Revista Românească pentru Educație Multidimensională
ISSN: 2066-7329 | e-ISSN: 2067-9270
Covered in: Web of Science (WOS); EBSCO; ERIH+; Google Scholar; Index Copernicus; Ideas RePeC; Econpapers; Socionet; CEEOL; Ulrich ProQuest; Cabell, Journalseek; Scipio; Philpapers; SHERPA/RoMEO repositories; KVK; WorldCat; CrossRef; CrossCheck

2023, Volume 15, Issue 4, pages: 507-529 | https://doi.org/10.18662/rrem/15.4/807
Submitted: June 16th, 2023| *Accepted for publication:* October 10th, 2023

Nurturing the Temporal Dynamic of Reflection Among Pre-Service Teachers: the Contribution of Peer Observation and Written Reflection

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Abstract: *This study aimed to examine how peer observation and written reflection could led Pre-Service Teachers (PSTs) in improving the temporal dynamics of their reflection during the Physical Education practicum. Given its dynamic and collaborative nature, an action-research design was conducted throughout an academic year to explore the ongoing and deliberate adaptation of peer observation and written reflection strategies to develop PSTs' reflection. Six PSTs and the first author, who took on the dual role of external facilitator and researcher, participated in this study. As facilitator, the first author scaffolded the implementation of both pedagogical strategies over the school year. PSTs' reflections were gathered through semi-structured interviews and reflective journal. Also, additional field notes were gathered by the facilitator during participant observation. The findings showed that an intentional structured combination of peer observation and written reflection helped PSTs to develop their ability to reflect-in-action and to reflect on reflection-in-action. The interaction between peer observation and written reflection enabled PSTs to understand the problems derived from their own pedagogical practice, as well as the need to search for new and better solutions. Doing so, PST started to reflect in an action-oriented and critical way. From a practical standpoint, we recommend that Physical Education Teacher Education programs include the development of a temporal dynamic of reflection not only through peer observation and written reflection, but also using multiple strategies (e.g., audio recordings, video analysis, etc.). By nurturing the temporal dynamic of reflection, PSTs can ongoingly re-examine themselves and their pedagogical intervention critically.*

Keywords: *reflective practice; teacher training; sports pedagogy; action research; physical education; reflection skills.*

How to cite: Azevedo, E., Araújo, R., Ramos, A., & Mesquita, I. (2023). Nurturing the temporal dynamic of reflection among pre-service teachers: the contribution of peer observation and written reflection. *Revista Românească pentru Educație Multidimensională, 15*(4), 507-529. https://doi.org/10.18662/rrem/15.4/807

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Introduction

Recognising that learning is constructed from practical experiences, the reflective practice is widely recognized as essential to help pre-service teachers (PSTs) becoming aware of their own knowledge (Dewey, 1933; Mulryan-Kyne, 2021). In this sense, the PSTs consciousness is promoted by dealing with the inevitable dilemmas and trade-offs involved in daily decisions made during practice. Whilst juggling these demands throughout the practicum, PSTs can develop a problematising view of pedagogical intervention and have the opportunity to improve, correct, understand and modify their praxis on the spot (Saiz-Linares & Susinos-Rada, 2020). However, for PSTs deconstruct experiences and capture all the insights of practice, different timings of reflection should take place and be developed during their pedagogical intervention (Miller, 2022). Indeed, PSTs need to develop a complex view of teaching (Davis,2006), which requires becoming aware of the different perspectives of their own actions, framing their intentionality (Moon, 2013).

By developing the temporal dynamics of reflection, PSTs can increase their quality of reflection because the moment of grasping meaning is a working tool for further insights (Dewey, 1933). In other words, the *tempus* (i.e., from Latin meaning time) is a tool for understanding other things. Thus, PST can create their own scaffolding process for developing learning (Vygotsky, 1978). From this rational, reflection reveals as an interactive process that can take place at different moments and can be categorized into different manners depending on when it takes place (Dewey, 1933). Cowan (2006), for example, presented 'reflection-for-action', which involves weighing up options in response to impending demands and making appropriate plans. On the other hand, Cowan and Stroud (2016) introduced 'composting reflection', as a re-encounter with an existing collection of past experiences that have already been reflected upon but perhaps never adequately pursued.

Despite the different moments of reflection presented in the scientific literature, the actions that characterise the professional activities of PSTs can be related to the moments of reflection introduced by Schön (1987). For instance, reflection-on-action could help PSTs reflect on their previous analyses (i.e., 'reframing'), supporting the adaptations of their teaching plannings. Afterwards, during the pedagogical intervention, PSTs need to analyse what is being performed to make effective decisions, which requires the ability to reflect-in-action. Finally, an evaluation phase encourages PSTs reflect on what they have done in the previous two phases, that is, they need to reflect on reflection-in-action to understand what can be

done next to improve their teaching. All these phases are cyclical in nature, as they interact and inform each other (Schön, 1987).

