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Review article

Learning to use the blackboard during the correction, discussion and recap phase: A challenge for preservice teachers during practicum

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ABSTRACT

Our study shows how 11 pre-service teachers learned to use blackboards in the correction, discussion and recap phase of instruction during the 3 years of their initial training. By studying their own perceived experience through think-aloud protocols, we contribute to better comprehension of a complex professional gesture that becomes transparent for experts, of the way expertise in using the blackboard grows and of pre-service teachers' learning process during practicum. We highlight six perceived difficulties that provide levers for training, a continuum of professional development concerning blackboard use, and two learning paths for and from using the blackboard.

1. Introduction

During practicums, pre-service teachers (PST) teach the class or, should we say, try to teach the class. As a matter of fact, they often perceive these episodes as a complex, compound and critical job (Gillett-Swan & Grant-Smith, 2017), among other reasons because they have to do what they are learning to do, without really knowing how to do it. At the same time, PST are expected to learn to teach based on this experience (Dewey, 1938; Kolb, 1984; Schön, 1983).

In earlier research conducted in the French-speaking part of Belgium, we examined how primary school PST learn to teach through their practicum experiences during the 3 years of their initial training,[1] from their point of view (Blondeau, 2023). In this article, we focus on how they learned how to use the blackboard[2] during the correction, discussion and recap (CDR) phase of instruction, a typically difficult area in the continuum of skills development (Blondeau, 2023).

In a time of smartboards, white boards (IWB) and connected classrooms, studying the traditional blackboard might seem outdated. However, PST still find using blackboards challenging (Blondeau, 2023). Studies have shown that many teachers use IWB merely as large-scale blackboards or presentation tools (De Vita et al., 2014, pp. 1–16). Aside from document projection, IWB usage often mirrors traditional blackboard practices (Kyriakou & Higgins, 2016; Roland et al., 2016), focusing only on substitution or augmentation as specified in Puentedura's (2013) substitution, augmentation, modification and redefinition (SAMR) model of technology integration in education, without modifying or redefining tasks. Moreover, in French-speaking Belgium, despite the rise of IWBs, traditional blackboards remain widely used.

So, by examining the use of the blackboard by PST, we aim to contribute to better comprehension of (i) a complex professional gesture that becomes transparent for experts, by investigating the novice experience, (ii) how expertise in using the blackboard grows and (iii) the learning process of PST during practicum.

1.1. Teaching practicum: an opportunity for situated, diverse learning

The significance of practicums in teacher training has been internationally recognized (Anderson & Stillman, 2013; Desbiens et al., 2013), particularly with regard to situated and contextualized learning (Blondeau et al., 2021; Korthagen, 2010; Walton & Rusznyak, 2013).

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[1] Starting in September 2023, the initial training was extended from 3 to 4 years and the students earn a master's degree.

[2] Not all blackboards are necessarily black. They can be black or green (used with sticks of chalk) or white (used with dry-erase markers). Flipchart papers can also be attached to the blackboard using magnets. In this article, we limit the use of IWB to what can be done with a classic black or white board and to the projection of a document identical to the one used by the pupils.

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Practicums provide a secure environment in which to practice teaching under the supervision of qualified professionals, such as cooperating teachers (Clarke et al., 2014) or academic supervisors (Zeichner, 2010).

In practical terms, the practicum allows PST to familiarize themselves with the teaching environment (Desbiens et al., 2013), observe practices (Gürsoy, 2013), experiment with methods, analyze situations (Blondeau, 2023) and reflect on their responsibilities and aspirations as teachers (Borges & Séguin, 2013).

Through face-to-face experiences in the workplace, PST benefit from modifying their beliefs about teaching (Korthagen, 2010; Mesker et al., 2020), building practical knowledge, developing their skills (Azéma, 2015), increasing their motivation to continue studying and constructing a professional identity (Chu, 2021; Katz et al., 2011; Nghia & Tai, 2017). They also gain insight into school culture (Mesker et al., 2020; Walton & Rusznyak, 2013) and the specific school hosting the practicum (März & Kelchtermans, 2020; Mesker et al., 2020).

