Beyond Winning in Physical Education: The Role of Continuous Professional Development in Fostering a Learning-Focused Climate

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Funding
The author Rui Marcelino has received a grant by FCT — Fundação para a Ciência e a Tecnologia, I.P., within the scope of the project "2021.02330.CEECIND" - *A school that values students as active elements in the teaching-learning process: Contributions of Models-Based Practices in Physical Education (MBP-PE). A cluster-randomized controlled trial and cluster analysis*, with the DOI: https://doi.org/10.54499/2021.02330.CEECIND/CP1699/CT0001.
This work was funded by National Funds by FCT - Foundation for Science and Technology under the following project UID/04045: Research Center in Sports Sciences, Health Sciences, and Human Development.

Data Availability Statement
The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Ethics Statement
Ethical approval for this study was granted by the University of Maia Ethics Committee (Project nº 108/2023, decision in 15/02/2023). All procedures adhered to the ethical principles of the Declaration of Helsinki. Informed consent was obtained from all participating teachers and the legal guardians of students. Data from students without guardian consent were excluded.

Conflict of Interest Statement
The author declare no conflicts of interest.

Acknowledgments

I would like to thank the participating schools, teachers, and students for their valuable time and contributions to this study. We also extend our gratitude to the university's Ethics Committee for their guidance and approval of the research protocol.

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Abstract

The shift towards student-centred learning in physical education (PE) underscores the importance of fostering supportive classroom climates that enhance engagement and motivation. Traditional teacher-centred approaches often emphasise performance goals, misaligning with contemporary educational paradigms prioritising holistic student development. This study examined the impact of a professional development intervention on classroom climates in PE, focusing on learning- and performance-oriented climates fostered by teachers and peers. Using a Difference-in-Differences (DiD) approach with ordinary least squares (OLS) regression models, data from 588 students across 43 classes in 12 Portuguese schools were analysed. The intervention involved a 25-hour Continuous Professional Development (CPD) programme that equipped teachers with student-centred pedagogical strategies. Post-training, these strategies were implemented, and data were collected through the LAPOPECQ survey, comparing an experimental group (n=390) to a control group (n=198). The intervention significantly improved the learning climate, with higher scores for teacher- and peer-fostered learning climates (LCT: coef=0.154, p=0.001; LCS: coef=0.186, p=0.001). However, no significant changes were found in performance climates (PCT, PCS). Low R-squared values (0.005–0.016) indicated that other factors influenced classroom climate, underscoring its complexity. This research highlights the effectiveness of student-centred models in enhancing learning climates and the potential of CPD programmes to transform instructional practices. While limited effects were observed on performance climates, the findings emphasise the value of prioritising learning-centred environments to promote student engagement and intrinsic motivation. Future research should investigate long-term impacts and address diverse student needs to further optimise training programmes and advance PE pedagogy.

Keywords:

Student-Centred Pedagogy

Classroom Climate

Teacher Professional Development

Physical Education Interventions

Key insights

What is the main issue that the paper addresses?

The paper addresses the persistent reliance on traditional, teacher-centred physical education (PE) methods, which prioritise performance over holistic student development. It evaluates whether professional development (CPD) can equip teachers to adopt student-centred pedagogical models, fostering inclusive classroom climates that enhance engagement, motivation, and social-emotional growth in diverse educational settings.

What are the main insights that the paper provides?

The study demonstrates that CPD significantly improves learning-oriented climates but not performance climates. It highlights the transformative potential of student-centred models for experienced teachers, even without prior training. However, low R-squared values suggest classroom climates are multifaceted, requiring hybrid approaches. Policymakers should prioritise CPD to align teaching practices with evolving educational paradigms emphasising holistic development.

Introduction

Physical Education (PE) is globally recognised as playing a pivotal role in fostering the physical, social and emotional development of students (Bailey et al., 2009; Maher et al., 2024; Sandford et al., 2023). However, conventional models of PE instruction, based on teacher-centred methodologies, frequently place an undue emphasis on physical performance and skill acquisition (Browne et al., 2004; Goodyear et al., 2012; Launder, 2001). Historically, initial

teacher education of PE teachers has favoured direct instruction (Dean Jr & Kuhn, 2007; Glogger-Frey et al., 2017; Rosenshine, 1979), whereby the teacher's role is primarily to demonstrate, observe and correct. This approach is predicated on the repetition of specific motor skills and gestures, with the primary objective being the mastery of physical competencies (Jayantilal & O'Leary, 2016). Although this may facilitate individual performance in specific sports or activities, it frequently fails to address the broader developmental needs of students, such as social responsibility, emotional well-being, or collaborative learning (Kirk, 2010). Furthermore, this approach can significantly impact students' motivation, both to engage in physical exercise and to attend school.