Previous empirical investigations in the field of teacher education have demonstrated that 'reflection-on-action' is usually highlighted and used by teachers (Umutlu & Kim, 2020). To date, investigation focus on the impact of developing reflection-in-action and reflection on reflection-in-action reveals scarce on scientific literature. Both moments, however, are essential, for PSTs not only to do not get 'stuck' in the middle of their practical problems, but also because each moment of reflection can provide more information about their teaching practice and contribute to deepen their reflection content (Cavanagh & McMaster, 2015; Umutlu & Kim, 2020). Namely, the interplay, and development of such temporal dynamics of reflection could open possibilities to attribute meaning of the pedagogical experiences lived by PSTs, facilitating and raising the ability to be critical about their practice (Ravanal Moreno et al., 2021). Specifically in the complex and ever-changing context of Physical Education (McEvoy et al., 2015), PSTs must make spontaneous decisions, not only based on what is happening at that particular moment but also according to the insights that emerge from previous reflections. Although empirical research has highlighted the temporal dynamics of reflection in teaching as a prerequisite for professional development (Mälkki & Lindblom-Ylänne, 2012), to the best of our knowledge there is no research that shows how these temporal dynamics can help PSTs developing and nurturing their reflection. The exploration of this topic could be particularly relevant to inform how physical education teaching education programs, could be updated to address the development of such skills in PSTs training.

Especially for PSTs who face the complexity of real-life situations, they need to 'reflect-in-action' (Umutlu & Kim, 2020) and 'reflect on reflection-in-action' (i.e. what is most difficult for PSTs to develop). Scientific literature has been argued that PSTs' own thinking process needs to be more structure to evolve their ability to reflect (Lee, 2010). In this regard, peer observation and written reflection has been indicated as efficient pedagogical strategies to structure the reflection procedures (Almusharraf, 2020). Peer observation can be a valuable strategy for developing 'reflection-in-action' for PSTs as it promotes analysing, reflecting and making decisions about teaching (Engin & Priest, 2014), as well as it helps PSTs obtain a meaning from practice based on and observational analysis (Lawson, 2018). However, learning through observation is not just imitating (Bandura, 1977), therefore observing someone teaching might not be enough to develop PSTs' reflection, and its temporal dynamics. In a complementary viewpoint, written reflections

can provide PSTs with a personal space to clarify their own thoughts, helping to systematise their ideas (Lee, 2010). Through writing, PSTs could look at an event and record their thoughts, while formulating questions about their own practice (Richards & Farrell, 2005). Doing so, PSTs could analyse the attitudes of their peers, contrasting attitudes, problems, and solutions thereby expanding their understanding about teaching-learning process (Gadsby, 2022). Several studies have shown that through written reflection, PSTs construct their own understanding of problems inherent of their personal teaching experiences, rather than adopting ideas from others in a passive manner (e.g., Suphasri & Sumalee, 2021; Yu & Chiu, 2019). Nevertheless, some support is also proclaimed in written reflection (Cengiz, 2020), namely a guided collaborative and intentional support that help PSTs leading their reflections to a deeper interpretation of their lived pedagogical experiences and guiding, in consequence, to the development of their own understandings.

Accordingly, the combination of peer observation and written reflection with appropriate support can, therefore, develop a dynamic interplay of different reflection' timings (Roffey-Barentsen & Malthouse, 2013). Indeed, written reflection combined with peer observation not only increases self-awareness (Korucu Kis & Kartal, 2019), but also the focus and complexity of PSTs' reflections (McCormack, 2001). Research in PE has been highlighted reflective writing and peer observation as predominant strategies to promote PSTs' reflection (Azevedo et al., 2022). However to our knowledge, there have been no studies that have examined, in a complementary fashion, the combination of peer observation and written reflection pedagogical strategies to develop the temporal dynamics of reflection in PST.

Thus, following an action-research design during a PE academic year, the present study aimed to examine how peer observation combined with written reflection impacted on developing the temporal dynamics of PSTs' reflection.

