

Hybrid professional development systems in physical education: How problem-situations foster teachers' reflective practice

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Abstract

The advent of digital learning technologies is paving the way for innovative approaches to enhance teacher professional development by integrating face-to-face interactions with online learning experiences. Nevertheless, the extent to which these hybrid systems facilitate the development of reflective practices among educators, particularly in the realm of physical education, which necessitates rapid decision-making, dynamic engagement, and practical problem-solving, remains ambiguous. This integrative review examines the potential of hybrid professional development frameworks that are anchored in authentic problem scenarios to foster reflective practices among physical education instructors. Adhering to PRISMA guidelines, we identified and analyzed sixteen studies sourced from prominent international databases, employing a qualitative synthesis complemented by a methodological evaluation through the Mixed Methods Appraisal Tool (MMAT).

The findings identify four interdependent mechanisms: (1) practice-based anchoring of reflective learning through authentic professional dilemmas; (2) stabilization of teaching activity through digital artefacts such as video and annotation tools; (3) collaborative inquiry processes within synchronous and asynchronous hybrid environments; and (4) generation of decision-making alternatives as indicators of reflective transformation.

Based on these results, the article proposes the H-SPTR framework (Hybridization–Situation–Praxis–Temporality–Reflectivity), a scalable conceptual model explaining how hybrid training systems may support reflective professional development.

The study highlights implications for designing low-cost technology-enhanced teacher training systems, especially in practice-oriented disciplines and resource-constrained educational contexts.

Keywords: Hybrid professional development; Reflective practice; Physical education; Educational technology; Teacher learning; Blended learning

1. Introduction

Educational systems increasingly require scalable and cost-effective professional development solutions capable of improving teacher practice under changing institutional and technological conditions. Advances in digital learning technologies have accelerated the emergence of hybrid professional development systems combining face-to-face and online modalities. These systems create new opportunities for flexible, sustained, and practice-based teacher learning beyond conventional workshop models [1], [2].

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In Morocco, this dynamic is embedded in a particular curricular and institutional trajectory. Strategic Vision 2015–2030, Framework Law 51.17, and the OP 2007–2009 have initiated the transition toward innovative approaches, positioning the learner as an actor in the construction of knowledge through purposeful and contextualized tasks. In this perspective, the problem-situation constitutes the core of the didactic device, as far as it engages the student in an activity mobilizing varied resources to overcome a cognitive, motor, or strategic challenge or obstacle.

In contrast, continuing professional development for teachers remains structured around transmissive formats centered on top-down themes, neglecting the analysis of teaching practices and the exploration of professional dilemmas generated by problem-situations. This situation is particularly problematic in Physical Education (PE), a highly practice-based discipline, where teacher competence is manifested in the ability to act within motor situations marked by uncertainty, risk, interactional dynamics, and the necessity to make immediate decisions. In this framework, the capacity to analyze one's own professional action and to derive learning from it constitutes a central issue that numerous studies have associated with reflective practice [3], [4], [5]. This competence appears particularly salient in disciplines confronted with uncertain and highly situated didactic situations involving a bodily dynamic such as Physical Education [6], [7].

However, the integration of the problem-situation as an object of reflection in continuing professional development can only be achieved through mediations and conditions seeking to overcome institutional, organizational, and cultural constraints (representations and resistance to change...etc.) The rise of hybrid systems, articulating face-to-face and distance modalities, opens opportunities to extend analysis and reflectivity over deferred periods allowing the combination of action, analysis, verbalization, and projection. Recent studies emphasize that hybrid formats make it possible to articulate synchronous and asynchronous temporalities, fostering extended spaces for analysis and the co-construction of professional meaning [8], [9]. These studies highlight the importance of an intentional structuring of digital artefacts to support learning anchored in real practice rather than a mere technological transposition of traditional training formats.

At the same time, several studies show that video and hybrid training systems make it possible to preserve traces of real work and to support an in-depth analysis of action, both in initial teacher education and in continuing professional development. However, the literature remains heterogeneous regarding the pedagogical and instrumental mediations mobilized to support reflectivity. Moreover, existing works remain dispersed across several traditions (initial training, professional development, video-based training, peer inquiry, experiential learning, and the didactics of activity), which makes it difficult to define "reflectivity" in hybrid training contexts in PE, as well as to understand the pedagogical, social and instrumental dimensions associated with it.

This review considers Physical Education as a favorable field for studying the mechanisms through which hybrid devices can foster the evolution of reflective practice in the professional environment. The objective is not only to provide a description, but to offer an interpretative framework that could, consequently, enrich the design of training devices in other action-oriented professional contexts.

The question guiding this review is as follows: How do hybrid devices mobilizing problem-situations support the development of reflective practice among PE teachers?

At the epistemological level, this study adopts an integrative review approach with an explanatory focus, aiming to identify and model the mechanisms through which hybrid professional development settings support teachers' reflective practice.

