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7 **Students' perceptions of physical education teachers' (de)motivating styles via the**
8 **circumplex approach: differences by gender, grade level, experiences, intention to**
9 **be active, and learning.**
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Abstract

Grounded in Self-Determination Theory (SDT), an integrative and fine-grained circumplex model, based on teachers' autonomy-support, structure, control and chaos, has been proposed. The present study aimed to examine possible differences in students' perceptions of physical education (PE) teachers' motivating and demotivating styles and the eight different approaches, respectively, regarding students' socio-demographic variables, and different affective, cognitive, and behavioral outcomes. A sample of 669 Spanish secondary students aged 12-17 years ($M_{age}=14.65$; $SD=1.47$; 52% girls) participated in this cross-sectional study. Boys reported significantly higher values in chaotic style and the domineering approach than girls. Second- and third-cycle students (Year 10, Year 11, and Year 12) reported significantly higher values in autonomy-supportive and structuring styles, and significantly lower values in the domineering approach than first-cycle students (Year 8 and Year 9). Second-cycle students (Year 10 and Year 11) reported significantly higher values in the demanding approach than first-cycle students (Year 8 and Year 9). Third-cycle students (Year 12) reported significantly lower values in the awaiting approach than the first-cycle students (Year 8 and Year 9). Finally, as a whole, students who reported positive experiences in PE, high learning, and high intention to participate in physical activity, reported significantly higher values in autonomy-supportive and structuring styles, as well as the demanding approach, and significantly lower values in chaotic style. The results highlight the importance of PE teachers adopting motivating styles and avoiding demotivating styles, especially with boys and lower grade levels, to promote meaningful experiences in PE and an active lifestyle.

Keywords: need-supportive behaviors, need-thwarting behaviors, circumplex model, physical education, secondary education, consequences.

Introduction

In recent years, a large body of research has paid particular attention to understanding the factors that may influence young people's physical activity (PA) levels, highlighting physical education (PE) teachers as one of the most important factors (Vasconcellos et al., 2020). Notably, according to Self-Determination Theory (SDT; Ryan and Deci, 2017), PE teachers may generate the necessary positive experiences, knowledge, abilities, and values for students' lifelong PA participation as a result of their (de)motivating teaching styles (Vasconcellos et al., 2020).

Recently, an integrative and fine-grained circumplex model, based on teachers' autonomy-supportive, structuring, controlling, and chaotic styles within one circular structure, has been proposed in the educational domain (Aelterman et al., 2019). However, evidence in PE is still limited (Burgueño et al., 2023; Escrivá-Boulley et al., 2021). This circumplex model identified eight teaching approaches within these four (de)motivating styles, two (de)motivating approaches per style, that varied in the level of directivity and support or thwarting of basic psychological needs (BPNs) (e.g. Aelterman et al., 2019; see Figure 1). To shed light on some of the pitfalls and questions associated with autonomy-supportive, structuring, controlling, and chaotic styles within this circumplex approach to PE, this study has two aims: to examine, from the students' perspective, the extent to which teaching styles and approaches differ in terms of (1) students' gender and grade level, and (2) affective, cognitive, and behavioral outcomes such as PE experiences, PE learning, and intention to participate in PA, respectively.

(De)motivating teaching styles/approaches based on the circumplex approach

According to SDT (Ryan and Deci, 2017), teachers' interaction styles can be more supportive or thwarting of students' BPNs, with implications for students' motivation and

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2
3 (mal)adaptive outcomes. Recently, from a more integrative and detailed circumplex
4 approach (Aelterman et al., 2019), four teaching styles called autonomy support,
5 structure, control and chaos, and eight teaching approaches can be distinguished
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8 depending on the level, either high or low, of directiveness and support or thwarting of
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12 BPNs used by teachers to interact with students (see Figure 1).
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16 [INSERT FIGURE 1 NEAR HERE, PLEASE]
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20 The first (de)motivating teaching style, characterized by a low level of
21 directiveness and a high level of need-support, is autonomy support. PE teachers provide
22 an autonomy-supportive environment when they take the students' perspective into
23 account, providing opportunities for choice or explaining reasons to perform an activity.
24 This style consists of participative and attuning approaches. A participative teacher
25 identifies students' personal preferences by listening to their points of view and
26 suggestions, and tries to offer various meaningful options so that the students can continue
27 their learning according to their level and at their own pace. An attuning teacher tries to
28 find ways to make the exercises more interesting and enjoyable to nurture the students'
29 interest, providing a meaningful rationale for each task (Aelterman et al., 2019). The
30 second (de)motivating teaching style, characterized by a high level of directiveness and
31 a high level of need-support, is structure. PE teachers provide a structuring style when
32 they know the students' capabilities and abilities, guiding and assisting them in their
33 learning. This consists of guiding and clarifying approaches. A guiding teacher helps
34 students to progress in their learning through clear, constructive, and valuable feedback,
35 and shows them how to complete the tasks in various steps. A clarifying teacher clearly
36 and transparently informs students about their expectations (Aelterman et al., 2019).
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3 The third (de)motivating teaching style, characterized by a high level of
4 directiveness and a high level of need-thwarting, is control. PE teachers adopt a
5 controlling style when they pressure and force students to think, feel and behave in a
6 certain way. This style consists of demanding and domineering approaches. A demanding
7 teacher requires discipline from his/her students through controlling informational
8 language such as “you must...” to clarify what they should do. This type of teacher does
9 not tolerate contradictions and threatens punishments or sanctions if the students do not
10 comply. A domineering teacher pressures students to comply with these requests by
11 inducing feelings of guilt, inferiority, disappointment, and shame (Aelterman et al.,
12 2019). The last (de)motivating teaching style, characterized by a low level of
13 directiveness and a high level of need-thwarting, is chaos. PE teachers adopt a chaotic
14 style when they allow students to learn independently with no clear guidelines. This style
15 consists of abandoning and awaiting approaches. An abandoning teacher disengages from
16 the students because they think students should learn to be responsible for their behavior.
17 An awaiting teacher adopts a so-called “laissez-faire” attitude, giving the entire initiative
18 to act to the students, and not planning lessons very much because they prefer to wait and
19 see how things go (Aelterman et al., 2019).