Methodology

Study Design

Given its reflexive and interventionist nature, this study followed an action research design (AR) (Lewin, 1946). The AR design allowed the external facilitator (EF) to consciously adjust and intentionally plan the pedagogical intervention during the cyclical process of planning, acting, observing, and reflecting on practice (Coghlan, 2019). Particularly, the EF, with her knowledge, experience, willingness to dialogue, and persistence,

promoted a critical and self-analysis of PSTs (Marshall et al., 2022). During the three AR-cycles, the EF provided ongoingly support for PSTs developing their reflection ability, with a particular focus on different timings of reflection. Here, the peer observation and written reflection were the main pedagogical strategies used to tailor-made the support provided by the facilitator to satisfy the individual needs of each PST. Namely, the role of EF was to understand the PSTs' moment of reflection were doing (i.e. PSTs' analysis of their own pedagogical practice and when such analysis took place) and, based on this information, to provide targeted and tailored support to the PSTs to develop further moments of reflection.

As recommended by Gilbourne (1999), the AR involved firstly a diagnosis phase in which the EF become familiar with the ability of PSTs reflect at different moments. At this phase, the EF examined the content, timing and difficulties faced by PSTs during their pedagogical practice. In the two subsequent AR-cycles, an attempt was made to develop 'reflection-in-action' and 'reflection on reflection-in-action', with peer observation and written reflection being introduced and adapted to help PSTs develop the interplay and temporal dynamic of reflection.

Context and Participants

Six PSTs participated in this study during the 2017-2018 academic year. All the participants belong to a Portuguese faculty of sports science. Throughout the school year, the PSTs were supervised by a cooperating teacher and a supervisor from the faculty. Purpose and convenience sampling criteria were used to select the six PSTs (Sarstedt et al., 2018). Participants were selected based on their availability, willingness to participate and affiliation with the same school placements (i.e., doing practicum in the same schools' context). The first author performed the dual role of researcher and external facilitator. She has seven years of experience as a dance teacher and holds a master's degree in teaching Physical Education. This study followed the guidelines of the Declaration of Helsinki and it was approved by the institutional research ethics committee of the first author's institution. Participants were informed about the scope of the study and signed an informed consent form. Confidentiality and anonymity were declared and ensured using pseudonyms.

The temporal dynamics of reflection: a conceptual framework

As the pedagogical practice took place in real-time the ability to reflect-in-action reveals paramount. When PSTs reflect-in-action, they note something of potential value during their current activity and point out what

might be add to their skills or understanding in the future (Schön, 1987). Thereby, 'reflection-in-action' encompasses a critical thinking when the action occurs. However, to reflect on the practice, PSTs need to think about the time after their pedagogical intervention. That is, PSTs need to reflect-on-action, so that they can look back at one or more recent experiences and find out what they can retrieve to improve their pedagogical skills and understanding of the teaching-learning context (Moon, 2013). In addition, PSTs need to 'reflect on reflection-in-action' as this activity aims to produce a good verbal description of 'reflection-in-action' that can be shared with peers. Through this reflection moment, PSTs can look back at the action (i.e., pedagogical intervention), reflecting on the moment of reflection-in-action (Schön, 1987). Grounded on the conceptualisation of Moon (2013) and Schön (1987), we summarised the reflection moments abovementioned, as well as the key elements of peer observation and written reflection (see Figure 1).

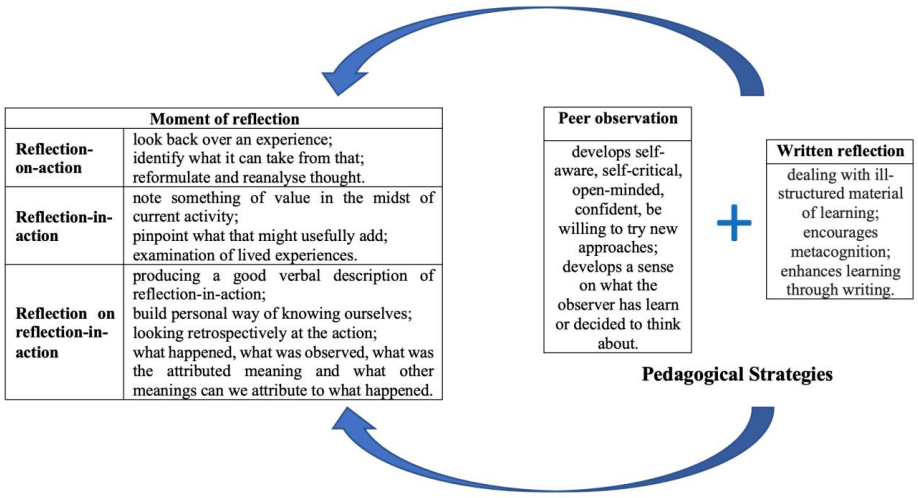


Figure 1. Timing of reflection adopted by Schön (1987) and Moon (2013) and strategies to develop reflection adopted by Moon (2006) and Cosh (1998).