1.1. Theoretical foundations

The conceptual proposition developed in this study is grounded in three complementary theoretical strands: (1) reflective practice in teacher education; (2) the problem-situation as a reflective mediation; (3) hybridity and digital artefacts as support for professional development. Their articulation makes it possible to situate the contribution of the explanatory mechanism H-SPTR (Hybridization – Situation-Problem – Praxis – Temporality – Reflectivity) within contemporary debates on professionalization in PE.

1.1.1. Reflective practice

Reflectivity has occupied a main place in teacher education since Schön, who distinguishes reflection-in-action and reflection-on-action while emphasizing their situated rather than solely cognitive character (Schön, 1983). In practice-based disciplines, reflectivity cannot be reduced to a simple introspective return to one's representations; it refers to the capacity to transform action through the analysis of real work under constraints. Several studies in teacher

education have shown that reflection tends to remain focused on technical gestures or on students' learning, to the detriment of examining meso-situated pedagogical decisions [11], [12]. In PE, this tendency is often highlighted in studies addressing video-centered reflectivity (Azevedo et al., 2024; Bjørndal, 2025). Approaches derived from work analysis [13], [14], [15] and from the clinic of activity [16], [17] emphasize the necessity of objectifying real activity through mediations (recordings, verbalizations, planning documents, self-confrontations), to enable a process of problematization. In this perspective, reflective practice is conceived as an instrumented activity oriented toward the re-enactment of action [18], rather than as an internal cognitive process or a personal trait.

1.1.2. The problem-situation as a reflective mediation

In professional didactics, the notion of the problem-situation refers to a configuration in which an obstacle compels the actor to reorganize their schemes of action [14], [19]. In PE, these situations frequently emerge when the constraints of the motor task (technical requirements, rules, material organization) combine with constraints related to safety, heterogeneity, or temporal regulation [20], [21].

Several authors have mobilized the problem-situation in professional didactics, demonstrating that it constitutes a powerful lever for revealing action schemes, provoking conceptualization in experience and supporting the analysis of real activity [15], [22], [23]. Studies show a limited exploitation of this potential. This limitation is partly due to their focus on students' learning rather than questioning teachers' professional transformation [24]. For his part, Mezirow (2001) emphasizes that dilemmas or dissonances experienced in practice represent powerful triggers of critical reflection, fostering a productive cognitive disequilibrium [25]. The problem-situation is therefore not a simple pedagogical exercise, but a triggering tool of reflectivity that provides access to the teacher's meso-situated decisions (management of rotations, calibration of difficulty, structuring of oppositions), and that makes it possible to question practice-based trade-offs between learning, motor engagement and safety [26]. This reflective mediation crystallizes these practical issues through digital artefacts and serves as support for dialogic inquiry work.

1.1.3. Hybridity, video, and inquiry in professional development

The literature on video-based training identifies video as a powerful artefact capable of "extending training on questions and problems of teaching" [27] and of breaking with devices focused exclusively on theoretical inputs [28]. Several studies in PE show that teaching activity is strongly situated, at the bodily and decisional levels (Fletcher, Ní Chróinín, & O'Sullivan, 2023), and that video-annotation and the confrontation with filmed traces support the analysis of activity and professional development [13], [29].

At the same time, studies in teacher education mobilize hybrid devices combining face-to-face and online activities to structure professional development cycles grounded in guided reflection, video, and peer exchanges [30]. These devices are embedded in an inquiry logic where teachers analyze situations, formulate hypotheses for action and discuss alternative possibilities [2], [31].

These points converge toward the idea that, in hybrid devices, video and digital artefacts ensure a function of instrumental stabilization of activity, whereas inquiry spaces (synchronous or asynchronous) ensure a function of extension and mediation of reflective work, aligning with the line of research on situated professional development [32], [33].

2. Method

2.1. Review design

This study is embedded in an integrative review approach with an explanatory aim, whose objective is to combine conceptual and empirical works to define a mechanism through which reflective practice is constructed in hybrid training devices in (PE). It is not an exhaustive literature review on reflectivity, but a targeted inquiry seeking to identify, within a limited corpus, the components of an explanatory model for the continuing professional development of PE teachers.

2.2. Sources of information and search strategy

The literature search was conducted between January and July 2025 in four international databases (ERIC, Scopus, Web of Science, ScienceDirect) and complemented by a manual search in specialized French-language journals. The last query was conducted in September 2025. The search covered the period 2004-2025, to encompass the recent development of video-based training, hybrid devices, and research on reflective practice in PE.

