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Multi-System Influences on Physical Education Preservice Teachers' Teaching Practice in Pandemic Times

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ABSTRACT

Teacher training programmes and physical education activities were strikingly affected by the COVID-19 pandemic. Consequently, this study attempted to uncover (i) the systems factors that influenced the teaching practice of 28 preservice teachers during school placement, and how different multi-system interacting influences impacted on (ii) predominant, or (iii) differentiated teaching practices. Data included individual and focus group interviews, field notes, post-observation sessions, and digital portfolios. Eleven system-related factors were identified: macrosystem (lockdown regulations); exosystem (experiential learning); mesosystem (mentoring); microsystem (technology); and individual attributes. Teaching practices were influenced by interacting classroom conditions, prior learner-centred training, mentoring and personal attributes.

KEYWORDS

COVID-19; teacher education; distance-learning; digital skills; school placement

Introduction

The COVID-19 pandemic has caused unprecedented challenges to society given the abrupt need to restructure and adapt the internal functioning of the various activity fields of human life. This turmoil was particularly hard-hitting in the field of education, especially in schools and teacher training (O'Brien et al., 2022; Stracke et al., 2022). In agreement, this study was focused on the consequences of the COVID-19 pandemic in Physical Education Teacher Education (PETE), particularly on the teaching practices of aspiring teachers (preservice teachers, PSTs) taking place during their school placement in pandemic times. The setting of the present study was a PETE programme in Portugal, which, like the rest of the world, experienced the hardships of the restrictions resulting from the COVID-19 pandemic (Flores et al., 2020). Conducting research on the PSTs' teaching practices (henceforth termed as PTP) is particularly relevant because it (i) indirectly expresses the level of effectiveness of PETE programmes, (ii) represents a critical professional moment for the retention of PSTs (future teachers) in the profession (an even more pressing need given

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the increasing loss of attractiveness of the teaching profession), and (iii) often is a stage for pedagogical renewal of PE practices and a moment of meaningful learning experiences for PE students (Calderón & MacPhail, 2021).

The menace of new pandemic confinements remains a plausible reality. Therefore, there is a pressing need to understand rapidly, and comprehensively, how the specific set of pandemic circumstances shapes the PTP to devise informed means that leverage PETE programmes. This is even more important in the present day because many university-based programmes are struggling to meet public accountability demands, plans are contentiously being made to turn teacher education over to for-profit entities and, consequently, many courses in face-to-face learning (F2F) are now emphasizing online methods of preparation for teachers or even exclusively adopting distance learning (DL) course formats (Rice & Deschaine, 2020).

A brief synopsis on PETE research in pre-pandemic times

Research on PETE has long tried to understand the mechanisms that impact on PTP during PSTs' school placement, particularly in three core domains. Firstly, research on curriculum development (clarifying the philosophical paradigms, theoretical orientations, and conceptual models for optimizing courses content and teacher education practices). Research showed that essential elements of an extensive and adequate teaching preparation should include: conceptual and curricular programme coherence and school context integration (Bain & Moje, 2012) and collaborative, inquiry, critical, and practice-based teacher training pedagogies which provide active learning opportunities to PSTs (Tinning, 2020). Secondly, research on the knowledge structures that regulate PTP (relationships between different knowledge bases and how they contribute to teaching effectiveness). The intensified engagement of PSTs in the effective development of pedagogical content knowledge through several knowledge bases (e. g., content knowledge: the knowledge and skills needed to perform a task or the ability to organize, represent, and adapt tasks) (Farias et al., 2022; Ward & Ayvazo, 2016), prior, or during school placement positively impacts on PSTs' instructional representations and ability to adapt content to the learner's needs. Thirdly, research aiming to understand the social, cultural, and environmental factors that impact on PTP (social aspects of teacher learning, factors in individual's life history and socialization that shape their frame of beliefs and values and consequent pedagogical action). The school culture and specific contextual circumstances of the school placement present different degrees of support or resistance to critically influence PTP (Hordvik et al., 2020). For example, the nature and quality of the mentoring provided by cooperating teachers (CTs) and university supervisors have been fundamental in supporting (or not) the improvement of PTP (Calderón & MacPhail, 2021). In line with research conducted in international settings, these influential elements have also been noticed in the PETE programmes in Portugal (Valério et al., 2022). In addition, CTs are teachers permanently placed in school placement schools and are responsible for integrating the PSTs into the school community and provide them with on-the-spot and proximal training and ongoing support in developing their teaching practices. The university supervisors establish a bridge between university and school and have a less in-depth role in supporting the PSTs than the CTs.

How may a complexity multidimensional research approach extend knowledge on PETE and on the interplay of influences that impact on PTP?

To avoid unidimensional and potentially more “linear epistemological approaches” to knowledge construction (e.g., Fazio & Gallagher, 2009), especially in general teacher education, research has been progressively adopting more holistic approaches to the study of the factors that (positively or negatively) influence PTP during school placement.

In considering this premise, this study embraces the ecological model proposed by Bronfenbrenner (1979) as an organisational frame that aspires to the understanding of the holistic phenomenon under study. Bronfenbrenner’s (1979) ecological model allows us to analyse the interplay of multiple systems (macro, exo, meso, micro) that surrounds PSTs and attempts to understand the varied influences on their teaching practice. The influential systems include the macro (educational policy and changing cultural, social, and political factors), exo (past teacher education experiences), meso (school’s structural and cultural factors: values, beliefs and traditions that rule the institution’s professional practice), and micro (classroom setting, conditions, and dynamics) systems. It is theorised that factors in one system influence factors in adjacent systems. For instance, Portuguese PSTs might share the same national educational policy and PE curriculum (macrosystem) and might have been subject to similar PETE training (exosystem), but they encounter different school-specific cultures (mesosystem) or gym conditions (microsystem). These may result in different patterns of teaching practice (e.g., involve students waiting for their turn to participate in peer-assessment activities if the space available only allows half of the class to be active at a time). During any given teaching episode occurring at a micro-level (in the gym) practitioners will strive to resolve issues and adapt to the conditions that surround them during their teaching practice. Multi-system influences on the PSTs’ decisions on the lesson planning or lesson task organisation may implicitly manifest as PSTs deal with the influence exerted by their cooperating teachers (CTs) during a previous work meeting (meso-system: stressing the use of certain instructional practices in detriment of others). On the other hand, when CTs, more or less consciously or overtly, explicitly or implicitly, try to influence the PTP, they may be, themselves, acting under the influence of the expectations that the school board holds about their professional practice (macro-system) (Ell et al., 2017).

