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Meaningful physical education versus autonomy support: effects on self-determined motivation and affectivity during a fitness unit

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ABSTRACT

Background: The assessment of physical fitness (PF) has traditionally formed part of Physical Education (PE). However, PF testing in schools has generated debate, with critics highlighting negative impacts on students' motivation and self-concept when testing is conducted in isolation, and advocates pointing to its role in tracking progress and informing instruction. This study positions two pedagogical approaches within this debate: Meaningful PE, which emphasises personally relevant, enjoyable, and socially engaging learning through six key features supported by democratic and reflective pedagogies; and Autonomy Support (AS), which applies self-determination theory to foster student choice, rationale provision, and non-controlling communication. We examined the effects of these approaches when integrated into PF units.

Material and method: Ninety-two students ($M = 14.75$ years; $SD = 0.58$) from the third and fourth year of secondary education from two schools were divided into two groups (Meaningful PE group, $n = 48$ and AS group, $n = 44$). A quasi-experimental design with pre-test and post-test measures was used.

Results: Repeated measures ANOVAs taking time as a within-subject factor, and group and gender as between-subject factors, revealed significant factor x group interactions in identified regulation, external regulation, amotivation, self-determination index (SDI) and negative affect in favour of the Meaningful PE group. No factor x gender interactions were found. Intergroup MANOVA(s) showed that, at pre-test, the Meaningful PE group reported higher intrinsic motivation, introjected regulation, and autonomy, while the AS group reported higher physical attractiveness. At post-test, the Meaningful PE group reported higher intrinsic motivation, identified regulation, introjected regulation, and SDI, whereas the AS group reported higher negative affect. Irrespective of the intervention, most variables reflected higher levels in males.

Impact statement: Embedding Meaningful PE within PF units appears to foster more self-determined motivational profiles and

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reduce negative affect compared to approaches based on AS. These findings align with scholarship highlighting that pedagogical coherence, personal relevance, and meaningful engagement are central to students' motivational and affective responses to PF tasks. Framing fitness assessment within broader educational goals, rather than as isolated performance measures, may help address longstanding motivational concerns associated with PF in PE. The results underscore that the educational value of PF is not inherent to the content itself, but contingent upon the pedagogical framework through which it is enacted. From an educational perspective, these findings provide PE teachers with evidence-based guidance to implement meaningful, student-centred fitness practices that enhance motivation, reduce negative affect, and promote inclusive experiences.

Introduction

Physical fitness (PF) is a set of attributes related to health and motor skills (Caspersen, Powell, and Christenson 1985), which has traditionally formed part of Physical Education (PE) as content to be developed. The assessment of PF allows teachers to measure the physical characteristics of students by means of specific tests (Caspersen, Powell, and Christenson 1985). Therefore, the assessment of PF continues to be a widespread practice in school PE curricula (Alfrey 2024; Safron and Landi 2022; Yang et al. 2025).

The use of PF tests has generated considerable debate in the educational community (Alfrey and Landi 2022; Yager, Alfrey, and Young 2021). Often these PF tests are conducted in isolation, in a single lesson, without integration into broader PE programme and with unclear educational objectives (Alfrey and Landi 2022; Simonton, Mercier, and Garn 2019). In this regard, it has been observed that, when PF tests are implemented in a decontextualised manner, their use may be associated with a decreased self-esteem (Yager, Alfrey, and Young 2021), attitudes (Mercier and Silverman 2014), motivation (Silverman, Keating, and Phillips 2008) and conditional skills (Costigan et al. 2024); as well as increased levels of anxiety, fear and worry (Alfrey 2024; Costigan et al. 2024). It is also likely that the outcomes obtained are more reflective of students' extracurricular experiences than of the opportunities offered within the school environment (Alfrey 2024). Furthermore, males have been shown to exhibit more positive attitudes and higher motivation towards PF tests compared to females (Mercier and Silverman 2014).

Several authors have indicated that these negative factors are not inherent to PF assessment itself, but rather to the ways in which PF tests are commonly conceived and implemented in PE, frequently framed within logics of public health and performance control (Alfrey and Landi 2022; Gard and Pluim 2017; Safron and Landi 2022). The use of these tests from a health-risk reduction approach centred on the reduction of potential health risks may not promote meaningful learning nor motivate students in the long term (Johns 2005). In addition, the scientific literature has shown that PF assessment practices can take on a regulatory and performance-control character, with consequences for students' experiences, identities, and educational trajectories, especially when they function as high-stakes assessments (Gard and Pluim 2017; Safron and Landi

2022; Yang et al. 2025). Consequently, PF tests within PE are influenced by tensions between health objectives, performance control, and students' subjective experiences (Alfrey 2024; Gard and Pluim 2017; Safron and Landi 2022).

From an educational perspective, these debates bring to the forefront the question of what students are expected to learn through PF assessment in PE. Beyond merely constituting a mechanism for measuring performance or certain health-related outcomes, Silverman, Keating, and Phillips (2008) argue that physical fitness tests should not only serve assessment purposes but also function as an active tool to enhance teaching and learning, emphasising that all students should be able to attain appropriate levels of health-related PF. In this regard, when fitness testing is embedded within student-centred pedagogical approaches, such as peer-facilitated and group-based designs, it has been shown to foster engagement and be perceived as a valuable educational experience (O'Keeffe, MacDonncha, and Donnelly 2021). Accordingly, effective teaching practices are needed to enhance adolescents' experiences in PE that foster enjoyment, learning, participation and improved PF (Costigan et al. 2024; Ladwig, Vazou, and Ekkekakis 2018). Therefore, a rethinking of PF assessment is needed to integrate them into teaching units aligned with pedagogical approaches that prioritise students' active participation, autonomy and personal relevance.