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42 ***Differences in students’ perceptions of (de)motivating teaching styles in terms of***
43 ***gender and grade level***
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46 Studies on how students’ gender and grade level can affect their perceptions of PE
47 teachers’ (de)motivating styles have reported mixed results. Regarding gender, previous
48 research did not find differences in students’ perceptions of autonomy support (Burgueño
49 and Medina-Casabón 2021; Leo et al., 2022). However, some research reported that
50 boys perceived more autonomy support and structure than girls (Viira and Koka, 2010),
51 while other studies revealed that girls perceived more structure than boys (Burgueño and
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3 Medina-Casabón 2021; Leo et al., 2022). Similarly, other studies reported no gender
4 differences in perceptions of controlling style (Abós et al., 2022; Koka and Sildala 2018).
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6 Nevertheless, despite findings in other studies indicating that boys perceive more
7 controlling (Burgueño and Medina-Casabón, 2021; Leo et al., 2022) and chaotic
8 (Burgueño and Medina-Casabón 2021; Leo et al., 2022) styles than girls, another study
9 reported that girls, rather than boys, perceived their PE teachers as having a more
10 controlling style (De Meyer et al., 2014).
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19 Regarding grade level, Burgueño and Medina-Casabón (2021) found that older
20 secondary students perceived more need-support teaching behaviors and fewer need-
21 thwarting teaching behaviors than younger students, except for the chaotic style where no
22 differences were observed. Conversely, other studies revealed that students in higher
23 school grades reported less teacher autonomy-supportive (De Meyer et al., 2014) or
24 controlling styles (Jang et al., 2020) than students in lower grades of secondary education.
25
26 Finally, some studies have shown no significant relationship between students' age and
27 autonomy-supportive (Tilga et al., 2020; Van Doren et al., 2021), structuring (Van Doren
28 et al., 2021) or controlling styles (De Meyer et al., 2016; Tilga et al., 2020; Van Doren et
29 al., 2021). Considering these inconsistent results and the lack of studies based on the eight
30 teaching approaches proposed by the circumplex model, further research is necessary to
31 shed light on possible gender and grade level differences in students' perceptions of PE
32 teachers' (de)motivating styles to target interventions for priority students.
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49 ***Differences in students' perceptions of (de)motivating teaching styles in terms of***
50 ***adaptive outcomes***
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53 Based on SDT (Ryan and Deci, 2017), PE teachers' (de)motivating styles have been
54 related to a broad range of students' (mal-)adaptive outcomes via need
55 satisfaction or frustration (Vasconcellos et al., 2020). Previous research has indicated that
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3 students' perceptions of PE teachers' autonomy-supportive and structuring styles are
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5 positively related to an array of positive affective (i.e. experiences), cognitive (i.e.
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7 learning-related), and behavioral (i.e. intention to be active) outcomes, and negatively,
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9 albeit to a lesser extent, to maladaptive outcomes (Vasconcellos et al., 2020).
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11 Furthermore, there is less evidence that PE teachers' controlling style has been positively
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13 related to negative consequences such as fear of failure, less engagement, etc. in PE
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15 lessons and, negatively, to a lesser extent, to adaptive outcomes (Vasconcellos et al.,
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17 2020). Finally, relatively few studies have examined the association between chaotic style
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19 and different (mal)adaptive outcomes in PE lessons. González-Peño et al. (2021) found
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21 no relationship between PE teachers' chaotic style and students' engagement through a
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23 study carried out with an observational methodology. Nevertheless, Leo et al. (2022)
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25 found that students' perceptions of PE teachers' chaotic style was negatively related to
26
27 their behavioral and emotional engagement. Therefore, more studies are required to
28
29 examine the potential relationship between teachers' chaotic style and the eight teaching
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31 approaches of the circumplex model, and affective, behavioral and cognitive outcomes in
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33 the PE domain.
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39 ***The present study***

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41 To fill the gaps mentioned above, the present study had two aims: to examine the possible
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43 differences in students' perceptions of different (de)motivating teaching styles and
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45 approaches in terms of (1) gender and grade level, and (2) affective, cognitive, and
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47 behavioral outcomes such as PE experiences, learning, and intention to participate in PA,
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49 respectively. Regarding the first aim, no hypothesis was formulated, given the
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51 inconsistent results of previous studies. Concerning to the second aim, we hypothesized
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53 that students who reported more positive experiences, as well as higher perceptions of
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55 learning and intention to participate in PA, would report higher levels of motivating
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3 approaches, and lower levels of demotivating approaches, compared to students who
4 reported negative experiences, lower perception of learning and lower intention to
5 participate in PA.
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10 **Method**

11 *Participants and context*

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13 A convenience sample of 669 high school students ($M_{age}=14.65\pm 1.47$; 52% girls; Year
14 8=197, Year 9=161, Year 10=141, Year 11=102, and Year 12=68) from different high
15 schools located in Northeastern Spain participated in this cross-sectional study. Student
16 responses regarding (de)motivating teaching styles came from several classes of 10
17 different PE teachers ($M_{age}=38.56\pm 7.18$; 20% women), each of whom taught
18 approximately 60 students of different school grades and had previous teaching
19 experience ($M=10.77\pm 7.18$). In the Spanish context, PE is compulsory during secondary
20 education and students receive two or three 50-minute coeducational lessons per week.
21 All of the students in the study had two sessions a week. Furthermore, the PE curriculum
22 places emphasis on student-centered approaches. Generally, PE teachers' annual teaching
23 plans are made up of six to eight different teaching units per year related to the six motor
24 action domains, which are individual, opposition, cooperation, collaboration-opposition,
25 natural environment, and corporal expression content. Along with this motor content, in
26 a cross-cutting manner, the Spanish PE curriculum addresses other important learning
27 content related to health, culture, emotions, sustainability, and the construction of an
28 active lifestyle.
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50 *Instruments and variables*

51 *Socio-demographic variables*

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3 Gender (boy or girl), grade level, and age were self-reported by students. In line with the
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5 Spanish secondary education curriculum, school grade was categorized into first cycle
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7 (i.e. Year 8 and 9), second cycle (i.e. Year 10 and 11), and third cycle (i.e. Year 12).
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10 *Teaching styles*

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12 Students' perceptions of (de)motivating teaching approaches from their PE teacher were
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14 assessed using the Spanish version (Burgueño et al., 2023) of the Situations-in-School in
15
16 Physical Education questionnaire (SIS-PE; Escriva-Boulley et al., 2021). The SIS-PE
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18 questionnaire presents 12 situations with four items each, commonly occurring in PE
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20 lessons. The 48 items are divided into two motivating styles (i.e. autonomy support and
21
22 structure) and two demotivating styles (i.e. control and chaos). These are in turn divided
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24 into two teaching approaches, resulting in a total of eight instructional approaches. Four
25
26 items refer to participative, eight to attuning, seven to guiding, five to clarifying, seven to
27
28 demanding, five to domineering, eight to abandoning, and four to awaiting approaches
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30 (for more information on the SIS-PE student Questionnaire, see Burgueño et al., 2023).
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32 Students were asked to indicate the extent to which each item reflected their PE teachers'
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34 actions on a seven-point Likert scale ranging from one ("does not describe my PE teacher
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36 at all") to seven ("describes my PE teacher extremely well"). In the present study,
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38 confirmatory factor analysis (CFA) showed a good fit of the data to the four-factor
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40 structure ($\chi^2(3.673, n=669)=3945.463, p<.001$; CFI=.906; TLI=.901; RMSEA=.064;
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42 90% CI= .061-.066).
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49 *PE experiences*

