adopting an SDT-based circumplex perspective, illuminates the connections between PE teachers' personal traits and motivational mechanisms and their adoption of a variety of (de)motivating approaches for optimal PE classroom management. Our results show that male, secondary school, and more experienced PE teachers scored lower on the two autonomy-supportive approaches, and higher on controlling and chaotic approaches. These results demonstrate the importance of considering the individual characteristics of each PE teacher in future professional development programmes, as these can be associated their motivational process and behaviour during the lessons. Moreover, our findings suggest that PE teachers' need-based experiences and motivational quality are associated with the use of a combination of (de)motivating approaches in PE lessons. Specifically, PE teachers' BPN satisfaction primarily promotes their autonomous reasons for teaching and, in turn, autonomy-supportive and structuring approaches to guiding students in the classroom. Conversely, PE teachers' BPN frustration primarily favours both controlled reasons and amotivation for teaching and, consequently, controlling and chaotic approaches to directing students in lessons. Taken as a whole, this research lays the first foundations for developing continuous PE teacher education programmes which, drawing from their personal traits, aim to help PE teachers both favour their BPN satisfaction and autonomous motivation, and engage with a variety of motivating approaches for optimal classroom management. A complementary goal would be to help PE teachers minimise their experiences of BPN frustration, controlled motivation and amotivation, and avoid a mainly demotivating teaching profile as much as possible in PE lessons.

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Figure 1. Circumplex approach to (de)motivating styles in PE.
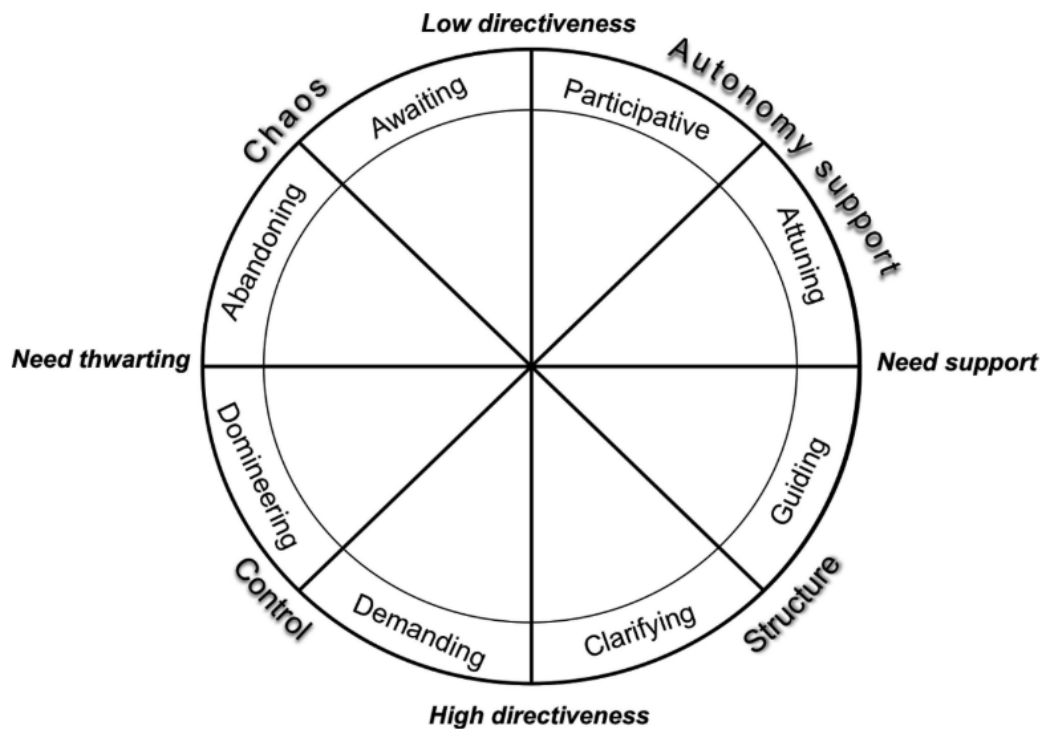
Note. Graphical representation taken from Aelterman et al. (2019).

