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### A Circumplex Approach to (de)motivating Styles in Physical Education: Situations-In-School–Physical Education Questionnaire in Spanish Students, Pre-Service, and In-Service Teachers

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#### ABSTRACT

Building upon self-determination theory and the circumplex approach, the objective of this study was to adapt the Situations-in-School–Physical Education (SIS–PE) questionnaire and to gather validity and reliability evidence in the Spanish PE context. Three samples of 1441 students (46.43% girls), 473 in-service teachers (35.73% women), and 654 pre-service teachers (50.31% women) participated. Multidimensional scaling analyses indicated that (de)motivating styles (autonomy support, structure, control, and chaos) were graphically depicted by a two-dimensional circular structure differing into need-supportiveness (horizontal axis) and teacher directiveness (vertical axis). Eight specific approaches (two per stye) were additionally identified (participative, attuning, guiding, clarifying, demanding, domineering, abandoning, and awaiting) drawing an ordered pattern of correlations. Bifactor exploratory structural equation modeling additionally supported four overarching styles and eight specific approaches. Reliability and external validity were met in the three samples. The Spanish versions of the SIS-PE questionnaire are valid and reliable measures to assess students', in-service, and pre-service teachers' perceptions of (de)motivating styles.

#### **KEYWORDS**

need-supportive style; needthwarting styles; teaching style; teaching behavior; circumplex model

#### Introduction

Physical Education (PE) teachers take a central position in the classroom to guide students in their learning process (White et al., 2021). According to selfdetermination theory (SDT; Ryan & Deci, 2017), the (de)motivating style from the PE teacher, namely, the specific manner in which (s)he interacts, behaves, and communicates with students in classroom practice (Aelterman et al., 2019), is especially important to improve student outcomes. While PE teacher's motivating styles (i.e., autonomy-support, structure, and involvement) yielded numerous adaptive outcomes in students, demotivating styles (i.e., control, chaos, and coldness) have been broadly associated with maladaptive outcomes for students (Burgueño et al., 2022; Curran & Standage, 2017; Vasconcellos et al., 2020). This, notwithstanding, many PE teachers wonder how to use a highly autonomy-supportive style without falling into a chaotic style, in the same way as they are more likely to confuse structure and control and vice-versa.

Building upon SDT (Ryan & Deci, 2017), Aelterman et al. (2019) recently forwarded an integrative and fine-

grained conceptualization of (de)motivating teaching styles that integrates autonomy support, structure, control, and chaos into a circular structure in accordance with level both of teacher need-supportiveness (i.e., the extent to which teacher supports or thwarts students' needs) and teacher directiveness (i.e., the degree to which the teacher takes the initiative in learning interactions or transfers it to students themselves) present in each of them. Consistent with this circumplex approach, Aelterman et al. (2019) developed the Situations-in-School (SIS) questionnaire to measure (de)motivating styles from the teacher. Later, the SIS questionnaire was adapted to the PE context in a sample of Belgian and French in-service teachers (i.e., Situations-in-School-Physical Education (SIS-PE) questionnaire; Escriva-Boulley et al., 2021). Given the need to develop specifically designed instruments for the PE context, it is important to expand the validity and reliability evidence of the SIS-PE in other socio-linguistic contexts (e.g., Spanish) and with the different educational agents involved in PE, including secondary students, inservice, and pre-service PE teachers. This will allow us to obtain a more comprehensive and holistic understanding of the (de)motivating styles, as well their respective teaching approaches, in the eyes of students, in-service, and pre-service teachers in the PE context. Therefore, this research sought to adapt the SIS–PE questionnaire (Escriva-Boulley et al., 2021) and to gather validity and reliability evidence for use in students, in-service, and pre-service teachers in the Spanish PE context.

### *Circumplex approach to (de)motivating teaching styles in PE*

Recently, building upon SDT (Ryan & Deci, 2017), a more integrative and fine-grained perspective (i.e., circumplex approach) putting teachers' autonomy-support, structure, control, and chaos within a circular structure (or teaching wheel) along two dimensions (see Figure 1) has been proposed in the educational domain (Aelterman et al., 2019) and PE context (Escriva-Boulley et al., 2021). The horizontal dimension reflects the teacher's level of needsupportiveness, with autonomy-supporting and structuring styles representing more need-supportive teaching behaviors and with controlling and chaotic styles depicting more need-thwarting teaching behaviors. The vertical dimension expresses the teacher's degree of directiveness, with structuring and controlling styles being the most directive styles and with autonomy-supportive and chaotic styles representing the less directive ones.

Aelterman et al. (2019) further argue that each of the four aforementioned (de)motivating styles is, in turn, composed of two specific teaching approaches. Autonomy-support involves PE teachers displaying an interpersonal tone of receptivity, empathy, and flexibility to attend to students' preferences, choices, and interests (Vansteenkiste et al., 2019). Autonomy-supportive practices are manifested by participative (i.e., the teacher provides students with opportunities for choice, asks them for their opinions, and welcomes their suggestions) and/or attuning approaches (i.e., the teacher fosters students' personal interests, accepts expressions of negative affect, and explains the relevance of each activity performed) (Aelterman et al., 2019). Structure refers to PE teachers taking progress- and processoriented attitudes to seek alignment with students' levels of ability, strengths, and potential learning (Vansteenkiste et al., 2019). Structuring practices are implemented by guiding (i.e., the teacher provides students with helpful guidelines, growth-oriented feedback, and encouragement for the successful task completion) and/or clarifying approaches (i.e., the teacher clearly informs students about the goals and expectations of the lessons, and follow-up with them to monitor their progress) (Aelterman et al., 2019).

Control involves PE teachers adopting a tone of pressure for students to think, feel, and behave in a teachers-prescribed way (Vansteenkiste et al., 2019). Controlling practices are expressed by demanding (i.e., the teacher imposes students' responsibilities and



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

obligations as to what they must do without tolerating contradictions using explicit and direct strategies, including forceful and commanding language, threats, contingent utilization of rewards, and punishments) and/or domineering approaches (i.e., the teacher puts pressure on students to meet his/her requests through intrusive and manipulative strategies such as guiltinduction, public shame, nonverbal expressions of disapproval, and intimidation) (Aelterman et al., 2019). Finally, chaos refers to PE teachers with a laissez-faire attitude, in which they behave in an unpredictable and inconsistent manner with no clear guidelines, which confuses students and makes it difficult for them to develop their skills and achieve desired outcomes (Vansteenkiste et al., 2019). Chaotic practices are reflected by abandoning (i.e., the teacher leaves students to their fate since, after repeated interventions, he/she has given up) and/or awaiting approaches (i.e., the teacher prefers to wait to how things evolve and if students are able to take the initiative on their own) (Aelterman et al., 2019).

In contrast with understanding (de)motivating styles in exclusively categorical terms, the circumplex model allows one to adopt a gradual perspective (Aelterman et al., 2019). In other words, the differences among styles are more progressive and rely on the degree to which each approach within the circumplex model represents need-supportive, relative to need-thwarting teaching practices, as well as high, relative to low, in teacher directiveness. To illustrate, attuning and guiding approaches are high on need-supportive teaching practices, but they are qualitatively different in their level of directiveness, and although the participating and awaiting approaches are both low on teacher directiveness, they differ in the extent to which these are needsupportive versus need-thwarting.

# Associations between the students' and teachers' perception of (de)motivating teaching styles and their need-based experiences

A substantial body of SDT-based research in PE has reported a positive association of students' perceptions of autonomy-supportive and structuring styles from their teacher with the satisfaction of their basic psychological needs for autonomy (i.e., experiences of personal ownership), competence (i.e., experiences of effectiveness and mastery), and relatedness (i.e., experiences of closeness and mutual care) (Curran & Standage, 2017; Vasconcellos et al., 2020). Instead, students' perceptions of teacher control were positively related to the frustration of their needs for autonomy (i.e., experiences of coercion and being controlled), competence (i.e., experiences of ineffectiveness and inferiority), and relatedness (i.e., experiences of loneliness and social exclusion) (Curran & Standage, 2017; Vasconcellos et al., 2020). Although little is known about the consequences associated with a chaotic teaching style in PE, a growing number of studies have observed a positive correlation between students' perceptions of a chaotic style from PE teacher and their need frustration (Burgueño & Medina-Casaubón, 2021; Burgueño et al., 2022).