The keywords were defined based on the research problem and translated into English and French, then subsequently combined using Boolean operators (AND, OR). The example of a complete query used in Web of Science is presented below:

("reflective practice" OR reflexive OR "teacher reflection")*

AND

("physical education" OR PETE OR "physical education teacher")*

AND

("professional development" OR video OR "teacher learning")*

2.3. Eligibility and Exclusion criteria

2.3.1. Studies were retained when they met all the following criteria:

Peer-reviewed articles, scientific book chapters, or dissertations.

Studies focusing on: PE or practice-based disciplines presenting functional analogies, on reflective practice, teacher education, the problem-situation, critical incidents, pedagogical dilemmas.

Hybrid/Digital: integration of digital artefacts (video, video-annotation, online journals, platform, videoconferencing) within a hybrid device (face-to-face and distance)

Population: in-service PE teachers (continuing professional development) or in professional training

Empirical studies (qualitative, quantitative, or mixed) and explicitly argued theoretical contributions.

In the present review, the notion of “problem-situation” is mobilized in an extended sense, referring to any authentic professional configuration marked by tension, uncertainty or a decisional dilemma arising from real work. It thus includes situated teaching situations subjected to reflective analysis within hybrid devices or mediated by digital artefacts (notably video), as far as they engage a process of inquiry oriented toward the understanding and transformation of action.

2.3.2. Exclusion criteria:

Studies do not explicitly address reflectivity or professional development.

Studies focused exclusively on students unless they analyzed reflective mechanisms explicitly transferable to the professional development of PE teachers.

Works focused exclusively on teachers’ beliefs, attitudes or declared satisfaction, without analysis of activity.

Studies involving pre-service teachers were included only when the pedagogical situations reproduced authentic teaching dilemmas comparable to in-service professional contexts.

2.4. Selection process

In accordance with the PRISMA 2020 flow diagram [34], the selection process was conducted in several stages. Initially, all references identified through the databases (n=312). After removal of duplicates (n= 58), 254 references were subjected to a screening of titles and abstracts. At this stage, (n=221) references were excluded (out of scope). The remaining articles (n=33) were examined through full-text reading. At the end of this phase, (n=17) studies were excluded for the following reasons:

- Absence of empirical data or usable theoretical grounding (n = 6)
- Absence of an explicit link with professional reflectivity (n = 5)
- Non-hybrid devices or without significant digital mediation (n = 4)
- Conceptual duplicates or secondary publications (n = 2).

The final corpus therefore comprises 16 studies (N=16), including 10 empirical studies and 6 conceptual studies mobilized for their theoretical contribution to explanatory modeling. (Figure 1).

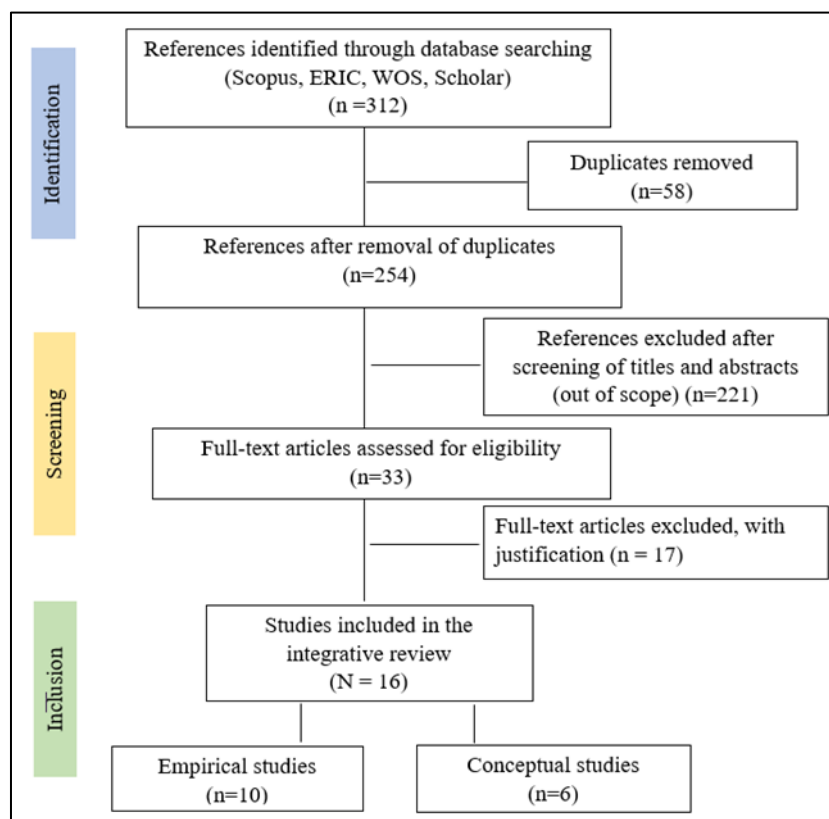


Figure 1 PRISMA process (adapted)

2.5. Methodological quality assessment of the studies

The 10 empirical studies retained were assessed using the Mixed Method Appraisal Tool (MMAT) [35]. Each study was independently examined by two reviewers according to the criteria appropriate to its design (qualitative, quantitative, or mixed). Divergences in appraisal were discussed until agreement was reached. A summary table of the MMAT scores is presented in **Table 3**.

