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COMIENDOP: a protocol to improve the motivational teaching styles of pre-service primary physical education teachers

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Introduction: Pre-service primary teachers, especially primary Physical Education (PE) teachers, must acquire core teaching skills and effective classroom management strategies. The acquisition of motivating teaching styles in PE lessons has positive consequences for both teachers and students. Grounded in Self-Determination Theory and the Circumplex Model, the present study presents the first intervention program designed to foster motivating teaching styles (i.e., autonomy support and structure) and prevent (de)motivating teaching styles (i.e., control and chaos) among preservice primary PE teachers.

Methods: The training program also strives to improve preservice primary PE teachers' competence and motivation, which might increase motivation for PE and physical activity engagement in the students later under their charge. A quasi-experimental design was employed that took a mixed methods approach. A total of 370 participants from the [anonymized peer review process] will participate in the study. Participants were divided into control and experimental groups. The intervention program is structured into two main phases (i.e., general and specific phases) and will last a total of 35 h. Theoretical and practical face-to-face sessions will be conducted by university PE specialist professors. Following the training program, participants will complete school placements to apply what they have learned.

Findings and discussion: Pre-service primary PE teachers will learn to effectively use motivational strategies and teaching skills, whilst also adopting motivating teaching styles during practical sessions. Motivation, (de)motivating teaching styles, and perceptions of efficacy and competence will be assessed via questionnaires and focus groups. Findings represent an important first step towards improving motivational training programs for pre-service primary PE teachers and improving the quality of university teaching.

KEYWORDS

strategies, teaching, self-determination theory, circumplex model, program

1 Introduction

Initial basic training in professional competences during Physical Education teacher education (PETE) is fundamental for ensuring continued quality of Physical Education (PE) classes in primary schools (Asún et al., 2020). Professional competency development is a dynamic and ongoing process which begins at university and continues throughout

professional practice, with a concomitant impact on student success (Férriz et al., 2023).

According to the Ministry of Education of Quebec (2020), three types of professional teaching competencies are related to classroom design and management, and to teacher-student and student-student interactions. Specifically, such competences include those that pertain to development of the teaching profession. As a result, trained teachers are more likely to acquire well-oriented competencies that will equip them to resolve issues and manage the classroom or group (Férriz et al., 2023). Thus, the teaching behaviors enacted during lessons (e.g., PE lessons) will impact student experiences and, in this way, directly influence their motivation and learning process (Bartholomew et al., 2018). In light of this, teachers should train to enact motivational teaching behaviors from the very early stages of PETE.

A large body of research demonstrates that the teacher's interpersonal style is associated with active student engagement and, as a consequence, is key to the teaching process (Curran and Standage, 2017; Leo et al., 2020; Reeve et al., 2014; Van den Berghe et al., 2016). According to Self-Determination Theory (SDT; Ryan and Deci, 2017), PE teachers can adopt a variety of motivational teaching styles during lessons. However, the issue is rarely black and white. Indeed, any given PE teacher can independently enact different teaching styles during their everyday teaching (Leo et al., 2020; Van den Berghe et al., 2013). For this reason, given the importance of teaching styles and their consequences regarding student motivation, it is necessary to design programs for pre-service primary teachers that are aimed at improving PETE. In this regard, current evidence focuses on in-service teachers and pre-service secondary school teachers (Cheon et al., 2020; Conesa et al., 2023; García-Cazorla et al., 2024; Mayo-Rota et al., 2025).

1.1 (De)motivating teaching styles: self-determination theory and the circumplex model

Need-supportive interpersonal styles (i.e., autonomy, competence and relatedness-supportive behaviors) are associated with autonomous motivation, and positive behavioral, cognitive and affective outcomes (e.g., achievement, enjoyment, well-being and classroom engagement). In contrast, need-thwarting interpersonal styles (i.e., autonomy, competence and relatedness-thwarting behaviors) are related to negative and non-adaptive outcomes among students (e.g., boredom, depression and lack of motivation) (White et al., 2021; Diloy-peña et al., 2025).

Based on SDT, the Circumplex Model (Aelterman et al., 2019) examines different dimensions the (de)motivating styles (i.e., autonomy support, structure, control and chaos) employed in a PE classroom, which allows more in-depth examination of relevant motivational variables.

With regards to motivating teaching styles, the first typed is named autonomy support and is characterized by a low level of instruction and high level of need support. PE teachers who take student needs or preferences into consideration promote an autonomy-supportive environment. Autonomy-support is composed of participative (i.e., the PE teacher understands student attitudes and provides opportunities for choice) and attuning approaches (i.e., the teacher empathizes with students) (Vansteenkiste et al., 2019). The second motivating teaching style is named structure, which is

characterized by a high level of instruction and low level of need support. In this case, PE teachers guide students and adapt tasks to student needs to improve their competence and learning. Structure can emerge through a guiding (i.e., the PE teacher guides the students' learning process where necessary) and clarifying teaching approach (i.e., the PE teacher sets clear and differentiated goals and informs students of their achievements) (Vansteenkiste et al., 2019).