Data collection

The present study used multiple sources to better understand the temporal dynamics of reflection of PSTs (Denzin, 2012). Data collection included focus group interviews (FG), reflective journals (RJ), participant observations (i.e., external facilitator), and non-participant observation (i.e., peer observation). This sequence on data gathering was repeated throughout the academic year to gain a comprehensive and coherent picture of the

moment and content of PSTs' reflections. The data collection phase followed the general cyclical pattern of AR (Patton, 2015).

The AR-cycles were initiated by a FG with a total of three semi-structured sessions (Patton, 2015) (one per AR cycle), in which a list of questions was prepared to stimulate discussion. Here, the EF had the opportunity to explore any new theme that might emerge, which were also further explored (Freebody & Freiberg, 2006). The FG was audio-recorded and subsequently transcribed verbatim by the first author. The FG was conducted by the EF in the faculty and lasted about 110 minutes. The FG interviews aimed to explore the PSTs' thoughts and doubts about their own pedagogical practice, to understand their temporal dynamics of reflection (i.e., which moment of reflection they were reaching), as well as to clarify some ideas that were not so clear in their RJ or participant observation (Patton, 2015).

A total of 18 participant observations (three per PST) were conducted by the EF, in the schools where PSTs were performing their pedagogical practicum. The participant observation allowed the EF diagnosing the ability of PSTs reflect at different moments and difficulties faced by them during their pedagogical practice, while also motivated PSTs to reflect on their own pedagogical intervention and, utmost, to share their reflections with their peers. Moreover, participant observations enabled PSTs debate the observation of different teaching practices, encouraging PSTs to criticise the reasons and assumptions associated with their personal perspectives of teaching (Haigh, 2005). Particularly, participant observation provided an opportunity to understand how PSTs' thoughts were expressed in their teaching practice and to access any practice-related issues that could not be verbalised (Öhman & Quennerstedt, 2012). The EF designed pedagogical actions (i.e., questioning) for the PSTs to address in the following sessions and express their thoughts in the next FG and RJ.

The third step involved non-participant observation (i.e., peer observation) aimed to develop 'reflection-in-action' of PSTs. The peer-observation was conducted by the group of PSTs while observing a colleague teaching a PE class, and enabled an ongoingly group reflection. Peer observation allowed PSTs see how their colleagues dealt with many of the similar problems that themselves faced daily. In addition, it helped them narrow the gap between the PSTs' ideas of teaching and what actually happened during the PE lessons (Richards & Farrell, 2005).

The reflective journals were written by the PSTs and aimed to describe, reflect, examine, and criticise their pedagogical experiences. PSTs wrote a total of 18th reflections (three per PST), including information about

their participant and peer observations, as well as any other thoughts and insights that could emerge. Namely, in each written reflection PSTs could identify their weaknesses, strive for improvement, and connect their existing knowledge with new information (Abednia et al., 2013). Specifically in this study, written reflections were used to help PSTs reflect on various aspects of teaching in the context in which they were working and rethink their ideas about teaching and reflection (Lee, 2007).

Data analysis

Aligned with the cycle and interactive nature of an AR-design, the collection and analysis of data were ongoingly intertwined to develop new explanations that might better fit the unique features emerging from the data (Patton, 2015). As it is almost impossible to be fully inductive in research (Braun & Clarke, 2019), initially it was followed procedures of a deductive process, with themes being developed concomitantly with data analysis (Nowell et al., 2017). Initially, the deductive approach was needed because the formulation of the interview questions and the research goals resulted from the adopted conceptual framework (i.e., Figure 1). Nevertheless, the study gradually became largely inductive, as the themes that emerged from the discussions of the PSTs (Maine et al., 2017).

Given the potential for the researcher to identify, analyse, and report patterns (or themes) within a large data set, the thematic analysis was used to examine the data set (Braun & Clarke, 2012). The thematic analysis involved six stages (Braun & Clarke, 2019). The first coding stage involved the researcher become familiar with the entire dataset through repeated reading. In the second stage, initial codes were created from the data obtained in the FGs, RJs, POs and participant observation and manually added line by line to identify critical categories (i.e., deductive approach) (Nowell et al., 2017). The third phase involved the generation of themes related to the content and temporal reflection of the PSTs, as well as the pedagogical strategies implemented by the EF. At this phase, written notes were added to assist the authors interpret the data (i.e., inductive approach). The fourth step involved the confirmation that the themes represent explicitly the excerpts coded and the whole dataset by creating a thematic map of analysis. The fifth phase included going back and forth through the data repeatedly to check if the analysis could have misrepresented the data through poor coding, and to ensure that the structure of the temporal dynamics of reflection aligned with the concepts portrayed in Figure 1. The sixth phase involved (re)naming the identified themes in a way that captured the temporal effect of the AR

epistemology (i.e., the same themes reported over the three cycles might present different configurations).