The high scores (from 4/5 to 5/5), reflect the methodological coherence of the analyzed studies, despite major limitations related to small sample sizes and the absence of longitudinal follow-up. In accordance with the principles of integrative reviews, these scores did not serve as exclusion criteria, but as weighting indicators for the interpretation of the results. Their purpose was to nuance the conclusions according to the relative robustness of the studies.

The 6 conceptual studies addressing reflectivity in PE, the use of video in professional training and the conceptualization of instrumental mediations were retained for their theoretical operativity in the construction of the explanatory model (**Table 2**),

2.6. Data extraction and analysis

The data were extracted using a standardized analysis matrix (Table 1), structured around five variables: 1) author and year of publication; 2) Type of device; 3) Methodological design; 4) Reflective focus; 5) Main contribution to the H-SPTR model.

The data were analyzed according to two approaches, a deductive approach, grounded in the theoretical framework (reflective practice; problem-situations; digital artefacts; hybrid inquiry; decisional projection) and an inductive approach, inspired by the approach of Thomas & Harden, (2008), allowing the emergence of sub-categories derived from the empirical data (forms of inquiry, specific instruments, types of meso-situated decisions, obstacles to reflectivity). The coding was conducted manually using an analysis grid developed for the review; the codes were

grouped into analytical themes, which structured the Results section and informed the construction of the explanatory model H-SPTR.

2.7. Inter-coder reliability

The initial coding was conducted by the first author following an iterative procedure of thematic grouping. To limit the interpretative bias inherent in qualitative syntheses, a second researcher conducted an independent coding on a random sample of the corpus. This sample is consistent with the practices of interpretative reviews, in which the primary objective is not the production of a statistical reliability index but the conceptual stabilization of analytical categories. The units of meaning and their linkage to the dimensions of the model were compared, and divergences were the subject of in-depth discussion aimed at making explicit the criteria of interpretation and refining the operational definitions. This process led to minor adjustments without substantial modification of the architecture of the proposed explanatory framework.

2.8. Methodological limitations

This review presents several limitations. First, the corpus remains modest in size (N=16) and heterogeneous from the standpoint of methodological designs, which limits any systematic comparison of the devices studied. Second, empirical studies rely on short-term qualitative data, with few longitudinal follow-up devices. Third, despite the use of PRISMA and the MMAT, the analysis relies in part on an inductive interpretation, inherent to the explanatory aim of the review, which may be influenced by the researchers' disciplinary experience. Finally, the analyzed corpus does not allow for the inference of causal relationships between the transformation of classroom practices and hybrid devices. The contribution of this study is thus situated within an explanatory and pre-modeling perspective, aiming to identify chains of mediations and conditions of possibility of reflective practice, rather than within an evaluative or generalizing logic.

3. Results

The analysis of the corpus reveals a transversal mechanism through which hybrid devices support the development of reflective practice in PE, by articulating four main components: (1) the problem-situation as an authentic practice-based object (SP-A); (2) its stabilization through digital artefacts (SP-R); (3) its processing within hybrid inquiry formats and (4) decisional projection as a reflective output. These components structure our analytical approach based on the results presented below.

3.1. The problem-situation as a practice-based support for reflective practice

The studies show that problem-situations emerge within teaching activity in PE when the teacher must arbitrate between motor, material, temporal and pedagogical constraints [31], [37], [38], [39]. They frequently take the form of critical incidents, pedagogical dilemmas or tensions between learning, safety, and student heterogeneity [29], [37], [39]. These configurations align with the definition of the problem-situation as an obstacle compelling the reorganization of action schemes, as formulated in professional didactics [37], [39].

These problem-situations are mobilized in training devices as practice-based objects enabling teachers to shift reflection from declarative registers toward meso-situated decisions related to the design and regulation of tasks, the management of space, instructions or modes of differentiation [26], [29], [31], [37], [39]. This function of practice-based anchoring is consistent with conceptual reviews that invite the conception of reflectivity in PE as reflection on and in action rather than on general beliefs [38], [40].

3.2. Stabilization of problem-situations through digital artefacts

The results show that the PS becomes truly analyzable only once stabilized through digital artefacts. Video, video-annotation, and reflective journal devices are used to suspend the temporality of action (T), segment relevant moments and materialize traces upon which analysis can rely [13], [29], [31], [38], [41]. In several studies, video of the teacher's own lesson is mobilized in self-confrontation or guided analysis (Bjørndal, 2025; Kaloudis et al., 2025; Lenzen & Poussin, 2019; Moussay, 2013). Whereas others privilege the use of reference video case banks [37], [41]. Video-annotation tools make it possible to associate comments with precise segments, identify "moments of rupture" and support an objectification of activity based on observable facts [26], [31], [41]. This function of instrumental stabilization of problem-situations aligns with the line of conceptual works on video as a training artefact centered on real work [27], [42] and on the notion of instrumentation of activity [39]. Thus, stabilization through digital artefacts appears, across the corpus, as a condition of possibility for reflective practice because it transforms the authentic problem-situation (SP-A) into a revisited problem-situation (SP-R), shareable and manipulable.