On the other hand, (de)motivating teaching styles are denominated a control style and are characterized by high levels of instruction and need-thwarting. PE teachers who adopt this style tend to pressure and control students regarding the way in which tasks should be performed. This style is divided into demanding (i.e., the teacher uses controlling language to demand specific behavior) and domineering teaching approaches (i.e., The PE teacher assumes a position of power over students) (Vansteenkiste et al., 2019). The final (de)motivating teaching style is named chaos and is characterized by low levels of directiveness and need-thwarting. Teachers who adopt this style give students excessive freedom and create confusion in the learning process. This style consists of abandoning (i.e., The PE teacher gives up after repeatedly trying to explain exercises) and awaiting approaches (i.e., The PE teacher adopts a so-called "laissez-faire" attitude after introducing a task) (Aelterman et al., 2019).

Some consequences associated with the use of (de)motivating teaching styles have been associated with students' need-based experiences. Substantial research has reported that autonomy-support and structure-motivating styles employed in PE lessons may promote the satisfaction of students' basic psychological needs (BPN) (Curran and Standage, 2017), thereby fostering their autonomous motivation. Conversely, control and chaos styles have been linked to need frustration in students (e.g., negative experiences, failure and loneliness) (Curran and Standage, 2017; Vasconcellos et al., 2020; García-González et al., 2023), which, in turn, could trigger controlled motivation or amotivation (García-González et al., 2023).

Despite the well-known consequences of (de)motivating teaching styles, a large number of in-service teachers adopt control and chaos teaching styles. In relation to pre-service teachers. A recent study (Mayo-Rota et al., 2024) found that female pre-service secondary PE teachers adopted more motivating approaches (i.e., participative and adaptive) than male pre-service secondary PE teachers with apparent effects on their motivation for future professional practice. In this vein, controlled motivation in pre-service teachers has been found to positively predict the adoption of a controlling and clarifying approach regardless of sex (Mayo-Rota et al., 2024). In contrast, autonomous motivation in pre-service teachers positively predicts the use of autonomy support and structure styles (Escriva-Boulley et al., 2021; Mayo-Rota et al., 2024). However, to the best of our knowledge, no studies exist at the present time which have targeted pre-service primary PE teachers to analyse their motivational processes and improve their use of (de)motivating teaching styles. It is important to note that a study protocol has recently been published for pre-service PE teachers based on Circumplex Model (Mayo-Rota et al., 2025).

1.2 SDT-based motivational training programs for pre-service PE teachers

In consideration of the benefits for students and teachers, improving the motivating teaching styles of pre-service PE teachers during initial

basic training is crucial for teacher skill development. To our knowledge, five SDT-based training programs have been implemented in the educational context over the last few years. The majority of these focused on autonomy-supportive strategies (Cheon et al., 2020; Conesa et al., 2023; García-Cazorla et al., 2024; Mayo-Rota et al., 2025), whilst two were also based on the Circumplex Model (García-Cazorla et al., 2024; Mayo-Rota et al., 2025). However, as far as we are aware, only one motivational training program exists for pre-service secondary PE teachers that is based on SDT and the Circumplex Model, and there is no existing program for primary teachers.

To design effective motivational training programs for teachers, several fundamental elements must be considered. Firstly, the training program must be adapted to the target population by acknowledging the factors that influence the adoption of (de)motivating teaching styles in pre-service PE teachers (e.g., personality traits, future teaching environment, future students' characteristics and beliefs about the learning process) (Pelletier et al., 2002; Roth and Weinstock, 2013; Reeve et al., 2018; García-Cazorla et al., 2024).

Secondly, the provision of constructive and individual feedback after training sessions is fundamental for improving the motivational teaching style adopted. To support this, an observational methodology is recommended as a means of providing instant feedback through videos or audio (Bouten et al., 2023; García-Cazorla et al., 2024). Despite the importance of this issue, only one study based on autonomy-supportive strategies has followed an observational methodology (Reeve and Cheon, 2021), whilst one other study designed an implementation program through the use of a novel observational instrument (i.e., SIS-PE) (García-Cazorla et al., 2024).

Third, the addition of practical sessions appears to be an effective strategy for applying concepts learned during earlier theoretical sessions (Aelterman et al., 2013; García-Cazorla et al., 2024; Mayo-Rota et al., 2025). Moreover, strategies implemented throughout the training program should align with students' aims. Such strategies could be specific activities to be performed in practical sessions by pre-service teachers as a means of promoting competence and adaptive motivational processes (González-Peño et al., 2023).