However, we also welcome in this study the consideration of the individual as a complex and influential system, insofar as their unique repertoire of experiences and identity attributes decisively affect the nature of their professional decisions (i.e., their teaching practice). In agreement, this study draws on a confluence of perspectives that converge on complexity theory. Although drawing on Bronfenbrenner’s (1979) ecological frame, we extend its analytic power by placing at the fore the interactions occurring between individual’s idiosyncrasies (e.g., their knowledge, background, beliefs, dispositions, identity) and the influential multi-factors that operate at different levels to influence PTP (Ell et al., 2017; Gemmink et al., 2021). On the one hand, it requires simultaneous consideration of elements found in teacher development systems (i.e., PSTs), the relationships between these elements (e.g., mentoring support) and the social context (e.g., schools) that incorporates these elements. On the other hand, it acknowledges the idea that PSTs act under the effect of nested layers of influences that are simultaneously interacting, resulting in specific observable patterns of PTP. Such interactions are shaped across multi-layered influences (systems) through interpersonal transactions that create specific sets of meanings, values, and

praxis structures (Light, 2008). It reflects a process in which various cognising agents/learners are inseparably intertwined and whereby “personal knowledge and activity are enfolded in, and unfold from, social interaction, collective knowledge, and activity” (Light, 2008, p. 28). Further, individual teaching practices are strongly mediated by the projection of each PST’s individual life history. In this perspective, PTP is thought to be influenced by idiosyncratic clusters of beliefs, knowledge and background experiences, which may lead to different professional goal-setting and interpretations of actions and meanings governing PSTs’ understanding and praxis (Davis & Sumara, 2006).

What is known about the pandemic impact in PETE?

During the pandemic outbreak, virtually every country in the world imposed social distancing (F2F) or home confinement (DL) to stop the virus transmission (World Health Organization [WHO], 2020). In university courses, social distancing norms were applied during periods of F2F classes. Students were spaced further apart in classes and the number of students in F2F classes was reduced with rotating systems (classes took turns between online and F2F classes). In PE lessons, social distancing allowed lessons in F2F format but applied several restrictions such as restricting the exchange of equipment between students (e.g., balls) and that students were placed at least two metres apart from each other in the gyms. During home confinement, all lessons took place online in a DL format, both at the university and schools.

Contextualising this study further, the turmoil was particularly distressful for PSTs who joined the PETE programme in 2019-21 as they oscillated between participating in course units training delivered in F2F learning and DL formats. In the following year, the Portuguese government authorities decided to begin the 2020-21 school year, initially using F2F, then transiting to DL. In essence, PSTs who started their Master’s training in 2019 were faced with two periods of F2F and DL both during their first-year’s course units (as learners) and during their second-year’s school placement (as teachers).

Despite the pervasive impact of the COVID-19 pandemic, there is a dearth of research on its effects on PETE and school functioning, particularly to what regards PTP in school placement. Stracke et al. (2022) spoke of chaos, panic, apprehension, and insecurity among higher education students. O’Brien et al. (2022) found negative effects of the pandemic on PSTs’ wellbeing and teaching practice, while Varea and González-Calvo (2021) stressed that PSTs experienced mixed emotions (e.g., happiness and enthusiasm before the lockdown versus sadness and uncertainty during the online teaching). Overall, the PSTs believed that PE had lost its identity in the DL context. The pandemic context, and the pressing need for the use of virtual pedagogies, has uncovered a new field of educational problems to be solved. Knowledge of the effect on PTP of the utterly different circumstances in which PSTs were trained during the course units (F2F, DL) that prepared them for school placement teaching in pandemic times and their consequent teaching practice is urgently required. Importantly, it is important to understand the hindrances emerging from teaching PE in such different contexts and formats as F2F learning or DL. In agreement, this study aimed to respond to three research questions:

- (1) What are the systems factors that potentially influence PTP during pandemic times?
- (2) What is the predominant profile of PTP and how do the different systems factors interact to influence PTP?

- (3) Is there a differentiated profile of PTP and how do the different systems factors interact to influence that differentiated PTP?

Methods

The concept of “teaching practice” adopted in this study draws on the concept presented by Gemmink et al. (2021) and includes all teachers’ verbal and nonverbal behaviours occurring during teacher-pupil interactions aimed at achieving particular learning goals. Teaching practice includes behaviours related to models of teaching and respective planning, executing, and evaluating of lessons, and artefacts such as lesson plans, talks about what they would do in a particular lesson, observed task presentation, activity organization, or instructional intervention. The unit of analysis of PTP in this study was, therefore, the events (or teaching moments) taking place either in the gym (during F2F) or during the online PE lessons delivered by PSTs during the DL period.

Study design

This study followed a qualitative longitudinal approach (Bryman, 2012) that took place during the second year of a PETE course, while PSTs were engaged in their school placement. Multiple data collection points and sources were applied, including data collected from the beginning of the first term (September of 2020) to the end of the second term (April of 2021) of the 2020–2021 academic year. The unpredictable circumstances of the pandemic outbreak implied that this study had to be conducted during two school terms to capture information on two markedly distinct contexts of PTP: first school term—F2F learning; second school term—DL.

Setting

The school placement experiences of PSTs enrolled in the second year of a PETE programme at a sport faculty of a university in Northern Portugal was the setting. Typically, PSTs stay in schools for two full and consecutive school terms (approximately from September to April). The first term of the school placement took place in a F2F context in PE classes with restrictions on interpersonal distance imposed nationally by government regulations and managed locally by each school board. In the second term, with the national lockdown, the schools were shut down and PE lessons took place online in a DL format.

Seventy-two PSTs were placed in 24 host public schools in groups of two to three PSTs. During their school placement, each PSTs was set responsible for teaching one fixed class. The PSTs taught an average of three teaching units per school term (two team sports—basketball, handball, football; one individual sport—Athletics, Gymnastics; and one Outdoor Adventurous Activities unit—Orienteering). Each group of PSTs were supervised by a school host CT and by one university supervisor (henceforth named as supervisor). Overall, the PSTs went through an 800-hour training process comprising 29 weeks. The training also included once-a-week support sessions provided by each supervisor to their group of PSTs. Supervisors’ support also included field observation of PTP and subsequent post-observation reflection sessions.