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51 In line with previous research (Diloy-Peña et al., 2021), students' experiences in PE
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53 classes were assessed using the question: "What are your experiences in PE lessons like?"
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55 The response possibilities were: (1) "very bad", (2) "bad", (3) "regular", (4) "good", and
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3 (5) “very good”. “Very bad”, “bad”, and “regular” experiences were categorized as
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5 “negative”, whereas “good” and “very good” experiences were categorized as “positive”.

6 7 8 *Perceived learning in PE*

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10 In line with previous research (Aelterman et al., 2016), students’ perceptions of learning
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12 in PE were assessed using the question: “How much do you learn in PE?” The response
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14 possibilities were: (1) “nothing”, (2) “little”, (3) “enough”, and (4) “a lot”. Given the
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16 small number of option (1) responses (“nothing”), it was grouped with option (2) “little”
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18 for subsequent analysis.
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20 21 22 *Intention to participate in PA*

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24 Students’ intention to participate in PA was assessed using three items (e.g. “I intend to
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26 do active sports and/or physical activities during my leisure time in the next 5 weeks...”)
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28 of the Spanish version of the Theory of Planned Behavior Questionnaire (Tirado et al.,
29
30 2012). This is a seven point Likert scale from one (strongly agree) to seven (strongly
31
32 disagree). For subsequent analyses, students were categorized by cluster analysis into
33
34 “very low” ($n=46$; $M=1.42\pm 0.46$), “medium” ($n=181$; $M=3.66\pm 0.69$), and “very high”
35
36 ($n=442$; $M=6.30\pm 0.70$) intention to participate in PA (for a further review of these
37
38 analyses, see supplementary file 1). In the present study, CFA showed a good fit of the
39
40 data to the one-factor structure ($\chi^2(2.743, n=669)=11.25, p<.001$; CFI=.990; TLI=.990;
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42 RMSEA=.046, 90% CI=.001-.064).
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46 47 48 *Procedure*

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50 Before starting the study, the main researcher contacted the school faculty and PE
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52 teachers to inform them of the research objectives and request their collaboration. Next,
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54 families or legal guardians were asked to provide informed consent for their children’s
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56 participation in the research. The questionnaires were completed in paper-and-pencil
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58 format in 25 minutes in a classroom. During the questionnaire administration, the main
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3 researcher was present to answer any questions, whereas the PE teachers were absent to
4 avoid bias in the answers. The study was approved by the Ethics Committee for Clinical
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6 Research of Aragon (CEICA) (PI22/363).
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9 10 ***Data analysis***

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12 As preliminary analyses, homoscedasticity between the dependent and independent
13 variables was checked by Levene's test ($p>.05$). Then, the linear relationship was
14 assessed with correlation analyses and the multivariate normality was assessed through
15 the Mardia coefficient. Multicollinearity between covariate variables was also assessed
16 with the variance inflation factor. These preliminary analyses were considered before
17 conducting the subsequent statistical analyses. Afterwards, descriptive statistics,
18 reliability using McDonald's omega ω , and Pearson's bivariate correlations were
19 calculated for the study variables, except for students' and teachers' gender, for which
20 Spearman's coefficient was used. Next, differences in students' perceptions of
21 (de)motivating teaching styles across teachers ($n=10$) and teachers' gender were
22 calculated, through a multivariate analysis of variance (MANOVA), to explore the
23 necessity of including these as covariates in subsequent analyses. We then conducted a
24 multivariate analysis of covariance (MANCOVA) of students' perceptions of PE
25 teachers' (de)motivating teaching styles and approaches across students' gender and
26 grade to test for significant differences between the study variables. Based on these
27 results, gender and grade level were also considered covariates in subsequent analyses.
28
29 Finally, we performed MANCOVAs to examine differences in students' perceptions of
30 PE teachers' (de)motivating teaching styles and approaches in terms of PE experiences,
31 perceived learning in PE, and intention to participate in PA. MANCOVAs were run using
32 a bootstrap technique with 5000 resamples to obtain more accurate estimates of results
33 and to improve the robustness of analyses (Hair et al., 2018). In all analyses, if significant
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3 differences were found, post-hoc tests were performed using the Bonferroni method. The
4
5 level of statistical significance was set at $p < .05$. Effect sizes (η^2_p) ≤ 0.06 were considered
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7 low, $0.06 < (\eta^2_p) \leq 0.14$ moderate, and $(\eta^2_p) > 0.14$ high (Field, 2009). Analyses were
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9 conducted using SPSSv25.
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14 **Results**

15 ***Preliminary results***

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17 Table 1 presents the reliability (ω), descriptive statistics and bivariate correlations
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19 among the study variables.
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24 [INSERT TABLE 1 NEAR HERE, PLEASE]
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26 Before performing the main analyses, a significant multivariate effect of teachers
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28 (Wilks' $\lambda=0.55$, $F(72, 39)=5.56$, $p<.001$, $\eta^2_p=.070$) and teachers' gender (Wilks' $\lambda=0.37$,
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30 $F(8, 66)=8.86$, $p<.001$, $\eta^2_p=.097$) on students' perceptions of (de)motivating teaching
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32 styles was obtained. Therefore, teachers and teachers' gender were controlled as
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34 covariates in the subsequent analyses.
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37 ***Differences in students' perceptions of (de)motivating teaching styles in terms of*** 38 39 ***gender and grade level (aim 1)*** 40 41