3.3. Hybrid inquiry as a social mediation of reflective transformation

Once stabilized, the problem-situations feed forms of hybrid inquiry (P) within which teachers collectively analyze video excerpts, confront their interpretations and elaborate hypotheses for action [26], [29], [37], [38], [39]. These formats combine synchronous times (seminars, workshops, videoconferences) and asynchronous activities (video annotation, forums, reflective journals) [13], [31], [41]. In several studies, the inquiry is structured by questions, analytical frameworks or explicit criteria, and accompanied by a trainer [29], [30], [37], which brings it closer to the dialogic inquiry approaches described in conceptual works on professional development [27], [42].

The corpus suggests that when the inquiry is weakly structured, exchanges tend to be limited to normative judgments ("good/bad lesson") or to a posteriori rationalization [39], [41]. Conversely, when the revisited problem-situations (SP-R) are examined through questions targeting meso-situated decisions and when analytical frameworks are made explicit, discussions more frequently lead to a re-problematization of action and to a reflective elaboration of contextual alternatives, thus highlighting the role of social mediation and dialogue in the transformation of reflective practice [40], [42].

In sum, empirical and conceptual works converge on the fact that social mediation is the key operator enabling the transformation of individual and subjective reflection (personal feeling) into shared reflection, capable of generating collective solutions to professional dilemmas.

3.4. Decisional projection as an output of reflective practice

The main output identified across the corpus is not an observable transformation of practices, but a decisional projection (R) in the form of a re-enactment of action. Several studies show that, following the analytical process, teachers elaborate new instructions, reconfigure motor tasks, consider adjustments in differentiation or changes in the temporal and material organization of lessons [29], [30], [31], [43]. These re-enactments remain at a projective or planned level, but they illustrate the possibility of reconfiguring activity at an intermediate and contextualized "meso-situated" level.

Some studies report indications of the transfer of these decisions into subsequent practice (effective modification of the organization of a cycle, evolution of the management of interactions, new forms of feedback) [29], [30], but longitudinal follow-ups remain rare and insufficiently detailed [38], [43]. This framework makes it possible to interpret decisional projection as an intermediate indicator of the development of reflective practice, thus aligning with conceptual models that conceive reflectivity as a gradual process oriented toward the reconfiguration of action rather than as a stable outcome [38], [40].

3.5. Synthesis: convergence of the corpus

The analysis of the corpus favored the adoption of an explanatory and pre-modeling stance: although it does not allow for the inference of strong causal relationships between hybrid devices and the durable transformation of practices, it nevertheless reveals chains of mediation through which problem-situations, digital artefacts and hybrid inquiry contribute to structuring actors' decisional reconfigurations.

These elements converge toward a transversal mechanism of development of reflective practice in a hybrid context, whose components are synthesized in Table 4, which highlights the articulation between empirical findings and conceptual frameworks. The five dimensions retained in the H-SPTR framework were selected because they emerged recurrently across the analyzed corpus and represented analytically distinct yet functionally interdependent mechanisms involved in structuring reflective professional development.

3.6. Empirical illustration of the model

The study by Cocca and Cocca (2024) provides empirical evidence consistent with the H-SPTR mechanism, detailing how a hybrid video-reflection device enables teachers to move progressively from the identification of pedagogical dilemmas to articulating their choices (practice-based trade-offs) and then to critical distancing, ultimately leading to a transformation of professional vision and to a decisional projection oriented toward the future improvement of practices. This process thus illustrates the systemic articulation of the dimensions of the H-SPTR model and its capacity to operationalize reflective practice in a hybrid training context.

4. Discussion

The analysis of the results shows that the development of reflective practice among PE teachers in hybrid devices does not reduce individual introspection based on beliefs, nor to the application of external pedagogical prescriptions. It operates within real-situated activity, which consists in selecting and re-experiencing authentic teaching situations.

A first point concerns the practice-based anchoring of reflectivity. In the studies analyzed, reflectivity is triggered when a dilemma, a critical incident or a tension arises in action, compelling the teacher to arbitrate between technical, motor, safety, temporal or curricular constraints. The PS then becomes an object of analysis, making it possible to focus reasoning not on general principles (how should one teach?) but on meso-situated decisions (what is feasible here and now given ...?). This tendency aligns with works on professional didactics and activity-based training, which emphasize the importance of analyzing real work for the development of professional competences. This anchoring choice makes it possible to shift reflectivity from a declarative register to a decisional register, centered on the operative choices that structure didactic and pedagogical action.