Participants

Immediately before the PSTs' enrollment in school placement training (September 2020), the entire cohort of 72 PSTs were invited to participate in the study. A total of 28 PSTs (15 males and 13 females, mean age = 23 ± 19 years) agreed to participate based on the following criteria: (i) to have met 90% attendance in all course units taken in the first PETE year; and (ii) strictly voluntary participation. These PSTs taught 28 elementary and secondary PE classes (10 seventh to ninth-grade classes and 18 tenth to twelfth-grade classes).

Ten CTs (seven males and three females; Mean age = ~ 50 years; Years of experience in teaching = ~ 30 years; and as CTs = ~ 20 years), were also participants. The participant supervisor was a 48 years-old male (not related to the research team). He was a former PE teacher with 10 years of experience and had been involved in the supervision of school placement training in the past 13 years.

Data collection

The several data collection sources included: (a) the audio recordings and notes taken by the supervisor during observation of PTP; (b) field notes taken by a member of the research team in the same lessons observed by the supervisor; (c) the digital portfolio of the 28 PSTs (including lesson plans and reflection diaries); (d) audio recordings of the post-lesson observation reflections held between the supervisor, the CT and their respective group of PSTs; (e) semi-structured focus group (FG) interviews; and (f) individual interviews.

A total of 21 FG interviews were conducted separately with PSTs and their CTs at three moments in time. The PSTs were divided into three groups of six PSTs plus two groups of 5 PSTs (equals 15 FGs across the three points in time) and the CTs were divided into two groups of 5 CTs (equals 6 FGs at three points in time). The participants of each FG were changed along the data collection points and with the grouping of PSTs coming from different schools.

The FG sessions lasted between 80 and 130 minutes and in all of them steps were taken to ensure that all participants were willing to contribute and to speak openly and truthfully (Bryman, 2012). The first FG carried out an exhaustive survey on the teaching conditions that the PSTs found in their schools at the entry of the first term (health safety procedures and nature of class organization and teaching activities imposed by the school boards on the CTs). The second FG session repeated the prior procedures to attempt to understand the particularities of the new DL conditions at the entry of the second term. In both the second and third blocks of FG, the PSTs and their CTs were encouraged to critically reflect on the different constraints and difficulties that potentially influenced the PTP in the two different settings of their school placement. This focus was extended to the training that PSTs had received during the course units in the first PETE course year. To help PSTs confront their subjective perceptions and interpretations about the teaching moments experienced with other points of view, the researchers used reflection-prompts extracted from data collected in the interviews with the CTs, the field notes of their lesson observations and from PSTs' reflective diaries (e.g., "the work of the basketball passing in lesson x , wouldn't there really be the possibility of implementing small-sided games as an alternative to the exclusive use of isolated skill-drills?").

Three individual interviews were conducted with the supervisor. The first interview sought to understand the main pedagogical and instructional elements that he intended to observe and evaluate during his field observations, as well as his expectations as to what should be the nature of PTP. The following interviews captured his perceptions of the factors that most influenced the nature of the observed PTP. Each interview lasted about 90 minutes.

Data analysis

All the interviews and audio recordings data were transcribed verbatim. A mixed content and thematic analysis (Braun & Clarke, 2019) was used to interpret and organize the data.

Figure 1 provides a summary of the data analysis steps. The examples of categories and themes displayed in Figure 1 refer to one of the final first-order themes (“Mesosystem: Programme mechanisms, school culture and organization, and mentoring”). Steps 1 to 8 responded to research question 1. Step 9 responded to research question 2 and 3. Based on data from field observations and on the database referring to different individuals situated in similar and different microsystems (i.e., placed in the same school/different schools), we tracked the data entries of these individuals throughout all system layers (macro, exo, meso, etc.). When observing the teaching episodes of a given PST (microsystem), this information was crossed with information regarding their CT and supervisor, their school’s culture and organization (mesosystem), their sport and coaching background and reported learning experiences lived in the course units (exosystem). This allowed to identify interplay patterns between influential factors and PTP.

Trustworthiness

Guba and Lincoln (1994) propose that it is necessary to specify explicit ways of establishing the quality of qualitative research that provides an alternative to reliability

Stage	Description	Processes and Coding
1. Data immersion	Becoming acquainted with the data and its prominent broad ideas	Data carefully and thoroughly read; assisting loose notes taken on general ideas implicit on the data (“PETE support”; “Mentoring”)
2. Generating initial codes/data labels	Taking the concept “Influential elements” as a reference, analytical fracturing of data into smaller units that capture concepts/ideas	Initial categories were generated (with regard to mediation of preservice teachers’ teaching practices by cooperating teachers: “Cut off autonomy” or Alignment; pressure to follow school curriculum”
3. Establishing and defining category properties	A sounder characterization of codes/assigning them properties to become representative categories	“Cut off autonomy” property: “CT imposes lesson plan objectives”; agreement/disagreement points are denoted (“Cut off autonomy” had opposite properties to “Provide autonomy”.)
4. Deleting, merging, refining categories	Initial categories were relabelled into new comprehensive categories depicting both negative and positive properties	“Cut off autonomy”/“ Provide autonomy” are grouped into higher-order categories: “Modelling teaching practice”
5. Assigning units of analysis to categories	All information units were assigned to one category.	The excerpt “they need to consider the school’s educational project” was allocated to the category “CTs modelling”
6. Forming second-order themes	Taking the core theoretical concept of “Factor” in reference, categories and linked into broader themes	“Modelling teaching practice” by cooperating teachers and “Bridge with PETE models” by the university supervisor are aggregated into the factor labelled as “Mentoring”.
7. Theoretical input and forming first-order themes	Themes are revisited in a dialogic interplay between the properties of the emergent categories/ themes and the theoretical concepts (“multi-layer systems”)	“Mesosystem: Programme mechanisms, school culture and organization, and mentoring”.
8. Calculate the percentage of information units that fall into each category	The goal was to see what proportion of data excerpts fitted in each first-order theme	13% of data excerpts were allocated to the theme “School organization, culture, and curriculum”
9. Charting interplay patterns across previously coded data	Explanatory structures and relationship patterns are formed between the coded system-related influences and the observed PTP	PTP consisting predominantly of skill-drills PE activities were interconnectedly influenced by macrosystem (social distancing regulations), microsystem influences (only half class participated at a time) and personal attributes (level of time investment in planning PE activities)

Figure 1. Steps of the mixed content and thematic analysis (Braun & Clarke, 2019).

and validity as they are ascertained in quantitative research. Several procedures were used to assure the quality of research. First, the prolonged participation in the social setting of the phenomenon and the ongoing, iterative, and intertwined process of data collection and analysis allowed the researchers to ensure a high level of congruence between the concepts derived by the data and the respective inferences drawn (internal validity). Second, multiple accounts of the social reality in the study were gathered through several data sources (data triangulation) and the data analysis process was subject to member validation. The PSTs, the CTs and the supervisor were provided with an account of the findings to seek corroboration or correction of the interpretations made (credibility). Data analysis also underwent an “auditing” approach (Bryman, 2012). Led by the first author, the analysis was carried out collaboratively by several members of the research team. Verification of interpretation was performed by collecting new data (e.g., during the ensuing FG). The data was also subject to peer checking analysis. Two qualitative researchers unrelated to the study were asked to examine some samples of the original data and to allocate the different pieces of data to the different categories (“checking themes:” Braun & Clarke, 2019). Potential divergences were debated until consensus was reached, in some cases leading to the relabeling of some categories and themes.