In recent years, an approach to PE called Meaningful PE is spreading (Fletcher et al. 2021; Ní Chróinín et al. 2023). This approach to PE is a pedagogical innovation that places meaningful learner experiences at the centre of teacher decision-making, and facilitates transfer between the lived experience in PE and other areas of life (Fletcher and Ní Chróinín 2022; Ní Chróinín et al. 2023). Precisely, Meaningful PE is based on characteristics that learners themselves have identified as important (Fletcher et al. 2021; Ní Chróinín et al. 2023): social interaction, challenge, personally relevant learning, delight, fun and motor competence. The approach is supported by democratic pedagogies, which promote students' active participation in decision-making, co-design of tasks and peer assessment; and reflective pedagogies, which foster self-assessment and analysis of one's own experience through learning journals or guided discussions (Fletcher and Ní Chróinín 2022). In primary school students within PE, it has been observed that the implementation of this approach develops greater active participation and motivation, as well as greater awareness of what they do (Ní Chróinín et al. 2023). This Meaningful PE approach offers a flexible framework for teachers to adapt their practice to their students' needs and interests, in order to promote the internalisation of physical activity as part of an active lifestyle (Ní Chróinín et al. 2023).

This methodological shift is also evident in approaches based on autonomy support (AS), grounded in Self-Determination Theory and promoting the satisfaction of the BPN (basic psychological needs) of autonomy, competence, and relatedness (Ryan and Deci 2020). AS in PE is conceived as a form of teaching that promotes constructive and dialogical competence-based learning, aimed at the formation of critical, autonomous, reflective and responsible individuals (Gómez-Rijo, Jiménez Jiménez, and Fernández Cabrera 2023). To this end, the teacher, in his or her role of authority, adopts the students' perspective, recognises their emotions, provides meaningful information and offers real opportunities for choice, avoiding the use of pressure or impositions (Black and Deci 2000). In fact, fostering autonomy in PE enhances students' ability to make decisions and regulate their own learning; and generates a better learning

climate where BPN are satisfied (Moreno-Murcia and Sánchez-Latorre 2015; Pérez-González et al. 2019; Raabe et al. 2019). In addition, AS promotes greater intrinsic motivation, satisfaction, and emotional well-being towards the subject and physical activity; and favours participation both inside and outside the school environment (Escriva-Boulley et al. 2018; Moreno-Murcia and Sánchez-Latorre 2015; Pérez-González et al. 2019; Raabe et al. 2019). To foster AS in PE, teachers can involve students in the design and evaluation of tasks, the establishment of rules and peer learning (Gómez-Rijo, Jiménez Jiménez, and Fernández Cabrera 2023). Reeve (2016) establishes six instructional behaviours to be developed by PE teachers in AS: take the students' perspective, vitalise inner motivational resources, provide explanatory rationales, acknowledge and accept negative affect, rely on informational and non-pressuring language, and display patience.

Although both approaches share a student-centred orientation, Meaningful PE primarily focuses on the design of learning experiences and curricular tasks, whereas AS is enacted through teachers' instructional behaviours and interpersonal style. In this sense, both approaches have been proposed as general pedagogical approaches in PE and could address the criticisms raised regarding specific PF tests by promoting learning and self-reflection strategies rather than instruments of performance or social comparison. However, to our knowledge, no study has analysed the impact of programmes based on Meaningful PE and AS on affective-motivational variables (i.e. motivational regulations, BPN, and affective responses) and physical self-concept (i.e. students' perceptions of their physical competence and attributes) in PF units within PE.

Against this background, this study set out to examine the affective-motivational and physical self-concept impact of Meaningful PE in a fitness unit compared to a methodology that supports learner autonomy. More specifically, the objectives were the following: (a) to analyse the effects of a PF unit using both methodologies on students' motivational regulations (i.e. autonomous and controlled reasons for participation), BPN, physical self-concept and affectivity (i.e. positive and negative affect experienced in relation to the unit), (b) to compare the effects of both methodologies, and (c) to contrast the differences according to gender, considering the interventions implemented and apart from these conditions. It was hypothesised that the Meaningful PE unit would have more positive effects: (1) on students' self-determined motivation; (2) on affectivity in general. Considering the scarce evidence on this topic and the fact that no comparisons have been made between the two methodologies, no hypotheses in relation to physical self-concept were speculated. Finally, it was hypothesised that (3) in most of the variables under study, males would score higher than females, irrespective of the intervention used. This hypothesis was formulated based on some evidence that males tend to score higher on self-determined motivation (Navarro-Patón, Lago-Ballesteros, and Arufe 2020), NPB (Fraguela-Vale et al. 2020; Gómez-Rijo et al. 2014), physical self-concept (Malo et al. 2011) and affectivity (Fierro-Suero et al. 2022).

Material and method

Research design

A quasi-experimental design was carried out with pre-test and post-test measures with two non-equivalent groups, each assigned to a different pedagogical intervention:

Meaningful PE and AS. It was a non-probabilistic convenience sampling design, and one of the teachers who participated in the project (Meaningful PE approach) was one of the researchers (Barrenetxea-García, Ortuondo Bárcena, and Méndez-Giménez 2025). Both teachers had prior experience teaching PF units and received theoretical guidance on the pedagogical principles informing their respective approach prior to the intervention.