Fourth, although there is no consensus regarding the optimal duration of training programs, evidence suggests that short programs ranging between three to 12 h in duration are ideal for avoid discouragement and boosting participation. However, it is important to highlight that, programs should be adapted to the context and, in some instances, longer, well-designed programs may be justified (García-Cazorla et al., 2024; Mayo-Rota et al., 2025).

Finally, in consideration of the implications of adopting a (de) motivating teaching style, it is necessary to shed more light on the impact of initial pre-service teacher training programs on the motivational styles of primary PE teachers. Hence, the present study aims to describe the design and implementation of a motivational training program for pre-service primary PE teachers (i.e., students enrolled on a Primary Education Teaching degree).

2 Materials and methods

2.1 Study design and contextualization

The current study will be carried out in mid-sized cities located in a region of Spain called Aragon. The training program will be conducted with students enrolled on the Primary Education Teaching degree imparted at the [anonymized peer review process] during third- and fourth-year PE in Primary School modules. The PE in Primary School module is annual and comprises between 6 to 10 h a week of timetabled teaching, corresponding to a total of 250 h for each student. Through this module, students cover the PE curriculum, basic learnings related to motor-action (i.e., individual, opposition, collective, body-expression and outdoor activities) and teaching intervention. The present study is focused on the teaching intervention unit which runs for 4 months and comprises a total of 30 h divided between face-to-face learning and autonomous completion of coursework tasks. At the need of the third year, some students decide to specialize in Physical Education to teach PE for primary school and can earn credits from up to five subjects. During the specialization process, students conduct an intervention module which lasts 20 h. The academic year in Spain runs from September to June.

A quasi-experimental design will be applied given that natural classroom groupings prevent randomization via a mixed-methods approach. Pre-service primary teachers agreeing to participate in the study will be divided between experimental and control groups depending on the faculty within which they are studying a Primary Education Teaching degree [the experimental group will come from (anonymized peer review process), whilst usual practice control groups will be recruited from (anonymized peer review process)]. Groups will be assigned according to convenience.

The training program is made up of two main phases: (1) A general phase which will be rolled out during the third year, and (2)

2024-2025. GENERAL PHASE					2025-2026. SPECIFIC PHASE						
October	November-December	January	February-May	June	September	October	November	December	January	February-May	June
T1	General School-placement	T2	Training program. General phase	T3	T4	Training program. Specific phase: Phase I		T5	Exams period	PE School-placement	T6
Pre-test questionnaires		Intermediate-test questionnaires		Post-test questionnaires Focus group	Pre-test questionnaires			Intermediate-test questionnaires			Post-test questionnaires Focus group

FIGURE 1 Intervention program timeline.

A specific phase which will follow in the fourth year. Both phases comprise theoretical and practical sessions. Given that it is necessary for pre-service teachers to have studied and interiorized fundamental elements related to PE, the training program will begin in February, after 6 months of teaching (see [Figure 1](#) for further information on the phases). The study was approved by the Research Ethics Committee of the [anonymized peer review process].

2.2 Participants and recruitment

Study participants will be recruited from the three faculties of Education in the region of Aragon. A total of approximately 370 pre-service primary teachers from the [anonymized peer review process] will be invited to participate in the present study. Participants will be attending one of several faculties of Education (i.e., anonymized peer review process) belonging to the [anonymized peer review process]. All will be enrolled on the degree in Primary Education Teaching. The experimental group will comprise approximately 180 students from [anonymized peer review process] whilst the control group will comprise approximately 190 students from [anonymized peer review process] and [anonymized peer review process]. Participation will be voluntary and anonymous. The following inclusion criteria is defined: (1) Students enrolled on the Primary Education Teaching degree during the 2025/2026 academic year; (2) Students enrolled on the Physical Education in Primary School (third year) module or any module of the Physical Education specialty; (3) Students enrolled on face-to-face courses.

2.3 Measures and data collection

A mixed-method methodology will be used to collect data through questionnaires and a focus group. Study approval was received from the Research Ethics Committee and pertinent procedures were followed to ensure data quality.

With regards to questionnaires, pre-service primary PE teachers will provide data by filling out different questionnaires before, during and after the training program. Data will be collected at six different time-points, with data collection estimated to require approximately 20 min (see [Figure 1](#)).

2.3.1 Socio-demographic variables

Age, sex, prior PE experience (none to extensive; 1 to 5), subject studied, and faculty will be reported by pre-service primary teachers.