Ethical considerations

Prior to the study, ethical authorization was obtained from the Ethical Committee of the host university. At the beginning of the school placement, the research team met with the entire group of PSTs, presented the study, provided a thorough explanation of the objectives and procedures, specified the participants eligibility criteria, and asked for volunteers. The procedures were repeated for the remaining participants (CTs and supervisor). It was explained that all participants could withdraw from the study at any time. After stressing the requisites of anonymity and confidentiality, the informed consent based on the Declaration of Helsinki was signed by all parties.

Results and discussion

Three main themes were generated from the data to respond to research questions 1, 2 and 3, respectively. The first theme maps the influential factors and respective systems. The two following themes offer an integrated analysis of the nature of the observed PTP, the multi-system factors that influenced PTP, and the interplay between the various systems factors. The narrative in themes two and three progresses in reference to the literature and to the data in theme one and respective excerpt number marked with a # in the column “Data excerpt examples” (Figure 2). While theme two addresses the mainstream PTP and respective interplay of influences, theme three uncovers patterns of differentiated PTP and respective interplay of systems influences. Figure 3 helps answer research questions 2 and 3 by providing a schematic representation of the interplays between the systems factors affecting PTP.

System	Influential Factors	Influential Elements: Constraining (-), enabling (+), undefined (?) influences	Data units % ^a	Data excerpt examples
Macro	1. National lockdown regulations	(-) (FFL) Social distancing rules; (DL) national lockdown (home confinement); (DL) data protection laws	15%	#1 National lockdown regulations: (F2F) <i>The interpersonal contact between students in face-to-face classes should be reduced to a minimum</i> (September 2020); #2 (DL) <i>All teaching activities must take place in a distance-learning regime (January 2021)</i> ; #3 PST27: (according to data privacy law) <i>Students were not obliged to turn on their cameras.</i>
	2. National and school Curriculum	(?) (FFL/DL) Holistic PE developmental goals	7%	#4 Curriculum guidelines: <i>'Critical and creative thinking'; 'Personal development and autonomy'; 'Reasoning and collaborative problem-solving'; 'physical, motor, cognitive and social-emotional essential learning outcomes'</i> ; #5 CT4: <i>They seem to be prepared for teaching swimming but the school does not offer that possibility.</i>
	3. Experiential learning (course units)	(FFL) Experiential/active learning: (+) micro-teaching/(-) no micro-teaching; (+)(FFL) "Living the curriculum"/(+)(FFL) Peer-teaching/cooperative learning; (DL)(+) Video-based learning; (-) no training to teach PE in DL format	15%	On training experiences lived in the first-year course units (a) PETE training in a FFL format - #6 PST25: <i>There was little micro-teaching, we only taught three swimming lessons to a group of sixth-grade students.</i> #7 PST11: <i>Professor X applied Sport Education, my leadership skills improved when I coached my group mates. I wanted to develop that enthusiasm in my students (later during the school placement).</i> (b) PETE training in a DL format - #8 CT6: <i>They lacked explicit technological training on how to teach PE in DL formats;</i> #9 PST5: <i>We learned handball tactics much better through video-records analysis of real PE students playing.</i> #10 CT5: <i>They spend little time at school planning their lessons, PST14 rushes off to teach at a gym, PST15 is coaching at the club.</i>
	4. Extra-school professional obligations	(FFL/DL) (-) Extra school professional occupations: coaching/fitness-trainers/other jobs (cashier at the supermarket)	5%	#11 CT2: <i>Experienced athletes and youth coaches show better error detection ability from the start.</i> #12 CT7: <i>Prior undergraduate training is key. PSTs coming from our faculty show greater content knowledge than others. That are good in error detection feedback.</i>
	5. Sport and educational background	(FFL) (+) higher/(-) lower content knowledge; coaching/athlete experiences; quality of institution provenience (under-graduation training)	5%	#13 CT12: <i>The 90-min lessons were cut down to 45-min. We had to enact very effective task transitions to get more practice time.</i> #14 CT2: <i>PE has a long tradition here. The principal did not interfere in the PE content.</i> #15 PST17: <i>All forms of game-play were banned/CT5: Only isolated skills practice was allowed.</i> #16 CT2: <i>The school no longer offers swimming lessons because the local swimming pool is under construction.</i>
Meso	6. School organization, culture, and curriculum	(-) (FFL) PE time cut down; (FFL) (-) low PE status: no content selection autonomy (mandatory skills-drills); (+) high PE status: content selection autonomy (basic game forms allowed)	13%	#17 PST1: <i>We observed and reflected on every lesson taught by our fellow PSTs/ PST8: My peer-teaching activities were based on strategies used by my mates;</i> #18 PST14: <i>PST15 showed me how to use App S.</i> #19 PST17: <i>We had a basic understanding of Cooperative Learning (developed in the first-year PETE units). Yet, studying the model in greater depth (during the self-study research project) to apply it in the DL context allowed me to generate greater social development during the group activities (online breakout rooms).</i> #20 CT4: <i>I prompt them to make their own decisions (...) though, they need to consider the school's educational project;</i> #21 CT7: <i>I believe that PSTs learn best if they make their own decisions and deal with the consequences of these; even in cases where I could have proposed a richer (educationally) PE task;</i> #22 Field notes: <i>CT2 is an Orienteering expert; he showed the PSTs how to carry out an exhaustive topographic survey of each student's home surroundings and presented several Apps that allow to monitor, in real time, the distance ran by children;</i> #23 PST21: <i>Sometimes the CT was not able to support us on the on-the-spot problems felt when implementing Sport Education (pedagogical model);</i> #24 PST21: <i>He (CTx) couldn't help us with the technologies;</i> #25 PST12: <i>He (US) is an expert in student-centred models. After the first meeting (post-lesson observation) I finally understood how I could apply more student-centred strategies even during skills-drills tasks.</i>
	7. PETE embedded support mechanisms	(+) (FFL/DL) peer-modelling/collaborative professional development (+) (DL) research-based professional development	3%	#26 Field notes: (PST1) <i>Physical activity levels are short. The (gym) space is narrow and only half of the class is physically active at a time;</i> #27 PST11 <i>breaks the lesson constantly because several students struggle to breath with their masks on;</i> #28 PST19: <i>Fixed groups of students went to the changing rooms in shifts. We lost 20 minutes of every lesson.</i> #29 PST12: <i>Some students didn't have space (to practice) in the living room;</i> #30 PST21: <i>They couldn't do squats because their younger siblings were sleeping next door.</i> #31 Field notes: <i>In School B, the classroom is now the perimeter surrounding each student's home. Students run outdoors for several kilometres ticking the control bases (Orienteering), monitored life through App S (control codes). Communication channels (PSTs/CT-students) are constantly kept via App W.</i>
	8. Mentoring	(FFL/DL) CTs modelling: (?) alignment with school curriculum expectations; (+) knowledgeable support; (-) no knowledgeable support (FFL/DL) (+) US modelling (support/alignment with teaching models taught in PETE course units)	11%	#32 Field notes: <i>PST2 engages student in filming their mates' handball skill trials and then meet to analyse it (...)</i> PST13's <i>students could be more committed and cognitively engaged in the isolated skill-tasks with the use of iPhones for peer performance analysis;</i> #33 PST21: <i>The laptop displayed a too narrow image. Students couldn't watch my demonstrations/</i> #34 PST15: <i>To motivate them, I performed the entire workout-plan together with them, so I couldn't provide on-the-spot feedback.</i> #35 PST11: <i>Students uploaded the videos of their fitness tasks on the (digital) platform. I analysed every video and sent them individualised feedback every week. This improved my feedback skills.</i>
Micro	9. Classroom and environment	(-) (FFL) Half-class format/health safety restrictions (low physical activity levels) (-) (DL) Urban locations ('living room as the classroom'); (+) rural locations ('home surroundings as classroom')	15%	#36 CT7: <i>The teaching methods training (first PETE year) is critical but more-and-more what differentiates the educational richness presented to students is PSTs' intellectual brightness and investment in studying and planning 'outside-the-box'.</i> #37 PST11: <i>Cooperative learning was something we really wanted to do. We created (digital) breakout rooms for students to work on their (dance) choreography interactively as a team.</i> #38 CT1: <i>They (PSTs) may have the same academic background but have different individual digital skills. The more technologically literate PSTs delivered more innovative and motivating lessons.</i>
	10. Technology	(+) (FFL/DL) Enhanced content-delivery/instruction (-) (FFL/DL) Impoverished content-delivery/instruction	5%	#39 PST12: <i>Some students didn't have space (to practice) in the living room;</i> #30 PST21: <i>They couldn't do squats because their younger siblings were sleeping next door.</i> #31 Field notes: <i>In School B, the classroom is now the perimeter surrounding each student's home. Students run outdoors for several kilometres ticking the control bases (Orienteering), monitored life through App S (control codes). Communication channels (PSTs/CT-students) are constantly kept via App W.</i>
Individual	11. Personal attributes	(+) (FFL/DL) Personal skills: Intellectual, work ethics, theoretical study, planning effort (+) (FFL/DL) Conceptual commitment to apply PETE pedagogies (DL)(-) Poor digital skills (boring lessons); (+) sound digital skills (motivating lessons)	6%	#39 PST12: <i>Some students didn't have space (to practice) in the living room;</i> #30 PST21: <i>They couldn't do squats because their younger siblings were sleeping next door.</i> #31 Field notes: <i>In School B, the classroom is now the perimeter surrounding each student's home. Students run outdoors for several kilometres ticking the control bases (Orienteering), monitored life through App S (control codes). Communication channels (PSTs/CT-students) are constantly kept via App W.</i>