Programme interventions

Meaningful PE

The programme consisted of a six-week PF unit delivered once per week (one and a half hours per session), designed and taught using Meaningful PE principles. The final task of the didactic unit was the interpretation and reflection on the results of the PF training plan. The PE teacher used a pedagogical approach following the six key characteristics of relevant experiences in Meaningful PE (social interaction, challenge, personally relevant learning, enjoyment, fun and motor competence) combined with democratic and reflective pedagogies (Fletcher and Ní Chróinín 2022). Application examples included: allowing students to choose between different versions of exercises and to adapt them to their personal level, conducting group discussions on the personal value of the activity, and using learning journals about progress and feelings in each session. Table 1 describes some of the strategies that the teacher used to strengthen the Meaningful PE characteristics during the programme. In the first session, the PE teacher explained the organisation of the programme (introduction, hypotheses, basic knowledge, materials, and evaluation), and the students performed the first recording of the measurements of the selected conditional tests. In the third year of secondary education (SE), strength was measured by means of the medicine ball throwing test (upper body explosive strength) and the standing long jump test (lower body explosive strength); and in the fourth year of SE, endurance was assessed by means of the Cooper test (aerobic endurance). The tests were selected considering their suitability to the training objectives of the PF unit. The students were divided into two groups to speed up and facilitate the test measurements. In the third year, students had two prior attempts to familiarise themselves with the specific tests and two further opportunities to record. In both academic years, working in pairs and collaboratively, they were responsible for recording the results on individual tracking sheets that the teacher kept in a folder. In the subsequent sessions (2–5), the students experienced and worked on training sessions to improve muscular strength (third year of SE) or endurance (fourth year of SE). The training sessions in both groups are shown as supplementary material. In the sixth session, the students carried out the second recording of the conditional test measurements (i.e. fitness-related performance measures), the interpretation of the results individually and as a group, and the submission of the learning diary.

AS

The programme consisted of a five-week PF unit delivered twice per week (fifty-five minutes per session), designed and taught using AS instructional behaviours. The final task of the didactic unit was the development of a training plan for PF improvement. Application examples included: allowing students to adapt the sequence of exercises, posing open-ended questions to foster reflection and providing constructive feedback

Table 1. PE teacher strategies to strengthen Meaningful PE characteristics during the PF programme.

	Strategies	
Characteristic	3rd year SE	4th year SE
Social interaction	According to their preferences, students select the group (3rd year) or the group and the number of participants (4th year) to conduct the session.	
	The recording of data in the specific test sessions is done collaboratively in pairs. One student is responsible for the recording of another student's data, and vice versa.	
	The specific training sessions are carried out in a circuit format, with a total of 12 activities. The teacher explains and models each task, and each student focuses specifically on one of them. At the end of the execution time of each exercise, students can ask questions about the subsequent task to another classmate if they have any doubts. At the end of the series, the teacher is again available to answer questions or suggest modifications.	
Challenge	The sessions are the same for everyone. However, the intensity (4th year) or the intensity and volume of the exercises (number of repetitions) (3rd year) depends on each student's PF. The teacher emphasises that effort is non-negotiable. If students require a rest because they are unable to continue the activity correctly, they understand that it is an integral part of improvement and training (3rd year). Or, if they need a rest because they cannot continue running, they are informed that it is more advisable to walk and keep accumulating volume (4th year).	
	In some tasks, the teacher proposes several execution options (regressions or progressions of the main task) so that students can choose according to their level of PF, and for students with motor and/or cognitive dysfunction.	
Personally relevant learning	At the beginning of the programme, the teacher explains the objectives and assessment tools, and formulates the following hypothesis: specific strength (3rd year)/endurance (4th year) training for four sessions will improve strength/endurance. Consequently, it will improve specific tests, PF and health.	
	The student conducts a personal reflection on the experience and its potential transfer to other academic and/or personal contexts at the conclusion of the programme, utilising the recorded learning diary and continuous feedback from the student-teacher. The student concludes that, by exerting effort and working diligently, they have a greater likelihood of achieving the established objective.	
Fun / Delight	Due to the development of a conditional capacity, the format of the training sessions is similar and the students feel more comfortable and relaxed. The teacher asks them during the cool down about the sensations experienced during the session while stretching, and the students compare themselves with previous sessions or experiences.	
	In the specific training sessions, students complete a 12-exercise circuit combining new tasks and previously practiced ones designed by the teacher (3rd year), and they learn and apply different training methods to develop endurance throughout the programme (4th year).	The teacher gives them the option of talking to a partner or listening to music while doing the series.
Motor competence	The sessions are the same for everyone. However, the intensity (4th year) or the intensity and volume of the exercises (number of repetitions) (3rd year) depends on each student's PF. The teacher emphasises that effort is non-negotiable. If students require a rest because they are unable to continue the activity correctly, they understand that it is an integral part of improvement and training (3rd year). Or, if they need a rest because they cannot continue running, they are informed that it is more advisable to walk and keep accumulating volume (4th year).	
	Due to the development of a conditional capacity, the format of the training sessions is similar and the students feel more comfortable and relaxed. The teacher asks them during the cool down about the sensations experienced during the session while stretching, and the students compare themselves with previous sessions or experiences.	
	The post-intervention specific test measurements reinforce to students the magnitude of personal effort and perseverance in achieving goals.	