2.3.2 (De)motivating teaching styles and approaches

The Spanish version of the Situations-in-School Questionnaire for PE [SIS-PE] will be administered. This tool was developed and validated in the Spanish PE context to assess students' and in-service and pre-service primary PE teachers' perceptions of (de)motivating styles ([Burgueño et al., 2024](#)). This questionnaire presents 12 teaching scenarios with four different reactions to each situation (i.e., in total 48 reactions). An example of a scenario is: "Class Rules: At the beginning of the school year, to propose operating rules, you..." providing

four response options: (1) Announce your expectations and the rules necessary for optimal cooperation (i.e., clarifying approach); (2) Do not worry too much about the rules of operation and their application. You intervene when a problem arises (i.e., awaiting approach); (3) Set out the rules that students are expected to follow. You also list the penalties for breaking them (i.e., demanding approach); (4) Invite students to suggest a few rules that will help them feel comfortable during the lesson (i.e., participative approach). Pre-service teachers will be asked to rate each reaction on a seven-point Likert scale (ranging from 1 to 7).

2.3.3 Competence satisfaction and frustration

Competence satisfaction and frustration of the PE primary teachers will be assessed using the Spanish version of the Basic Psychological Need Satisfaction and Frustration Scale ([Chen et al., 2015](#)). All eight items (four items per factor) are prefaced with "As a future teacher or Physical Education teacher..." followed by a statement that assesses competence satisfaction (e.g., "I have the ability to get it right") and competence frustration (e.g., "I feel insecure about my skills as a teacher"). Items will be assessed using a five-point Likert scale.

2.3.4 Autonomy-support by professors throughout teacher training

Participant perceptions about the way in which professors support their autonomy throughout their degree studies in general and during specific modules will be assessed using the Spanish version of The Learning Climate Questionnaire ([Núñez et al., 2012](#)). A total of 15 items will be posed to assess autonomy support (e.g., My professors have offered me options and allowed me to choose) in the context of: "During the Degree..." or "During the module of Physical Education in Primary School..." or "During modules of the Physical Education specialty..." Items will be assessed using a seven-point Likert scale.

2.3.5 Teachers' sense of efficacy

Pre-service primary teachers' sense of efficacy will be assessed using the Spanish version of the Teachers' Sense of Efficacy Scale ([Salas-Rodríguez et al., 2021](#)). The Scale starts with the stem "My sense of efficacy during PE lessons..." followed by 12 items that measure efficacy for instructional strategies (e.g., "To what extent can you craft good questions for your students?"), classroom management (e.g., "How much can you do to control disruptive behavior in classroom?") and student engagement (e.g., "How much can you do to motivate students who show low interest in schoolwork?"). Items will be assessed using a four-point Likert scale.

2.3.6 Teaching attitudes during PE lessons

The Teaching Attitude Scale ([Ramzan et al., 2014](#)) will be used to assess the attitudes of pre-service primary PE teachers during their lessons. A total of 30 items will be posed that are preceded by the stem "Your teaching attitude during PE lessons is defined by..." Items assess professional beliefs, professional association, compliance with rules and regulation, volunteering, and self-sufficiency. Items will be assessed using a five-point Likert scale.

Finally, three ad-hoc variables will be included to assess satisfaction with the degree, PE module and PE specialty using the question: (1) What is your degree of satisfaction with your degree, PE module and PE specialty?

In terms of qualitative methodology, two focus groups will be held, each lasting approximately 30 min. The first focus group will be held at the end of the general phase of the training program (T3) and the second focus group will be conducted at the end of the specific phase of the intervention (T6). The main themes covered through the focus group will be: (1) Training expectations; (2) Progression of (de) motivating teaching styles throughout the academic year, in general, and teacher training, specifically; (3) Perceived progression of (de) motivating teaching styles and psychological needs; (4) Strengths and weaknesses identified after training; (5) Factors perceived to affect teaching competence; (6) Motivation to practice after training. In order to promote participation, focus groups will start by providing a brief overview, followed by discussion revolving around general issues which become progressively more specific. Likewise, prior to finishing the focus group, a moderator will summarize the general perceptions identified over the course of the focus group to ensure that the main ideas are interpreted adequate.

In consideration of empirical recommendations (Masadeh, 2012), a total of six pre-service primary PE teachers will participate in each focus group. Participants will be selected via convenience sampling to ensure active participation. It should be noted that gender equality will be considered. Both focus groups will be conducted by a female expert in qualitative methodology, teaching styles and the SDT framework. They will be accompanied by a co-moderator who will take notes during the focus group and facilitate the interpretation of results following their transcription. Each focus group will last for approximately 40 min and will be conducted in participants' usual classes where they feel more comfortable.

2.4 "COMIENDOP" intervention program

The intervention is structured into two main phases: (1) General phase, and (2) Specific phase (see Figure 1). This intervention will last a total of 35 h. At the end of the specific phase, pre-service primary PE teachers will be asked to deliver a lesson. Both theoretical and practical sessions will be conducted by university PE teachers who are experts on SDT and the Circumplex Model, as reflected by their more than 10 years of experience in implementing programs based on these frameworks. Participating teachers will also possess teaching experience at both the primary and university levels. The program will call on pre-service teachers to put into practice effective strategies grounded in SDT (Ahmadi et al., 2023) and Circumplex Model (Aelterman et al., 2019). For instance, they will implement autonomy-, competence- and relatedness-supportive strategies through motivating teaching styles (i.e., autonomy supportive and structure styles). Moreover, each session will start with a brief review or summary of the previous session to reinforce student learning.