A second pivotal point concerns the mediating function assumed by digital artefacts. By capturing action (videos, annotations, digital journals, etc.), these artefacts transform it into an observable, shareable, and analyzable object outside the time of action. This stabilization makes reflective practice possible, as far as it allows access to dimensions of activity that are usually inaccessible to the actor in the first person. It also confirms the instrumented character of reflectivity in continuing professional development contexts, aligning with works that conceive video as a tool for objectification, distancing, and reconfiguration of action.

Thus, far from being a purely internal process, reflectivity appears as a social construction, dialogically elaborated in interaction with peers. This understanding invites a rethinking of continuing professional development devices as spaces of exchange and co-reflection through guided interactions rather than as mere transmissions of knowledge. The corpus indicates that when exchanges are structured, often within hybrid formats combining face-to-face and distance modalities, the analysis does not remain at the level of evaluative judgments such as “good lesson/bad lesson”. It shifts toward explanatory and decisional registers, providing the possibility of formulating contextualized hypotheses for action. This result highlights that reflectivity benefits not only from being externalized in artefacts (for example through video or annotation), but also from being shared, discussed, and reframed within a professional collective.

Reflectivity in PE fundamentally emerges from a dialectic between action and reflection on that action, constituting a process constructed in and for pedagogical action. This transformative dynamic rests on three interdependent pillars: a solid anchoring in the reality of classroom situations, instrumental support through digital artefacts enabling the capture and objectification of action, and the richness of collaborative exchanges among peers that enrich critical insight. Its development is articulated through a dual architecture: a temporal dimension, integrating the time of immediate experience, the deferred time of analysis and the prospective time of anticipation or re-enactment; and a hierarchical dimension, in which teachers’ thinking generally progresses from a descriptive stance of facts toward an interpretation of situations, then a critique of practices, ultimately leading to the reasoned projection of alternative courses of action. In sum, reflectivity presents itself as a situated and mediated professional learning process, progressively structuring teachers’ capacity to regulate and reinvent their pedagogical choices.

While existing reflective frameworks provide valuable insights into the phases and processes of reflective thinking, they insufficiently account for the mediational and environmental conditions through which reflective processes are structured in hybrid professional development contexts. In this respect, the H-SPTR model proposes a dynamic articulation of interdependent mediations rather than a simple juxtaposition of concepts. Hybridization (H) constitutes the sociotechnical architecture that makes it possible to identify problem-situations (S) arising from real practice. These activate the practice-based analysis (P) of professional arbitrations, while digital and dialogic mediation extends reflective temporality (T). This process leads to reflectivity (R) oriented towards decisional projection. (**Figure 2**)

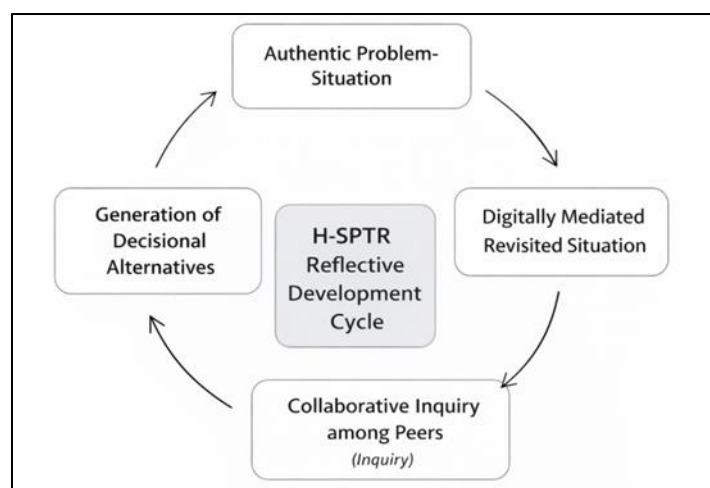


Figure 2 Explanatory mechanism H-SPTR

Although several models have conceptualized reflectivity as a cyclical process of professional learning, notably those of Schön (1983), Kolb (1984), and Korthagen (2001), the H-SPTR model offers a specific theoretical contribution by reconceptualizing the development of reflective practice through the situated and mediated conditions of its emergence within hybrid continuing professional development settings in physical education.

First, unlike traditional models centered on general reflection upon experience, H-SPTR posits that reflectivity primarily emerges from authentic problem-situations grounded in real professional practice. In this respect, the model shifts the starting point of reflective processes from lived experience toward the situated professional dilemma, emphasizing the contextualized arbitrations inherent in teaching activity.

Second, the model explicitly introduces instrumental mediation as a condition for reflective development. Whereas traditional approaches tend to conceptualize reflection mainly as a cognitive or discursive process, H-SPTR highlights the structuring role of digital artefacts in stabilizing, objectifying, and analytically revisiting professional activity.