oriented towards effort and personal improvement. Table 2 shows examples of the strategies that the teacher used to develop the AS characteristics during the programme. The programme lasted five weeks, with two sessions each lasting fifty-five minutes per session. In the first session, the students performed the first recording of the measurements of the conditional tests chosen on the basis of the Eurofit test battery (Europe 1988): shuttle run (10×5 metres) (running speed), standing long jump (lower body explosive strength), sit-ups (strength-endurance), flexed arm hang (isometric strength), sit and reach test (flexibility), and 20-meter shuttle run test (endurance). Sessions 2 and 3 were master classes given by the PE teacher to explain the theoretical content worked on. In sessions 4 and 5, the students, with the advice and help of the teacher, elaborated personal training plans oriented towards the tests that showed the most difficulties, as well as the practical initiation of the training plan itself. Subsequent sessions (6–9) were sessions of autonomous and self-regulated work outside the school. In the tenth session, the students performed the second recording of the PF test measurements.

Table 2. PE teacher strategies to strengthen AS characteristics during the PF programme.

Characteristic	Strategies 4th year SE
Competential learning	The teacher proposes that the students develop a training plan to improve their PF. Students create their plan in pairs, analyse their needs, design specific and individualised workouts (loads, progressions and rests), and present it digitally with images.
Provide meaningful information	The teacher conducts two initial theoretical sessions on the training techniques of basic skills (strength, endurance, speed and flexibility) and emphasises the importance of acquiring the fundamental knowledge to understand the basic principles of training. The students also receive two documents to help them: one on training methods and the other on the basic principles of training. A decalogy is used as an infographic to facilitate the understanding of the theoretical content.
Selection opportunities in task design	The students design their partner's training according to their needs, determined by an initial interview and the results of the PF tests; and decide the training schedules within the weekly planning (outside school hours), with the PE session as a mandatory day.
Shared evaluation	The sessions end with 10 min of reflection and feedback from the trainee to their partner trainer: were the training loads excessive or insufficient? This co-evaluation is key to the adaptability of subsequent training. Students are also aware of the grading rubrics.
Peer learning	Students work in pairs. Each group designs the training table and each member completes it individually. Likewise, students with similar basic physical capacity improvement workouts share exercises with other classmates.
Teaching styles/pedagogical models	The students know the date of the tests in advance; and in case of injury or absence, they must regulate and adapt their training. In the measurement session of the specific tests, the teacher uses the cooperative learning teaching technique called 'collective marker' to evaluate and score the improvement of each of the specific tests.
Strategies to promote motivation	The teacher shares the relevant audio of the 'Course Navette' test with the students so that they can practise in their leisure time, and also shares the measurement materials of the specific tests in the PE sessions to measure their progress. The teacher, in most sessions, plays music.
Teacher's language: informative, non-pressuring and patient	The teacher performs the first measurement at the beginning of the academic year. The students' individual progress varies according to the physical activity they perform in PE sessions, leisure time during school hours, and extracurricular activities. However, the work developed during the project is the most important part of the evaluation.

Participants

A total of 95 secondary school students from two schools were recruited for the study. A minimum attendance of 80% of the sessions was established to ensure that students sufficiently experienced the key components of each intervention, with 92 students (55 boys and 37 girls) being included in the final sample. The mean age of the students in School 1 was 14.70 ± 0.72 years with 24 students in the third year of SE and 24 in the fourth year; and in School 2, the mean age was 14.80 ± 0.46 years, with 44 students in the fourth year of SE. Both schools followed the Spanish educational curriculum (*Ley Orgánica de la Educación, LOMLOE*), and the interventions were led by the PE teacher. This study conformed to the Code of Ethics of the World Medical Association (Declaration of Helsinki). Each school had a single PE teacher responsible for all sessions. Ethical approval and permission were signed by school authorities (Barrenetxea-García, Ortuondo Bárcena, and Méndez-Giménez 2025); subsequently, all students were adequately informed, participated voluntarily, and anonymity was guaranteed throughout the study.

Data collection

For data collection, a freely accessible online questionnaire was developed using Google Forms with a descriptive design. The questionnaire included sections assessing demographic variables, motivational regulations, BPN, physical self-concept, and affectivity. The week prior to the start of the didactic units, the PE teachers at both schools sent the questionnaire to the students to be completed, with an estimated duration of 20 min. Subsequently, two different pedagogical approaches to the teaching and learning of PF in PE were implemented. At the end of each programme, the students again filled in and completed the questionnaires.

Instruments

Demographic data. Information on age, gender, date of birth, and school was recorded.

Motivational regulations. The different types of motivation were assessed using the *Perceived Locus of Causality Scale* (PLOC; Goudas, Biddle, and Fox 1994) translated into Spanish and validated in the context of PE by Murcia, González-Cutre, and Chillón (2009). The instrument was headed by the statement 'I participate in PE classes … '. It consisted of five factors and 20 items (four for each factor): *intrinsic motivation* (e.g. 'Because PE is fun'), *identified regulation* (e.g. 'Because I want to learn sport skills'), *introjected regulation* (e.g. 'Because I want the teacher to think I am a good student'), *external regulation* (e.g. 'Because I will get into trouble if I don't'), and *amotivation* (e.g. 'But I don't really know why'). The study by Murcia, González-Cutre, and Chillón (2009) obtained the following Cronbach's α values: 0.80 for *intrinsic motivation*, 0.80 for *identified regulation*, 0.67 for *introjected regulation*, 0.70 for *external regulation*, and 0.74 for *amotivation*. A Likert scale from 1 (*Not at all true for me*) to 7 (*Completely true for me*) was used. The scores obtained on each of the PLOC subscales were used to calculate the self-determination index (SDI): (2 × intrinsic motivation + identified regulation) − ((introjected regulation + external regulation) / 2 + 2 × amotivation). This index

revealed the degree of self-determined motivation and has been widely used in motivational research in the PE classroom. In the present study, the SDI values ranged from −9 to +16 between pre-test and post-test measures. Consistently, research in PE has shown that higher SDI scores predict greater effort, more positive attitudes, and stronger intentions to engage in future PA (Standage, Duda, and Ntoumanis 2005).