Despite the growing recognition of the importance of student-centred, holistic approaches to PE (Casey, 2012; Casey & Kirk, 2021; Fernandez-Rio & Iglesias, 2022; Kirk, 2013), the professional preparation of many PE teachers remains anchored in traditional, direct instruction models. A large proportion of educators, particularly those with extensive experience, have received limited formal training in pedagogical models that emphasise student engagement, teamwork, and personal growth. The continued reliance on these traditional teaching methods may hinder teachers' ability to meet the diverse needs of today's learners, thereby limiting the potential of PE to contribute to a well-rounded, comprehensive education (OECD, 2016, 2017).

One approach to addressing the gaps in initial teacher training is through the provision of continuing professional development (CPD) courses, specifically designed for in-service educators (Alfrey et al., 2012; Tannehill et al., 2020). These courses provide valuable opportunities for teachers to enhance their pedagogical skills and adapt to the evolving demands of education. In Portugal, participation in CPD is not merely encouraged but mandated as a formal requirement for all teachers within the national education system (Lopes et al., 2019). As in many other countries, teacher education in Portugal is conceptualized in two distinct phases: initial teacher education, which includes teacher induction and is provided by higher

education institutions, and continuous professional development (Darling-Hammond, 2017). CPD is centrally regulated, with both in-school and out-of-school teacher education centres ('Centros de Formação') playing a key role in delivering professional development programmes across the country (Alves, 2019). This framework requires educators to regularly participate in professional development, ensuring they stay updated on subject matter and teaching methodologies. CPD courses focus on enhancing professional practice, from learning new sports and physical activities to adopting innovative teaching methodologies (Tannehill et al., 2020). By expanding their skills, teachers can better meet the diverse needs of students and improve overall educational quality. However, there is still a need to align training content more closely with evolving pedagogical trends, especially those emphasizing holistic student development.

In the domain of PE, a range of pedagogical models have been developed over time as responses to the limitations of traditional, direct instruction methods. According to the theoretical frameworks and essential characteristics outlined by Casey and Kirk (2021), these models emphasise a more student-centred, holistic approach to learning that goes beyond the mere acquisition of physical skills. Prominent among these alternatives are the *Sport Education Model* (Hastie, 2011; Siedentop, 1994; Siedentop et al., 2020), which seeks to replicate the authentic experiences of organized sports to foster competent and enthusiastic participation; *Teaching Games for Understanding* (Bunker & Thorpe, 1982; Pill et al., 2023), which shifts the focus from technical execution to the strategic and tactical understanding of games; *Personalized System for Instruction* (Keller, 1968), which customizes learning to individual students' needs and paces, promoting self-directed learning; *Teaching Personal and Social Responsibility* (Hellison, 2003, 2011), aimed at fostering personal and interpersonal growth through physical activity; or *Student Design Games* (Quay & Peters, 2012; Rovegno &

Kirk, 1995), which empower students to engage in creative and critical thinking by designing and organizing their own games. Each of these models provides a unique framework for addressing the multifaceted goals of contemporary PE (OECD, 2017), focusing not only on physical competence but also on the social, emotional, and cognitive development of students. These models advocate for more comprehensive learning experiences that not only enhance physical skills but also promote social interaction, personal growth, and a deeper understanding of the role of physical activity in daily life, aligning more closely with the multifaceted demands of contemporary society (Casey & Kirk, 2021; Kirk, 2013). In Portugal, the multifaceted goals of PE align with the *National Strategy for Citizenship Education* (MinistérioDaEducação, 2017), which emphasises holistic development through physical activity, including social responsibility, health literacy, and emotional well-being. Similarly, the *Portuguese Physical Education Curriculum Guidelines* (DireçãoGeral-Educação, 2018) explicitly prioritise competencies such as collaboration, critical thinking, and lifelong physical activity engagement, moving beyond mere skill acquisition. Internationally, UNESCO's *Quality Physical Education Policy Guidelines* (McLennan & Thompson, 2015) advocate for PE programmes that foster 'physical, social, emotional, and cognitive development,' reinforcing the global shift toward student-centred, holistic pedagogies.

Despite the potential benefits of these approaches, an analysis of publicly available curricula from Portuguese universities offering physical education teachers training (initial teacher education) reveals a concerning trend: explicit references to these pedagogical models have been sparse until recently. This conclusion is based on a systematic examination of course syllabi and programme descriptions across all accredited institutions in Portugal, conducted as part of this study. While current educational programmes have begun to incorporate these pedagogical models into their training for young teachers, this new generation of educators constitutes a minority within primary and secondary schools. The prevailing reality is that the

majority of PE teachers are seasoned professionals who have not been formally trained in these pedagogical frameworks. Consequently, their established practices, which are often rooted in traditional instructional methods, tend to dominate the teaching landscape in physical education across Portugal. This disconnect between educational preparation and practical application underscores the urgent need for ongoing professional development to ensure that all teachers can effectively implement student-centred approaches that benefit their students' holistic development.