Theoretical sessions aim to enhance pre-service teacher knowledge of SDT and the Circumplex Model. These sessions will involve cooperative, dynamic and group-based tasks that will be designed and iteratively adapted to pre-service teachers' needs.

Practical sessions will be designed to closely replicate real-life PE teaching situations. During this type of sessions, pre-service primary PE teachers will deliver PE sessions to their classmates following a structured and supervised tutoring process. The class will be divided into two with one group assuming the role of primary school pupils who participate in the simulated PE sessions and the other group

observing the educational intervention from an observation laboratory. At the end of the session, both researchers and student-observers will provide feedback on teaching style, implementation of BPN-supportive strategies and core teaching skills.

Every action that will be carried out during the COMIENDOP intervention is described in Table 1.

2.4.1 General phase

The general phase will involve pre-service primary teachers enrolled on the subject of Physical Education in Primary School (third year of the degree). This phase lasts 14 h (approximately 1 h and 30 min each session) and is divided into five theoretical and three practical sessions aimed at teaching the theoretical concepts and ensuring practical application of the motivational strategies learned (see Table 1).

The first theoretical group session will aim to introduce the importance of optimizing educational intervention during professional practice. For this purpose, in the first part of the session, a theoretical workshop on SDT will be conducted. Once the fundamental concepts have been explained and the main motivational and theoretical aspects are understood, a set of BPN-supportive strategies related to PE will be introduced. Pre-service primary teachers will work in cooperative groups to identify which strategies are related specifically to each of the BPN-supportive strategies (e.g., "Why do you think that this motivational strategy could support autonomy?"). Finally, each group will share their reasoning behind their classification in order to reach a final global consensus.

The second theoretical session will start with a summary of the first session. This overview will make it possible to link SDT with an innovative theoretical framework named the Circumplex Model. Firstly, the lecturer will introduce the circumplex model with an emphasis on (de)motivating teaching styles. Secondly, in cooperative groups, pre-service teachers will explore the consequences of (de) motivating teaching styles. To this end, pre-service teachers will write down the different positive and negative consequences of given (de) motivating teaching styles used in primary lessons (e.g., "Low self-esteem is related to a controlling teaching style"). At the end of the session, a brainstorming task will be performed to illustrate the consequences of (de)motivating teaching styles.

The third theoretical session will focus on basic teaching skills (i.e., initial information, feedback, organization and time management). At the beginning, the professor will pose a question, such as: "What would a perfect session look like for you?" and "What are the basic elements that a primary teacher should use?" After brainstorming, individual teaching skills will be developed in greater depth. Following this, in groups, pre-service teachers will analyze the way in which effective use of the aforementioned skills could influence student BPN satisfaction (e.g., "How might explaining lesson objectives improve children's competence?"; "How might task difficulty choices influence children's autonomy and competence?"). The session will conclude with the presentation of the ideas developed by each group.

The fourth and fifth theoretical sessions will comprise a hybrid workshop related to the three previous sessions. In small working groups, pre-service teachers will design motivational strategies for a simulated PE lesson that they will later implement as a part of practical sessions. Each group will choose a topic (athletics, team games, body expression, etc.) and design a lesson and motivational strategies

TABLE 1 Actions to be taken during “COMIENDOP” intervention program.