Basic Psychological Needs Satisfaction Scale (PNSE; Wilson et al. 2006; Spanish version Moreno-Murcia, Huéscar, and Cervelló 2012). The PNSE consisted of 18 items, distributed in three dimensions: *competence* (6 items), *autonomy* (6 items), and *relatedness* (6 items). Responses were evaluated on a six-point Likert-type scale (1 = *Not at all true for me* and 6 = *Completely true for me*). Cronbach's alpha coefficients were $\alpha = 0.76$ for *competence*, $\alpha = 0.71$ for *autonomy*, and $\alpha = 0.79$ for *relatedness*.

Youth Physical Self-Concept Scale (C-PSQ; Fox and Corbin 1989; Spanish version Moreno-Murcia et al. 2007). The C-PSQ consisted of 28 items, distributed in four dimensions: *perceived competence* (9 items), *physical attractiveness* (7 items), *physical strength* (5 items), and *self-confidence* (7 items). Responses were rated on an eleven-point Likert-type scale (0 = *Strongly disagree* and 10 = *Strongly agree*). Cronbach's alpha coefficients were $\alpha = 0.87$ for *perceived competence*, $\alpha = 0.76$ for *physical attractiveness*, $\alpha = 0.67$ for *physical strength*, and $\alpha = 0.77$ for *self-confidence*.

International Positive and Negative Affect Schedule – Short Form (I-Spanas-SF; Thompson 2007; Spanish version Gargurevich 2010). The I-Spanas-SF included 10 items in two dimensions: *positive affect* (5 items) and *negative affect* (5 items). Items were scored on a five-point Likert scale, from 1 = *Not at all* to 5 = *Very much*. The overall Cronbach's alpha coefficients were $\alpha = 0.72$ for *positive affect* and $\alpha = 0.72$ for *negative affect*.

Data analysis

Quantitative data were processed using IBM® SPSS 27. Descriptive statistics were calculated, and the reliability of the measurement scales was tested with Cronbach's alpha statistic. Acceptable values ($\alpha > 0.70$; Nunnally 1978) were found for all scales, with the exception of *positive affect* in both pre-test and post-test administrations ($\omega = 0.69$ and 0.69, respectively); however, for research interest, these data were retained in subsequent analyses. A variable was determined to follow a normal distribution when the absolute values of skewness and kurtosis were less than 2 (Gravetter and Wallnau 2014), which was met in all cases.

To assess the effects of the interventions on motivational regulations, BPN, physical self-concept, and affectivity dimensions, repeated-measures ANOVAs were used with time as the within-subject factor and group (Meaningful PE, AS) and gender as the between-subject factor. The level of statistical significance was set at $p < 0.05$. Effect size was also calculated using partial eta squared (η_p^2). Cohen (1988) classifies effect size as small ($\eta_p^2 = 0.01$), medium ($\eta_p^2 = 0.06$), or large ($\eta_p^2 = 0.14$). For the comparison between groups, two intergroup MANOVA(s) were performed, one at each measurement time, taking as dependent variables motivational regulations, BPN, and the dimensions of physical self-concept and affectivity, and as fixed factors, the groups (Meaningful PE and AS) and gender. Finally, the independent samples *t*-test was run to compare pre-test and post-test values between males and females regardless of the intervention.

Results

Reliability and descriptive statistics. Table 3 shows the internal reliability coefficients, means, and standard deviations of the study variables at pre-test and post-test, for both the total sample and each group.

Main effects: intra-group comparison. Table 4 reports the effects of factor × group (F×G) interactions where significant results were obtained. All Box's *M* values were

Table 3. Cronbach's alpha and descriptive statistics of the variables under study in the total sample and by group.