Prior SDT-based research on the association from teachers' need-based experiences to their own (de)motivating styles showed that in-service teachers' need satisfaction at work was positively associated with autonomy-supporting and structuring styles, while their need frustration at work was positively related to the use of controlling and chaotic styles (Escriva-Boulley et al., 2021; Moè & Katz, 2022; Vermote et al., 2022). Even though an increasing body of research is focusing on chaos, little attention, so far, has been paid to identify antecedents of the adoption of a chaotic style. Therefore, developing instruments that include this demotivating style is a priority issue. Regarding preservice PE teachers, the single found study, so far, reported that pre-service teachers' need satisfaction was positively associated with their own needsupportive style, while need frustration was positively related to their own need-thwarting style (Burgueño et al., 2023).

# *Measuring (de)motivating styles from a circumplex approach in PE*

The SIS questionnaire was first used to measure both students' and in-service teachers' perceptions of (de) motivating teaching styles in the Flemish secondary education setting (Aelterman et al., 2019). The circular structure for (de)motivating teaching styles has been confirmed in other educational contexts with inservice teachers (Gordeeva & Sychev, 2021; Moè et al., 2022; Vermote et al., 2020), as well as in the sport context with athletes and coaches (Delrue et al., 2019), among others.

The SIS questionnaire has been slightly adapted to PE (i.e., SIS–PE questionnaire) with Belgian and French inservice teachers (for a further review of the modifications to the original version, see Escriva-Boulley et al., 2021). In particular, the results from multidimensional scaling analysis (MDS; Borg et al., 2018) supported the circular structure with four overarching teaching styles and eight specific teaching approaches differing in terms of need-supportiveness (i.e., x-axis) and directiveness (i.e., y-axis). Circular structure was additionally underpinned by an ordered pattern of correlations with adjacent approaches being positively correlated (representative of their compatible character), and correlations becoming weaker and even negative (representative of their more conflictual character) when moving along the circumplex. Although evidence in support of discriminant validity and reliability was, respectively, met, Escriva-Boulley et al. (2021) found higher correlations than expected between attuning and guiding approaches and between domineering and abandoning approaches, as well as marginal reliability scores in participating, abandoning, and awaiting approaches.

To the best of our knowledge, no studies to date were found to adapt and test the psychometric properties of the SIS-PE in the Spanish PE context with samples of students, in-service, and pre-service teachers. Considering that Spanish is the second most spoken language in the word, the development of the Spanish version of the SIS-PE will allow us to analyze teacher's behavior in a more integrative and fine-grained manner through a circumplex approach not only according to in-service teachers' perceptions (Escriva-Bulley et al., 2021), but also according to the students' and preservice teachers' perceptions. This gradual view could make a valuable theoretical and practical contribution to the existing PE teaching literature. Specifically, the circumplex approach may point to exactly which autonomy-supportive practices (e.g., providing students with choice) may be closer to an awaiting approach, and which structuring practices (e.g., providing students with clear guidelines for the task completion) may be closer to a demanding approach. Further, by analyzing teaching practice from a gradual view, the circular structure provides a first clue to how PE teachers may shift from one approach to another along the circumplex, depending on the obstacles and facilitators found. This information would be useful for PE teachers to know how to implement more effectively autonomysupportive and structuring styles and to avoid, simultaneously, falling into controlling and chaotic practices in the PE lessons. Moreover, the students' and teachers' versions of the SIS-PE will contribute to examine the degree of (dis)agreement on perceived (de)motivating styles used in the classroom practice. It will enable us to gather a broader basis of evidence to improve initial and continuous professional development programs in teachers.

#### The present research

The objective of this research was to adapt the SIS-PE questionnaire (Escriva-Boulley et al., 2021) and to gather validity and reliability evidence for use in the

Spanish PE context with samples of students, inservice, and pre-service teachers. Given the comprehensiveness of the study, we have concretized the general objective into three more specific objectives: to meet validity evidence based on the SIS-PE questionnaire's internal structure (aim 1); to provide the instrument's reliability evidence (aim 2); and to analyze the SIS-PE questionnaire's external validity (aim 3). Building upon previous research (Aelterman et al., 2019; Delrue et al., 2019; Escriva-Boulley et al., 2021; Vermote et al., 2020), we hypothesized that 1) the styles of autonomy support, structure, control, and chaos would be configured along two dimensions, depicting the degree of need-supportiveness (i.e., horizontal dimension) and the level of directiveness (i.e., vertical dimension); 2) every overarching style (i.e., autonomy support, structure, control, and chaos) would be operationalized in their two specific approaches (i.e., participative, attuning, guiding, clarifying, demanding, domineering, abandoning, and awaiting); 3) an ordered pattern of latent correlations among approaches, with adjacent approaches being most highly positively correlated and with the patterns turning into progressively less positive and even negative when one moves further away from that approach along the circumplex; 4) the four overarching (de) motivating styles and the eight specific teaching approaches would obtain an acceptable level of reliability; 5) students' perceptions of autonomysupportive and structuring teaching styles would be positively related to their need satisfaction, just as perceived controlling and chaotic teaching styles would be positively associated with their need frustration (Curran & Standage, 2017; Vasconcellos et al., 2020); 6) each one of the two autonomy-supportive and structuring approaches would be differently related to need satisfaction, as well as each of the two controlling and chaotic approaches would not be equally associated with need frustration in spite of the lack of previous SIS-based research with students; 7) teachers' need satisfaction at work would be positively associated with their autonomy-supporting and structuring styles, in the same way as need frustration at work would be positively related to their controlling and chaotic styles (Escriva-Boulley et al., 2021; Moè et al., 2022; Vermote et al., 2022); 8) teachers' need satisfaction at work would be more strongly associated with attuning and guiding than participative and clarifying teaching approaches, while need frustration at work is hypothesized to be more greatly related to domineering and abandoning than demanding and awaiting teaching approaches (Escriva-Boulley et al., 2021; Moè et al., 2022; Vermote et al., 2022); 9) for

pre-service teachers were expected to find similar results to those postulated with the in-service PE teacher sample.

#### Materials and method

#### Design and participants

Three independent and purposive samples were recruited for this cross-sectional study. The first sample included 1441 secondary education students (772 boys and 669 girls) aged 12–18 years ( $M_{age} = 15.94$ , SD = 1.66) from several public schools (n = 8) in four medium-sized cities of Spain. Students had two 50-min compulsory and coeducational PE lessons per week. The class size ranged from 20 to 32 students. The second sample consisted of 473 in-

service primary and secondary PE teachers (304 men and 169 women) aged 24–63 years ( $M_{age} = 37.36$ , SD =7.68). The third sample was made up of 654 preservice primary and secondary PE teachers (325 men and 329 women) aged 20–60 years ( $M_{age} = 23.14$ , SD = 4.28) from 10 public Spanish universities. The last two samples belonged to most of the geographic areas of Spain. Given that initial primary teacher education is organized into a concurrent model in Spain, inservice primary PE teachers held a BSc in Physical Education Primary Education, whereas pre-service primary PE teachers were enrolled in fourth academic year of this degree's program. Instead, On the one hand, inservice secondary teachers had a BSc in Sport and Exercise Sciences and a professional master's program in education, while in-service primary teachers had a BSc in Primary Education with a major in PE. On the other hand, pre-service secondary teachers were enrolled in the professional master's in education from different public universities, while pre-service primary teachers were enrolled in the last academic level of their specialty.