Trustworthiness

To acknowledge the potential consequences of the researcher's presence, several trustworthiness criteria were adopted (Coghlan, 2019), namely: (i) Participants were encouraged to share their honest opinions and viewpoints during the FG, so that PSTs' views were not influenced by each other- Thus all PST's thoughts were valued equally by the EF (Patton, 2015); (ii) Data triangulation, which implied the use of multiple data collection sources (i.e., FG, participant and peer observation, and RJ) intending to describe phenomena from different perspectives (Denzin, 2012); (iii) regular peer briefings and data analysis within the research team to minimise the risk of individual researcher bias in interpretive analysis (i.e. ,critical friend) (Patton, 2015); and (iv) PSTs were frequently asked about the implicit meaning of their actions and verbal interventions (Corbin & Strauss, 2014). These procedures regulated the limits of subjectivity, contributing to minimize the individual research bias (Nowell et al.,2017).

Results

Diagnosis phase – 'Reflection, what does it mean exactly?'

Initially, the PSTs showed that they did not attribute any value to the concept of reflection, associating it with one of the numerous tasks related to teacher's work: *'Sara - for me, reflection is only important because reflection is another one of the thousand things a teacher has to do.*' The PSTs looked at reflection as something that takes time: *'António – we do it because we have to. It is part of', but basically it is a waste of time, you have to be there thinking about what to write. It takes a lot of time.* 'Moreover, the PSTs demonstrated that they did not understand the meaning of reflection: *'António – to reflect is to think, isn't it? Reflecting is seeing if our plan is done well, if the lesson went well or not (…)*'. Also, initially they were confused with the exhaustive description of all the actions that must be performed during the lessons: '*Sara – it is being there, thinking of every little thing we did, and writing everything down without forgetting anything'* Still, PST were not aware of how reflection could impact on their professional development: '*Maria – honestly, we reflect now* [during the pedagogical practicum] *because we do not have any experience, otherwise we certainly would not reflect, the experience would already be enough*.' In addition, initially it was impossible for the PSTs analyse and decide while the lesson was occurring: '*Paulo - It is not possible for me to think about all the things that happen when I am teaching*.'

1st AR-cycle – 'I think later because I have time and peace to understand how it was.'

Based on the difficulties diagnosed by the facilitator, PST were invited to explore the meaning of reflecting at different moments '*Facilitator – You can reflect during, immediately after and sometime after the lesson, these ideas will help you improve your quality when you are teaching.*' Thus, the PSTs showed a preference for analysing the lesson immediately after it occurs: *'Sara - I am barely done with the class and I immediately think about what I could have done*.'

Distancing themselves from what was happening in class and reducing tensions related to teaching (i.e., reflection-on-action) provided PSTs a self-consciousness that was recognised by themselves as fundamental to reflect: '*Maria - (...)At home I have time and peace to do it without pressure, I can think about everything that happened in class and reflect.* 'In addition, PSTs felt that retrospective interpretation of what they experienced in class encouraged reflection-on-action, as the *tempo* is needed to identify and consider multiple elements that might contribute to understanding critical situations in class: '*Gustavo - (...) You see, everyone is more effective when they have time to think. So, we can think about many things that we did not see at that moment. It is not possible at the moment, only later.*' The PSTs showed that this kind of retrospective reflection was the only one they made, and that they cannot analyse their pedagogical intervention in other moments: '*Sara - so for me it is obvious that we can only evaluate what happened if we have something past that allows us to have something to think about, otherwise do we reflect about the air?*' Indeed, PST demonstrated that the understanding and relationship between the elements of the class necessary to find solutions can only be achieved at a later moment (i.e., reflection-on-action) and never in the meanwhile of the pedagogical intervention as reported by Maria: *'For example, how can we establish cause-effect relationships in class? In class, I cannot even understand or relate all things (...) only after class I think about how to develop a better strategy.'*

2nd AR-cycle – 'Reflecting about the actions of others helps me to understand how to decide in the moment.'