“COMIENDOP” intervention program		
General phase		
Theoretical sessions:	A1	Session 1 (1 h 30') <ul style="list-style-type: none"> - Presentation of intervention programme (e.g., aims, activities, informed consent) - Explanation of SDT (i.e., each BPN and some practical examples) - Examples of BPN-supportive strategies - Group-task: BPN-supportive strategies in PE lessons. Each group will classify different BPN’s strategies provided by professor. Later, each group will rotate to another group to check their classifications. Finally, all group
	A2	Session 2 (1 h 30') <ul style="list-style-type: none"> - Summary of session 1 - Explication of Circumplex Model: (de)motivating teaching styles in PE lessons and their consequences. Different examples will be provided and pre-services will link BPN’s strategies with the Circumplex Model.
	A3	Session 3 (1 h30') <ul style="list-style-type: none"> - Summary of session 2 - Teaching skills: How should they be used during PE lessons? Explanation of initial information, types of feedback, control of group and time, as well as examples about their application during real lessons.
	A4	Session 4 (1 h30') <ul style="list-style-type: none"> - Summary of session 1 and 2 - Design motivational strategies and collect all of them in an individual document. From tasks carried out during first sessions, they will design their own strategies to apply during practical sessions.
	A5	Session 5 (1 h30') <ul style="list-style-type: none"> - Design of the specific motivational strategies in two PE activities which will be implemented in the following sessions.
Practical sessions	A6	Session 6, 7 and 8 (2 h each one) <ul style="list-style-type: none"> - Application of motivational strategies and teaching skills in a simulated PE real-life situation. - Reflexive feedback after real-life situations (e.g., “What motivational strategies have been implemented?” “What have (de)motivating teaching styles been used?” How and How much feedback has been provided during the session?")
Individual sessions or tutorial actions (30' per cooperative group; 3 h)		
General phase' duration = 14 h		
Specific phase		
Specific phase: part I		
Theoretical session	A7	Session 1 (3 h) <ul style="list-style-type: none"> - Review of contents learned in general phase (Ahmadi et al., 2023; Ferriz et al., 2023) - Review of teaching skills in PE lessons - Co-design of the observation document to provide feedback during real-life situations
	A8	Session 2: Tutorial actions I (30' individual sessions per group; 3 h in total) <ul style="list-style-type: none"> - Individual sessions: Design of PE lessons to apply motivational strategies and teaching skills.
Practical sessions	A9	Session 3 and 4 (3 h per session) <ul style="list-style-type: none"> - Application of motivational strategies and teaching skills in a simulated PE real-life situation. - Reflexive feedback after simulated PE real-life situations supported by observational tool
Specific phase: part II		
Theoretical session	A10	Session 5: Tutorial actions II (individual sessions per group; 3 h in total) <ul style="list-style-type: none"> - Individual sessions: Design of PE lessons to apply motivational strategies and teaching skills.
Practical sessions	A11	Session 6 and 7 (3 h per session) <ul style="list-style-type: none"> - Application of motivational strategies and teaching skills in a simulated PE real-life situation. - Reflexive feedback after simulated PE real-life situations (e.g., “What BPN’s strategies have been implemented?” “What have (de)motivating teaching styles been used? What have been the consequences?” What type of feedback has been provided during the session?")
Specific phase' duration = 21 h		
Total duration = 35 h of intervention program		

*A = Action.

targeted towards teaching related content. All strategies will be compiled in an individual document for personal use in the future by teachers. Through “tutorial action,” this work will be supervised by a professor to ensure the quality and suitability of sessions and motivational strategies.

With regards to practical sessions (i.e., sessions 6, 7 and 8) within the general phase, a total of three practical sessions will be carried out. During these sessions, pre-service teachers will be required to apply (de)motivating teaching styles, BPN-supportive strategies and the four core teaching skills in simulated real-life scenarios. Based on the design elaborated in the fourth and fifth sessions, pre-service teachers will implement their designed PE sessions in small groups. One group member will be responsible for conducting the session, while their classmates will adopt the role of pupil or will observe the class. Each simulated session will last approximately 30 to 40 min, allowing for two or three real-life PE scenarios per session (two or three students will play the role of teacher, whilst the rest will behave as simulated primary school students). Simultaneously, six pre-service teachers will specifically observe the use of (de)motivating teaching styles and motivational strategies from an observation room and simultaneously complete an observation checklist in pairs. Following the implementation of real-life PE scenarios, participant-observers will lead the analysis of scenarios in collaboration with the professor. This final part of the simulated PE sessions will be essential for providing constructive feedback and improving their effectiveness as a future educational intervention.

2.4.2 Specific phase

Pre-service primary teachers who are enrolled on different modules on the Physical Education specialization will participate in the specific phase. This phase is divided into two sub-phases: (1) The first sub-phase will be conducted in September and October at the beginning of the academic year (12 h, 3 h per session), and; (2) the second sub-phase will be conducted in December (9 h, 3 h per session). Overall, the specific phase lasts a total of 21 h and will include three theoretical sessions and four practical sessions (see [Table 1](#)). This phase aims to apply the concepts internalized during the general phase and to deepen understanding of the theoretical frameworks. Participants will be able to implement more complex motivational strategies and observe their peers’ motivational teaching styles during full-length simulated PE-real life situations.

Both sub-phases are made up of theoretical and practical sessions. The first half of session 1 aims to review the content learned the previous academic year during the general phase, specifically, (de)motivating teaching styles, motivational strategies and normally used teaching skills during primary PE lessons ([Ahmadi et al., 2023](#); [Férriz et al., 2023](#)). The second half of this session will be focused on the co-design of an observation feedback tool for use during the real-life PE scenarios (i.e., sessions 3, 4, 6, and 7). In terms of elaboration of the observation tool, pre-service primary PE teachers will work in small groups to propose key elements for observation. Basically, the observation tool is designed to collect data on the essential competences and skills that a primary PE teacher should demonstrate during PE lessons. The professor will emphasize the inclusion of three key points: motivating teaching styles, motivational strategies and teaching skills.