		Pre-test			Post-test		
	Group	α	M	SD	α	M	SD
Intrinsic motivation	Meaningful PE		5.19**	1.10		5.16***	1.17
	AS		4.34	1.38		4.14	1.37
	Total	0.80	4.79	1.31	0.85	4.67	1.37
Identified regulation	Meaningful PE		5.45	1.23		5.58**	1.13
	AS		4.93	1.41		4.64	1.45
	Total	0.83	5.20	1.35	0.89	5.13	1.37
Introjected regulation	Meaningful PE		4.39**	1.36		4.26**	1.48
	AS		3.57	1.49		3.39	1.46
	Total	0.76	3.99	1.48	0.79	3.84	1.53
External regulation	Meaningful PE		4.07	1.36		3.63	1.32
	AS		3.63	1.40		3.90	1.56
	Total	0.71	3.86	1.39	0.78	3.76	1.44
Amotivation	Meaningful PE		2.53	1.51		2.17	1.21
	AS		2.39	1.29		2.70	1.38
	Total	0.75	2.46	1.41	0.77	2.42	1.31
SDI	Meaningful PE		6.54	4.55		7.62**	4.81
	AS		5.24	5.03		3.87	5.42
	Total	-	5.92	4.80	-	5.82	5.42
Competence	Meaningful PE		4.62	1.14		4.56	1.01
	AS		4.31	1.32		4.25	1.28
	Total	0.93	4.47	1.23	0.93	4.41	1.51
Autonomy	Meaningful PE		3.94**	0.93		3.83	0.82
	AS		3.25	1.22		3.42	1.20
	Total	0.86	3.61	1.13	0.84	3.64	1.03
Relatedness	Meaningful PE		3.64	1.00		3.53	0.99
	AS		3.60	1.16		3.75	1.06
	Total	0.83	3.62	1.08	0.81	3.64	1.03
Perceived competence	Meaningful PE		5.80	1.93		5.98	1.99
	AS		6.14	2.16		6.18	2.08
	Total	0.88	5.97	2.04	0.89	6.06	2.03
Physical attractiveness	Meaningful PE		4.95	2.11		5.01	2.64
	AS		5.91*	2.46		5.55	2.38
	Total	0.83	5.41	2.32	0.84	5.27	2.32
Physical strength	Meaningful PE		5.42	2.00		5.47	2.01
	AS		5.73	2.34		5.54	2.08
	Total	0.79	5.57	2.16	0.76	5.51	2.03
Self-confidence	Meaningful PE		5.98	2.48		5.98	2.33
	AS		6.32	2.50		6.53	2.49
	Total	0.85	6.14	2.48	0.87	6.24	2.41
Positive affect	Meaningful PE		3.26	0.69		3.25	0.66
	AS		3.28	0.79		3.23	0.77
	Total	0.66	3.27	0.63	0.65	3.24	0.71
Negative affect	Meaningful PE		1.85	0.80		1.73	0.72
	AS		1.98	0.74		2.12*	0.83
	Total	0.78	1.91	0.77	0.80	1.91	0.79

Note: In each column, groups differ at *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Table 4. Repeated Measures Analysis: Results of variables with main effects Factor×Group.

Variables	Main effects	Wilks´Lamba (1, 90)	*F*	*Sig*	η_p^2	*P*
Identified regulation	F×G	0.953	4.414	0.038	0.047	0.55
External regulation	F×G	0.923	7.330	0.008	0.077	0.76
Amotivation	F×G	0.945	5.169	0.025	0.055	0.61
SDI	F×G	0.920	7.667	0.007	0.080	0.78
Negative affect	F×G	0.956	4.061	0.047	0.044	0.51

Note: F×G = Factor×Group

greater than 0.05, indicating equality in the covariance matrices. No differences were found between genders in any of the study variables.

Intergroup comparison. In the intergroup MANOVA considering the pre-test measures of the dependent variables, significant effects emerged for the group: [Wilks' Lambda (1, 90) = 0.68, $F = 2.657$, $p = 0.003$, $\eta^2_p = 0.33$, $P = 0.98$]. In subsequent tests of intersubject effects (individual ANOVAs), differences were found in four variables: intrinsic motivation, introjected regulation, and autonomy in favour of the Meaningful PE group, and physical attractiveness in favour of the AS group (Table 5). In the intergroup MANOVA considering the post-test measures of the dependent variables, significant effects emerged for the group: [Wilks' Lambda (1, 90) = 0.549, $F = 4.399$, $p < 0.001$, $\eta^2_p = 0.45$, $P = 1.00$]. In subsequent tests of intersubject effects (individual ANOVAs), differences were found in five other variables: intrinsic motivation, identified regulation, introjected regulation, SDI (in favour of the Meaningful PE group), and negative affect (in favour of the AS group). Table 5 shows the *F*, *Sig.*, η^2_p, and *P* statistics in the intergroup comparisons, for both the pre-test and post-test measures with significant results. In terms of gender, significant differences were found between males and females in intrinsic motivation, SDI, the four dimensions of physical self-concept, and the two dimensions of affectivity in the pre-test. All were in favour of males, except for negative affect. In the post-test, significant differences were found in the same variables plus the three dimensions of the BPN. Again, males had higher mean values across all variables in comparison to females.

Comparison according to gender regardless of the intervention. Table 6 shows the descriptive statistics in the pre-test and post-test measures by gender in the study variables. Student's *t*-test showed significant differences in intrinsic motivation, SDI, the three BPN dimensions, perceived competence, physical strength, and self-confidence in favour of males in the pre-test and post-test measures, as well as in positive affect in the pre-test measures. It also showed significant differences in negative affect in

Table 5. Significant results of the intergroup ANOVAS on pre-test and post-test measures.

	Dependent variable	*F*	*Sig.*	η^2_p	*P*
Pre-test	Intrinsic motivation	9.923	0.002	0.10	0.88
	Introjected regulation	8.362	0.005	0.09	0.82
	Autonomy	7.817	0.006	0.08	0.79
	Physical attractiveness	4.883	0.030	0.05	0.59
Post-test	Intrinsic motivation	13.674	<0.001	0.13	0.95
	Identified regulation	11.313	0.001	0.11	0.91
	Introjected regulation	7.496	0.007	0.08	0.77
	SDI	10.819	0.001	0.11	0.90
	Negative affect	4.722	0.032	0.05	0.57

Table 6. Comparison of the variables under study by gender in pre-test and post-test. Descriptive statistics and effect size.