Once PST had already achieved the reflection-on-action, during this second AR-cycle the EF stimulated the ability of PST reflect-in-action by questioning them during FG interviews: *'Facilitator - can you explain me then what do you think about when you are teaching?'*

During the analysis, the PSTs noted that they examined the lesson in a retrospective fashion, but also were used to think about what was happing during the class (i.e., reflection in action): '*Gustavo – suddenly, I have the impression that while I am teaching the class, I was thinking about what I am going to do*

next. I am not just analysing afterwards, I am analysing during. I think.' However, despite PSTs tended to see what was happening, they did not change their pedagogical intervention: *'Gustavo - look, for example, I see that they could roll their body better while doing the roll...*'. Other PSTs tended to focus on the content of the reflection-in-action and made a connection between the students' engagement in the task and their preference for the sport: *'António - I am there thinking that as they do not like football at all, they are not engaged in the task*.'

Given the difficulties showed by PST in focusing on their own actions during the analysis and to intervene in the lesson (i.e., reflection-in-action), the facilitator asked PSTs observe the colleagues' lessons and suggested that they prepare a written reflection about those peer observations. In particular, the facilitator encouraged reflection on possible rationales for the choices made by the colleagues to help PSTs focus their attention on particular aspects: '*Facilitator - So when you observe your colleagues, I want you to understand how and why they behave the way they do? When they stick to the plan, when they change it, what made them change it or not? And what do you think about all this?'*

The observation of their colleagues stimulated the PSTs' confrontation with their own difficulties: *'Sara - when I saw them, I thought that I also have similar problems.* Moreover, it stimulated their self-criticism: '*Paulo - after this observation I could see that I also have to pay attention to my posture when I am speaking in front of the class (...)'.* While they were analysing their colleagues, PSTs started to question their own practice, becoming aware of their actions and transferring the way they should act if confronted with the similar situation (i.e., reflection-in-action): '*Gustavo - when I saw them, I thought that I should not act like that in their place (...)*'. Furthermore, peer observation fostered the ability of PSTs place themselves in the shoes of their colleagues, but also to explore future solutions for their own pedagogical intervention: '*Maria - when I saw them, I realised that if I were in the same situation, I would not act in the same way, because it did not seem to have sustainable results for the class.'*

On the other hand, observing their peers enabled the PSTs recognize the need to seek and study information that support a better decision-making in practice: '*Gustavo - (...) but I still do not know how to act, so I need to research and talk more about it to find appropriate solutions*', look for new ways to solve the same problems: '*Sara - while I was watching them I was thinking of a thousand and one ways to solve these problems, if one day the same thing happens to me I will already have some solutions*.' and understand that it was necessary to go beyond perspective and show solutions on how they could act in a future situation: '*Paulo (...) so in the next classes I should moderate my tone, because that can make them feel a bit intimidated*.'

Peer observation was crucial in making the PSTs aware of the importance of reflecting during the action, as it supports the change on pedagogical intervention in real time, improving the quality of the practice. This was particularly highlighted in Paulo's perspective: '*After watching them, I thought that I had to change something immediately. Today I realized that I was only concerned about the exercise and watching them performing it, but what I need to see if they had really noticed what the idea of the task was. So I interrupted the task and explained it again*.'

The written reflection showed to be valuable in helping the PSTs to better interpret the context of each pedagogical practice: '*Gustavo – when I write, I have the opportunity to develop my ideas about what happened while I was observing my colleagues teaching'* and also to raise complex questions about their own practice 'Gustavo – *I have also found that I question my interaction with the students, searching for the key to unlock such the relationship. I am responsible for this.'* Additionally, by writing about the observed elements, PST were able to clarify the verbalised ideas, revealing an understanding about the importance of establishing a relationship ideas among them: *'Paulo – (...) it is important to understand what contributes to the lesson not going as expected, and therefore I cannot ignore my presence, but I have to include it in the analysis along with the students' behaviour*.'

This ability of PSTs to reflect-in-action (i.e., intervene in the classroom to resolve teaching-learning issues) was particularly noted by the facilitator during the participant observation: '*Facilitator - It should also be noted that António, in reason of some students' difficulties in performing an action, interrupted the exercise and adapted it to facilitated students' understanding'*.

3d cycle – 'When I reflect on past ideas, I can understand other possibilities and rearrange my thoughts.'

At the beginning of this cycle, although the PSTs had already been developing reflection-in-action, they lack on reflection on a particular topic in past (i.e., reflection on reflection in-action): '*António - I would think about the same thing I am thinking now (...)*'. Thus, to become PSTs aware of the change in their praxis, the facilitator stimulated them to analyse how they had understood their actions at the beginning of their professional internship '*Facilitator - how did you think at the beginning and how do you think now? Has something changed?'*. This question initiated a critical debate among PST: '*Gustavo - Well, before class you could not even breathe properly, not even a fly could fit in your head with so many memories (...) today you are already breathing and acting.*; *Sara – it is true. Today I realise that it is not just about observing a lot of things, but focusing on what is really important'*. Also, the analysis of past events enabled PSTs

recognise the limits of their reflections and understand their mistakes, as reported by Sara and Maria: '*Sara - when I saw her [Cooperant Teacher] freaking out, I remembered that she had reacted like that too and I realised that I had changed. Today I already think that does not get me anywhere and I take a deep breath*; *Maria - I know now that I was wrong, I never worried so much about the bad conditions at school or complained so much.'*