42 Differences in students' perceptions of (de)motivating teaching styles and approaches in
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44 terms of gender and grade level are reported in Table 2. The multivariate effects of gender
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46 on (de)motivating teaching styles and approaches were significant (Wilks' $\lambda=0.96$, $F(8,$
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48 $65)=3.50$, $p=.002$, $\eta^2_p=.036$). Compared to girls, boys reported significantly higher values
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50 for the domineering approach, and chaotic style and approaches. The multivariate effects
51
52 of grade level on (de)motivating teaching styles and approaches were also significant
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54 (Wilks' $\lambda=0.88$, $F(16,13)=5.37$, $p<.001$, $\eta^2_p=.061$). Second- and third-cycle students
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56 reported significantly higher values in autonomy-supportive and structuring styles and
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3 the associated approaches, and significantly lower values in the domineering approach
4 than first-cycle students. Second-cycle students reported significantly higher values in the
5 demanding approach than first-cycle students. Third-cycle students reported significantly
6 lower values in the awaiting approach than first-cycle students.
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12 [INSERT TABLE 2 NEAR HERE, PLEASE]
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14 ***Differences in (de)motivating teaching styles in terms of students' outcomes (aim 2)***

15 Differences in students' perceptions of PE teaching approaches in terms of PE
16 experiences, perceived learning in PE, and intention to participate in PA are presented in
17 Table 3. First, the multivariate effects of teaching styles and approaches on PE
18 experiences were significant (Wilks' $\lambda=0.85$, $F(8, 65)=13.46$, $p<.001$, $\eta^2_p=.141$). Students
19 who reported positive experiences in PE showed significantly higher values in autonomy-
20 supportive and structuring styles and the associated approaches, as well as the demanding
21 approach, while showing significantly lower values in chaotic style and the associated
22 approaches. Second, the multivariate effects of teaching styles and approaches on
23 perceived learning in PE were significant (Wilks' $\lambda=0.76$, $F(16, 13)=11.77$, $p<.001$,
24 $\eta^2_p=.126$). Students who perceived that they learned a lot reported significantly higher
25 values in autonomy-supportive and structuring styles and the associated approaches, as
26 well as the demanding approach compared to those who perceived that they did not learn
27 anything or did not learn enough. On the other hand, students who perceived that they
28 were not learning anything had significantly higher values of the abandoning approach
29 than those who reported learning enough and a lot. Third, the multivariate effects of
30 teaching styles and approaches on intention to participate in PA were significant (Wilks'
31 $\lambda=0.94$, $F(16,13)=2.55$, $p=.001$, $\eta^2_p=.030$). Students with a very high intention to
32 participate in PA reported significantly higher values of autonomy-supportive and
33 structuring styles and the associated approaches, as well as the demanding approach,
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3 compared to those with medium and very low intention to participate in PA. Students
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5 with a medium intention to participate in PA reported significantly higher values in the
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7 awaiting approach than those with a very high intention to participate in PA.
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10 [INSERT TABLE 3 NEAR HERE, PLEASE]
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12 **Discussion**

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14 Grounded in the circumplex model, the main objectives of this study were to examine
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16 differences in students' perceptions of different (de)motivating teaching styles and
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18 approaches in terms of gender, grade level and different affective, cognitive, and
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20 behavioral outcomes. The main results revealed that: 1) boys reported higher values,
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22 compared to girls, in chaotic styles and abandoning and awaiting approaches, as well as
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24 in the domineering approach; 2) upper-grade level students reported higher values in
25
26 autonomy-supportive (i.e. participative and attuning) and structuring styles (i.e. guiding
27
28 and clarifying), and significantly lower values in the domineering approach and chaotic
29
30 style (i.e. abandoning and awaiting) than lower-grade level students; 3) students who
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32 reported positive experiences and perceived high learning in PE, as well as a high
33
34 intention to participate in PA, showed higher values in autonomy-supportive (i.e.
35
36 participative and attuning), structuring (i.e. guiding and clarifying) styles and the
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38 demanding approach, while showing lower values in chaotic style (i.e. abandoning and
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40 awaiting).
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46 ***Differences in students' perceptions of (de)motivating teaching styles in terms of*** 47 48 ***gender and grade level (aim 1)*** 49

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51 In relation to the first aim, the results of this study showed that, although no differences
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53 were found in autonomy support and structure, boys reported higher values in the
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55 domineering approach, as well as in chaotic style and approaches than girls. These results
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57 are partially in line with previous studies in PE lessons. Burgueño and Medina-Casubón
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(2021) and Leo et al. (2022) found no differences in students' perceptions of autonomy supportive style, but they observed differences in structuring style that benefit girls. However, in the study conducted by Viira and Koka (2010), boys perceived higher values in structuring style. The observed results can be explained by the notion that autonomy-supportive strategies may be uniformly perceived by the whole group, whereas structure style may show more individual variability among students. For example, the type of feedback provided by the teacher could be different according to gender (Nicaise et al., 2007). Our results are in line with most studies indicating that in PE, boys perceived more controlling and chaotic styles than girls (Burgueño and Medina-Casabón, 2021; Leo et al., 2022). Consistent with our results, a previous study conducted by De Meyer et al. (2016) also found that boys perceived a higher use of internally controlling behaviors (i.e. domineering), but not of externally controlling behaviors (i.e. demanding) than girls. These results could explain why boys and girls perceive their PE teachers' commands, orders, and instructions in the same way. However, as boys tend to present more disruptive behaviors than girls in PE lessons (Granero-Gallegos et al., 2019), perhaps PE teachers' domineering behaviors tend to focus more on boys. Finally, the high values found in PE teachers' chaotic style and approaches in boys may be attributed to their preference for rather structured tasks that allow them to demonstrate their skills. On the other hand, girls may lean towards more open-ended tasks with fewer explicit guidelines, potentially explaining lower values in this style and approaches (Mitchell et al., 2015). Consequently, boys may be more sensitive to report higher levels of perceived abandoning and awaiting approaches when the PE teacher gives some responsibility during PE classes.

Regarding grade level, students in the higher grades reported higher levels in autonomy-supportive and structuring styles and approaches, and significantly lower