Despite these opportunities, research struggles to define the real benefits of practicums. Some studies have questioned their effectiveness, claiming no significant impact on beliefs or practices (Spallanzani et al., 2017; Vanmeerhaeghe, 2023) or noting discrepancies between actual and planned impacts (Vanmeerhaeghe, 2023). However, other research has indicated changes, reconfigurations and development in PST (Azéma, 2015; Blondeau, 2023; Vanmeerhaeghe, 2023), although the causes and mechanisms behind these transformations often remain unclear (Azéma, 2015).

1.2. Subjective experience as a means of investigating cognition in practice

To understand the opportunity for learning encountered by PST during their practicums, we were interested in the subjective experience of the actor as a way of investigating cognition in practice, that is, how PST learn from their experiences. To approach this subjective experience, we adopted an activity-based approach (Durand & Theureau, 2016; Yvon & Saussez, 2010). This approach emphasizes two aspects of actors' activity: a visible part, accessible to an exterior observer (actions), and an invisible part, inside the actor's mind, inaccessible to an exterior observer (deliberations, emotions, hesitations, feelings, concerns, dilemmas, etc.; Hubault, 1996).

By combining these two aspects, we prioritized the actors' intrinsic perspectives in order to understand their personal experiences, the construction of meaning that accompanies their activity and the learning that occurs based on the situations they face. Gaps between an actor's expectations and what actually happens result in disruptions (Theureau, 2006, 2015). Learning is thus understood as the actor's response to environmental disruptions, which force changes in behavior and underlying systems of references. Thus, learning is viewed as a change in behavior rather than simply an accumulation or modification of representations (Poizat et al., 2024; Theureau, 2006, 2015).

By applying an activity-based research approach to the situation of PST, we are contributing to knowledge of the mechanisms underlying their learning during practicum and opening the door to new ways of teacher training, through the understanding gained of how these PST progress in the teaching profession (Joinel Alvarez & Lussi Borer, 2023; Poizat et al., 2024). Indeed, in accordance with activity theories, we consider learning as a modification of practices that results when PST understand that, due to unexpected disruptions, those practices are not longer viable (Poizat et al., 2024). In the case of using the blackboard, we consider that the disruptions are numerous and common because of the novelty of the situation and the inexperience of the PST.

1.3. The correction, discussion and recap phase of instruction

The CDR phase is a time for collectively reviewing tasks, validating achievements, discussing strategies and institutionalizing knowledge (Bourbao, 2010). It involves the teacher using students' experiences to introduce, structure and clarify scientific and technological concepts they explored through tasks (Bybee, 2014). This phase can also involve collective correction, often through a dialogue between the teacher and students, including correction on the blackboard (Jorro & Mercier-Brunel, 2014). Group interaction is key, as social interaction stimulates deep processing such as self-explanation and elaboration (Visschers-Pleijers & Dolmans, 2006).

During the CDR phase, multiple concerns arise: regaining attention, reviewing past activity, checking conformity with instructions, correcting and validating pupils' work, discussing strategies, fostering participation and institutionalizing knowledge (Bourbao, 2010). This phase is crucial for learning, involving analysis, discussion and validation of the learning traces, often mediated by the use of the blackboard.

The CDR phase is challenging for PST. Many struggle to explain concepts or organize corrections, describing it as a moment of "struggle", "hell, "war" or "panic" (Blondeau, 2023). In this research, we aim to understand how the blackboard is used in this typically complicated phase of a lesson and how the use of the blackboard can support working through this phase or make it more difficult.

1.4. Using the blackboard

The CDR phase often requires written support for structuring rules, concepts and collective corrections, with the blackboard being a common tool (Lepoire-Duc, 2011; Nonnon, 2000). Despite being a frequent, complex professional gesture, its use, especially by PST, has been under-researched (Eilam & Poyas, 2006; Mellado, 1998). The blackboard can be seen as (i) a material and symbolic object supporting teacher gestures, routines and actions, (ii) a mediator in the transmission and appropriation of knowledge, at the heart of the teacher–learner dialectic; and (iii) a medium for public writing anchored in the oral discourse of the classroom (Nonnon, 2000). Its use varies with the tasks, either planned or improvised, and serves two main functions: (i) defining the activity by structuring the lesson as a marker of its progress and (ii) institutionalizing knowledge to support learning (Lepoire-Duc, 2011; Nonnon, 2000).