To trigger the re-evaluation and reformulation of the PSTs' ideas, the EF invited them writing on their previous thoughts: '*Facilitator: I would like that you analyse your initial RJ, contrasting your past reflections with the last ones. If you find out that your thinking has been changing, try to reflect about why it happened and how it helped becoming a better teacher.'* Through this retrospective analysis, the PSTs noticed that in the past their reflections did not include aspects that they consider essential today: '*António - it is possible to verify that my ideas were closely related to the fulfilment of the class objectives (...) they did not include the behaviour of the students, the environment of the class, my readiness to teach this subject. I noticed that this [thinking about past ideas] allowed me to analyse [pedagogical intervention] more effectively now*.' Complementarily, peer observation revealed vital for PSTs know *a priori* what concrete elements they should focus on during peer analysis, which helped them gain space to connect thoughts: '*Gustavo - now I have a kind of mental space to know immediately what I should focus on my critique, and I know what points I should pay attention to, and of course I do not feel the pressure of teaching the class myself*.'

Through peer observation and written reflection, PST examined their original attitudes, becoming aware of their initial mistakes and how it contributed to guide their professional development at this stage, namely: '*Maria - when I think of who this teacher was in the beginning, I think about these problems, and I do not want to repeat them.'* The PSTs recognized how limited was to reflect exclusively based on behavioural steps (i.e., focusing on performance) without considering themselves and the circumstances of their pedagogical intervention: '*António - it is strange to notice that I thought that I was thinking about everything, but today I notice that these thoughts were very focused on the checklist (included or not included). Although today I am better at thinking about what I do in the class, I am also aware that I still need experience to improve my analysis and be more effective in teaching*. Nevertheless, the PSTs still sharing difficulties in using their new thoughts into practice, as Gustavo expressed: '*I mean, I am well aware of that stuff, but I am not sure that I am able to do it*.'

Discussion

Through an AR-design conducted over an academic year in the context of PE, the present study aimed to examine how peer observation combined with written reflection impacted on developing the temporal dynamics of PSTs' reflection. Overall, findings highlighted the impact of an intentional structured combination of peer observation and written reflection in developing PSTs' reflections, particularly from a dynamic temporal perspective. Indeed, through the support of the EF, the combined use of peer observation and written reflection seemed to have influenced the ability of PSTs reflect in different moments, enriching in consequence the content of their own reflections. In this sense, findings highlighted that PSTs were not only able to understand the different moments of reflection over time, but also to recognise that each one encompasses different perspectives which, when combined, can develop their quality of reflection. In parallel, PSTs have improved their pedagogical practice by no longer focusing only on themselves and their own performance, but also by being able to think more and better about the students' needs.

One of the elements that might have contributed to the development of PSTs' reflection was the interventive nature of AR-design, which allowed the EF to adapt, and monitor ongoingly her pedagogical strategies since the diagnostic phase. Emphasizing the importance of supporting continuously the development of PST's reflection, our findings corroborate the assumptions of Denha et al. (2022) and Krapivnyk et al. (2021) who stated that if reflection is not explicitly and purposefully achieved in the pedagogical process, the work may be ineffective. In the same vein, previously Wopereis et al.(2010) argued that probably the most important condition for acquiring good reflection is a high-quality guided practice rather than simply given tasks to reflect on.

Regarding the analysis of each AR-cycle, since the diagnostic phase, the EF identified that PSTs did not understand the reflection process (i.e., how it occurs, what is its importance on their professional developing). Afterwards, over the first AR-cycle, the PSTs demonstrated that they were reflecting mostly on their own pedagogical intervention it has occurred (i.e., reflection-on-action). As reported by PST, this temporal distance was needed to reflect by affording 'thinking material' to reflect and interpret their practice. In this regard, the tendency for novice teachers reflect mainly on action was recently pointed by Chen (2023).