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3 levels of domineering and chaotic styles and approaches than students in the lower grades.
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5 Although most previous studies found no relationship between students' age and
6
7 (de)motivating teaching styles (De Meyer et al., 2016; Tilga et al., 2020; Van Doren et
8
9 al., 2021), two recent studies in Spain found that older students perceived more need-
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11 supportive behaviors and fewer need-thwarting behaviors than younger students
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13 (Burgueño and Medina-Casabón, 2021; Leo et al., 2022). In relation to autonomy
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15 support, our results could be explained by PE teachers perceiving that students in higher
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17 grades show greater autonomy and responsibility for learning than students in lower
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19 grades. In addition, the decrease in autonomous motivation in PE (Ullrich-French and
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21 Cox, 2014) in the upper grades could also explain why PE teachers try to involve these
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23 students more in learning by listening to their interests (i.e. participative) and explaining
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25 the usefulness of the tasks (i.e. attuning).
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31 Regarding structuring style, particularly the guiding approach, our findings may
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33 be attributed, among other reasons, to the likelihood that students in higher school levels
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35 receive more constructive, specific, and valuable feedback than in lower school levels
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37 (Leo et al., 2022). This could be due to the increased complexity of tasks or to the
38
39 increased understanding of the feedback provided by the teachers (Leo et al., 2022).
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41 Regarding teachers' clarifying approach, our results might be explained by the notion that
42
43 students in higher school grades tend to focus more on learning objectives, whereas
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45 students in lower grades may focus more on playing with their peers and be less
46
47 concerned with the teacher's expectations (Burgueño and Medina-Casabón, 2021).
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51 Regarding teachers' domineering approach, our findings could be linked to the
52
53 likelihood that students in lower school grades tend to exhibit more disruptive behaviors
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55 compared to students in higher school grades (Granero-Gallegos et al., 2019).
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57 Consequently, PE teachers may implement these controlling practices with younger
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3 students as a means of tackling and stopping these disruptive actions. In relation to chaos,
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5 our findings may be attributed to the practice of PE teachers in lower grades of allowing
6
7 students a significant degree of freedom to approach exercises in their own way. In the
8
9 higher grades, lessons may be more specifically planned and structured, but this style
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11 often aims to encourage students to take excessive responsibility for their own learning
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13 (i.e. abandoning), while expecting the teacher to observe their responses (i.e. awaiting)
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15 (Leo et al., 2022).
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19 ***Differences in (de)motivating teaching styles in terms of students' outcomes (aim 2)***
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21 Partially consistent with the hypothesis of the second aim, overall results showed that
22
23 students who reported positive experiences, high perceived learning in PE, and a high
24
25 intention to participate in PA, also perceived significantly higher values in autonomy-
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27 supportive and structuring styles and approaches, as well as the demanding approach,
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29 compared to students with negative experiences, low perceptions of learning in PE, and
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31 medium and/or very low intention to participate in PA. Consistent with our results,
32
33 previous research found that students' perceptions of PE teachers' autonomy-supportive
34
35 and structuring styles were positively related to a wide range of positive affective,
36
37 cognitive, and behavioral outcomes (Vasconcellos et al., 2020). Consistent with the
38
39 circumplex model, our results extend previous research on this theoretical framework in
40
41 other areas (e.g. sport, education, health, etc.), highlighting that students who perceive
42
43 that their PE teacher encourages choice and involvement in their learning (i.e.
44
45 participative), provides an explanation of the usefulness of the tasks (i.e. attuning),
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47 structures the tasks into different steps, and provides clear, constructive, and valuable
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49 feedback (i.e. guiding), whilst communicating learning objectives and goals (i.e.
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51 clarifying), are more likely to report positive experiences in PE, high perceived learning
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53 in PE, and high intention to participate in PA.
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3 Regarding PE teachers' controlling style, our results are not entirely in line with
4
5 the majority of previous SDT-related research in PE (Vasconcellos et al., 2020). In a
6
7 previous meta-analysis, Vasconcellos et al. (2020) found that PE teachers' controlling
8
9 style was positively related to a set of negative consequences in PE lessons and
10
11 negatively, albeit to a lesser extent, to adaptive outcomes. In particular, different research
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13 studies that have examined the distinction between demanding and domineering
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15 approaches have shown that both demotivating approaches were positively related to
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17 maladaptive outcomes (e.g. oppositional defiance, controlled motivation, amotivation,
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19 etc.) (Abós et al., 2022; García-González et al., 2023). However, in line with our results,
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21 Aelterman et al. (2019) revealed that students' perceptions of the demanding approach
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23 was positively related to autonomous motivation and learning-related variables, but to a
24
25 lesser extent than motivating teaching approaches, whereas the domineering approach
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27 was negatively related to persistence.
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33 Moreover, consistent with our results, Aelterman et al. (2019) also reported a
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35 positive relationship between demanding and clarifying approaches. Therefore, the
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37 demanding approach could be perceived by students as the clarifying approach because
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39 it is situated next to the structuring style in the circumplex model (Aelterman et al., 2019).
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41 In this sense, students may perceive the use of controlling language from their PE teachers
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43 as positive to ensure that the whole group behaves in a prescribed way, as they believe
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45 that the teachers' intention is to improve their learning. In addition, given that many
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47 students exhibit disruptive behaviors in PE lessons (Granero-Gallegos et al., 2019),
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49 students may perceive that the demanding approach is justified to prevent the group from
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51 getting out of control. Further qualitative studies are required to find out more about why
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53 the demanding approach could be associated with positive consequences in PE lessons.
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3 Finally, the lower values found in PE teachers' chaotic style in students who
4 reported positive experiences in PE, high perceived learning in PE, and high intention to
5 participate in PA are in line with a recent study by Leo et al. (2022), who found that
6 students' perceptions of PE teachers' chaotic style were negatively related to behavioral
7 and emotional engagement. Our results expand the evidence of the few existing studies
8 in PE, suggesting that teachers who allow students to act independently, not providing
9 clear indications of what they should do (i.e. abandoning), and not planning the
10 development of the lessons (i.e. awaiting), could negatively affect both in-class (i.e.
11 experiences and learning) and out-of-class outcomes (i.e. intention to be physically
12 active).

25 **Limitations and future directions**

26 Although our findings expand previous evidence of the circumplex approach in PE, it is
27 also important to note the limitations and future directions. First, the use of a convenience
28 sample means the results should be interpreted with caution. Future studies should use
29 probability sampling to increase external validity. Second, a cross-sectional design was
30 used, so no causal relationships between the study variables can be inferred. Future
31 research, using longitudinal and experimental designs to examine the causal and long-
32 term effects of (de)motivating teaching styles and approaches in PE, is recommended.
33 Third, although affective, cognitive, and behavioral consequences were included, all were
34 positive. Moreover, perceived experiences and learning in PE were evaluated with a
35 single item. Using more advanced measures might provide a more accurate and complete
36 picture of the findings. Another limitation in terms of the outcomes of the study is that
37 only PE experiences, learning, and intention to be active were included as outcomes.
38 Therefore, future studies should address other outcomes related to the PE curriculum such
39 as motor, health-oriented, cultural or emotional learning goals. Future studies should also
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3 evaluate other negative affective, cognitive, and behavioral consequences such as
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5 boredom, inattention, and oppositional defiance, respectively, to obtain a more realistic
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7 picture of the relationship between the eight teaching approaches proposed by the
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9 circumplex approach, and the bright and dark sides of student motivation. The circumplex
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11 model does not include teacher relatedness support/thwarting, which constitute another
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13 teaching style within SDT (Ryan and Deci, 2017). Finally, another limitation is that
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15 possible variables that might influence students' perceptions of (de)motivating teaching
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17 styles and outcomes were not assessed. Therefore, variables such as classroom climate,
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19 students' personal traits, etc. should be measured in future studies.
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23 24 **Conclusions**