Figure 2. Paths from need-based experiences to teaching approaches via motivational quality in physical education teachers.
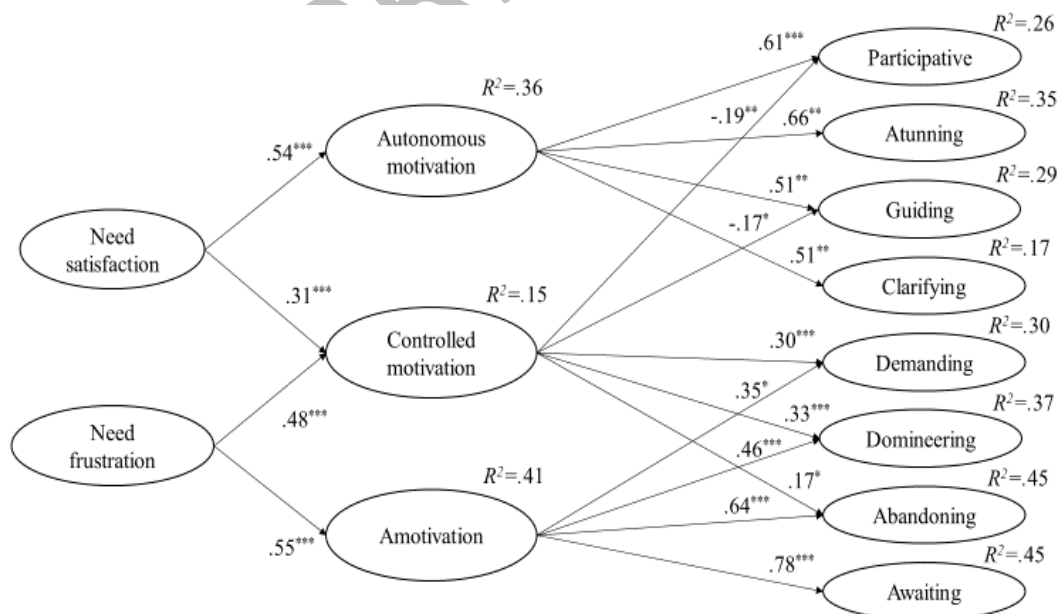
Note. Only significant paths are shown. ***$p<.001$, **$p <.01$, *$p<.05$.

Table 1. Mean differences by gender and school level in (de)motivating teaching approaches.

	Female	Male				Primary	Secondary			
	M(SD)	M(SD)	F	p-value	η^2_p	M(SD)	M(SD)	F	p-value	η^2_p
(De)motivating teaching approaches										
Participative	5.16(0.99)	4.91(1.05)	9.14	.003	.01	5.15(0.97)	4.83(1.08)	16.73	<.001	.03
Attuning	5.83(0.68)	5.78(0.69)	1.24	.266	<.01	5.85(0.66)	5.74(0.72)	4.60	.032	.01
Guiding	6.10(0.54)	6.03(0.61)	1.70	.193	<.01	6.07(0.60)	6.02(0.56)	1.18	.277	<.01
Clarifying	5.61(0.87)	5.55(0.84)	1.01	.315	<.01	5.54(0.89)	5.61(0.79)	1.19	.275	<.01
Demanding	3.14(1.11)	3.31(1.03)	3.85	.050	.01	3.03(1.11)	3.51(1.05)	34.64	<.001	.05
Domineering	2.39(1.07)	2.57(1.10)	4.32	.038	.01	2.28(1.00)	2.78(1.14)	37.67	<.001	.05
Abandoning	1.61(0.60)	1.75(0.69)	7.42	.007	.01	1.58(0.63)	1.85(0.67)	28.85	<.001	.04
Awaiting	2.72(1.16)	2.65(1.12)	0.51	.447	<.01	2.55(1.14)	2.82(1.11)	10.07	.002	.02

Note. Significantly different groups are shown by different letters in superscript.

Table 2. Mean differences by years of teaching experience in (de)motivating teaching approaches.

	0-9	10-19	20-29	+29			
	$M(SD)$	$M(SD)$	$M(SD)$	$M(SD)$	F	p	η^2_p
(De)motivating teaching approaches							
Participative	5.01(1.03)	5.08(0.99)	4.91(1.13)	4.69(1.10)	1.41	.240	<.01
Attuning	5.86(0.69)[a]	5.83(0.65)[a]	5.57(0.70)[b]	5.57(0.77)[ab]	5.60	.001	.03
Guiding	6.06(0.61)	6.09(0.57)	5.97(0.47)	5.94(0.80)	1.27	.285	.01
Clarifying	5.57(0.85)	5.59(0.85)	5.54(0.85)	5.54(0.81)	0.09	.965	<.01
Demanding	3.19(1.04)[a]	3.17(1.04)[a]	3.33(1.06)[a]	4.39(1.08)[b]	11.31	<.001	.05
Domineering	2.50(1.10)[a]	2.41(1.09)[a]	2.52(1.00)[a]	3.34(1.13)[b]	5.70	.001	.02
Abandoning	1.70(0.62)[a]	1.59(0.59)[a]	1.80(0.67)[a]	2.26(1.20)[b]	9.33	<.001	.04
Awaiting	2.73(1.13)[a]	2.52(1.03)[a]	2.70(1.24)[a]	3.16(1.41)[b]	3.26	.021	.01

Note. Letters in superscript reported significantly different groups (Bonferroni's correction at $p<.0125$).