^a Retrieved July 17, 2021, from <http://www.dge.mec.pt/educacao-fisica>

Figure 2. Summary of influential factors and respective elements (constraints and enablers) on Preservice teachers' teaching practice and respective data excerpts.

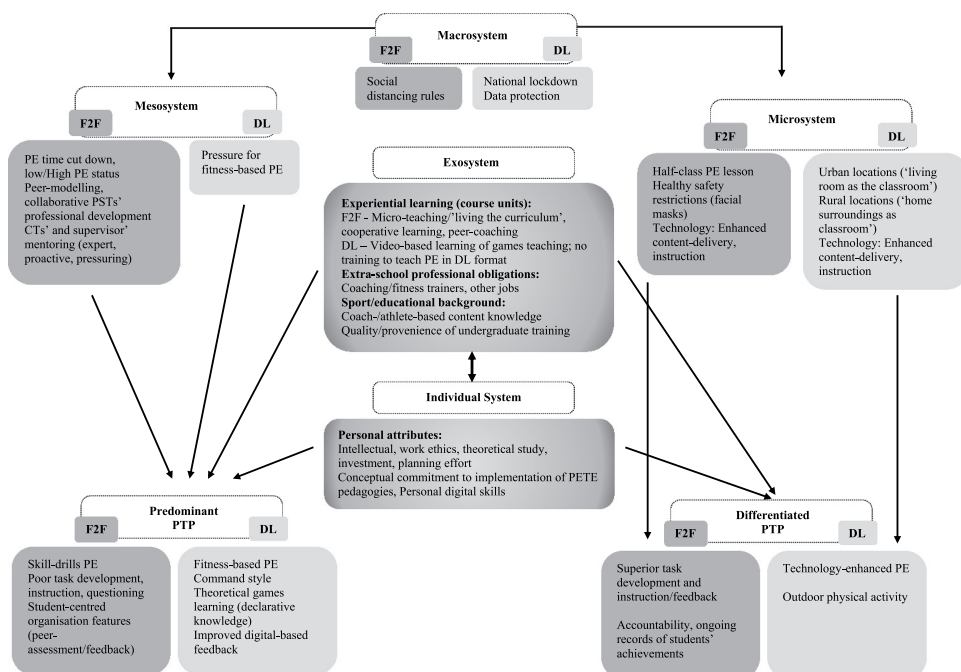


Figure 3. Schematic representation of the interplay between interacting factors that influenced the predominant and differentiated PTP.