To structure activities, the blackboard tracks lesson progress through written instructions or steps (Lepoire-Duc, 2011; Rieunier, 2014). To institutionalize knowledge, the blackboard is used to: (i) support teachers' explanations (Mellado, 1998), (ii) establish what is correct (Nonnon, 2000), (iii) transform a private statement into a public statement (Lepoire-Duc, 2011; Nonnon, 2000) in order to make it an object of comment or compare two proposals (Nonnon, 2000; Rieunier, 2014), (iv) transform students' words into a more conceptually formal proposal (Mellado, 1998; Nonnon, 2000; Rieunier, 2014) and (v) support pupils' awareness and reflection (Lepoire-Duc, 2011; Nonnon, 2000).

In conclusion, given all these aspects, we consider that use of the blackboard, or traditional non-enhanced use of the IWB, particularly in the CDR phase, is under-researched. This article addresses that gap by examining those aspects from the perspective of the PST and their growing skills during the practicum.

2. Materials and methods: documenting and analyzing observations of PST activity, both objective and subjective

This research aims to understand how PST learn to use the blackboard as a support for the CDR phase of instruction. We investigate this particular professional gesture to understand how the elements within it that support construction of the knowledge under discussion and institutionalization of what is discovered are developed.

2.1. Participants

To understand how PST develop their skill in using the blackboard, we had as our participants two cohorts (11 and 9 students) of French-speaking Belgian PST during the practicums of the 3 years of their training as primary school teachers. All participants were volunteers,

which is necessary for conducting self-confrontation interviews (Theureau, 2006). As a result, it was difficult to draw up a sample based on precise criteria. However, we did bring together a group of PST who displayed a variety of characteristics in terms of gender, age, mastery of disciplines or academic success. All students took part voluntarily, had the research protocol explained and were guaranteed anonymization, ability to withdraw, control over the data and its use and no interference with their academic results by our research. All participants signed a written consent form.

The numbers of filmed and self-confronted lessons, documented CDR phases and self-confrontation interviews in which the use o blackboard figured are shown in Table 1.

Table 2 summarizes, for the first cohort, how many interviews were actually used for the data analysis, and from which grades and PST. Out of the 11 participants in the first cohort, we ended up with useable data for 4 of them.

Table 3 is similar to Table 2, except that PST were filmed and interviewed once each term. Out of the 9 participants in the second cohort, we ended up with useable data for 6 of them.

2.2. Data collection: film and think-aloud protocol

For the first cohort (Sept. 2014–June 2019), we planned to film one lesson per student annually, for around 50 min. For the second cohort (Sept. 2019–June 2022), we aimed to film each student once per term, also for 50 min. After filming, we conducted an interview with the PST using a think-aloud protocol called self-confrontation (Dieumegard et al., 2021; Joinel Alvarez & Lussi Borer, 2023; Theureau, 2006). Though not always in a systematic way, we recorded 53 films and interviews. Annual filming allowed us to document professional development, particularly how PST learned to use the blackboard (Blondeau, 2023; Blondeau & Van Nieuwenhoven, 2021).

In a self-confrontation interview (Theureau, 2006), actors are confronted with traces of their activity to reveal, in a delayed fashion, the invisible part of that activity. In this way, we captured and made intelligible the complex processes involved in knowledge construction by PST related to a given situation (Korthagen, 2010; Lave, 1988; Suchman, 1987), through reports of their perceived experience (Dieumegard et al., 2021; Poizat et al., 2023; Poizat & San Martin, 2020; Theureau, 2006, 2015).

During self-confrontation interviews, PST reviewed their lesson videos with a facilitator trained in the think-aloud protocol (Dieumegard et al., 2021; Joinel Alvarez & Lussi Borer, 2023) (see Fig. 1). They were asked to explain their experience: “This guidance places novice teachers back in the activity’s context, helping them express their actions, expectations, emotions, and the knowledge applied during the activity” (Joinel Alvarez & Lussi Borer, 2023, p. 3).

Explanation was facilitated by the researcher, who invited description of the actions and reasoning involved, asked what rather than why questions, used mirror questions to accompany the putting of their perceptions into words and tried to document the dimensions listed in Table 4 (Theureau, 2006) (further in the text). The interviews were conducted in French and transcribed verbatim; quotations used as examples have been translated into English by the authors.