Table 3. Descriptive statistics and correlations of the study variables.

	M(*SD*)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Need-based experiences																	
1. Need satisfaction	4.43(0.42)	-															
2. Need frustration	1.78(0.50)	-.11***	-														
Motivational quality for teaching																	
3. Autonomous motivation	4.66(0.44)	.05**	-.04*	-													
4. Controlled motivation	2.52(0.77)	-.01	.10***	.02	-												
5. Amotivation	1.12(0.34)	-.04**	.06***	-.05**	.04*	-											
(De)motivating teaching approaches																	
6. Participative	5.00(1.03)	.05**	-.03	.08***	-.08	.02	-										
7. Attuning	5.80(0.69)	.08***	-.07**	.09***	-.03	-.05**	.35***	-									
8. Guiding	6.05(0.58)	.09***	-.07**	.06**	-.07**	-.05***	.18***	.22***	-								
9. Clarifying	5.57(0.85)	.09***	-.03	.06**	.08*	-.03*	.20***	.21***	.17***	-							
10. Demanding	3.25(1.07)	-.01	.09***	-.04	.31***	.07***	-.15**	-.10**	-.05	.21***	-						
11. Domineering	2.51(1.09)	-.05*	.13***	-.05	.40***	.10**	-.22***	-.16***	-.12***	.17***	.74***	-					
12. Abandoning	1.70(0.66)	-.05**	.08***	-.05*	.13***	.07**	-.13***	-.14***	-.12***	-.03	.23***	.29***	-				
13. Awaiting	2.68(1.13)	-.06**	.12***	-.05*	.13**	.08**	-.11*	-.16***	-.15***	-.13*	.16***	.22**	.20***	-			
14. Gender	-	.00	.02	-.01	.07**	.01	-.06**	-.02	-.02	-.02	.05**	.04*	.03**	-.01	-		

	M(SD)															
15. School level	-	.01	.03	-.02***	.04	.02	-.09**	-.03*	-.01	.02	.11***	.12***	.05***	.03	.02*	-
16. Teaching Experience	10.77(8.52)	.01	-.02	-.06**	-.07*	.05**	-.06	-.09***	-02	-.01	.12**	.07	.05	.06	.02	.06***	-

Note. ***p<.001, **p<.01, *p<.05.

Table 4. Indirect effects of need-based experiences on (de)motivating approaches via
motivational quality among pe teachers.