Furthermore, H-SPTR incorporates hybrid temporality as a structuring variable of reflective work. It suggests that reflective development depends not only on successive cognitive phases but also on the temporal organization of the training environment, particularly through the alternation between synchronous and asynchronous moments that foster confrontation, distancing, and reinterpretation.

Finally, the model proposes an ecological and systemic understanding of reflectivity, conceived not as an isolated individual activity but as the emergent product of interactions among training context, pedagogical mediation, digital instrumentation, and collective dialogic dynamics.

The H-SPTR model should therefore be understood as an interpretive abstraction derived from recurrent patterns identified across the reviewed literature, rather than as a direct empirical generalization based on observed causal relationships. Its purpose is to provide a heuristic and explanatory lens through which reflective professional development in hybrid PE settings may be conceptually understood.

5. Conclusion

This integrative review pinpoints the main mechanisms by which hybrid professional development nurtures reflective practice in Physical Education. The analysis brings to the fore the organizing role of authentic problem-situations, digital artefacts, collaborative inquiry, and decisional projection in shaping reflective processes.

A first contribution sheds light on the practical anchoring of reflective practice. The data show that in PE, reflection primarily emerges from tensions experienced within situated action, rather than from theoretical knowledge or general pedagogical principles. This result is consistent with research in professional didactics and activity analysis. However, it deserves to be nuanced: experience alone is not sufficient to produce reflective practice; it requires that problem-situations be explicitly constructed as objects of analysis. Otherwise, reflection tends to remain descriptive or justificatory.

A second contribution concerns the role of digital artefacts. While the literature often attributes a transformative power to video-based devices, the findings call for greater caution. Digital supports do not directly generate reflective practice; they primarily help stabilize and objectify activity; which is necessary but not sufficient. Their impact depends closely on the pedagogical frameworks that structure their use. This perspective distances itself from technocentric views and highlights the importance of carefully designed pedagogical mediation.

Third, the study emphasizes the central role of guided collaborative inquiry. Reflective practice appears as a socially constructed activity, developed through interaction among peers. However, collaboration alone does not guarantee high-quality reflection. Its effectiveness hinges on how exchanges are structured, on the trainer's facilitation, and on the analytical frameworks mobilized. This raises key questions about the pedagogical conditions required for hybrid devices to be effective.

A fourth contribution addresses the nature of reflective effects. Contrary to a linear view of professional development, the results suggest that reflection does not immediately lead to observable changes in teaching. It first takes the form of decisional projections, which reconfigure professional reasoning. This view foregrounds a gap between reflective processes and their enactment in practice and points to the lack of longitudinal studies capable of tracing this relationship.

Taken together, these insights invite a reconceptualization of reflective practice as situated, mediated, and extended over time. The proposed H-SPTR model organizes this dynamic by articulating five dimensions: hybridization, problem-situation, praxis, temporality, and reflectivity.

From a practical standpoint, the results suggest that PE training devices should be designed around authentic teaching situations, supported by digital artifacts, and structured through guided inquiry. Particular attention should be given to the design of analytical tasks and to the role of the trainer, which appear to be decisive for the quality of reflective engagement.

Compliance with ethical standards

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Disclosure of Conflict of interest

The authors declare that they have no conflict of interest.

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Appendices

Table 1 Empirical studies on reflectivity/training in PE (with hybrid or video mediations) (N = 10)

Code	Reference (short APA)	Context (PE)	Type of device	Methodological design	Reflective focus	Main contribution to the H-SPTR model
EMP1	Moussay (2013)	M2 STAPS trainee	Video-based training (Néopass@ction)	Qualitative case study	Analysis of real work	Stabilization of the problem-situation (SP-R) through video mediation
EMP2	Poussin et al. (2014)	PE teachers (Switzerland)	Video + self-confrontation	Qualitative multiple cases	Situated didactic analysis	Problem-situation as a praxical object (SP-A)
EMP3	Lefstein & Snell (2011)	Continuing training (non-PE)	Video + dialogue	Interactional analysis	Professional dilemmas	Dialogic dimension of mediated reflectivity
EMP4	Lenzen & Poussin (2019)	Initial PE training	Alternation + reflective writing	Discourse analysis	Reflective aims	Shift from praxis → decisional reformulation
EMP5	Colasante (2011)	PE pre-service	Video-annotation tool	Design-based qualitative	Critical reflection on practice	Instrumental hybridization and reflective immersion
EMP6	Cocca & Cocca (2024)	Primary PE (Mexico)	VBR video program (6 months)	Mixed intervention (pre/post)	Professional vision	Extended reflective temporality and projection
EMP7	Kaloudis (2025)	Primary PE teachers	PD on paralympic values	Qualitative action research	Technical–critical progression	Structured reflective transformation
EMP8	Fletcher et al. (2023)	PE training	Structured PD device	Empirical qualitative study	Reflective professional learning	Articulation practice–reflectivity in PE
EMP9	Azevedo (2023)	PE training (Portugal)	Peer observation + writing	Structured intervention	Reflective temporal dynamic	Temporal mediation and projection
EMP10	Bjorndal (2025)	Mentoring including PE	Video + transcripts	Qualitative study	Mentoral reflectivity	Supported decisional projection

Note. The empirical corpus includes studies strongly aligned with hybrid/video mediation as well as complementary studies focusing on collaborative reflective processes, included for their theoretical contribution to the inquiry dimension.