In this way, we collected two types of data: *observational* data through videos, allowing us to document context, behaviors, words or interactions, and *narrative* data, allowing us to understand invisible activity (Hubault, 1996) in the form of what PST thought, saw, felt, experienced and understood about the situation (Theureau, 2006).

Table 1
Available data collected for both cohorts.

	Total number of filmed lessons with follow-up self-confrontations	Total number of documented correction, discussion and recap phases	Total number of self-confrontation interviews in which the use of the blackboard was mentioned
1st cohort (n = 11)	27	21	6
2nd cohort (n = 9)	26	24	15
Total (n = 20)	53	45	21

Table 2
Filmed lessons with mention of the blackboard during the CDR phase in the self-confrontation interview, for the first cohort, by grade and PST (n = 6).

Aliases	1st grade	2nd grade	3rd grade	Total
Clara	x			1
Chloé	x			1
Judith		x		1
Ruchard	x	x	x	3
Total	3	2	1	6

Table 3
Filmed lessons with mention of the blackboard during the CDR phase in the self-confrontation interview, for the 2nd cohort, by grade and PST (n = 15).

Aliases	1st grade		2nd grade		3rd grade		Total
	1st term	2nd term	1st term	2nd term	1st term	2nd term	
Céline			x	x			2
Claire	x		x	x	x		4
Fanny	x			x	x	x	4
Frédéric			x				1
Laurence	x		x	x			3
Noémie				x			1
Total	3		4	5	2	1	15



Fig. 1. A student screening their filmed lesson during a self-confrontation interview.

2.3. Data analysis: combining observational and narrative data

The CDR phase within each interview was identified. For this article, we focused on comments relating to the use of the blackboard. We connected observational data in the film and narrative data in the self-confrontation interview for each type of comment related to the use of the blackboard (Dieumegard et al., 2021; Poizat & San Martin, 2020; Theureau, 2006), as in Fig. 2

We then carried out content analysis (Prasad, 2008; Stemler, 2001) according to Dieumegard et al. (2021) . For each discrete unit of activity present in the words of the PST (Theureau, 2006), we identified the subjective components of the activity: concerns, anticipations, referential systems, perceived indices used to understand situations, subjective

Observational data that can be seen on the film	Narrative data
	
Laurence faces the blackboard and turns her back to the pupils. She's writing "exclamation mark" with her right hand in the first of the three columns she drew on the blackboard. Her writing is too big and sticks out into the middle column.	Laurence: *(In my lesson plan), I had to draw the exclamation mark straight away. And, on the spur of the moment, I wrote it.* Researcher: *And at some point, you see that you're reaching too…* L: *I reach the end (of the column) and I hesitated to cut the word where it was needed, but I didn't know if they (the pupils) would understand. So, I left it like that. I went a bit too far, but I wasn't satisfied.*
She draws an exclamation mark in parentheses below the words "exclamation mark".	L: *At this moment, I draw the exclamation mark in parentheses, and I'm not satisfied.* R: *You're already not satisfied.* L: *Because it's the kind of thing that I do in my summaries, directly, but not for the pupils.*
	
She moves in front of the second column. She draws a dash on the line with the words "exclamation mark" that goes too far into the second column. She erases the dash. She draws another dash just above and writes: "question mark".	R: *You draw a dash. You erase the dash.* L: *Yes, because I thought... Firstly, I made the "mistake" of going on, of going over, I thought they wouldn't understand if I put a dash there. So I chose to draw it above, and at least I think I've got more space.*

Fig. 2. Sample of combined observational and narrative data from Laurence's class and interview (1st year - 1st term - 2019–2020).

actions and (in)validations of those actions (Theureau, 2006). Table 4 presents an excerpt from the corpus related to the example shown in Fig. 1.