	β (SE)	p-value	95% CI_{BC}
Indirect effects of need satisfaction on participative approaches			
Total indirect	.254(.074)	.001	(.13, .38)
Specific indirect via autonomous motivation	.332(.109)	.002	(.15, .51)
Specific indirect via controlled motivation	-.057(.026)	.032	(-.10, -.01)
Specific indirect via amotivation	-.022(.044)	.621	(-.09, .05)
Indirect effects of need frustration on participative approaches			
Total indirect	.124(.079)	.119	(-.01, .25)
Specific indirect via autonomous motivation	.017(.050)	.728	(-.06, .10)
Specific indirect via controlled motivation	-.088(.038)	.019	(-.15, -.03)
Specific indirect via amotivation	.019(.101)	.053	(.03, .36)
Indirect effects of need satisfaction on attuning approaches			
Total indirect	.304(.088)	.001	(.16, .50)
Specific indirect via autonomous motivation	.354(.123)	.004	(.15, .56)
Specific indirect via controlled motivation	-.043(.026)	.097	(-.09, .00)
Specific indirect via amotivation	-.008(.023)	.746	(-.05, .03)
Indirect effects of need frustration on attuning approaches			
Total indirect	.019(.093)	.835	(-.13, .17)
Specific indirect via autonomous motivation	.018(.052)	.725	(-.07, .11)
Specific indirect via controlled motivation	-.066(.038)	.084	(-.13, -.00)
Specific indirect via amotivation	.068(.127)	.596	(-.14, .28)
Indirect effects of need satisfaction on guiding approaches			
Total indirect	.227(.087)	.009	(.08, .37)
Specific indirect via autonomous motivation	.278(.112)	.013	(.09, .46)
Specific indirect via controlled motivation	-.053(.025)	.033	(-.09, -.01)
Specific indirect via amotivation	.002(.013)	.890	(-.02, .02)
Indirect effects of need frustration on guiding approaches			
Total indirect	-.084(.091)	.359	(-.23, .07)
Specific indirect via autonomous motivation	.014(.041)	.727	(-.05, .08)
Specific indirect via controlled motivation	-.082(.037)	.026	(-.14, -.02)
Specific indirect via amotivation	-.016(.118)	.892	(-.21, .18)
Indirect effects of need satisfaction on clarifying approaches			
Total indirect	.283(.093)	.002	(.13, .44)
Specific indirect via autonomous motivation	.273(.120)	.023	(.08, .47)
Specific indirect via controlled motivation	.020(.026)	.447	(-.02, .06)
Specific indirect via amotivation	-.010(.023)	.665	(-.08, .03)
Indirect effects of need frustration on clarifying approaches			
Total indirect	.136(.092)	.137	(-.02, .29)
Specific indirect via autonomous motivation	.014(.041)	.727	(-.05, .08)
Specific indirect via controlled motivation	.031(.040)	.435	(-.03, .10)
Specific indirect via amotivation	.091(.114)	.422	(-.09, .28)
Indirect effects of need satisfaction on demanding approaches			
Total indirect	.137(.062)	.028	(.03, .24)
Specific indirect via autonomous motivation	.066(.070)	.344	(-.05, .18)
Specific indirect via controlled motivation	.092(.031)	.003	(.04, 014)
Specific indirect via amotivation	-.021(.039)	.587	(-.09, .04)
Indirect effects of need frustration on demanding approaches			
Total indirect	.339(.074)	<.001	(.22, .46)
Specific indirect via autonomous motivation	.003(.010)	.743	(-.01, .02)

Specific indirect via controlled motivation	.144(.040)	<.001	(.08, .21)
Specific indirect via amotivation	.191(.083)	.022	(.05, .33)
Indirect effects of need satisfaction on domineering approaches			
Total indirect	.164(.063)	.009	(.06, .27)
Specific indirect via autonomous motivation	.093(.063)	.140	(-.01, .20)
Specific indirect via controlled motivation	.100(.032)	.002	(.05, .15)
Specific indirect via amotivation	-.029(.052)	.582	(-.14, .06)
Indirect effects of need frustration on domineering approaches			
Total indirect	.416(.073)	<.001	(.30, .54)
Specific indirect via autonomous motivation	.005(.014)	.732	(.02, .03)
Specific indirect via controlled motivation	.156(.041)	<.001	(.09, .22)
Specific indirect via amotivation	.255(.082)	.002	(.12, .39)
Indirect effects of need satisfaction on abandoning approaches			
Total indirect	.062(.069)	.367	(-.05, .18)
Specific indirect via autonomous motivation	.050(.058)	.388	(-.05, .15)
Specific indirect via controlled motivation	.051(.024)	.030	(.01, .09)
Specific indirect via amotivation	-.039(.071)	.580	(-.16, .08)
Indirect effects of need frustration on abandoning approaches			
Total indirect	.434(.077)	<.001	(.31, .56)
Specific indirect via autonomous motivation	.003(.008)	.745	(-.01, .02)
Specific indirect via controlled motivation	.080(.035)	.023	(.02, .01)
Specific indirect via amotivation	.251(.093)	<.001	(.20, .50)
Indirect effects of need satisfaction on awaiting approaches			
Total indirect	.106(.084)	.206	(-.03, .25)
Specific indirect via autonomous motivation	.128(.095)	.176	(-.03, .29)
Specific indirect via controlled motivation	.027(.032)	.404	(-.03, .08)
Specific indirect via amotivation	-.048(.086)	.573	(-.19, .09)
Indirect effects of need frustration on awaiting approaches			
Total indirect	.479(.112)	<.001	(.30, .66)
Specific indirect via autonomous motivation	.007(.019)	.732	(-.03, .04)
Specific indirect via controlled motivation	.042(.050)	.403	(-.04, .12)
Specific indirect via amotivation	.431(.128)	.001	(.22, .64)

Note. CI$_{BC}$ = 95% bias-corrected bootstrap confidence interval.

Supplemental material

Table SM1. Mean differences by gender and school level in need-based experiences and motivation.