		Pre-test			Post-test		
	Gender	M	DT	d Cohen	M	DT	d Cohen
Intrinsic motivation	Male	5.07*	1.10	1.27	5.03**	1.20	1.30
	Female	4.36	1.49		4.14	1.43	
Identified regulation	Male	5.40	1.16	1.32	5.37	1.20	1.34
	Female	4.90	1.52		4.78	1.54	
Introjected regulation	Male	4.01	1.39	1.48	3.93	1.58	1.53
	Female	3.97	1.62		3.71	1.45	
External regulation	Male	3.77	1.19	1.39	3.79	1.41	1.45
	Female	3.99	1.66		3.72	1.50	
Amotivation	Male	2.39	1.38	1.41	2.38	1.31	1.32
	Female	2.57	1.46		2.49	1.32	
SDI	Male	6.88*	4.03	4.68	6.82*	4.84	5.31
	Female	4.50	5.52		4.34	5.94	
Competence	Male	4.89***	0.99	1.13	4.83***	0.89	1.04
	Female	3.85	1.31		3.79	1.23	
Autonomy	Male	3.86**	1.10	1.09	3.88**	0.97	1.00
	Female	3.25	1.08		3.28	1.04	
Relatedness	Male	3.85*	0.96	1.04	3.89**	0.90	0.98
	Female	3.27	1.16		3.26	1.09	
Perceived competence	Male	6.75***	1.52	1.81	6.88***	1.37	1.78
	Female	4.80	2.17		4.88	2.26	
Physical attractiveness	Male	5.78	2.09	2.29	5.70	1.92	2.28
	Female	4.86	2.57		4.63	2.73	
Physical strength	Male	6.10**	2.00	2.07	5.95*	1.80	1.97
	Female	4.77	2.18		4.85	2.20	
Self-confidence	Male	6.91***	2.04	2.30	7.07***	1.67	2.20
	Female	5.01	2.65		5.01	2.81	
Positive affect	Male	3.42*	0.61	0.71	3.35	0.67	0.70
	Female	3.04	0.84		3.08	0.76	
Negative affect	Male	1.76	0.71	0.76	1.69	0.62	0.75
	Female	2.14*	0.81		2.25***	0.91	

Note: In each column, groups differ at $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.
Male ($N = 55$), Female ($N = 37$).

favour of females in the pre-test and post-test measures. All results showed large effect sizes (Cohen's *d*, small = 0.02, medium = 0.05, and large = 0.08).

Discussion

This study compared the impact of two PF programmes, one based on Meaningful PE and the other on AS, on motivation, the three BPNs, four dimensions of physical self-concept and two dimensions of affectivity in PE students. The results allowed us to accept hypothesis 1: intervention through Meaningful PE would lead to more positive effects on students' self-determined motivation. These findings were based on an increase in the SDI in the Meaningful PE group and a decrease in the AS group. The SDI is calculated by weighting the different types of motivation, with greater weight given to the more autonomous forms (intrinsic motivation and identified regulation) and less weight to the more controlled forms (introjected regulation, external regulation, and amotivation). The results align with the postulates of both Self-Determination Theory (Ryan and Deci 2020) and the Meaningful PE pedagogical approach (Fletcher et al. 2021; Ní Chróinín et al. 2023). The implementation of the key elements in the Meaningful PE intervention – social interaction, challenge, relevant learning, delight, fun and

motor competence – could have a positive impact on students' self-determined motivation. Nevertheless, these findings should not be interpreted as evidence that PF assessment is inherently motivating. Instead, they reinforce the idea that students' motivational experiences depend on how PF tasks are pedagogically implemented. It should also be noted that mean values for intrinsic, identified, and introjected regulation declined overall in both groups across time.

At the same time, increases over time were observed in identified regulation in the Meaningful PE group, and FxG effects on repeated measures in identified regulation, external regulation and amotivation, which exerted a significant effect on SDI. A person motivated by identified regulation internalises the underlying values and goals of engaging in physical activity to improve PF. They have internalised the reasons for engaging in the activity and adopted them as their own. In this intervention, activities such as the choice of exercises adapted to personal objectives and group debates on the relevance of PF were incorporated throughout the intervention. Thus, Meaningful PE interventions could help participants to strengthen their motives to train and improve their fitness, to de-emphasise rewards or external pressures, and to be less prone to feelings of amotivation, which implies an increase in their self-determined motivation to train PF. These results are in line with studies showing that meaningful experiences increase intrinsic motivation and engagement (Fletcher et al. 2021; Ní Chróinín et al. 2023).

By contrast, although the AS intervention incorporated autonomy-supportive instructional behaviours, such as providing choice, meaningful rationales, and non-controlling language, students in this group showed a decrease in SDI over time. One possible explanation is that the partial implementation of the programme outside school hours, together with fewer opportunities for shared reflection within PE lessons, may have limited students' perceptions of sustained pedagogical support. Research grounded in Self-Determination Theory suggests that autonomy-supportive behaviours are more effective when they are integrated into coherent pedagogical structures (Reeve 2016; Ryan and Deci 2020).

Regarding repeated measures analyses of the three BPNs, the results showed no FxG main effects. Only intergroup variations in autonomy over time were found; in the pre-test, the Meaningful PE group started from significantly higher levels that did not continue in the post-test. We speculate that the specific approach to this aspect in the AS group may have led to some improvement in this regard, although these improvements did not have significant effects.

The results allowed us to partially corroborate hypothesis 2: intervention through Meaningful PE would lead to more positive effects on affectivity, in general. The findings showed an FxG effect in repeated measures analyses on negative affectivity, derived from a decrease in post-test scores in the Meaningful PE group and an increase in the AS group. No differences were found in positive affectivity. The AS intervention was associated with negative affect, which is reflected in situations where nervousness, disgust, anger or fear arises. Negative affect has been widely described in relation to PF assessment experiences in PE (Alfrey 2024; Costigan et al. 2024; Mercier and Silverman 2014). It is likely that participants in this group experienced more negative affect during the conditional test measurements (pre- and end-of-unit) as well as in the implementation of the training plan compared to the Meaningful PE group.