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26 The use of a circumplex model in the present study provided an integrative and detailed
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28 model of the outcomes associated with students' perceptions of autonomy-supportive,
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30 structuring, controlling, and chaotic styles in PE lessons. First, our results showed the
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32 importance of developing gender and grade strategies for improving PE teachers' (de)
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34 motivating styles, particularly for boys and lower grades. Second, our results revealed
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36 that PE teachers should not only use autonomy-supportive and structuring styles with
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38 their students, but at the same time should avoid controlling and chaotic styles to achieve
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40 better experiences, higher perception of learning and intention to participate in PA.
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42 Although in this research, a demanding approach was positively associated with adaptive
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44 outcomes, more cross-sectional and, particularly, longitudinal studies exploring the
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46 benefits or risks of this type of teaching behavior seem to be lacking in PE lessons.
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48 Overall, taken together, these results could guide teacher education and school PE-based
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50 interventions so that all students, regardless of gender or grade level, will achieve
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52 adaptive experiences in PE classes through their PE teacher's motivating teaching style.
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Table 1. Descriptive statistics, Omega (ω) reliability coefficients, and correlations among study variables.

Variables	<i>M (SD)</i>	ω	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Autonomy support	4.41 (1.26)	.86	1	.88**	.96**	.79**	.76**	.76**	.43**	.51**	.20**	-.15**	-.18**	-.04	.02	-.26**	.19**	.43**	.46**	.20**
2. Participative	4.01 (1.50)	.70		1	.72**	.62**	.61**	.52**	.38**	.42**	.21**	-.04	-.06	.00	.01	-.29**	.20**	.33**	.39**	.15**
3. Attuning	4.60 (1.27)	.81			1	.80**	.77**	.70**	.42**	.51**	.18**	-.20**	-.23**	-.06	.01	-.23**	.17**	.44**	.44**	.21**
4. Structure	5.20 (1.07)	.87				1	.95**	.88**	.48**	.61**	.17**	-.29**	-.31**	-.15**	-.04	-.17**	.17**	.44**	.43**	.18**
5. Guiding	5.18 (1.22)	.82					1	.70**	.41**	.55**	.12**	-.30**	-.33**	-.16**	-.04	-.14**	.16**	.44**	.42**	.17**
6. Clarifying	5.22 (1.08)	.67						1	.49**	.58**	.22**	-.20**	-.22**	-.11**	-.05	-.16**	.16**	.35**	.38**	.15**
7. Control	4.34 (0.90)	.71							1	.87**	.82**	.23**	.23**	.17**	.06	-.18	-.06	.13**	.18**	.12**
8. Demanding	4.75 (0.97)	.62								1	.44**	.01	-.00	.04	-.00	-.19**	.04	.23**	.26**	.14**
9. Domineering	3.77 (1.19)	.58									1	.42**	.43**	.27**	.12**	-.11**	-.13**	-.06	.03	.05
10. Chaos	2.59 (1.13)	.84										1	.95**	.80**	.12**	.02	-.11**	-.19**	-.11**	-.06
11. Abandoning	2.56 (1.24)	.82											1	.57**	.11**	.06	-.09*	-.21**	-.13**	-.05
12. Awaiting	2.63 (1.29)	.65												1	.10**	.05	-.11**	-.09*	-.05	-.06
13. Students'gender ^a	52% ^b														1	.03	-.10**	.16**	.06	.17**
14. Teachers'gender ^a	20% ^c															1	-.04	-.11**	-.18**	-.03
15. School grade	53% ^d 36% ^e 11% ^f																1	.10**	-.09*	.02
16. Experiences	4.18 (0.67)	-																1	.53**	.27**
17. Learning	3.23 (0.35)	-																	1	.22**
18. Intention to PA	5.22 (0.64)	.93																		1

* $p < .05$; ** $p < .01$; ^a = Spearman's rho correlation; ^b = % of girl students in the sample; ^c = % of female teachers in the sample; ^d = % of students in 1st cycle (Year 8 and 9); ^e = % of students in 2nd cycle (Year 10 and 11); ^f = % of students in 3rd cycle (Year 12).

Table 2. Differences in students' perceptions of PE teaching styles/approaches in terms of gender and grade level.

Gender									
Teaching styles/approaches			Mean difference (i-j)	Contrast between groups					
	Girls (i) (n=347)	Boys (j) (n=322)		Standard error	p	F-value	η^2_p		
	<i>M (SD)</i>	<i>M (SD)</i>							
Autonomy support	4.38 (1.25)	4.43 (1.27)	-.05	.09	.566	0.45	.000		
Participative	3.99 (1.45)	4.04 (1.56)	-.05	.10	.640	0.21	.000		
Attuning	4.58 (1.28)	4.63 (1.25)	-.04	.09	.571	0.32	.000		
Structure	5.24 (1.07)	5.15 (1.08)	.09	.08	.265	1.37	.002		
Guiding	5.21 (1.23)	5.14 (1.20)	.07	.09	.433	0.61	.001		
Clarifying	5.28 (1.06)	5.16 (1.09)	.12	.08	.158	1.99	.003		
Control	4.29 (0.89)	4.40 (0.92)	-.11	.06	.099	2.13	.004		
Demanding	4.76 (0.94)	4.74 (1.01)	.02	.07	.866	0.28	.000		
Domineering	3.62 (1.20)	3.92 (1.17)	-.30	.09	.001	10.20	.015		
Chaos	2.46 (1.06)	2.73 (1.18)	-.27	.08	.002	12.04	.014		
Abandoning	2.44 (1.21)	2.69 (1.25)	-.25	.09	.010	6.76	.010		
Awaiting	2.48 (1.16)	2.79 (1.39)	-.31	.10	.002	9.49	.014		
Grade level									
Teaching styles/approaches				Mean difference	Contrast between groups				
	1 st cycle (i) (n=358)	2 nd cycle (j) (n=243)	3 rd cycle (k) (n=68)		Standard error	p	F-value	η^2_p	
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>						
Autonomy support	4.16 (1.32)	4.67 (1.12)	4.74 (1.12)	i-j	-.51	.10	.003	12.71	.031
				i-k	-.58	.15	<.001		
				j-k	-.07	.16	.338		
Participative	3.74 (1.53)	4.26 (1.43)	4.57 (1.32)	i-j	-.52	.11	.040	12.42	.036
				i-k	-.83	.17	<.001		
				j-k	-.31	.19	.012		
Attuning	4.38 (1.35)	4.87 (1.11)	4.83 (1.13)	i-j	-.49	.10	.003	8.19	.029
				i-k	-.45	.15	.010		
				j-k	.04	.17	1.000		
Structure	4.98 (1.17)	5.47 (0.89)	5.38 (0.90)	i-j	-.49	.09	<.001	12.52	.037
				i-k	-.40	.13	.008		
				j-k	.09	.14	1.000		
Guiding	4.96 (1.34)	5.44 (0.99)	5.39 (1.01)	i-j	-.48	.10	<.001	9.56	.037
				i-k	-.43	.15	.017		
				j-k	.05	.16	1.000		
Clarifying	5.00 (1.13)	5.51 (0.93)	5.37 (1.02)	i-j	-.51	.09	<.001	12.62	.010
				i-k	-.37	.13	.017		