Mapping the multi-system influences on PTP

Figure 2 provides a mapping of the macrosystem, exosystem, mesosystem, microsystem, and individual factors considered to be influential on PTP. The data is presented in a summarized manner through excerpt examples (“Data excerpt examples”).

The columns “System” and “Influential factors” depict 11 influential factors (main themes, e.g., “Macrosystem: Lockdown regulations, curriculum, and assessment;” or “Exosystem: Experiential background and alignment”). Each influential factor contained a set of discrete influential elements. The 30 influential elements included 15 facilitating/enabling elements (e.g., “school autonomy decisions on PE format”; F2F: N = 5; DL: N = 3; F2F/DL: N = 6), 14 constraining elements (e.g., “no micro-teaching during course units”; F2F: N = 6; DL: N = 5; F2F/DL: N = 2), and 2 undefined influences (e.g., “alignment with school curriculum expectations”; F2F/DL: N = 2).

Several findings in the present study resonate with findings in the study by Gemmink et al. (2021) who researched the multi-system influences on the teaching practice of in-service primary teachers. Gemmink et al. (2021) uncovered macrosystem influences on teaching practices that were related to educational accountability and curriculum standards, mesosystem factors that were related to school organizational features and culture (which subtly “pressured” teachers to follow certain pedagogies advocated by the school), and microsystem factors that were related to professional development opportunities occurring through spontaneously collaborative interactions between teachers. Gemmink et al. (2021) further revealed the existence of a “chain of pressure” triggered by the school audit process (Inspectorate of Education) with significant increases in teacher bureaucratic workload.

This reduced time for more careful preparation of classes with an impact on teachers' actual classroom teaching performance. In a top-down fashion, the school directors imposed on the teaching staff the curricular guidelines valued by the Ministry of Education (e.g., the implementation of more inclusive teaching practices), resulting in momentarily changes in teachers' practice, but without these practices being incorporated into their professional praxis. In short, some teachers integrated more inclusive pedagogies into their classes almost exclusively at times that they knew to be formal periods of assessment of their teaching activity.

Although the various systems (macro, meso, micro) found in Gemmink et al. (2021) have also manifested in our study, the pandemic circumstances gave rise to a differentiated profile of influencing elements. Macrosystem influences such as curriculum guidelines (i.e., holistic PE goals) were also perceived. However, the most impactful macrosystem elements were the regulations placed by the national-wide social distancing rules (F2F) and home confinement (DL). This set of circumstances imposed on PSTs the obligation to plan and deliver PE activities that maintained interpersonal distance during F2F, and, in the second term, almost all schools (except for one school in a rural setting) required the implementation of "virtual PE classes" in the DL format. This had shaped markedly the "classroom" microsystem conditions to the detriment of learning opportunities provided to PE students (see next themes). Namely, most of the PE activities in F2F consisted of isolated skill-drills tasks due to the prohibition of students sharing objects (balls) and space to maintain social distancing in the gym. In DL, the PE classes involved fitness-based activities operated under poor environmental conditions, for they took place in the students' living spaces while hindered by intrinsic limitations to the use of technology (i.e., poor quality of the Wi-Fi or technological devices in students' homes). Also new was the fact that often the image and data protection law (macrosystem) was a strong constraint on the PSTs' ability to interact pedagogically with their students because they were not required to turn on the cameras. Conversely, in Tarchi et al.'s study (2022), with PSTs in the role of students (during DL course units in general education studies), the PSTs found some benefits in these restrictions. The online classes and digital resources offer them some sense of privacy and decision-making to how much they wished to expose themselves in the class.

Predominant PTP and multi-system influences

Field notes: School A, PST12

The class is 'split in half,' students take turns, half class is physically active, the other half is sitting. PST12 took this opportunity to engage the non-active students in observation, taking records and in providing peer-feedback before their turn in the drills practice. However, in both turns, students spend 15 minutes, grouped in lines, performing the same uninterrupted circuit of handball drills. Shooting at the goal from the left side, a zigzag dribbling through cones, self-passing at the wall then back again to shooting at another goal. One-size-fits-all, there is no differentiation, variability, or a progressive sequencing of the level of complexity of the technical drills. Most students disengage from the task long before it is finished.

The above excerpt represents the prevalent profile of PTP captured by documental analysis and lesson observation of PSTs during F2F. In this period, "game-based activities were practically inexistent and fully replaced by skill-drills PE" (PST21). In addition, it was possible to denote immature PTP containing instructional and content development issues:

“poor error detection and quality feedback,” “lack of modified tasks to meet different learning needs,” “much direct instruction, low questioning,” or “immature task presentation” (Field notes, supervisor’s records, post-observation meetings) (see also Silva et al., 2021). Conversely, as examples of PE activities found with more active involvement of students in the learning process were the implementation by many PSTs of student-centered lesson organization features based on “students” participation in persistent teams and peer-assessment interactions, both in team (basketball) and individual sports (athletics)” (supervisor’s notes).

Such PTP profile was not unique to the pandemic circumstances in this study, for it has mirrored previous teaching practices uncovered by PETE research in non-pandemic times. In a systematic review on PSTs’ school placement experiences, Silva et al. (2021, p. 809) identified several pedagogical shortcomings in PTP. Besides poor managerial skills exhibited during implementation of games-based practice (“for having students running around the playground”), PTP tended to reveal conceptual confusion regarding the pedagogical principles of the teaching models learned in the course units, tended to show low pedagogical content knowledge and consequent inability to design appropriate modified games, and inefficient student engagement in decision-making processes (leadership roles, collaborative problem-solving, student-designed tasks). Prior research has linked such PTP profile to the inability of CTs and supervisors to provide expert mentoring (mesosystem) (Calderón & MacPhail, 2021), but essentially to exosystem influences related to the lack of development in the PSTs of in-depth knowledge of the subject content during the teaching preparation course units (Ward & Ayvazo, 2016), and to the PSTs’ anticipatory socialization experiences (e.g. their upbringing as athletes embedded in autocratic, directive, teacher/coach-centered pedagogies) (Silva et al., 2021).

However, as a novel finding, the data showed that PTP was shaped by a complex web of interactions occurring between several influences emanating from various systems. Particularly during F2F, possibly the most self-evident interaction occurred between the exosystem and the mesosystem. A misalignment was identified between the PETE curriculum and sport content training taught to PSTs (exosystem) and the curricular mesosystem possibilities actually found in their school placement. PTP was influenced either by the (un)available infrastructures (#16) or level of autonomy of PE departments at each school in defining the curriculum and format of PE activities (#14/15):

PST23: The micro-teaching training prepared me for teaching swimming but there was no swimming in my school’s curriculum.