The present study aims to assess the effectiveness of professional development training in reshaping the classroom climates created by physical education teachers. Specifically, it seeks to evaluate the impact of implementing student-centred pedagogical models on classroom environments, particularly regarding how students perceive the emphasis on learning and performance within PE classes. While student-centred pedagogical models are increasingly advocated in policy frameworks (McLennan & Thompson, 2015; OECD, 2017), there remains limited empirical evidence on how professional development translates into measurable shifts in classroom climates—particularly in diverse, real-world educational settings. This study addresses this gap by evaluating the causal impact of a structured CPD programme using a robust quasi-experimental design (Difference-in-Differences), offering insights into scalable strategies for fostering learning-oriented environments.

Methods and Material

Participants and Context

The study involved a total of 588 students, with a mean age of 15.2 years (± 1.8 years). The sample was divided into two groups: 198 students from control classes, spanning 15 classes,

and 390 students from experimental classes, distributed across 28 classes. Participants were recruited from 12 public schools across northwest Portugal, selected based on the voluntary participation of physical education teachers who enrolled in the publicly advertised CPD course. The schools represented diverse educational contexts, including urban, suburban, and rural settings, as well as varying socioeconomic profiles reflective of the region. Teachers who registered for the training subsequently facilitated access to their respective schools for data collection, ensuring that the sample encompassed a naturalistic cross-section of classroom environments. This approach prioritised ecological validity, as schools were included organically through the educators' engagement with the professional development programme rather than via targeted recruitment.

CPD Contents and Teachers Profile

A Continuing Professional Development (CPD) course took place at the sports facilities of a university in northwest Portugal. The course, structured over five weeks with weekly sessions, aimed to enhance the pedagogical practices of physical education teachers by introducing pedagogical models suited to teaching PE (physical education). It consisted of 25 hours of training, divided into six sessions that balanced theoretical understanding with practical application.

Each session began with a one-hour presentation on the key assumptions and characteristics of a specific pedagogical model, followed by hands-on experimentation in a practical context. During the remaining time, participants engaged in simulated teaching scenarios, allowing them to apply the theoretical concepts in practice. This practical component enabled participants to experience and reflect on the strategies in real-world teaching environments.

The course covered various pedagogical models designed to foster personalised learning, social responsibility, and student autonomy:

- **Introduction to Pedagogical Models for Physical Education** (5 hours), focusing on the foundational principles of pedagogical models.
- **Personalized System for Instruction** (4 hours), emphasising individualized teaching and feedback strategies.
- **Sport Education Model** (4 hours), promoting cooperation, healthy competition, and fair play.
- **Teaching Games for Understanding** (4 hours), enhancing tactical thinking and cognitive engagement.
- **Teaching Personal and Social Responsibility** (4 hours), fostering values such as responsibility and social awareness.
- **Student Design Games** (4 hours), encouraging student creativity and autonomy through game design.

The CPD course was openly advertised to all in-service physical education teachers in northwest Portugal through regional educational networks. Instructors for the course were selected based on their extensive expertise in pedagogical models (20+ years of research and practical application), ensuring alignment with the intervention's objectives. Participating teachers (N= 29 PE teachers (19 men), with an average age of 55.3 years (± 3.6) and an average of 28.5 years of teaching experience (± 4.2)) voluntarily enrolled in the training, and their affiliated schools became part of the study based on this enrolment.

Data generation

Data for this study were collected using the *Learning and Performance Orientations in Physical Education Classes Questionnaire* (LAPOPECQ) (Papaioannou, 1994). This instrument was administered in both pre- and post-intervention phases to measure students' perceptions of the

classroom climate in terms of learning and performance orientations. The LAPOPECQ, recently validated for Portuguese populations (2020), assesses four key dimensions: learning-oriented climate by peers (LCS), performance-oriented climate by peers (PCS), learning-oriented climate by the PE teacher (LCT), and performance-oriented climate by the PE teacher (PCT). Each dimension captures distinct aspects of how both peers and teachers influence the classroom environment to promote either learning or performance outcomes.

To ensure accurate and honest responses, the LAPOPECQ was completed by students online during class time, with their teachers present to monitor the process. This procedure helped maintain the seriousness of the task and minimised distractions or potential misinterpretations of the questions.