#### Instruments

# Common student, pre-service, and in-service teacher measures: (De)motivating teaching styles in PE

To assess (de)motivating teaching styles according to perceptions of students, in-service, and pre-service teachers in PE, we used a translation to Spanish of the SIS– PE questionnaire (Escriva-Boulley et al., 2021) that was originally developed with students and in-service teachers (Aelterman et al., 2019). Some slight modifications were made to the questionnaire for students and pre-service teachers (see Appendix A). This vignettebased self-reported instrument includes 12 authentic

teaching situations, which were either more proactive (e.g., "The teacher presents a difficult lesson that requires a lot of effort from the students") or more reactive (e.g., "A couple of students have been rude and disruptive") in nature and referred to situations dealing with either the learning process or student behavior. For each of the 12 situations, there are four distinct responses (i.e., 48 items), with each representing an autonomy-supporting, structuring, controlling, and chaotic style. The SIS-PE questionnaire includes four participative and eight attuning items for a total of 12 autonomy-support items; seven guiding and five clarifying items together constitute 12 structure items; seven demanding and five domineering items form 12 control items. Finally, eight abandoning and four awaiting items make up a total of 12 chaos items. For instance, in the in-service/pre-service teachers' SIS-PE questionnaire version, situation nine states: "It is time for students to participate. You ... " that is followed by four possible responses: a) suggest different levels of difficulty and ask the students at which level they would like to practice (autonomy support, participative approach); b) demand that it is time to work, whether they like it or not. You explain to them that sometimes they have to learn to do things against their will (control, domineering approach); c) do not plan too much and watch how things develop (chaos, awaiting approach), and d) set out step-by-step the key points that will guide their progress through the learning process (structure, guiding approach). A second example is situation 12, "A student leaves the locker room late for the second time in a row. He/she seems to be somewhere else. You ... " followed by four response options: a) take the student aside after the lesson and ask if anything is wrong (autonomy support, attuning approach); b) repeat your expectations regarding punctuality in class (structure, clarifying approach); c) explain to the rest of the class that you are disappointed that he/she is late for the second time in a row (control, domineering approach); and d) do not say anything. At the end of the day, you cannot interact with every student, you have to teach first. You focus on the lesson (chaos, abandoning approach). In-service and pre-service teachers were asked to rate on a 7-point Likert-type scale from 1 (does not describe me at all) to 7 (describes me extremely well) to which degree each of the four responses described themselves. Students responded to the same 12 situations, although the vignettes and answers were adapted to represent the students' view of teachers' behaviors (for a further inspection, see Appendix A). They were also asked to rate the extent to which the items correspond to (de)motivating practices from their PE teacher on a 7-point Likert-type scale

from 1 (does not describe my teacher at all) to 7 (describes my teacher extremely well).

#### Students' need-based experiences

To assess students' perceptions of need satisfaction and need frustration in PE lessons, we used the Spanish PE version (Zamarripa et al., 2020) of the Psychological Need Basic Satisfaction and Frustration Scale (Chen et al., 2015). It is preceded by the stem "In my PE lessons ... " and followed by 24 items that, grouped into four items per factor, measure autonomy satisfaction (e.g., "I feel a sense of choice and freedom in the things I undertake"), competence satisfaction (e.g., "I feel confident that I can do things well"), relatedness satisfaction (e.g., "I feel that the people I care about also care about me"), autonomy frustration (e.g., "Most of the things I do feel like I have to"), competence frustration (e.g., "I feel disappointed with many of my performances"), and relatedness frustration (e.g., "I feel that people who are important to me are cold and distant toward me"). Responses were rated on 5-point Likert-type scale from 1 (strongly disagree) to 5 (strongly agree). Consistent with SDT and previous studies in PE, two need-satisfaction and need-frustration composite scores were calculated by averaging mean values of autonomy, competence, and relatedness satisfaction and frustration, respectively. In this research, an acceptable fit was achieved for the hierarchical two-factor confirmatory factor analysis (CFA) model  $(\chi^2/df = 2.68; \text{ CFI} = .914; \text{ TLI} = .902; \text{ SRMR} = .075;$ RMSEA = .066, 90%CI = .058-.074).

### In-service and pre-service teachers' need-based experiences

To assess in-service and pre-service teachers' perceptions of need satisfaction and need frustration, we used the need-satisfaction items of the Basic Psychological Needs at Work Scale for in-service teachers (Abos et al., 2018) and the need-frustration items from the Basic Psychological Need Satisfaction and Frustration Scale (Chen et al., 2015), respectively. Both scales include 12 items that, grouped into four items per factor, measure autonomy satisfaction (e.g., "I feel free to execute my tasks in my own way"), competence satisfaction (e.g., "I am able to solve problems at work"), and relatedness satisfaction (e.g., "When I am with the people from my work environment, I feel as though I can trust them"); as well autonomy frustration (e.g., "Most of the things I do feel like I have to"), competence frustration (e.g., "I feel disappointed with many of my performances"), and relatedness frustration (e.g., "I feel that people who are important to me are cold and distant toward me"). The preceded stems of these scales were "At my work ... " for in-service teachers, and "As a PE teacher ... " for pre-service teachers. Responses were rated on a 5-point Likert-type scale from 1 (strongly disagree) to 5 (strongly agree). Importantly, whereas for in-service teachers all items related to need-based experiences were measured, pre-service teachers were only asked to rate items concerning competence satisfaction and frustration. In this research, for the in-service teacher sample, a suitable fit was obtained for the hierarchical two-factor CFA model ( $\chi^2/df = 2.59$ ; CFI = .94; TLI = .92; SRMR = .071; RMSEA = .058, 90%CI =.053-.064). In the pre-service teacher sample, there was an adequate fit for the two-factor CFA correlated model ( $\chi^2/df = 3.07$ ; CFI = .97; TLI = .95; SRMR = .040; RMSEA = .056, 90%CI = .040-.073).

#### Procedure

The SIS-PE adaptation and translation process was conducted following the International Test Commission guidelines (Bartram et al., 2018). Firstly, a forward translation of the French version of the SIS-PE questionnaire to Spanish was developed by a professional translator with experience in educational research. Secondly, an expert panel of three researchers reviewed this first translation to adapt the expressions and to ensure that each situation and item response captures the (de)motivating style and approach translated. Thirdly, a back translation from Spanish to French was developed and compared to the original version. No significant discrepancies were found between both versions and the final versions for students and teachers (see Appendix A) were used for this study.

Once the different versions of the Spanish SIS-PE questionnaire were developed, the research team contacted various schools, teachers, and universities to request their collaboration to participate in this study. Prior to the data collection process, informed consent was obtained from all participants. Students completed the questionnaires in a paper-pencil version, while inservice and pre-service teachers completed an onlinebased questionnaire. One of the researchers administered the questionnaire to the students in the absence of PE teachers. In-service teachers were contacted by professional-development PE networks and associations for professional teacher training. In-service and pre-service versions of the questionnaires were introduced by an agreement for participation and a brief explanation about how to complete the questionnaires to ensure an accurate completion. This research was approved by the Ethics Committee of the University of Extremadura

(153//2022) and followed all ethical procedures for the data collection established in the Helsinki Declaration.

#### Data analysis

For the provision of validity evidence based on the internal structure of the different versions of the SIS-PE questionnaire (aim 1), MDS analyses (Borg et al., 2018) were run through the Proxcal procedure in IBM<sup>®</sup> SPSS Statistics (version 28.00 for Windows), as well as different factor models performed in Mplus (version 8.4; Muthén & Muthén, 1998-2018). Firstly, MDS provide a graphical representation of the dimensional structure of the instrument. Namely, items that are highly positively correlated will be displayed close to each other in the geographical area, whereas highly negatively correlated items will be shown in the opposite space. By running analyses with one to six dimensions, we aimed to inspect if the data could be adequately represented by a two-dimensional solution. For these analyses, euclidian distance and ordinal proximity transformation measures with standardized item scores were utilized (Borg et al., 2018). For a better interpretation and selection of the best-fit representation, normalized raw stress with values close to 0 and the Tucker's congruence coefficient with scores up to 0.95 as acceptable were adopted (Borg et al., 2018). To expand validity evidence based on the SIS-PE's internal structure, we tested the robustness of different plausible factor models: a) an eight-factor CFA model, in which items loaded on their respective (de)motivating teaching approach; b) a second-order four-factor CFA model, in which four hierarchical factors (i.e., the four overarching styles) were specified by two primary-order factors (i.e., their two respective approaches); c) an exploratory structural equation modeling (ESEM) approach, in which items loaded on eight domain factors (i.e., the eight approaches), and d) a bifactor ESEM approach, in which items loaded both on eight domain factors (i.e., the eight specific approaches) and on four global factors (i.e., the four overarching styles). The models were run by the weighted least square mean and variance adjusted (WLSMV) estimator given that it is more robust to Likert-type scales and considering non-normal data (Li, 2016). Complementary to the WLSMV estimator, the rotation target oblique was used for the ESEM approach and orthogonal for the bifactor ESEM approach. Assessment of each model's fit was made by a combination of goodness-of-fit measures: the coefficient between chi-square and degrees of freedom  $(\chi^2/df)$ , Comparative Fit index (CFI), Tucker-Lewis index (TLI), Standardized Root Mean-Square Residual (SRMR), Root Mean Square Error of Approximation

(RMSEA) together with the 90% confidence interval (90%CI) and Akaike Information Criterion (AIC). Values up to 3 for the  $\chi^2/df$  coefficient, higher than .95 for CFI and TLI, and lower than .060 for SRMR and RMSEA are indicative of a good fit to data, while an acceptable fit is obtained with scores as high as 5 for the  $\chi^2/df$  coefficient, over .90 for CFI and TLI, and below .080 for SRMR and RMSEA (Kline, 2016). AIC is typically used to select between competing models, indicating that the model with the lowest score would be chosen as the most parsimonious (Kline, 2016). Thereupon, mean scores, and latent correlations from the measurement model of the structural equation modeling (SEM) approach were reported for the four (de) motivating styles with each other and eight approaches with each other. Correlations show a good level of discriminant validity with values up to .85, while scores as high as .90 are indicative of reasonable discriminant validity (Kline, 2016).