PST17: We’re well trained (in the handball course unit) in a tactical, games-based perspective. But then, we could only teach skill-drills.

In addition, the influence of the macrosystem was critical (F2F: the mandatory social distancing norms, #1; DL: national lockdown, #2/3). It greatly influenced the school mesosystem organization as the PE practice time was cut down in all schools due to time lost during application of health safety regulations (#13). This also had critical implications in the shaping of the microsystem conditions at the “classroom level” by the adoption of half-class participation formats (#15). The PTP was additionally influenced at a macrosystem level in the form of the national curriculum guidelines (holistic objectives of PE, #4). All the analysed lesson plans identified, at least, the PSTs’ pedagogical intention

to promote multidimensional development of PE outcomes (motor, physical activity, psychosocial, sport culture and cognitive goals).

Despite the various macro, meso, and microsystem-related influences, the PSTs manifested an adherence to teaching PE based on student-centered models (e.g., Sport Education). In this respect, the (enabling or constraining) effect of the exosystem on PTP emerged as particularly influential, especially, the nature of the pedagogical training and experiences lived by PSTs in the course units. The model-based, student-centered PETE training positively influenced the PSTs in their following school placement attempts to implement student-centered pedagogies in their PE classes (#7). In this process, the PSTs felt as prepared (or not) for teaching particular sport content as the level of experiential learning (micro-teaching, cooperative learning) they have previously had (or not) in the different course units (#6/9). These findings strengthen the educational value of engaging PSTs in “Living the Curriculum” experiences during pre-school placement course units (Deenihan et al., 2011). Its “two-in-one” format (teaching/learning a model integrated with teaching/learning a particular sport content) allows the teacher candidate to experience first-hand the role of a student engaged in the model (relating empathically to the feelings, experiences, and enthusiasm to be potentially experienced by their future students). Concurrently, there is a deeper processing and cognitive engagement with the transformation of the specific sport content through student-centered dynamics (peer-teaching, collaborative problem-solving of case studies) (Calderón & MacPhail, 2021). In addition, the pivotal role PSTs have assigned to peer-, micro-teaching and discovery-learning experiences corroborates evidence that teacher candidates typically express a preference for practical, hands-on learning/teaching, which they consider more useful (Calderón & MacPhail, 2021). This reinforces the benefits of engaging future (an in-service) teachers in active, critical, collaborative, and meaningful learning activities in their training to teach PE both in F2F and DL formats (Calderón & MacPhail, 2021).

However, the abovementioned exosystem factors (course units training) interacted, shaped and were shaped by additional factors to influence PTP. On the one hand, microsystem conditions (classroom circumstances) changed drastically, compared to typical pre-pandemic PE lessons (#26/27/28), to present unexpected challenges to school boards and organization, to mentors (CTs and supervisor) and PSTs (O'Brien et al., 2022). On the other hand, PTP was markedly influenced by several mesosystem influences such as the school organization, culture, and curriculum (#13/14), the support mechanisms embedded in the PETE programme (e.g., PSTs modeled each other's practice through collaborative interactions emerging from extended group work) and, importantly, by the active mentoring from the CTs and the supervisor regarding the implementation of the PE programme guidelines (#20/22).

During DL, there was a general impoverishment of the pedagogical wealth of the PE activities offered to students by their PSTs when compared to F2F. There was a generalized disruption of students' active engagement in their PE learning experiences and lower implementation of student-centered dynamics. This was influenced by the dominant pedagogical intention and PTP of having “students engaged in as much physical activity as possible within the ‘time slot’ of the PE lesson” (CT8). This occurred “primarily through fitness-based activities delivered during synchronised online classes taught through command instruction by PSTs themselves or by “virtual instructors” (digital resources, e.g., “youtube - Tabata workout”) (supervisor's notes). Nonetheless, our PSTs did point out

certain opportunities for improving their teaching afforded by the DL circumstances (Tarchi et al., 2022). The delayed feedback afforded by technology allowed some PSTs to improve their feedback provision (#3).

The lack of explicit training during course units (exosystem) on how to teach PE specifically in the DL format was one of the shortcomings most strongly emphasized by PSTs (#8). These results partially align with Tarchi et al. (2022) study of the potential advantages/disadvantages of F2F compared to DL related to teacher preparation experiences prior to school placement teaching. The student-teachers deemed F2F teaching preparation activities to be overall more beneficial than DL. Conversely, DL included greater comfort (“it is often uncomfortable to sit there for hours; not having a compulsory attendance policy”) and provided more room for individual management (as students “have more time to do other things”). The advantages of F2F were most evident in developing greater institutional identity (“helps to experience the university dimension as a physical space”), there was less reliance on technology (“not everyone necessarily has a personal computer”) and benefited their social connections (“during discussion it is easier to pay attention to non-verbal cues;” “I am more inclined to talk and ask questions in F2F class”).

Again, a strong interplay between various interacting system influences was noted. Specifically, the influence of the mesosystem was manifested in multiple ways. Firstly, many CTs, especially those that seemed to enact a more directive mentoring style, pressured their PSTs to engage students in as much physical activity in the lesson time slot as possible (#22). This was “detrimental to PSTs’ implementation of collaborative and discussion activities among students” (Field notes). Secondly, most CTs were unable to provide specialised technological support for PSTs to innovate their PTP (#24). Thirdly, the microsystem conditions of DL alone, highly dependent on technology, and the issues naturally emerging from the use of these tools, as well as the circumstances of the students’ family dynamics and their living space (#29/30) placed several constraints on PTP development. However, it should be noted that such interplay of circumstances also afforded opportunities for PSTs to enhance their PTP. The PSTs felt they had improved their feedback quality and individualization, as “the complexity of fitness-based content is relatively low, and also not having to spend hours traveling to the school gave us more time to plan the activities and above all to invest more in the feedback given to each student” (PST9).

Differentiated PTP and multi-system influences

The pandemic circumstances posed challenges to PSTs markedly different from the conditions and problems PSTs (and their mentors) had typically encountered in the past in the process of PSTs’ professional development in school placement. However, even under “such unprecedented circumstances,” the CTs and the supervisor considered that “several PSTs could still have presented more innovative and richer PE activities” (CT7). Indeed, besides the mainstream PTP depicted in the previous theme some PSTs were able to present differentiated PE proposals to their students:

Field notes: School A, PST2

PST2 created multiple circuits for teaching handball skills. Students spend a balanced time slot practicing each task (about 5-min). Tasks have different complexity (standing shoot, jump

shoot) and at every 10 trials each learning group receives peer-feedback from the classmates waiting off-task. They then decide to either progress to a more complex task or stay and practice that skill a bit more. She also delivers very specific, cues-based information.