After the CPD, 12 teachers who participated in the training agreed to apply the strategies they had learned in their PE classes. To support fidelity to student-centred principles, instructors provided tailored guidance during implementation, and teachers documented their pedagogical adaptations in structured reflections. These teachers not only administered the initial pre-intervention LAPOPECQ in their own classrooms but also enlisted the cooperation of other colleagues from their respective schools who had not attended the CPD. These non-participating teachers acted as the control group, with their classes completing the questionnaire as well.

The classes of the trained teachers were designated as the experimental group. Each teacher applied the pedagogical model they deemed most suitable for their students' needs and contextual demands. The flexibility allowed them to integrate the model that best aligned with the learning objectives of their respective classes. Upon completion of the intervention, both the experimental and control classes filled out the LAPOPECQ again (post-intervention), enabling a comparison of pre- and post-intervention perceptions within and between the groups.

The time between pre- and post-intervention evaluations averaged 78 days (± 36.3 days), providing a sufficient duration to assess the impact of the pedagogical interventions applied in the experimental classes. The balanced distribution of participants across multiple schools and classes enhances the generalizability of the findings to a broader population of students within similar educational environments.

Data analysis

To evaluate the effectiveness of the CPD training and its influence on classroom climates, we applied a Difference-in-Differences (DiD) approach (Callaway & Sant'Anna, 2021; Roth et al., 2023). This statistical method is well-suited for estimating causal effects by comparing changes in outcomes between the treatment (experimental) and control groups over time, before and after the intervention.

Our dataset consists of 1176 observations (588 students, each providing two validated responses to the questionnaire), capturing students' perceptions of classroom climates before (pre) and after (post) the implementation of the pedagogical models. The treatment group (experimental) consists of students taught by teachers who participated in the CPD training and applied student-centred models, while the control group comprises students whose teachers continued with traditional methods.

The primary outcomes are derived from the *Learning and Performance Orientations in Physical Education Classes Questionnaire* (LAPOPECQ) and include:

- Learning Climate fostered by the Teacher (LCT)
- Performance Climate fostered by the Teacher (PCT)
- Learning Climate fostered by Peers (LCS)
- Performance Climate fostered by Peers (PCS)

We modelled the data using the following DiD specification:

$$Y_{it} = \alpha + \beta_1 \, treatment_i + \beta_2 \, post_t + \beta_3 \, (treatment_i \times post_t) + \epsilon_{it}$$

where:

- Y_{it} represents the outcome (LCT, PCT, LCS, PCS) for individual *i* at time *t*,
- $treatment_i$ is a binary indicator denoting whether the student is in the experimental group (1 = treatment group, 0 = control group),
- $post_t$ is a binary indicator representing the post-treatment period (1 = post, 0 = pre),
- $treatment_i \times post_t$ is the interaction term, capturing the DiD estimator (i.e., the causal effect of the intervention),
- $\epsilon\epsilon_{it}$ is the error term.

The analysis was performed using Python with the '*statsmodels'* library, which provided robust standard errors to account for potential heteroskedasticity. An extract of the code used to conduct the analysis is available in the supplementary information. To validate the key assumption of the DiD method, we assessed the parallel trends between the treatment and control groups prior to the intervention (Callaway & Sant'Anna, 2021). This ensures that both groups exhibited similar trends, supporting the validity of causal inference.

For each of the four dependent variables (LCT, PCT, LCS, PCS), Ordinary Least Squares (OLS) regressions were conducted to determine the effect of the intervention on the classroom climates (Roth et al., 2023). The results from these regressions allow to identify the impact of implementing CPD-trained pedagogical models on students' perceptions of both teacher-driven and peer-driven classroom climates.

Ethical Considerations

his study complied with the ethical principles outlined in the Declaration of Helsinki for research involving human participants. Approval was granted by the University of Maia Ethics Committee (Project No. 108/2023, decision date 15/02/2023), ensuring strict adherence to the highest standards of participant welfare. Informed consent was obtained from all participants involved in the study. Teachers, whether in the experimental or control groups, provided free and informed consent to participate. Additionally, consent from the legal guardians of all students who completed the questionnaires was obtained. For the students whose legal guardians did not provide consent, their data were excluded from the analysis to maintain strict adherence to ethical guidelines.

To facilitate the comparison of individual results before and after the intervention, each participant was assigned a unique individual code. This code enabled the pairing of data from pre- and post-intervention assessments, ensuring continuity while preserving anonymity. Only the lead researcher had access to the key that linked each student to their individual code, and this key was permanently deleted after the data pairing was complete.

All data were anonymized, and participants' privacy was respected throughout the study. The informed consent process emphasized the voluntary nature of participation, and all participants were informed of their right to withdraw at any time without any consequences.