For inspection of the SIS-PE questionnaire's reliability for the three samples (aim 2), McDonald's omega ( $\omega$ ) coefficient was computed, considering .70 as good cutoff point and .60 as a reasonable cutoff score, respectively (Dunn et al., 2014). For analysis of external validity of the SIS-PE questionnaire (aim 3), a two-step SEM approach was conducted (Kline, 2016). The first step includes testing the robustness of a measurement model, in which the target variables are freely correlated. The second step consists of a structural model in which the different associations from independent variables to dependent variables are tested. For the student sample, the two-step SEM tested the associations from students' perceptions (de)motivating styles and approaches from the teachers (i.e., independent variables) to their need satisfaction and frustration (i.e., dependent variables). For the in-service and preservice teacher samples, two-step SEM examined the associations of in-service and pre-service teachers' perceptions of need satisfaction and frustration (in the case of pre-service teachers, only need for competence) at work (i.e., independent variables) with their own (de) motivating styles and approaches (i.e., dependent variables).

#### Results

# Validity evidence based on the SIS-PE internal structure (aim 1)

#### Multidimensional scaling analyses: Dimensionality

To assess if a range of hypothesized teaching practices were depicted along two dimensions, a one- up to a sixdimensional configuration was separately examined based on the non-metric MDS analyses for the student, in-service, and pre-service PE teacher samples. We selected a two-dimensional instead of one-dimensional solution given that it had a reduction in normalized raw stress of 0.13, 0.14, and 0.11 for students, in-service, and pre-service PE teachers, respectively, and because the additional decrease in normalized raw stress for the three-dimensional solution was much smaller (i.e., 0.05 for students and in-service teachers, and 0.04 for pre-service teachers). Tucker's congruence scores were 0.94 for the two-dimensional solution in students, inservice, and pre-service teachers, while the three-dimensional representation obtained values of 0.97 considered as unacceptable. Further, the screen-test verified



Figure 2. Two-dimensional representation of the SIS-PE items in secondary students.



Figure 3. Two-dimensional representation of the SIS-PE items in in-service PE teachers.



Figure 4. Two-dimensional representation of the SIS-PE items in pre-service PE teachers.

this selection by suggesting the suitability of a twodimensional representation for the three samples.

The first dimension of the circular pattern (i.e., the X-axis in Figures 2, 3, and 4) could be interpreted as need-thwarting, relative to need-supportive teaching behaviors. Teaching practices with the control items (lower left quadrant) and chaos items (upper left quadrant) had negative coordinates, while the autonomysupport items (upper right quadrant) and the structure items (lower right quadrant) had positive coordinates on this dimension. The second dimension (i.e., Y-axis) could be interpreted in terms of teacher directiveness. The chaos items and the autonomy-support items (except for two items in the in-service teacher sample) had positive coordinates on this dimension. Conversely, the structure items (except for one item in the in-service teacher sample and another item in the pre-service sample) along with the control items (except for two in the student sample) had negative coordinates on this dimension. Altogether, the four theoretically hypothesized styles (i.e., autonomy support, structure, control, and chaos) could greatly be depicted in distinct areas by the circumplex across the three samples.

# Multidimensional scaling analysis: Distinction into approaches

A more thorough examination of the content and the position of every item in the circumplex structure (see Appendix B and C) showed that each of the four styles (i.e., autonomy support, structure, control, and chaos) was divided into two distinguishable approaches. In general, for the three samples, four autonomy-support items referring to providing opportunities for choice and promoting initiative fell into the participative approach, whereas eight other autonomy-support items that concern the teachers' tendency to accept the students' opinions and feelings, and the provision of meaningful rationale for activities fell into the attuning approach. Only three items from the in-service teacher sample were found in coordinates that are distinct from what is theoretically hypothesized, with one item (participative7) falling into the attuning2 and attuning5) into the clarifying-approach subarea.

Furthermore, seven other structure items, which included providing feedback, help, and encouragement, as well as useful strategies for the task completion lay on the guiding approach, while five structure items referring to reporting goals and expectations for the lesson were situated on the clarifying approach. However, there were various items in coordinates different from theoretically expected, with two items (clarifying12 and guiding2) situated on the attuning-approach subarea in students; one item (guiding2) falling into the attuningapproach subarea and two other items (i.e., clarifying1 and clarifying8) into the attuning-approach subarea in in-service teachers. In pre-service teachers, one item (guiding6) was situated on the attuning-approach subarea and another item (guiding2) very near the center of the circumplex structure.

Moreover, seven control items that concern to underscore students' tasks and obligations put pressure on them for strict compliance and use (threats of) punishments lied on the demanding approach, while five another control items referring to intrusive controlling strategies such as guilt-induction, withdrawal of attention or nonverbal displays of disappointment were situated on the domineering approach. Nonetheless, some items were found to fall into other areas of the circumplex structure, with two items (demanding4 and domineering11) situated on the awaiting-approach subarea in students, two items (demanding8 and demanding11) lying on the domineering-approach subarea for inservice teachers, as well as one item (demanding1) falling into the clarifying-approach subarea and two other items (demanding8 and demanding11) into the domineering-approach subarea in pre-service teachers.

Finally, eight chaos items referring to indifference and ignoring student activity when an action from the teacher is required fell into the abandoning approach subarea, whereas four chaos items concern to wait to see how the situation evolves and letting things unfold themselves were situated on the awaiting-approach subarea. Two items were detected with a position different from theoretically expected. Particularly, one item (awaiting1) in students and another item (awaiting9) in in-service teachers from the awaiting approach fell into the abandoning-approach subarea.

#### Factor modeling approaches: Internal structure

Table 1 shows goodness-of-fit measures obtained for every plausible factor model tested. The eight-factor and four-factor CFA models obtained a poor fit to the observed data in the three samples, while ESEM and bifactor ESEM models had an acceptable fit to data in the student, in-service, and pre-service teacher samples. In addition, the bifactor ESEM model obtained a lower AIC value than ESEM model, which suggested that the bifactor ESEM model was the most parsimonious and best-fitting one.

An examination of the bifactor ESEM parameter estimates revealed that, overall, global factors for autonomy support, structure, control, and chaos, and domain factors for participative, attuning, guiding, clarifying, demanding, domineering, abandoning, and awaiting approaches were well defined in students (see Appendix D), in-service teachers (see Appendix E), and pre-service teachers (see Appendix F). In the student sample, the four global factors (autonomy support:  $\lambda = \text{from } .32 \text{ to } .63$ ; structure:  $\lambda = \text{from .10 to .71}$ ; control:  $\lambda = \text{from .30 to}$ .62; and chaos:  $\lambda =$  from .38 to .73), the eight domain factors (participative:  $\lambda$  = between .29 and .65; attuning:  $\lambda$  = between .40 and 73; guiding:  $\lambda$  = between .38 and .75; clarifying:  $\lambda$  = between .38 and .62; demanding:  $\lambda$  = between .32 and .56; domineering:  $\lambda$  = between .34 and .58; abandoning:  $\lambda$  = between .37 and 72; and awaiting:  $\lambda$  = between 42. and .92) were, in general, well defined by significant target factor loadings. There were items with poor target factor loadings, which matched with the problematic items found in MDS (see Appendix C for a further theoretical explanation).