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					j-k	.14	.15	1.000		
Control	4.34 (0.97)	4.41 (0.81)	4.08 (0.85)		i-j	-.07	.07	1.000	2.07	.006
					i-k	.26	.11	.128		
					j-k	.39	.12	.255		
Demanding	4.65 (1.04)	4.94 (0.86)	4.60 (0.90)		i-j	-.29	.08	.049	3.21	.010
					i-k	.05	.12	.1000		
					j-k	.34	.13	.255		
Domineering	3.90 (1.23)	3.67 (1.14)	3.37 (1.08)		i-j	.23	.10	.004	9.11	.027
					i-k	.53	.15	.002		
					j-k	.30	.16	.726		
Chaos	2.70 (1.14)	2.47 (1.13)	2.39 (0.93)		i-j	.23	.09	.062	4.34	.012
					i-k	.31	.15	.105		
					j-k	.08	.16	1.000		
Abandoning	2.68 (1.26)	2.43 (1.24)	2.43 (1.08)		i-j	.25	.10	.065	3.19	.010
					i-k	.25	.17	.396		
					j-k	.00	.16	1.000		
Awaiting	2.75 (1.33)	2.55 (1.28)	2.31 (0.96)		i-j	.20	.11	.289	4.15	.012
					i-k	.44	.17	.025		
					j-k	.24	.18	.453		

Note: Teacher and teacher's gender were introduced as covariates. 1st cycle = Year 8 and 9; 2st cycle = Year 10 and 11; 3st cycle = Year 12

Table 3. Differences in students' perceptions of PE teaching styles/approaches in terms of PE experiences, PE learning, and intention to participate in PA.

		PE experiences		Contrast between groups						
Teaching styles/approaches	Negative (i) (n=96)	Positive (j) (n=573)	Mean difference (i-j)		Standard error	p	F-value	η^2p		
	M (SD)	M (SD)								
Autonomy support	3.43 (1.35)	4.57 (1.16)	-1.14		.12	<.001	61.45	.085		
Participative	3.19 (1.47)	4.15 (1.47)	-.96		.15	<.001	23.70	.035		
Attuning	3.55 (1.42)	4.78 (1.15)	-1.23		.12	<.001	73.41	.100		
Structure	4.29 (1.23)	5.35 (0.96)	-1.06		.11	<.001	78.74	.106		
Guiding	4.16 (1.39)	5.35 (1.10)	-1.19		.12	<.001	78.61	.106		
Claryfing	4.48 (1.22)	5.34 (1.01)	-.86		.11	<.001	48.24	.068		
Control	4.19 (0.98)	4.36 (0.89)	-.17		.10	.174	1.85	.003		
Demanding	4.37 (1.08)	4.81 (0.94)	-.44		.10	<.001	13.64	.020		
Domineering	3.94 (1.21)	3.73 (1.19)	.21		.13	.079	3.09	.005		
Chaos	3.17 (1.17)	2.49 (1.09)	.68		.12	<.001	32.99	.047		
Abandoning	3.24 (1.38)	2.45 (1.18)	.79		.13	<.001	35.92	.051		
Awaiting	3.05 (1.18)	2.56 (1.29)	.49		.14	.001	12.17	.018		
		PE learning			Contrast between groups					
Teaching styles/approaches	Nothing/little (i) (n=76)	Enough (j) (n=346)	A lot (k) (n=247)		Mean difference		Standard error	p	F-value	η^2p
	M (SD)	M (SD)	M (SD)							
Autonomy support	3.30 (1.16)	4.19 (1.12)	5.04 (1.13)		i-j	-.89	.13	<.001	78.82	.192
					i-k	-1.74	.13	<.001		
					j-k	-.85	.08	<.001		
Participative	2.89 (1.26)	3.78 (1.39)	4.69 (1.43)		i-j	-.89	.16	<.001	53.60	.139
					i-k	-1.80	.16	<.001		
					j-k	-.91	.10	<.001		
Attuning	3.51 (1.30)	4.40 (1.13)	5.22 (1.21)		i-j	-.89	.13	<.001	71.95	.179
					i-k	-1.71	.14	<.001		
					j-k	-.82	.09	<.001		
Structure	4.23 (1.26)	5.07 (0.96)	5.67 (0.90)		i-j	-.84	.12	<.001	70.49	.176
					i-k	-1.44	.12	<.001		
					j-k	-.60	.08	<.001		
Guiding	4.08 (1.48)	5.06 (1.08)	5.69 (1.03)		i-j	-.98	.13	<.001	64.47	.163
					i-k	-1.61	.14	<.001		
					j-k	-.63	.09	<.001		
Clarifying	4.45 (1.21)	5.08 (1.01)	5.65 (0.96)		i-j	-.63	.12	<.001	49.58	.130