Structural elements of the Meaningful PE approach may have buffered the negative affect derived from conditional training and physical exertion exercise: the encouragement of social interaction, choice of tasks based on personal condition, personal reflection on the lived experience and its possible transfer to other academic and/or personal contexts, and the focus on enjoyment and fun during PF work. Pedagogies that are supportive of meaningfulness, democratic and reflective and that pay attention to individual experiences (Ní Chróinín et al. 2023) can have an affective-emotional impact. This Meaningful PE approach is consistent with research highlighting that it is not enough to apply one-off autonomy strategies; it is necessary to have a coherent pedagogical framework that integrates PF tests into a meaningful learning process, with meaningful experiences connected to students' everyday lives and with evidence highlighting the role of teacher interaction in the sustainability of motivation (Escriva-Boulley et al. 2018; Johns 2005; Kirk and Tinning 2005; Ryan and Deci 2020).

Finally, the study findings corroborated hypothesis 3: males would score higher than females on the variables under study, irrespective of the intervention employed. Significant differences were found in intrinsic motivation, SDI, the three BPNs, perceived competence, physical strength, self-confidence in favour of males in the pre-test and post-test measures, as well as in positive affect in the pre-test measures. Significant differences were also found in negative affect in favour of females in the pre-test and post-test measures. In all cases, with large effect sizes. In light of these results, it seems that males are more self-determinedly motivated than females both in PE in general and for PF work in particular. In terms of BPNs, our results are consistent with previous studies that have reported a tendency for males to score higher than females on all three dimensions (Brunet and Sabiston 2009; Fraguela-Vale et al. 2020), although other studies have only shown differences in perceived autonomy and competence (Gómez-Rijo et al. 2014). These results are congruent with the Self-Determination Theory framework, such that high levels of satisfaction with the three BPNs lead to higher levels of self-determined motivation (Vasconcellos et al. 2019). In relation to physical self-concept, differences were also found in all dimensions except physical attractiveness. The results align with those reported by Fraguela-Vale et al. (2020) and Malo et al. (2011). A lower physical self-concept may explain, at least in part, the difficulty females experience in finding forms of physical activity that satisfy their need for competence (Fraguela-Vale et al. 2020). Finally, our results showed differences in affectivity in favour of males (higher positive affect in pre-test and lower negative affect in pre-test and post-test). The study by Fierro-Suero et al. (2022) also found significantly higher scores in females on anxiety, boredom, and hopelessness in the context of PE more broadly. However, other studies showed an opposite pattern, such as that of Mouratidis et al. (2009), who found significant gender differences in primary school students on emotions, with females reporting fewer negative emotions. Nevertheless, in the Meaningful PE group notable improvements were observed in perceived competence and positive affect in girls, which we speculate that pedagogies centred on the personal relevance of tasks, social interaction and reflection could help to reduce motivational gaps (Antonio Moreno-Murcia 2012; Gard and Pluim 2017). Therefore, PE teachers should promote inclusive and safe environments, with less social judgement and more support for BPN, to increase girls' participation and enjoyment (Mercier and Silverman 2014; Simonton, Mercier, and Garn 2019), especially when PF assessment is included (Alfrey 2024; Gard and Pluim 2017).

The findings of this study contribute to current debates on the role of PF testing in PE. In line with critical perspectives (Gard and Pluim 2017; Safron and Landi 2022), the results indicate that students' motivational and affective responses to PF assessment are not inherent to the tests themselves, but depend on the pedagogical framework in which they are embedded. In this sense, the findings should not be interpreted as a defence of PF testing, but rather as a call to critically consider what students are expected to learn through PF assessment and how pedagogical approaches mediate this learning experience (Alfrey and Landi 2022).

This study was not without limitations. On the one hand, the quasi-experimental research design, which lacked a control group, and the participation of a teacher-researcher in one of the groups (Meaningful PE), which may have supported fidelity to the pedagogical approach but may also have influenced students' experiences. Moreover, the intervention was implemented in different school contexts, with differences in lesson frequency and duration between groups; the small sample size; and the fact that School 2 (AS) included only fourth-year students, all of whom constitute additional limitations of the study. From a methodological perspective, the use of different Likert scale formats within the same questionnaire may have increased participants' cognitive load. Finally, the Meaningful PE group presented higher initial values in some motivational variables, which advises caution when interpreting comparisons between groups. Future studies should include experimental and longitudinal designs with a broad age spectrum, and examine through qualitative methods how students perceive PF tests from different pedagogical approaches.

Conclusions

The results of the present study confirm that the pedagogical framework influences students' experience, motivation and emotional responses during a PF unit. The Meaningful PE approach showed a significant increase in the self-determination index and a decrease in negative affect compared with the AS group. The combined application of meaningful characteristics together with democratic and reflective pedagogies favoured the personalisation of the experience and promoted meaningful learning, especially among girls, helping to reduce motivational gaps. Consequently, it is recommended that the planning of PF units be based on coherent pedagogical frameworks that offer students real options, foster reflection and connection with their interests, promote inclusive environments that reinforce perceived competence and enjoyment, and respond to the criticisms directed at the traditional use of PF tests in PE.

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