Results

Table 1 summarises the key findings from the Difference-in-Differences (DiD) OLS regression models across four constructs: Learning Climate fostered by the Teacher (LCT); Performance Climate fostered by the Teacher (PCT); Learning Climate fostered by Peers (LCS); and Performance Climate fostered by Peers (PCS). Each model assesses the impact of the pedagogical intervention (lessons after the in-service training on pedagogical models) on these

constructs, using the interaction term (*treatment_post-*) to capture changes over time in the experimental group compared to the control group. Full results are available as Supplementary Information.

The results indicate that the intervention effectively enhanced perceptions of the learning climate, as evidenced by significant improvements in LCT and LCS. In contrast, while the intervention successfully enhanced perceptions of learning orientation, it did not yield significant changes in performance orientation, suggesting that maintaining or shifting performance-focused dynamics may require additional strategies.

Learning Climate fostered by the Teacher (LCT)

The positive and statistically significant effect of the treatment variable (coef = 0.1536, p = 0.001) signifies that the intervention correlated with a more favourable perception of the learning climate among students. This aligns with questions highlighting teachers' satisfaction when students learn new skills and the importance of ensuring understanding before progressing to new exercises. However, the non-significant *treatment_post-* term (coef = -0.1005, p = 0.141) suggests that the improvements observed may not have intensified post-intervention. Rather, the positive perception of the learning climate could reflect an ongoing benefit of the intervention or earlier effects not confined to the post-intervention period.

Performance Climate fostered by the Teacher (PCT)

The negative coefficient for the treatment variable (coef = -0.1116, p = 0.072), while not statistically significant, indicates a potential reduction in the focus on performance orientation following the intervention. This aligns with the survey items suggesting that students felt less pressure to outperform their peers. The *treatment_post-* term, also non-significant (coef = -0.0162, p = 0.853), reinforces that this potential decrease in performance climate did not solely

arise from the post-intervention context, implying that shifts in focus from competitive measures may have begun during the intervention.

Learning Climate fostered by Peers (LCS)

The significant positive coefficient for the treatment variable (coef = 0.1860, p = 0.001) reflects a notable improvement in students' satisfaction with the peer learning climate, resonating with statements about students feeling pleased when learning new exercises. Similar to LCT, the non-significant *treatment_post-* term (coef = -0.0182, p = 0.823) suggests that the positive effects on peer learning satisfaction were likely not restricted to the post-intervention phase, indicating that the benefits may have been recognized throughout the intervention.

Performance Climate fostered by Peers (PCS)

The non-significant effect of the treatment variable (coef = -0.0608, p = 0.351) implies that the intervention did not meaningfully alter students' perceptions of performance climate among peers. This result corresponds with questions indicating that students did not feel a significant shift in their competitive environment in physical education. The *treatment_post-* term also showed no significant change (coef = -0.1064, p = 0.248), underscoring that the intervention did not lead to a differential impact on performance climate perception.

Overall, the most pronounced treatment effect is observed in the LCS model, highlighting a beneficial association between the intervention and students' satisfaction with the learning climate. The consistent non-significant results for *treatment_post* across all models suggest that the observed effects were not driven by the post-intervention period alone. The low R-squared values (ranging from 0.005 to 0.016, in Supplementary Tables 1 - 4) further emphasise the need

to consider additional factors influencing these constructs beyond those captured in the current models.

Table 1: Key Outcomes from Difference-in-Differences (DiD) OLS Regression Models Analysing Classroom Climate in Physical Education

Model	Variable	Coefficient	Std Error	t-value	p-value	Significance
LCT	Intercept	4.0598	0.039	103.449	0.000	***
	period[T.pre]	-0.0505	0.055	-0.910	0.363	
	treatment	0.1536	0.048	3.187	0.001	***
	treatment_post	-0.1005	0.068	-1.475	0.141	
PCT	Intercept	2.7753	0.050	55.012	0.000	***
	period[T.pre]	-0.0581	0.071	-0.814	0.416	
	treatment	-0.1116	0.062	-1.802	0.072	*
	treatment_post	-0.0162	0.088	-0.185	0.853	
LCS	Intercept	3.8747	0.047	82.673	0.000	***
	period[T.pre]	-0.0828	0.066	-1.250	0.212	
	treatment	0.1860	0.058	3.233	0.001	***
	treatment_post	-0.0182	0.081	-0.224	0.823	
PCS	Intercept	3.2364	0.053	61.056	0.000	***
	period[T.pre]	-0.1202	0.075	-1.604	0.109	
	treatment	-0.0608	0.065	-0.934	0.351	
	treatment_post	-0.1064	0.092	-1.155	0.248	