For the in-serve teacher sample, most target factor loadings were significant and evidenced generally both well-defined global factors (autonomy support:  $\lambda =$  from .08 to .75; structure:  $\lambda =$  from .32 to .62; control:  $\lambda =$  from .18 to .66; chaos:  $\lambda =$  from .31 to .62) and welldefined domain factors (participative:  $\lambda =$  between .08 and .75; attuning:  $\lambda =$  between .33 and .58; guiding:  $\lambda =$  between .37 and .64; demanding:  $\lambda =$  between .01 and .46; domineering:  $\lambda =$  between .50 and .68; abandoning:  $\lambda =$  between .30 and .66; and awaiting:  $\lambda =$  between .45 and .70). In addition to the problematic

	$\chi^2(df)$	χ²/df	CFI	TLI	SRMR	RMSEA(90%CI)	AIC
Secondary PE Students							
8-factor CFA	2367.67(1052)	2.25	.852	.841	.063	.043(.041046)	121692.55
4-hierarchical factor CFA	2574.67(1066)	2.42	.830	.821	.075	.046(.044048)	121908.56
8-factor ESEM	1170.39(772)	1.52	.954	.935	.023	.028(.025031)	120683.50
Bi-factor ESEM	939.25(618)	1.52	.964	.934	.018	.028(.024031)	120613.67
In-service PE teachers							
8-factor CFA	3097.86(1052)	2.94	.659	.635	.075	.064(.062067)	66773.93
4-hierarchical factor CFA	3240.64(1066)	3.04	.640	.628	.082	.070(.068072)	66989.94
8-factor ESEM	1223(.24(772)	1.58	.925	.897	.029	.035(.031039)	65503.50
Bi-factor ESEM	1278.08(618)	2.07	.930	.902	.022	.035(.032–.039)	65461.00
Pre-service PE teachers							
8-factor CFA	2435.81(1052)	2.32	.804	.789	.061	.045(.043047)	93468.33
4-hierarchical factor CFA	2562.91(1066)	2.40	.787	.775	.066	.046(.044049)	93572.24
8-factor ESEM	1404.39(772)	1.82	.910	.899	.027	.035(.032038)	92711.86
Bi-factor ESEM	882.90(618)	1.43	.962	.931	.020	.026(.022029)	92579.48

Note. CFA = confirmatory factor analysis; ESEM = exploratory structural equation modeling.

items found in MDS for in-service teachers, the bifactor ESEM model revealed that two items (i.e., part1 and part9) had marginal factor loadings on the global autonomy-support factor and the domain participativeapproach factor, suggesting that both could represent neutral teaching behaviors (see Appendix C for a further theoretical explanation).

For the pre-service teacher sample, the four global factors (autonomy support:  $\lambda = \text{from .31}$  to .88; structure:  $\lambda = \text{from .01}$  to .65; control:  $\lambda = \text{from .33}$  to .98; and chaos:  $\lambda = \text{from .25}$  to .85), the eight domain factors (participative:  $\lambda = \text{between .38}$  and .59; attuning:  $\lambda = \text{between .44}$  and .66, guiding:  $\lambda = \text{between .07}$  and .69; clarifying:  $\lambda = \text{between .43}$  and .61, demanding:  $\lambda = \text{between .32}$  and .65; domineering:  $\lambda = \text{between .41}$  and .64; abandoning:  $\lambda = \text{between .49}$  and .66; and awaiting:  $\lambda = \text{between 47}$ . and .64) were, in general, well defined by significant target factor loadings. Some items obtained a low factor loading on expected global and domain factors, although they were the same as the ones considered as problematic in MDS (see Appendix C for a further theoretical explanation).

#### **Correlational patterns**

As can be observed in students (Table 2), in-service teachers (Table 3), and pre-service teachers (Table 4), autonomy support and structure styles were positively intercorrelated, just as control and chaos styles were positively correlated with one another. Besides, autonomy support was negatively correlated with control and chaos in the in-service and pre-service teacher samples, while it was only negatively associated with chaos in the student sample. Structure was negatively correlated with chaos in the three samples, whereas it was positively associated with control in the student sample and negatively related to control in the in-service and preservice teacher samples. Additionally, latent correlations among the four (de)motivating styles were between -.62 and .84 in students, between -.61 and .83 in inservice teachers, and between -.63 and .77 in pre-service teachers.

By decomposing the four wider areas into eight subareas, correlational patterns were clearer for the three samples. Overall, evidence was met for an ordered pattern, with each subarea being most highly associated with the adjacent subareas (e.g., attuning approach was strongly related to participative and guiding approaches) and the pattern becoming decreasing positive and increasing negative as one moves along the circle across the three samples. The correlations situated on the diagonal were representative of the magnitude of the correlation among each couple of adjacent subareas. Further, latent correlations between the eight (de)motivating approaches ranged from -.46 to .86 in students, from -.58 to .90 in in-service teachers, and from -.67 to .87 in preservice teachers. Altogether, results met evidence in support of the SIS-PE's discriminant validity.

#### Reliability (aim 2)

Tables 2, 3, and 4 display that, across the three samples, reliability scores were suitable for the four styles with McDonald's omega ( $\omega$ ) scores being between .71 and .89 in students, between .73 and .77 in in-service teachers, and between .70 and .79 in pre-service teachers. Moreover, the eight approaches generally obtained suitable levels of reliability, with McDonald's omega ranging from .70 to 86 in students and from .70 to .75 both in in-service teachers and in pre-service teachers. There were some values between .60 and .70 that could be interpreted as minimally acceptable, such as demanding ( $\omega$ =.61) and domineering ( $\omega$ =.61) approaches for students, demanding ( $\omega$ =.64) approach for pre-service teachers. Nevertheless, marginal values were also found in participative approach ( $\omega$ =.53) for in-service teachers, as well as participative ( $\omega = .53$ ) and awaiting ( $\omega = .58$ ) approaches for pre-service teachers.

#### Structural equation modeling (aim 3)

For students, Figure 5 includes the paths both from perceived (de)motivating teaching styles and from approaches to need-based experiences. Firstly, and after verifying the robustness of the measurement model (see Appendix G), the structural model was tested with a good fit to the data:  $\chi^2(df = 382) = 956.50$ ,  $p < .001; \chi^2/df = 2.50; CFI = .934; TLI = .925; SRMR$ = .066; RMSEA = .048 (90%CI = .044-.052). Figure 5a shows that the students' perception of autonomy support and structure were positively associated with need satisfaction ( $\beta$ =.54, p < .001;  $\beta$  = .22, p < .001), and with need frustration ( $\beta$ =-.20, *p* < .001;  $\beta$ =-.13, *p*=.014) negatively. Perceived control and chaos were positively related to need frustration ( $\beta$ =.15, p=.008;  $\beta$ = .39, p < .001). Secondly, once the robustness of the measurement model was underpinned (see Appendix G), the structural model was tested with an acceptable fit:  $\chi^2(df = 360) = 957.66$ , p < .001;  $\chi^2/$ *df* = 2.66; CFI = .929; TLI = .916; SRMR = .061; RMSEA = .063 (90%CI = .057-.069). Figure 5b displays that students' perceptions of participative  $(\beta = .20, p = .001)$ , attuning  $(\beta = .34, p < .001)$ , guiding  $(\beta = .22, p = .001)$ , and clarifying  $(\beta = .15, p = .008)$ approaches were positively associated with their

nasea experiences.																
	ltems	Range	M(SD)	γ1	$\gamma_2$	Э	1	2	3	4	5	9	7	8	6	10
(De)motivating styles																
1. Autonomy support	12	1–7	4.34(1.34)	-0.27	-0.53	.89		.84***	62***	19***					.68***	38***
2. Structure	12	1-7	5.11(1.11)	-0.66	0.01	.88			.73***	38***					.64***	-46***
3. Control	12	1-7	4.14(0.94)	0.11	-0.20	.71				.14**					.18**	.45***
4. Chaos	12	1-7	2.58(1.16)	0.92	0.51	.87									12*	.38***
(De)motivating approaches																
1. Participative	4	1-7	4.12(1.52)	-0.16	-0.76	.72		.85***	.72***	.68***	.56***	.25***	16***	13*	.38***	35***
2. Attuning	8	1–7	4.56(1.32)	-0.40	-0.42	.84			.86***	.82***	.68***	.18**	35***	24***	.41***	37***
3. Guiding	7	1–7	5.06(1.30)	-0.77	0.11	.86				.85***	.76***	.07	49***	.43***	.34***	40***
4. Clarifying	Ŋ	1-7	5.15(1.11)	-0.51	-0.14	.70					.79***	.12*	42***	38***	.33***	28***
5. Demanding	7	1–7	4.60(0.99)	-0.22	0.07	.61						.74***	07	14*	.23***	31***
6. Domineering	ß	1–7	3.68(1.20)	0.11	-0.33	.61						'	.53***	.46***	.02	.31***
7. Abandoning	8	1–7	2.57(1.28)	0.91	0.27	.85								.86***	25***	.34***
8. Awaiting	4	1–7	2.58(1.20)	0.86	0.28	.71								'	20**	.29***
Need-based experiences																
9. Need satisfaction	12	1–5	3.69(0.74)	-0.40	-0.12	.87										45***
10. Need frustration	12	1–5	2.29(0.84)	0.53	-0.12	80.										,
Note. $\gamma_1$ = Standardized coeffi	cient of skev	vness; $\gamma_2 =$	Standardized co	efficient of	kurtosis. **	* <i>p</i> < .001,	)' > d <sub>**</sub>	01, * <i>p</i> < .05.								