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				i-k	-1.20	.13	<.001		
				j-k	-.57	.08	<.001		
Control	4.03 (0.96)	4.28 (0.82)	4.52 (0.96)	i-j	-.25	.11	.155	4.91	.015
				i-k	-.49	.11	.007		
				j-k	-.14	.07	.181		
Demanding	4.18 (1.09)	4.70 (0.88)	4.99 (0.99)	i-j	-.52	.11	<.001	17.55	.050
				i-k	-.81	.12	<.001		
				j-k	-.29	.08	.010		
Domineering	3.81 (1.14)	3.69 (1.11)	3.86 (1.32)	i-j	.12	.14	.666	0.77	.002
				i-k	-.05	.15	1.000		
				j-k	-.17	.09	.815		
Chaos	2.97 (1.05)	2.58 (1.04)	2.48 (1.24)	i-j	.39	.14	.010	7.60	.022
				i-k	.49	.14	<.001		
				j-k	.10	.09	.246		
Abandoning	3.05 (1.19)	2.55 (1.17)	2.43 (1.30)	i-j	.50	.15	.002	9.29	.027
				i-k	.62	.16	<.001		
				j-k	.12	.10	.244		
Awaiting	2.81 (1.17)	2.64 (1.15)	2.57 (1.29)	i-j	.24	.16	.690	1.95	.006
				i-k	.17	.17	.168		
				j-k	.07	.10	.677		

Intention to participate in PA

Teaching styles/approaches	Very low (i) (n=46)	Medium (j) (n=181)	Very high (k) (n=442)	Contrast between groups			F-value	η^2p	
				Mean difference	Standard error	p			
Autonomy support	<i>M (SD)</i> 3.74 (1.44)	<i>M (SD)</i> 4.15 (1.18)	<i>M (SD)</i> 4.58 (1.23)	i-j	-.41	.17	.413	12.60	.037
				i-k	-.84	.17	<.001		
				j-k	-.43	.10	.001		
Participative	3.36 (1.60)	3.81 (1.38)	4.16 (1.52)	i-j	-.45	.22	.735	5.95	.018
				i-k	-.80	.21	.021		
				j-k	-.35	.12	.030		
Attuning	3.93 (1.44)	4.33 (1.24)	4.79 (1.22)	i-j	-.40	.19	.417	13.85	.040
				i-k	-.86	.18	<.001		
				j-k	-.46	.10	<.001		
Structure	4.67 (1.34)	5.01 (1.10)	5.32 (1.01)	i-j	-.34	.17	.144	11.33	.033
				i-k	-.65	.16	.001		
				j-k	-.31	.09	.014		
Guiding	4.56 (1.57)	5.01 (1.23)	5.31 (1.14)	i-j	-.45	.19	1.000	9.39	.028

					i-k	-.75	.18	.001		
					j-k	-.30	.10	.007		
	Clarifying	4.83 (1.23)	5.01 (1.13)	5.35 (1.02)	i-j	-.18	.17	.236	9.76	.029
					i-k	-.52	.16	.005		
					j-k	-.34	.09	.001		
	Control	3.92 (0.78)	4.26 (0.91)	4.42 (0.90)	i-j	-.25	.14	.236	4.78	.014
					i-k	-.39	.13	.015		
					j-k	-.13	.07	.263		
	Demanding	4.27 (0.84)	4.64 (1.02)	4.85 (0.95)	i-j	-.37	.15	.140	7.67	.023
					i-k	-.58	.14	.001		
					j-k	-.21	.08	.048		
	Domineering	3.45 (1.01)	3.73 (1.18)	3.81 (1.21)	i-j	-.28	.19	1.000	0.68	.002
					i-k	-.36	.18	.769		
					j-k	-.08	.10	1.000		
	Chaos	2.66 (1.05)	2.68 (1.14)	2.54 (1.12)	i-j	.01	.18	1.000	1.95	.006
					i-k	.19	.17	.838		
					j-k	.18	.09	.224		
	Abandoning	2.69 (1.22)	2.62 (1.23)	2.53 (1.24)	i-j	.07	.20	1.000	1.14	.003
					i-k	.16	.19	.750		
					j-k	.09	.11	.735		
	Awaiting	2.61 (1.18)	2.80 (1.24)	2.56 (1.31)	i-j	-.19	.11	1.000	3.18	.009
					i-k	.05	.19	1.000		
					j-k	.24	.21	.044		

Note: Teacher, teacher's gender, student's gender, and grade level were introduced as covariates.

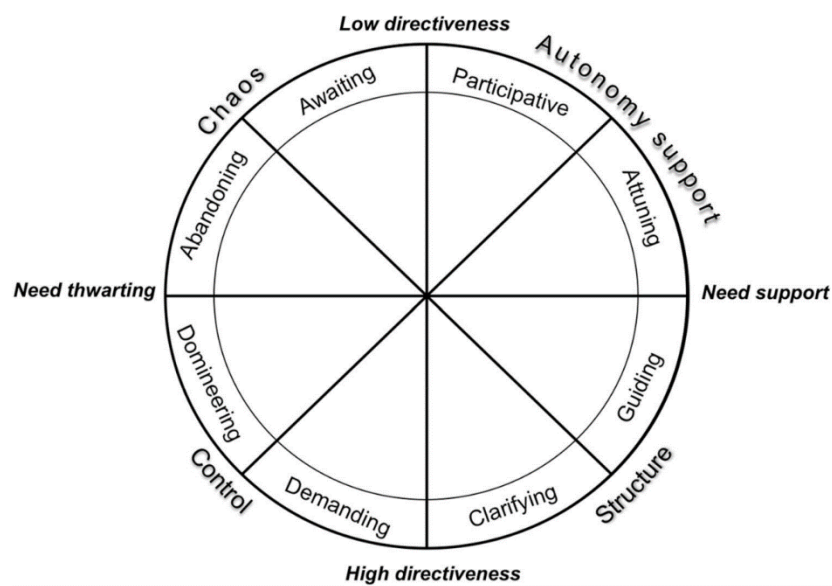


Figure 1. Graphical representation of the circumplex model (Aelterman et al. 2019).

Supplementary file 1

The three-cluster solution explained 83% of the variance in intention to participate in PA, whereas the two-cluster solution explained 77% and the four-cluster solution explained 85%. In this sense, the three-cluster solution was retained because it was theoretically more interpretable than the two- and four-cluster solution. In addition, compared to the two-cluster solution, the variance explained was significantly higher and with respect to the four-cluster solution, the explained variance was slightly higher, but not significantly. Furthermore, the four-cluster solution was not chosen because the four groups were not significantly different from each other, and the group of subjects per category did not exceed 5% in some of them. The double-split cross-validation method showed an average kappa value of 0.83 (very good agreement) for the three-cluster solution.

	Profile 1 (<i>n</i> =442) (66.06%) Very high intention to participate in PA	Profile 2 (<i>n</i> =181) (27.05%) Medium intention to participate in PA	Profile 3 (<i>n</i> =46) (6.89%) Very low intention to participate in PA
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)
Raw scores	6.30(0.70)	3.66(0.69)	1.42(0.46)
Z-scores	0.61(0.41)	-0.93(0.40)	-2.25(0.27)