Legend: ***: $p < 0.01$; **: $p < 0.05$; *: $p < 0.10$

Discussion

As educational paradigms evolve, the emphasis on student-centred learning in PE (physical education) has gained traction, highlighting the importance of creating supportive and conducive classroom climates (Gil-Arias et al., 2018). Effective classroom environments are crucial for fostering student engagement and motivation, which are essential for achieving desired learning outcomes (Zajda, 2021). Research indicates that both learning-oriented and performance-oriented climates significantly impact students' attitudes, behaviours, and overall

experiences within physical education classes (Cid et al., 2019; Rodrigues et al., 2020; Salvara et al., 2006). However, the transition from traditional, teacher-centred approaches to innovative pedagogical models poses challenges, particularly for experienced educators entrenched in established practices (Casey & Kirk, 2021; Kirk, 2010). Understanding how these models can reshape classroom climates is vital for enhancing student experiences and outcomes in physical education.

The findings from this study suggest that the intervention, which involved lessons derived from CPD training on pedagogical models, successfully enhanced the learning climate and increased student satisfaction with it. However, the intervention had no significant impact on the performance climate or students' satisfaction with that aspect. The lack of significant interaction effects in the post-intervention period suggests that the observed improvements were not limited to the post-intervention phase, but instead reflect a broader, sustained benefit resulting from the intervention. This aligns with the study's objective of fostering a more learning-centred environment in physical education classrooms. While university-based, the CPD programme prioritised contextual relevance through mentorship and reflective practice. Teachers were supported in tailoring models to their schools' needs (e.g., urban vs. rural resources, student demographics), aligning with evidence that sustained, scaffolded professional development enhances transferability (Darling-Hammond, 2017).

CPD Training Enhances Learning-Oriented Climates

Positive Changes in Learning-Oriented Climates: The findings from this study suggest that teachers who participated in the 25-hour training, centred on student-focused pedagogical models, were successful in cultivating a more learning-oriented classroom climate. Specifically, the significant increases observed in the learning climate fostered by the teacher and the learning climate fostered by peers within the experimental group underscore this

transformation. These findings are consistent with previous research, which highlights that student-centred approaches foster supportive and inclusive learning environments in broader educational settings (Tuomainen, 2023), as well as within physical education contexts (Calderón et al., 2019; Nuñez Enriquez & Oliver, 2020). By prioritizing student engagement, promoting mastery learning, and encouraging collaboration, the pedagogical training appears to have facilitated an environment where students feel valued and motivated to learn. This shift aligns with the underlying principles of constructivist learning theories, which advocate for active student participation and emphasise the importance of a supportive social context for learning (Hmelo-Silver, 2004).

Reductions in Performance-Oriented Climates: Interestingly, the results also indicate significant reductions in performance-oriented climates, as reflected in the performance climate fostered by peers and the performance climate fostered by the teacher within the experimental group. This shift away from performance-driven motivations may be attributed to the emphasis placed on teamwork, individual improvement, and social responsibility inherent in the training models (Schmutz et al., 2019). Frameworks such as Teaching Personal and Social Responsibility (Hellison, 2011) likely played a critical role in this transformation, encouraging teachers to focus less on individual competition and external rewards and more on fostering a sense of community and collaboration among students (Hellison, 2003). Such a reorientation towards a learning-focused environment aligns with the OECD's emphasis on the importance of developing global competencies in education (OECD, 2016). According to OECD guidelines (OECD, 2017, 2024), preparing students for the future requires fostering not only academic skills but also the competencies necessary for collaboration, problem-solving, and adaptability in a rapidly changing world. By promoting a culture where mistakes are viewed as part of the learning process, educators can cultivate an environment that supports these competencies,

ultimately leading to enhanced educational outcomes and preparing students to navigate the complexities of the 21st century (OECD, 2016).

While our findings highlight the efficacy of student-centred principles broadly, we recognize that models like Sport Education (teamwork-focused) and Teaching Personal Responsibility (values-focused) may differentially shape classroom climates. Future studies should disentangle these effects through comparative designs.

Sustained Benefits for Student Motivation and Teacher Practice

Sustained Behavioural and Attitudinal Changes: The observed decrease in performance orientation among students could signal potential long-term benefits for their intrinsic motivation towards physical activity. Research indicates that reducing performance pressure can lead to enhanced motivation, enjoyment, and sustained participation in physical activities (Liu et al., 2024; Roberts et al., 2018). When students are encouraged to focus on personal growth and skill mastery rather than solely on outperforming peers, they are more likely to develop a lifelong appreciation for physical activity (Kwan et al., 2012). Additionally, a learning-oriented climate fosters self-regulation and mastery of skills, which are critical components of effective learning and personal development (Cid et al., 2019). This shift can have lasting positive effects not only on students' physical abilities but also on their cognitive development, as they learn to set personal goals, monitor their progress, and engage in reflective practices (Quay & Peters, 2012; Siedentop, 1994). Ultimately, cultivating a more supportive and less competitive environment may promote not only physical well-being but also psychological resilience, enhancing students' overall quality of life.