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Table 2. Descriptive statistics, rbased experiences.	

	ltems	Range	M(SD)	۲ <sub>1</sub>	$\gamma_2$	з	-	2	3	4	5	9	7	8	6	10
(De)motivating styles																
1. Autonomy support	12	1-7	5.61(0.63)	-0.28	-0.17	.73	,	.83***	22***	47***					.38***	23***
2. Structure	12	1-7	5.88(0.54)	-0.17	-0.21	.76			19**	61***					.53***	35***
3. Control	12	1-7	2.95(0.85)	0.36	-0.18	<i>LL</i> .				.64***					14***	.31***
4. Chaos	12	1–7	1.88(0.55)	0.59	0.05	.75				'					16***	.26***
(De)motivating approaches																
1. Participative	4	1-7	5.07(0.98)	-0.46	-0.09	.53	,	.80***	.44***	.40***	26***	37***	42***	14***	.16***	05
2. Attuning	8	1-7	5.89(0.60)	-0.33	-0.16	.75			.80***	.68***	16***	31***	56***	23***	.46***	29***
3. Guiding	7	1-7	6.08(0.54)	-0.29	-0.25	.74				.61***	09*	30***	58***	16***	.47***	33***
4. Clarifying	S	1-7	5.59(0.79)	-0.36	-0.22	.70				'	.26***	.12**	24***	41***	.38***	12*
5. Demanding	7	1-7	3.17(0.98)	0.27	-0.22	.71						.90***	.56***	01	04	.21***
6. Domineering	S	1-7	2.39(0.97)	0.62	-0.16	.70							.70***	.16***	17***	.35***
7. Abandoning	8	1-7	1.57(0.53)	1.08	0.83	.73							ı	.30***	23***	.34***
8. Awaiting	4	1–7	2.60(1.09)	0.50	-0.57	.70									07*	.14**
Need-based experiences																
9. Need satisfaction	12	1–5	4.44(0.40)	-0.98	1.24	.80									'	72***
10. Need frustration	12	1-5	1.74(0.47)	0.82	1.27	.73										,

**Table 3.** Descriptive statistics, reliability coefficients, and latent correlations of in-service PE teachers' perceptions of (de)motivating teaching styles and (de)motivating teaching approaches and need-based experiences.

Note.  $\gamma_1$  = Standardized coefficient of skewness;  $\gamma_2$  = Standardized coefficient of kurtosis. \*\*\*p < .001, \*\*p < .01, \*p < .05.

Table 4. Descriptive statistics, rel	liability	coefficien	ts, and latent	correlat	ions of I	ore-serv	vice PE	teachers'	percepti	ons of (d	e)motivat	ting teach	ing styles	and (de)m	notivating	teaching
approaches and competence-base	ad exper	iences.														
	ltems	Range	M(SD)	۲ <sub>1</sub>	$\gamma_2$	з	1	2	3	4	5	9	7	8	6	10
(De)motivating teaching styles																
1. Autonomy support	12	1-7	5.81(0.62)	-0.33	0.08	<i>LL</i> .	,	***	13***	48***					60.	04
2. Structure	12	1-7	5.81(0.57)	-0.23	-0.37	.70		'i' '	19***	63***					.17***	16***
3. Control	12	1-7	3.07(0.86)	0.32	-0.14	.79				.56***					.16***	.06
4. Chaos	12	1-7	1.86(0.57)	1.15	1.66	.76									.01	66***
(De)motivating teaching approaches																
1. Participative	4	1-7	5.37(0.90)	-0.35	-0.42	.53	,	76*** .5	·1***	.28***	17**	29***	32***	13**	09	60.
2. Attuning	8	1-7	6.04(0.62)	-0.55	0.52	.75		- 8	32***	.56***	05	17***	56***	38***	.11*	05
3. Guiding	7	1-7	6.05(0.59)	-0.37	-0.30	.73				.65***	.01	18***	67***	42***	.20***	15***
4. Clarifying	Ŝ	1-7	5.47(0.80)	-0.39	0.04	.70					.41***	.30***	30***	34***	.12*	11**
5. Demanding	7	1-7	3.51(0.91)	0.11	-0.14	.64						.84***	.44**	.15***	.14**	01
6. Domineering	Ŝ	1-7	2.45(1.02)	0.63	0.01	.70						'	.64***	.36***	17***	.07
7. Abandoning	8	1-7	1.49(0.55)	1.95	1.49	.75							'	.68***	02	.19***
8. Awaiting	4	1-7	2.44(0.88)	0.70	0.62	.58								'	10*	.18***
Need-based experiences																
9. Competence satisfaction	4	1-5	3.97(0.75)	-0.78	0.73	.84									·	65***
10. Competence frustration	4	1–5	2.04(0.79)	0.47	-0.54	.73										
Note. $\gamma_1$ = Standardized coefficient of sk	kewness;  ہ	/ <sub>2</sub> = Standa	rdized coefficien	t of kurtosi	s. ***p < .(	оо1, ** <i>р</i>	<.01, *µ	o < .05.								

aching styles and (de)motivating teaching	
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**Figure 5.** Predictive associations from perceived (de)motivating styles and approaches to need-based experiences in students. Note. Significant paths are only shown. \*\*\*p < .01, \*\*p < .01, \*p < .05

need satisfaction, while perceived domineering ( $\beta$ =-.14, *p*=.007) and abandoning ( $\beta$ =-.18, *p* < .001) did it negatively. Perceived demanding ( $\beta$ =.14, *p*=.006), domineering ( $\beta$ =.19, *p*=.001), abandoning ( $\beta$ =.30,

*p*=.001), and awaiting ( $\beta$ =.13, *p*=.039) approaches were positively related to need frustration, whereas clarifying ( $\beta$ =-.12, *p*=.030) approach did it negatively.



Paths from need-based experiences to ide/motivating teaching approaches in in-service



**Figure 6.** Predictive associations from need-based experiences to (de)motivating styles and approaches among in-service PE teachers. Note: Significant paths are only depicted. \*\*\*p < .001, \*\*p < .01, \*p < .05

For in-service teachers, Figure 6 includes the associations of need-based experiences on (de)motivating styles and of approaches, respectively. On the one hand, once the robustness of the measurement model was met (see Appendix G), the structural model was tested with an acceptable fit:  $\chi^2(df = 382) = 1494.244$ ,  $p < .001; \chi^2/df = 3.91;$  CFI = .910; TLI = .899; SRMR = .074; RMSEA = .071 (90%CI = .067-.075). Figure 6a shows that in-service teachers' need satisfaction was positively associated with their autonomy support  $(\beta = .43, p < .001)$ , structure  $(\beta = .61, p < .001)$ , and control  $(\beta = .18, p < .001)$ . In-service teachers' need frustration was positively related to their control ( $\beta$ =.45, *p* < .001) and chaos ( $\beta$ =.38 p < .001), while being negatively associated with structure ( $\beta$ =-.11, p=.027). On the other hand, and once support for the measurement model was met, the structural model was tested with an acceptable fit:  $\chi^2(df = 360) = 723.75$ , p < .001;  $\chi^2/df = 2.01$ ; CFI = .926; TLI = .911; SRMR = .062; RMSEA = .046 (90%CI = .041 - .051). Figure 6b displays that in-service teachers' need satisfaction was positively related to participative  $(\beta = .27, p < .001)$ , attuning  $(\beta = .52, p < .001)$ , guiding  $(\beta = .61, p < .001)$ , and clarifying  $(\beta = .48, p < .001)$ approaches, as well as to demanding ( $\beta$ =.23, p < .001) approach. Need satisfaction was negatively associated with domineering ( $\beta$ =-.18, *p* < .001) and awaiting ( $\beta$ =-.08, p=.045) approaches. Moreover, in-service teachers' need frustration was positively associated with demanding ( $\beta$ =.38, *p*<.001), domineering ( $\beta$ =.48, *p*<.001), abandoning ( $\beta = .36$ , p < .001), and awaiting ( $\beta = .20$ , p < .001) approaches, and with clarifying ( $\beta$ =-.32, p<.001) approach negatively.