Table 2 Conceptual/theoretical studies structuring the SP–reflectivity–hybridity framework (N = 6)

Code	Reference (short APA)	Nature of the work	Theoretical focus	Structuring contribution to the H-SPTR model
CON1	Standal & Moe (2013)	Narrative review in PE	Models of reflectivity (Schön, Hatton & Smith, Van Manen)	Clarifies the technical–practical–critical levels and makes it possible to position H-SPTR as a mechanistic rather than hierarchical model
CON2	Chaliès, Gaudin & Tribet (2015)	Theoretical analysis (video in PE training)	Video as an artefact of alternation	Legitimizes the instrumental stabilization of problem-situations (SP-R) within hybrid devices
CON3	Leblanc & Blanes-Maestre (2018)	Theoretical chapter (video-based training)	Immersion and pedagogical imagination	Illuminates the role of artefacts in decisional projection (dimension T → R)
CON4	Gaudin & Chaliès (2015)	Literature review on video-based training	Pedagogical functions of video	Provides a typology of uses (illustration, self-confrontation, analysis) supporting the Hybridization axis
CON5	Pastré (1999, 2002)	Professional didactics	Concept of professional situation	Anchors the problem-situation in a praxical and instrumental reading
CON6	Rabardel & Samurçay (2006)	Instrumental approach	Mediation through artefacts	Theorizes instrumentation and supports the analysis of the PS as a manipulable object within the device

Table 3 MMAT (2018) synthesis for empirical studies (N=10)

Code	Type of design (MMAT)	Methodological summary	MMAT appraisal (0–5)	Synthetic critical comment
EMP1	Qualitative (single case study)	Case study centered on one trainee: video data and verbalizations analyzed within the framework of the clinic of activity	4/5	Coherence between theoretical framework and data collection; limited transferability due to single participant.
EMP2	Qualitative (multiple cases)	Video + self-confrontations; grounded in the framework of joint action and PER	4/5	Solid and theoretically grounded design; absence of explicit triangulation with student learning data.
EMP3	Qualitative (case study)	Video immersion; discourse analysis and observations in PE context	3.5/5	Relevant contribution on reflective immersion; analytical description sometimes insufficiently detailed.
EMP4	Qualitative (discourse analysis)	Analysis of reflective written productions in alternation; structured textual corpus	4/5	Rigor in categorization; contextualization limited to initial training.
EMP5	Qualitative / design-based	Video-annotation device; usage traces and interviews	4/5	Digital tool well described; indicators of reflective depth insufficiently explicated.
EMP6	Quasi-experimental (mixed intervention)	Six-month video program; pre/post measures of professional vision	5/5	Robust longitudinal intervention; high methodological coherence; sample nonetheless limited.
EMP7	Qualitative action research	Ten-week professional development program; journals, observations, and interviews	4/5	Relevant qualitative triangulation; cautious generalization.
EMP8	Qualitative (PE – Fletcher et al.)	Empirical study in PE training; analysis of reflective dynamics	4/5	Methodological coherence and disciplinary anchoring; devices are less centered on video mediation.
EMP9	Structured intervention	Peer observation + reflective writing; measurement of reflective competences	4/5	Structured design and explicit temporal dynamic; risk of self-selection bias.
EMP10	Qualitative (mentoring)	Video + transcripts; content analysis of mentoring practices	4/5	Interesting contribution on the mentoring dimension; context not exclusively PE.

Table 4 Convergence of the corpus

Axis	EMP	CON	Convergence
SP-A	EMP1-EMP2-EMP7-EMP8- EMP9	CON1-CON5	PS as a praxical object
SP-R	EMP1-EMP3-EMP5-EMP6-EMP10	CON2-CON6	Instrumental stabilization
Inquiry	EMP3-EMP7-EMP9-EMP10	CON1-CON2- CON4	Social mediation and guidance
Re-enactment	EMP3-EMP7-EMP9	CON1- CON3	Meso-situated projection

Note. The references coded EMP1, EMP2..., correspond to the empirical studies listed in the appendix tables (Table 1). The codes CON1, CON2..., refer to the conceptual works presented in the appendix (Table 2)