Post-observation meeting

Supervisor: The tasks diversity was interesting. Where did that come from?

PST2: I'm used to teach many of these drills at my club (she's a youth handball coaching).

School C, PSTs 14, 15, 16

This is one of the only two schools where game-based tasks are allowed. However, no student engaged in actual 1 on 1 (badminton) game-play. Children had no opportunity to tactically explore and comprehend the game. (Post-observation session)

These excerpts uncover a pronounced interplay between the exosystem and mesosystem. Specifically, schools C and E were the only two schools that allowed for game-based PE activities. Yet, all PSTs in these schools (PSTs 14, 15, 16; PSTs 21, 22, 23, respectively) still opted to adopt skill-based instructional approaches. Moreover, the data triangulation uncovered the influence of exosystem influences as these were some of the schools in which the CTs reported a lower investment by their PSTs in the hours spent at school in studying and planning the PE activities. This event was associated with the extra-school professional obligations of these PSTs (exosystem, #10). There was also an interaction with the CTs' mentoring process (mesosystem) as in these schools the CTs seemed to lack expert knowledge in the specific pedagogies taught to PSTs in the PETE curricular units (e.g., game-based approaches). These CTs might not have been (or felt) able to help PSTs to transfer what they learned in the course units to the school placement (#23) (Valério et al., 2022).

However, the fact that some of the PSTs who presented differentiated PTP (displaying greater instructional maturity and higher active engagement of students in learning) still operated under similar conditions (also had professional obligations beyond school) to other PSTs who have not done so, suggested the existence of a differentiating profile of influences. In the particular case of PST2 (and a few others alike), she was currently a handball player and youth coach (#11). Indeed, the personal sporting and coaching background of PSTs was an exosystem element stressed by CTs and PSTs as a precursor to higher content knowledge and basic pedagogical skills (#12). Firstly, this suggests that PTP was strongly influenced by PSTs' occupational socialization experiences (Silva et al., 2021). Secondly, it also highlights the very particular cultural characteristics of the coach education programmes in place in the country where this study was conducted. Indeed, in Portugal, most coach education programmes occur at an higher education level (i.e. sport sciences undergraduate courses) and are strongly oriented toward development of sport-specific content and pedagogical knowledge (Mesquita et al., 2022). Consequently, thirdly, the repertoire of experiences and skills lived in these coaching courses may somewhat mitigate the lack of practical micro-teaching experiences that may eventually be absent from PETE course units. Fourthly, the need for PETE to continue to invest in the in-depth development of content knowledge in teacher candidates is reinforced, for this may lead to the higher pedagogical content knowledge that is embedded in many facets of PTP (unit planning, tasks type, instructional intervention) (Ward & Ayvazo, 2016).

As an additional relevant finding, the differentiation of PTP during the DL period uncovered a marked interaction between microsystem conditions and PSTs' personal attributes as influencing elements of PTP. In the following excerpt, the PTP observed in school B stood out among the various schools by the fact that it was the only one located in a rural context. The microsystem conditions were utterly differently as it was the only school where the PE included outdoor activities on the periphery of each student's home. Concurrently, the CT at this school showed a more proactive mentoring style and had high technological expertise. This was influential on the innovative PE activities that PSTs presented to their students:

Supervisor's notes: CT2's technological skills, combined with his expertise in orienteering outdoor activities is impressive. PSTs 4, 5, 6 are using GPS tracking systems to monitor and score the distance run by each student in real time. As the activity progresses, CT2 shows how PSTs can use app W. to offer timely feedback to students.

These findings underscore the importance of PETE programmes providing specialised training in the digital pedagogical skills that PSTs need for effective teaching in DL contexts. Evidence from PSTs engaged in training programmes based on the Technological Pedagogical and Content Knowledge (TPACK) (Koehler & Mishra, 2009) framework reported gains across several digital knowledge domains. PETE programmes are thus advised to consider a sound pedagogy of technology (Calderón et al., 2020) with the potential to promote the highest level of teacher reflection and knowledge retention through online micro-teaching with virtual classroom technology, making final assessments through video-based case studies. Web conferences and online forums are important for engaging critically with different educational issues and connect with course content through practical videos focused on authentic classroom situations (Casey et al., 2017).

Conclusions

This study showed that PTP is complexly, multidimensionally, and interconnectedly influenced by a web of influential multi-layered systems, factors and respective elements.

In response to research question 1, what influences PTP in pandemic times, the PTP was strongly mediated by the macrosystem mandatory regulations, but also by the nature of the mentoring provided to PSTs and by the situated conditions that each school's organization (mesosystem) imposed on the microsystem conditions of the PE "classroom." Regarding research questions 2 and 3, the unique circumstances of the COVID-19 pandemic uncovered a set of interacting system influences. PSTs' personal attributes and certain exosystem elements related to their life history might help aspirant teachers overcome potential constraints imposed by the macrosystem (confinement regulations) and mesosystem (school organization of PE activities).

Elements such as the nature of CTs' mediation and the type of preparatory training received pre-school placement (strategies for actively engaging PSTs in knowledge construction) had a critical influence both on the predominant PTP and on the differentiated PTP.

Even though the placement of PSTs in collaborative knowledge-sharing contexts (due to working in groups in schools) was a marked influence, the PTP seems to be strongly mediated by the personal attributes of each individual PST (their background as a coach or even the higher education instituting where they underwent their initial bachelor's degree training).

In addition, the heavily fitness-based PE lessons applied during DL seemed to have diminished the achievement of multidimensional outcomes (cognitive, social, personal responsibility). The PSTs struggled to apply in the DL the same pedagogies they have learned during their course units for teaching PE in regular F2F conditions. Again, the personal attributes (individual technological skills) of each PST and the expert mediation by CTs was suggested to compensate for a potential lack in PSTs' digital skills.

As recommendations for PETE programmes, it may be conceivable to include specific content knowledge development related to technology use (i.e., TPACK) as standard training practice. This study also reinforces the need to continue to develop PETE teacher education practices that promote (future) teachers' pedagogical flexibility, creativity, and with the ability to adjust teaching practice to the diverse, unique, and impossible to predetermine conditions of each PE teaching context.

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