For pre-service teachers, Figure 7 includes the relationship between competence-based experiences with (de)motivating styles and approaches. Firstly, and after endorsing the measurement model (see Appendix G), the structural model was tested with a suitable fit to the data:  $\chi^2(df = 382) = 961.582$ , p < .001;  $\chi^2/df = 2.52$ ; CFI = .925; TLI = .915; SRMR = .062; RMSEA = .048 (90%CI = .044 - .052). Figure 7a shows that pre-service teachers' competence satisfaction was positively associated with autonomy support ( $\beta$ =.11, p=.001), structure ( $\beta$ =.29, p < .001), control ( $\beta$ =.15, p < .001) while being negatively related to chaos ( $\beta$ =-.22, p < .001). Need frustration was positively associated with control ( $\beta$ =.35, p < .001) and chaos ( $\beta$ =.33, p < .001), and with autonomy support ( $\beta$ =-.09, p=.004) negatively. Secondly and once support for the measurement model was gathered (see Appendix G), the structural model was tested with a good fit to the data:  $\chi^2(df = 360) = 779.59$ , p < .001;  $\chi^2/$ *df* = 2.17; CFI = .946; TLI = .935; SRMR = .051; RMSEA = .042 (90%CI = .038-.046). Pre-service teachers' competence satisfaction was positively related to attuning ( $\beta$ =.13, p < .001), guiding ( $\beta$ =.25, p < .001), clarifying ( $\beta$ =.12, p = .007), and demanding ( $\beta$ =.22, p < .001) approaches, as well as negatively to domineering ( $\beta$ =.33, p < .001), and abandoning ( $\beta$ =-.23, p < .001) approaches. Instead, competence frustration was positively associated with demanding ( $\beta$ =.14, p < .001), domineering ( $\beta$ =.33, p < .001), abandoning ( $\beta$ =.34, p < .001), and awaiting ( $\beta$ =.21, p < .001) approaches.

#### Discussion

The present research aimed to adapt the SIS-PE questionnaire (Escriva-Boulley et al., 2021) and to test the psychometric properties for use in the Spanish PE context with samples of students, in-service, and pre-service teachers. Altogether, the results gathered evidence to consider the Spanish SIS-PE questionnaire as a valid and reliable measure to assess students', in-service, and pre-service teachers' perceptions of (de)motivating teaching styles under a circumplex approach in the Spanish PE context.

# A circumplex approach to (de)motivating styles in PE (aim 1)

Consistent with our hypotheses and following both the original SIS questionnaire (Aelterman et al., 2019) and the adaptation to PE (Escriva-Boulley et al., 2021), the results from MDS showed that the wide array of (de) motivating teaching practices were best depicted graphically by a two-dimensional circumplex pattern for students, in-service, and pre-service teachers in PE. In the three samples, the horizontal dimension (i.e., x-axis) represented the degree to which teachers are needsupportive, relative to need-thwarting, with autonomysupportive and structuring styles having positive coordinates, and with controlling and chaotic styles having negative coordinates on this dimension. The vertical dimension (i.e., y-axis) denoted the teachers' level of directiveness, reflecting the extent to which teachers take the initiative in the classroom with structuring or controlling styles (negative coordinates), or students have more opportunities to perform a leading role when teachers adopt an autonomy-supportive or chaotic style (positive coordinates). Consistent with Aelterman et al. (2019) and Escriva-Boulley et al. (2021), our findings also gathered additional support for a more fine-grained picture by discerning among eight teaching approaches. Particularly, every overreaching (de)motivating style could be decomposed into two specific teaching approaches.

In line with the instrument's original version (Aelterman et al., 2019) and different adaptations with



Paths from competence-based experiences to (de)mativisting teaching approaches in j eachers



**Figure 7.** Predictive associations from competence-based experiences to (de)motivating styles and approaches in pre-service PE teachers. Note. Significant paths are only shown. \*\*\*p < .001, \*\*p < .01, \*p < .05

teachers (Escriva-Boulley et al., 2021; Vermote et al., 2020), the correlational results drew a gradual and ordered pattern among the eight teaching approaches across the three samples, with each approach being most positively correlated with adjacent ones (e.g., participative approach with attuning and guiding approaches) and with correlations turning into non-significant (e.g., participative approach with demanding and awaiting approaches) or even negative (e.g., participative abandoning and domineering approach with approaches) when moving along the circular model. Nonetheless, there were some exceptions at the boundaries between high and low teacher directiveness, where certain adjacent approaches (e.g., attuning and clarifying approaches in students, and domineering and abandoning approaches in both in-service and pre-service teachers) showed higher correlations than expected. That is, students' perceptions of an attuning approach covaried more strongly with a clarifying than a participative approach. Similarly, in both in-service and pre-service teachers, a domineering approach went more easily hand in hand with an abandoning approach than with a demanding approach. These results would partially contribute to argue why the obtained findings in our study did not draw a perfect circular, but rather an oval (in students and pre-service teachers) or rhomboid (in in-service teachers) structure, with the less directive practices clustering on the upper side and the more directive ones on the lower side, differentiated from each other according to their more need-supportive (right side) or more need-thwarting (left side) nature.

Complementary to MDS analyses, the results of our study were the first to gather a basis of psychometric evidence for the SIS-PE's internal structure. Particularly, the bifactor ESEM model obtained a good fit to the student, in-service, and pre-service teacher data compared to other plausible factor models. Overall, these results suggest that items could represent both four overarching (de)motivating styles (i.e., autonomy support, structure, control, and structure) and eight specific teaching approaches (i.e., participative, attuning, guiding, clarifying, demanding, domineering, abandoning, and awaiting) in the Spanish PE context with samples of students, in-service, and pre-service teachers.

#### Reliability for (de)demotivating styles and approaches in the Spanish SIS-PE questionnaire (aim 2)

In accordance both with the original version of the SIS questionnaire (Aelterman et al., 2019) and the adapted

version to PE with in-service teachers (SIS-PE; Escriva-Boulley et al., 2021), the findings from this study showed a good reliability level for each of the four (de)motivating styles in the three samples. Regarding the eight teaching approaches, the results found that, although most of teaching approaches obtained good reliability scores, some of them had a marginal value. Following previous research with teachers (Escriva-Boulley et al., 2021; Vermote et al., 2020), low scores were found in participating approach for the two teacher samples and in awaiting approach for pre-service teachers. Likely, these poor values would be partially explained by the small number of items (i.e., four) comprising them, which might have underestimated the degree of reliability of each item (Dunn et al., 2014). For the in-service teacher sample, marginal values in the participative approach could also be explained by a maximization of measurement errors in two items (i.e., part1 and part9). These items could be interpreted by in-service teachers more as neutral teaching behaviors than participative practices. Regarding the pre-service teacher sample, our results suggest that they were less sensitive to distinguishing between participative and awaiting approaches. A further rationale could be because they are adjacent approaches within the circumplex model and both are characterized by a low directiveness, which could have maximized the measurement errors in their items. To illustrate, the teacher allows his/her students to participate in a joint decision process (i.e., participative approach), but the room offered to them is too open and may even, temporarily, create confusion and uncertainty, given that the teacher remains on standby and seeing if students are capable of taking the initiative in the target ongoing activity (i.e., awaiting approach). Concerning the student sample, we found minimally acceptable scores for demanding and domineering approaches, which aligned with prior research in young athletes (Delrue et al., 2019). It could be thought that since control is composed by demanding and domineering approaches, students are less sensitive to perceive when their teacher uses one or another controlling approach in classroom practice. To illustrate, when the teacher explains to all students that he/she was disappointed because some of them were late to class, most of them could interpret that their teacher adopted a demanding approach by requiring timeliness and discipline, while those students arriving late could perceive as their teacher used a domineering approach by interpreting their message as a personal attack. This fact would increase the measurement error in items and, therefore, reliability levels were attenuated in both controlling approaches (Dunn et al., 2014).

### Criterion variables for (de)motivating styles and approaches in the Spanish SIS-PE questionnaire (aim 3)

External validity for the Spanish SIS-PE version was met for the three samples. In students, our results were consistent with previous SDT-based research (Burgueño et al., 2022; Curran & Standage, 2017; Vasconcellos et al., 2020), such that students' perceptions of the two motivating styles were positively related to need satisfaction, with autonomy support a greater association than structure. having Contrasted with Vasconcellos et al. (2020), these findings underline that autonomy support played a greater role than structure in fostering students' need satisfaction, suggesting that taking a teaching behavior based more on understanding than guidance would be more beneficial for students to feel their autonomy, competence, and relatedness as more satisfied in PE classroom practice. Similarly, perceived two demotivating styles were positively associated with students' need frustration, although chaos had a higher association than control. These findings highlight that chaos was much more detrimental than control to facilitate students' need frustration, in line with prior research with youth athletes (Delrue et al., 2019). This would lie in that students would be prone to feel their needs as more frustrated, when they perceive their teacher as adopting a tone relied more on laissez-faire than pressure in PE lessons.