During session 2 (at sub-phase one) and session 5 (at sub-phase two), individual small groups formed during the first session will

choose a specific PE topic (i.e., individual activities, body expression, team games) to focus on and, subsequently, design a PE session. Sessions 2 and 5 involve “tutorial actions” with each cooperative group. Throughout these sessions, the professor will provide group-specific and constructive feedback to ensure that the lesson pre-services design for future practical sessions is suitable. Each tutorial action will last approximately 30 min per group.

Sessions 3, 4, 6 and 7 are conceived to implement real-life PE scenarios which will be organized into different themes. These sessions will follow the same structure as the practical sessions delivered during the general phase. However, the main difference is the existence of student-observers who will use the co-designed observation tool to assess the teaching intervention. Moreover, time allocated to final reflections will be extended to 1 h (rather than 30 min) in acknowledgement of the fact that pre-service primary PE teachers are now completing the last stage of their degree and are more capable of making deeper reflections. Hence, the final intellectual reflection is expected to be more critical and nuanced, drawing on a broader understanding of the COMIENDOP intervention program.

It should be noted that, following the specific phase, pre-service primary PE teachers will complete a school placement. This period will last for 4 months and provides the opportunity to apply learning acquired throughout the training program. During this placement, pre-service primary PE teachers will be required to implement a teaching unit under the supervision of a professor. Professors and university teaching staff will jointly review these materials in a face-to-face meeting, which will be held prior to imparting the teaching unit. This meeting will ensure the continuity and transfer of learning, as well as coherence between the general phase, specific phase and practical school placement.

2.5 Analysis plan

2.5.1 Quantitative analysis

Data analyses will be performed using IBM SPSS Statistics (v. 25.0). First, descriptive statistics (means, standard deviations and frequencies, where appropriate) will be calculated for all variables. Compliance of data with the normality assumption will be assessed using the Kolmogorov–Smirnov test. Depending on outcomes, parametric or non-parametric tests will be applied.

To evaluate intervention effectiveness, univariate and multivariate analysis of variance (ANOVA and MANOVA) will be conducted to analyze changes over time (within-subject factor) and between groups (experimental vs. control; between-subject factor) in the following outcome variables: (1) (De)motivating teaching styles and approaches (SIS-PE); (2) Competence satisfaction and frustration; (3) Perceived autonomy support; (4) Teachers’ sense of efficacy, and; (5) Teacher attitudes. Should normality assumptions be violated, then the Wilcoxon signed-rank test (pre-post within groups) and the Mann–Whitney U test (experimental vs. control) will be employed. The Bonferroni correction will be applied to adjust outcomes. Effect sizes will be calculated for all outcomes to assess the practical relevance of the results. For parametric tests, partial eta squared (η^2p) will be reported. Effect sizes will be interpreted using conventional benchmarks: $\eta^2p = 0.01$ (small), 0.06 (medium), 0.14 (large). For non-parametric tests, effect size r will be calculated as $r = Z / \sqrt{N}$, where Z is the test statistic and N is the total number of observations.

Benchmarks for interpretation will be: $r = 0.10$ (small), 0.30 (medium), 0.50 (large).

To account for potential confounding factors (i.e., age, sex, academic faculty, and prior experience in PE), relevant baseline variables will be included as covariates in the statistical models. Where appropriate, analyses of covariance (ANCOVA) will be applied to statistically control for inter-individual variability and isolate intervention effects.

In addition to analysing the impact of the training program on (de)motivating teaching styles, comparative analysis of the motivational teaching profiles of third- and fourth-year pre-service primary PE teachers will be performed. To this end, cluster analysis will be performed based on the Circumplex Model of teaching styles. This analysis will integrate key motivational dimensions such as autonomy support, structure, control and chaos. This approach will enable the identification and categorization of distinct motivational profiles aligned with the theoretical model, thereby providing a deeper understanding of pre-service primary teachers' motivational orientations and potential evolution throughout the teacher education program. The level of statistical significance for all statistical analyses will be set at $p < 0.05$.

2.5.2 Qualitative analysis

Audio recordings from focus groups were transcribed and entered into NVivo Pro version 12.0 software. From a general point of view, deductive thematic analysis (Braun et al., 2021) based on focus group transcript data will be conducted. A professional qualitative researcher will lead data analysis, whilst working alongside other study researchers. After data familiarization, the transcripts will be coded (draft themes) based on main themes. Later, two researchers will discuss identified themes until agreement is reached on their final inclusion. This process will inform an iterative analytical approach which will enable better quality analysis (Shenton, 2004).