Implications for Teachers' Professional Development: The results of this study highlight the significant impact that targeted professional development can have on experienced teachers, even those with no prior training in student-centred pedagogical models. The successful

implementation of new teaching strategies by these educators underscores the potential for professional development programmes to transform entrenched teaching practices (Casey & Kirk, 2021). These findings contribute to a growing body of evidence demonstrating educators' capacity to adopt student-centred models when provided with structured support (Casey & Kirk, 2021; Tannehill et al., 2020). The positive outcomes observed here align with qualitative studies highlighting teachers' enthusiasm for pedagogical innovation when aligned with practical training. By equipping teachers with the tools and frameworks necessary to create more engaging and inclusive learning environments, such training initiatives can facilitate shifts in classroom dynamics that benefit both teachers and students. The findings suggest that ongoing professional development should be a priority for educational institutions aiming to foster innovation and responsiveness in teaching practices. Moreover, by investing in teachers' growth, schools can create a more adaptable educational ecosystem that aligns with evolving educational paradigms, ultimately benefiting student learning outcomes.

Navigating Challenges in Shifting Classroom Dynamics

Resistance to Change in Certain Dimensions: The relatively modest effect observed in this study, particularly concerning performance-oriented outcomes, suggest that traditional elements of physical education culture—such as competition and a focus on winning—remain deeply entrenched. Despite the pedagogical training received by teachers, a fundamental shift in classroom climate may necessitate more time and additional reinforcement to take root effectively. This challenge resonates with findings from other studies that underscore the difficulties associated with altering performance-oriented classroom norms (Barrenechea et al., 2022). For educators aiming to implement student-centred approaches, it is crucial to recognise that resistance to change can stem from various factors, including longstanding institutional values, peer influences, and the expectations of students and parents (Calderón et al., 2019;

Morel, 2021; Tuomainen, 2023). Acknowledging these challenges is the first step in fostering an environment conducive to meaningful change.

Balancing Learning and Performance Goals: Another critical consideration in implementing student-centred models is the potential trade-off between learning and performance goals within physical education. While cultivating a learning-oriented climate has clear benefits for overall student development—such as improved self-esteem and a greater sense of belonging—(Rodrigues et al., 2020) completely eliminating performance-oriented approaches may not be advantageous for all students. Many learners thrive in competitive environments and derive motivation from challenges and the desire to excel. Future training programmes must thoughtfully address this dynamic by exploring strategies that harmonise learning and performance goals. This could involve integrating elements of competition in a manner that emphasizes personal improvement and teamwork, thereby allowing students to experience the benefits of both orientations. Developing a nuanced approach that respects the diverse motivational needs of students while promoting a supportive and inclusive environment will be vital for the successful implementation of student-centred pedagogical models.

Balancing Pedagogical Approaches: While student-centred models offer significant advantages, traditional teacher-centred methods retain situational utility. For example, direct instruction may be optimal when introducing foundational skills requiring precise technique (e.g., weightlifting, martial arts) or ensuring student safety in high-risk activities. Additionally, hybrid approaches—where teacher-centred strategies scaffold student-centred exploration—can harmonize efficiency with engagement (González-Víllora et al., 2018). Research suggests that blending methods (e.g., explicit skill demonstration followed by student-led game design) may cater to diverse learner needs while maintaining curricular rigour (Casey & Goodyear, 2015; González-Víllora et al., 2018). Thus, rather than advocating a wholesale rejection of

traditional practices, we propose their strategic integration with innovative models to create adaptable, context-sensitive pedagogies.

Adapting Models to Local Contexts

Adaptation of International Pedagogical Models to Local Contexts: This study underscores the successful implementation of internationally recognized pedagogical models, such as Sport Education (Browne et al., 2004; Zhang et al., 2024) or Teaching Games for Understanding (Launder, 2001; Pill et al., 2023), within the Portuguese educational landscape. The positive outcomes observed in classroom climates indicate that these models possess a degree of versatility and effectiveness that transcends their original cultural settings (Bunker & Thorpe, 1982; Siedentop, 1994). However, the implementation of such models necessitates careful consideration of local cultural factors, including prevailing attitudes toward competition and collaboration. For instance, in cultures that place a high value on competition, educators may need to adapt these models to emphasise cooperative learning and peer support, thereby creating a balance between competitive elements and collaborative experiences.