Furthermore, our results revealed that students' perceptions of attuning and guiding approaches were more strongly associated, than participative and clarifying approaches, with their need satisfaction. Moreover, perceived domineering and abandoning approaches were more highly linked, than demanding and awaiting approaches, to need frustration. Consistent with Vansteenkiste et al. (2019), these findings suggested that that some autonomy-supportive (i.e., attuning) and structuring (i.e., guiding) approaches more strongly support need satisfaction, while other approaches of autonomy support (i.e., participative) and structure (i.e., clarifying) foster students' need satisfaction to a lesser degree. Hence, participative and clarifying approaches are thought to be more need-enabling approaches since they would create the conditions necessary for students to satisfy their needs (Aelterman et al., 2019; Vansteenkiste et al., 2019). Likewise, our results raise that while some controlling (i.e., domineering) and chaotic (i.e., abandoning) approaches actively facilitate students' need frustration, other more need-depriving approaches (i.e., demanding and awaiting) could not directly facilitate students' need frustration, but rather hamper potential need-support (Aelterman et al., 2019; Vansteenkiste et al., 2019).

In in-service PE teachers, and following previous studies with in-service teachers (Moè & Katz, 2022; Vermote et al., 2022), our findings showed positive associations of need satisfaction with structure and, to a lesser extent, with autonomy support, and positive relationships between need frustration and chaos and, to a lesser extent, control. An explanation would be that when teachers feel high levels of need satisfaction at work, they are prone to use motivating styles in classroom, although they would prefer to adopt a more directive than understanding attitude to have the feeling of efficiently managing the classroom and optimally guiding their students in the PE practice (Cheon et al., 2020). Instead, when PE teachers feel high need frustration at work, they tend to adopt demotivating styles in their practice, with highly controlling instead of chaotic strategies, to direct their students in the classroom given that they think that it is better to do anything than nothing (Cheon et al., 2020). Regarding pre-service PE teachers, the findings revealed positive associations of competence satisfaction with structure and, to a lesser extent, with control, and positive relationships between competence frustration and chaos and, to a lesser extent, control. Given the lack of previous research in pre-service teachers, these results suggest that when pre-service teachers feel efficient in managing the classroom (i.e., competence satisfaction), they would tend to be more directive using more structuring than controlling practices in order to optimally guide their students in PE. Conversely, pre-service PE teachers would be prone to adopt need-thwarting strategies, with more chaotic than controlling practices, when they feel unable in addressing students' learning in the PE lessons.

Moreover, our results in both samples of teachers indicated, as in students, that attuning and guiding approaches would better represent need-supportive approaches while participative and clarifying approaches would be merely need-enabling approaches, in the same way as domineering and abandoning approaches would be truly need-thwarting approaches, and demanding and awaiting approaches would be simply need-depriving approaches (Aelterman et al., 2019; Vansteenkiste et al., 2019). Considering that not all teaching approaches were equally need-supportive or need-thwarting in students, in-service, and pre-service teachers, this study gathers more evidence in favor of the circumplex structure regarding a more gradual perspective for (de)motivating teaching styles in PE.

#### Implications for teaching practice

The availability of the Spanish students' and in-service and pre-service primary and secondary teachers' versions of the SIS-PE would be useful for PE teachers, students, and researchers, among others. The application of the Spanish SIS-PE questionnaires allows to know the students' and teachers' perceptions regarding (de)motivating teaching styles and, in addition, to analyze the degree of agreement between students' and teachers' reports to discover differences or similarities concerning their views. For example, PE teachers can use this instrument every once a while during the academic year to have their students evaluate aspects of their planning, assessment, and their teaching behavior. This information could help teachers to be more aware of the perception of the whole group or of each of their students about their teaching behaviors in order to reinforce what they are doing or, on the contrary, to change it. Indeed, the SIS-PE questionnaire could be applied in intervention research as a diagnostic point or to assess, in the eyes of students and teachers, the potential changes in (de)motivating styles, as well as other motivational outcomes, after a school-based PE intervention program. Thus, Ahmadi et al. (2023) classification system about need-supportive teaching strategies could be used in intervention research for in-service and/or pre-service PE teachers to train how to implement motivating teaching strategies both to effectively manage the classroom and to optimally guide students' learning without falling into demotivating practices in the PE lesson.

The three Spanish SIS-PE questionnaires will also allow researchers to focus on the moment-to-moment and day-to-day changes in the eyes of both students and their PE teachers. This will make it possible to gather a basis of evidence on how PE teachers could progressively change along the circumplex away from more need-supportive to need-thwarting approaches, or vice versa, depending on students' characteristics (e.g., school grade, gender, or motor competence), situational characteristics (e.g., the content to be taught, class schedule, or classroom size), or their need-satisfying and need-frustrating experiences. For instance, a PE teacher might "regress" (i.e., changes from need-supportive to need-thwarting practices) or "progress" (i.e., changes from need-thwarting to need-supportive practices) over specific periods of the academic year.

Furthermore, the SIS-PE questionnaire would be useful to ascertain how the four (de)motivating styles or their respective teaching approaches may be combined in classroom practice in the eyes of students and teachers, which would allow us to expand and refine not only the number of retained profiles based on (de)motivating styles but also their potential implications for students or teachers. This body of evidence would be helpful to enhance initial and continuous professional development programs for in-service and pre-service PE teachers on the beneficial and detrimental effects of their own teaching behavior in classroom practice.

#### Limitations and future research directions

Regarding the complexity of the human cognitive processes, any measurement instruments' validation should be understood as an ongoing process over time. Hence, future studies should tackle the shortcomings and unknowns arising from the limitations present in this validation research. First, although the students' and teachers' versions of the SIS-PE questionnaire are considered valid and reliable measures in the Spanish PE context, future studies in other countries and cultures are required to test the psychometric properties of the different versions of the instrument. Further, it is necessary that new research checks the content of some items to improve the instrument's validity and reliability evidence, which, depending on the culture and language, could have problems to capture the meaning of the (de) motivating approaches to which they theoretically belong. Second, although our results have gathered a robust support for the four overarching (de)motivating styles, evidence for a clear distinction between eight specific teaching approaches needs to be additionally provided in the Spanish samples of students, inservice, and pre-service teachers in the PE context. It is plausible that there might be a conceptual overlap of the eight specific teaching approaches that, while practical categorization is possible, statistical distinction still remains to be strongly underpinned. Third, this study was cross-sectional, which made it impossible to establish causal relationships among the target variables. Further longitudinal and/or experimental research is, therefore, required to shed more light on the associations of (de)motivating styles, and their respective teaching approaches, with need-based experiences over time. In this same vein, future studies may also consider analyzing the relationships between (de)motivating teaching styles, and their respective approaches, and other more distal outcomes among students, as well as examining the potential antecedents of these (de)motivating styles and the eight teaching approaches among

in-service and pre-service teachers in PE. Fourth, in the in-service and pre-service PE teacher samples, the low but significantly explained variance in participative and awaiting approaches obtained in SEM suggested that need-based experiences could represent more distal than proximal predictors of both teaching approaches. Although this point was not necessarily indicative of a psychometric problem, there is a need for future studies to test the associations of need-based experiences with the eight teaching approaches in other different samples of teachers to verify if the predictions are kept irrespective of the features of the target participants or they might vary depending on the context and characteristics of the sample under study. Fifth, two of the three independent samples represented in-service, and pre-service primary and secondary teachers, but the sample of students was only from secondary school. Further studies are recommended to expand the students' and teachers' versions of the SIS-PE questionnaire with students and teachers from other school levels.

#### Conclusions

The present study gathers evidence to consider the Spanish SIS-PE questionnaire as a valid and reliable measure of the students' and in-service and preservice primary and secondary teachers' perception of (de)motivating styles and approaches in PE. Besides, this research provides support for a circumplex model proposed for the SIS-PE questionnaire in the eyes of students, in-service, and pre-service teachers in PE. The results support a gradual perspective for (de)motivating teaching styles, with teaching approaches differing from one another in a more progressive rather than a categorical view.

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