	Female	Male				Primary	Secondary			
	M(SD)	*M(SD)*	F	*p-value*	η^2_p	*M(SD)*	*M(SD)*	F	*p-value*	η^2_p
Need-based experiences										
Need satisfaction	4.43(0.40)	4.42(0.43)	0.03	.834	<.01	4.41(0.43)	4.45(0.41)	1.59	.208	<.01
Need frustration	1.77(0.50)	1.79(0.50)	0.23	.632	<.01	1.77(0.52)	1.79(0.48)	0.12	.729	<.01
Motivational quality for teaching										
Autonomous motivation	4.70(0.42)	4.64(0.45)	2.52	.113	<.01	4.71(0.42)	4.59(0.45)	13.02	<.001	.02
Controlled motivation	2.38(0.77)	2.59(0.77)	12.03	.001	.02	2.47(0.75)	2.58(0.81)	3.49	.062	.01
Amotivation	1.10(0.27)	1.13(0.37)	0.65	.421	<.01	1.09(0.31)	1.16(0.37)	6.93	.009	.01

Note. Significantly different groups are shown by different letters in superscript.

Table SM2. Mean differences by teaching experience in need-based experiences and motivation.

	0-9	10-19	20-29	+29			
	$M(SD)$	$M(SD)$	$M(SD)$	$M(SD)$	F	p	η^2_p
Need-based experiences							
Need satisfaction	4.41(0.43)	4.45(0.38)	4.43(0.44)	4.43(0.59)	0.38	.766	<.01
Need frustration	1.80(0.52)	1.72(0.45)	1.78(0.52)	1.91(0.55)	1.77	.152	.01
Motivational quality for teaching							
Autonomous motivation	4.72(0.38)[a]	4.67(0.37)[a]	4.49(0.58)[b]	4.43(0.73)[b]	9.32	<.001	.04
Controlled motivation	2.57(0.79)	2.46(0.74)	2.46(0.76)	2.46(0.83)	1.05	.369	.01
Amotivation	1.09(0.25)[a]	1.10(0.27)[a]	1.22(0.55)[b]	1.31(0.69)[b]	6.39	<.001	.03

Note. Letters in superscript show significantly different groups (Bonferroni's correction at $p < .0125$)

Table SM3. Direct effects of target variables

	β (SE)	p-value	95% CI$_{BC}$
Direct effects on participative approach			
Autonomous motivation	.614(.170)	<.001	(.33, .89)
Controlled motivation	-.185(.071)	.009	(-.33, -.07)
Amotivation	.352(.191)	.065	(.04, .67)
Direct effects on attuning approach			
Autonomous motivation	.656(.192)	.001	(.34, .97)
Controlled motivation	-.140(.074)	.059	(-.26, -.02)
Amotivation	.122(.238)	.607	(-.27, .51)
Direct effects on guiding approach			
Autonomous motivation	.514(.175)	.003	(.23, .80)
Controlled motivation	-.172(.071)	.015	(-.29, .06)
Amotivation	-.029(.213)	.891	(-.38, .32)
Direct effects on clarifying approach			
Autonomous motivation	.505(.193)	.009	(.18, .82)
Controlled motivation	.065(.082)	.432	(-.07, .20)
Amotivation	.165(.206)	.423	(-.17, .50)
Direct effects on demanding approach			
Autonomous motivation	.122(.126)	.332	(-.09, .33)
Controlled motivation	.303(.064)	<.001	(.20, .41)
Amotivation	.345(.141)	.014	(.11, .58)
Direct effects on domineering approach			
Autonomous motivation	.172(.113)	.128	(-.14, .36)
Controlled motivation	.327(.064)	<.001	(.22, .43)
Amotivation	.462(.131)	<.001	(.25, .68)
Direct effects on abandoning approach			
Autonomous motivation	.092(.107)	.389	(-.08, .27)
Controlled motivation	.168(.067)	.012	(-.08, .28)
Amotivation	.635(.155)	<.001	(.38, .89)
Direct effects on awaiting approach			
Autonomous motivation	.237(.172)	.167	(-.05, .52)
Controlled motivation	.087(.102)	.391	(-.08, .26)
Amotivation	.779(.182)	<.001	(.48, 1.08)
Direct effects on autonomous motivation			
Need satisfaction	.541(.071)	<.001	(.42, .66)
Need frustration	.028(.083)	.736	(-.11, .17)
Direct effects on controlled motivation			
Need satisfaction	.305(.073)	<.001	(.19, .43)
Need frustration	.476(.075)	<.001	(.35, .70)
Direct effects on amotivation			
Need satisfaction	-.062(.108)	.567	(-.24, .12)
Need frustration	.553(.092)	<.001	(.40, .70)

Note. CI$_{BC}$ = 95% bias-corrected bootstrap confidence interval.