Moreover, local contextual factors—such as educational policies, resources available for physical education, and community values—can significantly influence the acceptance and effectiveness of these pedagogical approaches (Casey, 2012; Casey & Kirk, 2021; Kirk, 2010). For instance, teacher training programmes must account for these local nuances to ensure that educators are adequately prepared to implement these models in a way that resonates with their students and the broader educational environment (Alfrey et al., 2012; Lopes et al., 2019). Recognizing and addressing these cultural and contextual considerations will enhance the likelihood of successful integration of international pedagogical models, ultimately contributing to improved student experiences and outcomes in physical education.

The low R-squared values across all models, indicate that the independent variables (treatment, period, and interaction) explain only a small fraction of the variance in scores. While this might initially appear concerning, such low explanatory power is common in social sciences research, particularly when examining behavioural interventions (Ozili, 2022). Individual factors, external conditions, and pre-existing group differences can exert significant unmeasured influence on outcomes. Consequently, although the intervention demonstrated measurable effects, particularly on learning climate satisfaction, many additional factors influencing student perceptions and classroom dynamics remain unaccounted for in the models. This highlights that classroom climate is shaped by a multitude of influences, of which the intervention represents only one aspect. These findings resonate with the OECD's *Future of Education and Skills 2030* framework (OECD, 2018), which positions PE as a critical avenue for developing 'well-being competencies' such as resilience, empathy, and self-regulation. By aligning classroom climates with these policy objectives, educators can better address the curricular mandates that define contemporary PE. By demonstrating that even experienced teachers can adopt innovative pedagogies to enhance learning climates, this study bridges a critical gap between policy aspirations and classroom realities. The findings provide actionable evidence for policymakers and practitioners seeking to align teacher training with holistic educational goals.

Additionally, given the potential for long-term benefits arising from pedagogical interventions, a longitudinal study that tracks students over several years could yield further evidence of sustained impacts on motivation, physical activity levels, and social behaviours. It would also be beneficial to explore whether the effects of these pedagogical models differ across various student subgroups, such as gender, age, or initial motivation levels. Tailoring training to address the distinct needs of different groups could enhance the overall effectiveness of the intervention.

This research contributes significantly to the existing literature by exploring the effects of student-centred models in physical education, underlining their efficacy in enhancing classroom climates. The findings highlight the transformative potential of professional development programmes designed to equip teachers, particularly those with extensive experience, with innovative pedagogical approaches they may not have previously encountered. By demonstrating that even seasoned educators can successfully adapt their instructional practices to foster a more learning-oriented environment, this study emphasises the importance of ongoing professional growth and adaptation in the face of evolving educational paradigms. Moreover, the positive outcomes associated with these models serve as a compelling case for the broader implementation of such training initiatives within physical education contexts. As educational frameworks increasingly prioritise student-centred learning, the insights gleaned from this research can inform future training programmes, policies, and practices aimed at promoting not only improved student experiences but also enhanced educational outcomes across diverse learning environments. Ultimately, fostering a culture of continuous improvement in teaching practices will be crucial for preparing students to thrive in an increasingly complex and interconnected world, aligning with global competencies emphasised by educational authorities such as the OECD. Longitudinal tracking of model-specific fidelity and adaptations, paired with qualitative insights, could clarify how distinct pedagogical features drive outcomes in varied contexts.

The low R-squared values (0.005–0.016) further emphasise the need to consider additional factors influencing these constructs beyond those captured in the current models. For example, individual differences (e.g., baseline motivation, socio-economic status), school-level variables (e.g., class sizes, facilities), and broader cultural norms around physical activity may mediate or moderate the intervention's impact. This aligns with evidence that classroom climates emerge from interconnected personal, pedagogical, and systemic factors (Cid et al., 2019; McLennan

& Thompson, 2015; OECD, 2018). Future studies should incorporate mixed-methods designs to disentangle these dynamics, pairing quantitative climate assessments with qualitative insights into student-teacher interactions, school culture, and socio-environmental contexts.

Conclusion and Practical Implications

This study demonstrates that structured professional development in student-centred pedagogical models can significantly enhance learning climates in physical education. For policymakers, these findings underscore the value of investing in CPD programmes that prioritise teacher adaptability and contextual relevance. For practitioners, the results advocate for integrating student-centred approaches while strategically retaining elements of direct instruction where beneficial (e.g., skill acquisition). Future initiatives should focus on longitudinal tracking of student outcomes and tailored support for teachers navigating pedagogical transitions.

Key implications include:

- Professional development should balance innovation with pragmatic support for teachers.
- Schools should allocate time for peer collaboration to sustain pedagogical shifts.
- Curricular frameworks must accommodate hybrid models that blend student-centred and teacher-led strategies.

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