The universal criteria proposed by Tracy (2010) for qualitative research will be applied to ensure rigor. The present study addresses a relevant topic based on an innovative theoretical framework, the Circumplex Model. No such programs have previously been carried out among pre-service primary PE teachers to improve their teaching competences. The collection of extensive and complex data through focus groups will be crucial for informing a comprehensive discussion of the findings and ensuring methodological rigor. Sincerity will be achieved through self-reflective and transparent reporting of the analytical process regarding the effects of the intervention program. Furthermore, the combination of mixed-methods and the participation of several SDT expert researchers will provide a nuanced and in-depth perspective, thereby establishing credibility.

2.6 Practical implications

The present study has important implications for both pre-service and currently practicing primary PE teachers. Firstly, findings will contribute towards improving the initial training of pre-service primary teachers and, especially, pre-service primary PE teachers. Simultaneously, the enhancement of teaching competencies and integration of theoretical and practical sessions during PETE could lead to overall improvement in the quality of university degree teaching.

Secondly, involving pre-service primary teachers in their own learning process (e.g., co-designing the observation tool, creating motivational strategies, using self-assessment and implementing simulated real-life PE scenarios) and in developing motivational strategies could increase their motivation towards the continuation of their university degree and their future profession. Moreover, the present program represents the first step towards designing structured, sequenced and well-planned basic training focused on core teaching skills and motivating teaching styles based on circumplex model and SDT.

Thirdly, the intervention program will support provision of constructive and individual feedback during simulated real-life PE scenarios. This strategy will enhance the fundamental competencies related to teaching skills, in addition to the motivational strategies related to classroom management. As a result, such feedback could help to increase pre-service primary PE teachers' competence and their sense of efficacy in the profession. Moreover, raising awareness about the consequences of (de)motivating teaching styles could encourage the adoption of motivating teaching styles that will later foster student motivation for PE and improve physical activity engagement.

Fourthly, the whole intervention program is designed to ensure continued connections between PETE and real PE contexts (e.g., school placement). This fact promotes the real application of learning during their teaching placement period.

Fifthly, implementation of the program should be adapted to student characteristics. To achieve this, at the beginning of the program, it is recommended to assess the (de)motivating teaching styles used by pre-service primary school teachers to progressively adapt the program, especially during the general phase. In this way, despite the relatively rigid program outline, the proposed motivational strategies and sessions could be modified depending on students' needs. Program adaptability is important, as it promotes the satisfaction of pre-service primary PE teachers' BPN and, consequently, improves their motivation towards teaching.

Finally, the feedback provided following engagement in simulated real-life PE scenarios should be constructive and understood by the students. For this reason, it is recommended that students take part in the co-design of the observation checklist. In this way, feedback will be structured by students themselves and will be more likely to enhance their competence and motivation.

2.7 Limitations

The present study has some limitations that are worth noting. A first limitation concerns the attendance of pre-service primary teachers to the training program. Attendance can sometimes dwindle; however, sessions will be designed to be dynamic and practical to help boost attendance rates. Second, inclusion of a large number of variables may result in a lengthy questionnaire. As all variables are fundamental for analyzing effectiveness of the training program, autonomy and relatedness satisfaction will not be assessed via quantitative methods, but, instead, explored in greater depth through focus groups. Third, practical sessions will not be recorded because the simulated real-life PE scenarios designed for the program will be shorter than real PE lessons, and recording could increase pressure on pre-service primary PE teachers with concomitant negative effects during practical sessions. Fourth, random group assignment will not

be possible, which could generate some bias in the findings. Fifth, the present program may address an important gap in the field. However, it is recommended that future programs expand the sample and, once the effects have been assessed, ensure their sustainability.

Finally, the importance of assessing the behavioral and motivational effects on pre-service primary PE teachers and their students should be highlighted, wherever possible, following program implementation.

3 Conclusion

In summary, the present study presented a detailed protocol for a training program designed for pre-service primary PE teachers, which is grounded in SDT and the Circumplex Model. Development and explanation of the strategies involved supports its replicability and adaptability to other specific educational contexts. Through subsequent implementation, pre-service primary PE teachers are expected to adopt autonomy support and structured teaching styles and to effectively apply essential teaching skills. Finally, if proven effective, the training program may serve as a significant step towards enhancing the quality of the training process at the university stage.

Data availability statement

The datasets presented in this article are not available because the participants did not give their consent to share the data publicly. Requests to access the datasets should be directed to msanzr@unizar.es.

Ethics statement

The studies involving humans were approved by Research Ethics Committee of the University of Zaragoza (Reference MS_CEIN_2025_11). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

MS-R: Writing – original draft, Project administration, Data curation, Validation, Funding acquisition, Visualization,

Conceptualization, Supervision, Software, Writing – review & editing, Resources, Formal analysis, Methodology, Investigation. JJ-C: Funding acquisition, Conceptualization, Writing – review & editing, Investigation, Supervision. AA: Funding acquisition, Writing – review & editing, Supervision, Investigation, Conceptualization, Methodology.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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