To encourage PSTs reflect-in-action, in the second AR-cycle, the EF suggested that PSTs observed the classes of each other (i.e., peer

observation) and developing written reflection on those observations. Also, EF provided some tips to guide PSTs' attentional focus during the class observation. The integration of such strategies enabled PSTs confront their own insecurities, examine their own pedagogical interventions and seek for new ways to solve similar problems. Specifically, written reflection revealed to be crucial in helping the PSTs examine what, how and why of their thoughts. Indeed, when writing about pedagogical intervention of their colleagues, PSTs had '*the opportunity to develop my ideas'*, as expressed by Gustavo. Doing so, the ability to question their own practice in complex ways was highlighted. In addition, the PSTs were able to see the importance of clarifying their thoughts and stabilising a relationship between ideas. Here, the PSTs noticed that written reflection about derived from peer observation, allow them to construct solid arguments in relation to their own pedagogical intervention, which also enabled them to reflect-in-action (i.e., thinking about how to act in similar situations).

As Schön (1987) explained, reflection-in-action requires the development of critical thinking. Thus, our findings show that when PSTs combining both pedagogical strategies, they were able to include the above elements in their analysis and developed critical thinking skills. Namely, PSTs enhanced their ability to identify the what, how and why of their actions during the lesson (i.e., reflection-in-action) (Schön, 1987). Although the literature has been widely emphasized the importance of tools to develop reflection of teachers (Hammersley-Fletcher & Orsmond, 2005; Mouraz et al., 2022) and help them to understand their own reality (Batlle, 2023), studies have mainly focused on developing tools to promote 'reflection-on-action' (Umutlu & Kim, 2020) rather than in-action. In contrast, our findings suggest that the PSTs' reflection-in-action seems to have been prompted through the combination of peer observation and written reflection.

At the last AR-cycle, the EF aimed to stimulate PSTs analyse their past reflections and oldest thoughts expressed in RJ, contrasting it with the recent ones (i.e., developing reflection on reflection-in-action). Findings exhibited that through supported and structured written reflection, PSTs were able to pause and think twice on their initial 'written' thoughts to accomplish better insights. In this regard, the temporal distance afforded by peer observation revealed to be useful for PSTs have 'mental space' to know which elements were relevant focus on when analysing their colleagues.

Therefore, through the interactive process between peer observation and written reflection within this AR-cycle, the PSTs were able to reconsider their original thoughts, confronting it with the actual ones. Thus, PSTs noticed that, initially, they did not consider the elements they now deemed

as vital to reflect about. In particular, they emphasised the importance of analysing their past actions and thoughts to develop an awareness of their mistakes and look for ways to avoid them. Revisiting Liu's (2015) work highlighting the elements of critical reflection, the PSTs developed a critical reflection level by using such elements at this point. In contrast to the critical thinking skills that PSTs had demonstrated in the previous AR cycle, PSTs were also able to constantly analyse, question and critique established assumptions about themselves.

To summarise, in our study the peer observation and the written reflection, when combined and properly structured, seemed to have helped PSTs in developing their ability to reflect in the moment (i.e. reflection-in-action) and to re-examine their past reflections (i.e. reflection on reflection-in-action). Thus, the combination of both pedagogical strategies enabled PSTs reflect in a 'freeway', without pressure of assessment. As Silva and Mesquita (2016) examined, in a longitudinal study of student coaches learning, the nature of assessment severely limits the opportunities for learners analyse themselves. When PSTs are asked to reflect-in-action as part of an evaluation, they tend to engage in false reflection or compensatory reflection at the end of the design process (Zhang et al., 2023), while others even fake their reflection to gain approval from their supervisors (Suphasri & Sumalee, 2021). In our findings, both pedagogical strategies did not have an evaluative character, but an inclusive and constructive perspective that enabled the PSTs to ongoingly re-examine themselves and their pedagogical intervention. Accordingly, PSTs understood their weaknesses as an opportunity to grow up as teacher and develop their reflection ability.

Final thoughts

The findings of this study provide a new understanding of how the combination of peer observation and written reflection can impacted on developing the temporal dynamics of PSTs' reflection and to teach them how to use such tools to enhance their own professional development. In fact, through peer observation and written reflections, PSTs were able to understand their own problems and the need to look for new and better solutions, which enabled them to reflect in an action-oriented way, re-evaluate their previous reflections and improve their quality of reflection.

Despite the potential of the interaction between the respective pedagogical strategies, the development of the temporal dynamics of reflection needs to include other strategies (e.g., video diaries, web forums, peer lessons, questioning and collaborative reflection). The use of diverse strategies, in a complementary, structured and intentional fashion, might

guide PST identify and examine their lived experiences from different points and perspectives in time, stimulating their ability to interpret the particularities of each educational context. Therefore, future studies should focus on investigating specific pedagogical strategies that promote reflection among PSTs, implementing, monitoring, intervening and adapting to the particular practice to each PST needs.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the Portuguese Foundation for Science and Technology (FCT) [grant number SFRH/BD/134292/2017]. The authors have no conflict of interest to declare.

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