From all this material, we then identified emergent themes (Given, 2008; Stemler, 2001; Williams & Moser, 2019), which are developed in the following sections. For each theme, data analysis enabled us to identify problems and solutions that are typical of PST using the blackboard at different stages of their training (Blondeau, 2023). The typical nature of the occurrences, or typicality, was pointed out by the participants themselves or identified by the researcher, based on the repetition or similarity of the situations analyzed (Durand, 2007). These typical occurrences are understood here as invariants that structure



She writes “question mark” after the new dash, but there’s not enough space and the end of the word is written descending, almost vertically.	L: *I write “question ma-r-k”*[3] *and then it falls.* R: *You realize at this point that…* L: *That, in the end, I didn’t write smaller than the other (line). And I think to myself: all right, I'll leave it like that. In fact, I was a bit confused at the time. I ask myself the question: "Should I erase, rewrite in a smaller font? And, at the same time, I told myself I don't have the time.* (...)
She draws a question mark under the words “question mark”.	R: *And you draw the question mark underneath.* L: *Underneath* R: *But there are no more parentheses.*
	L: *There are no more parenthesis* (...) *because, there, as I thought to myself before, the parenthesis is something that I use in my summaries, it’s not for the pupils.*



(...) She writes “to ask a” on the same line, above “question mark”. She hesitates one second, her arm moves in the air. She writes “question” just below the “a”, slightly offset so that it can be written out in full. She explains what she’s doing to the pupils while she’s doing it.	(...) L: *There, I don’t make the mistake anymore because I see well that the space is too short.* R: *Yes.* L: *So, I rewrite a little at the bottom and tell the pupils that I'm writing "question" at the bottom, so that they don't get confused. I'm learning from my mistakes as I go along, in fact. And in the end, now, I know how I would have done it.*

Fig. 2. (*continued*).

Table 4
The subjective dimensions of Laurence's experience when she's writing "question mark" (Theureau, 2006).

Dimensions	Definitions	Samples in Laurence's experience
Concerns	Set of concerns or interests of the actor, not yet realized	Write "question mark" without going outside of the column. Time is running out. Draw the question mark without parentheses. Write "to ask a question" without going outside of the column.
Anticipations	Defining the actor's expectations in relation to the current situation, extending the action into the immediate future	She's going to go outside of the column when she writes "question mark" and "to ask a question".
Referential systems	All the references (theory, actual practice, observed practice, personal rules, etc.) that the actor uses as a basis for their action.	Previous experience of the written length of the "exclamation mark" phrase. Previous experience of drawing parentheses. Parentheses are for her summaries, not for pupils. She knows the space needed to write.
Perceived indices	Attribution of meaning by the actor to a perceived, recalled or interpreted element	She is not writing smaller when she writes "question mark". There is not enough space to write "question".
Actions	Segment of activity that is narrated, shown or commented	Write "question mark" descending. Ask herself if she has to erase and rewrite smaller, decide to not rewrite because of the time. Draw the question mark. Write "to ask a", hesitate, and write "question", above, slightly offset. Explain to the pupils how it is written.
(In)validation	(In)validation of reference systems to the test of action. Subsequent construction of a new or modified system.	Invalidate the length of the writing out of "question mark". Validate drawing the question mark without parentheses. Validate writing "question".

practice and its related cognitive processes (Durand & Theureau, 2016; Poizat et al., 2023; Theureau, 2006). This typicality can be identified in our study based on (i) different occurrences in a single actor's activity, (ii) different activities of an actor involved in various similar situations, (iii) different activities of several actors involved in similar situations, (iv) different activities of several actors involved in several different situations (Poizat et al., 2023) or (vi) the identification by actors of the typical nature of the activity (Theureau, 2006). The validity of the analyses was ensured by the triangulation of data sources (observational and narrative) and a consensus type of coding aiming at reaching agreement (Mukamurera et al., 2006; Stemler, 2001). The analyses were validated by feedback to and from the stakeholders at the end of the process.

3. Results: a combination of data that highlights typical concerns of PST about using the blackboard

Our study highlighted two types of results: typical difficulties that acted as a lever for professional development and developmental trajectories. We first set out the six difficulties documented; then, we follow Laurence's story, which summarizes and illustrates this process.

3.1. Six difficulties as learning situations

Six difficulties or typical bumpy moments (Romano, 2006) were identified by the PST, which we consider as triggers for learning. In these situations, the gap between expectations and what actually happened forced the PST to modify their behavior to deal with the emerging difficulty and return to a situation more in line with their expectations. For each of them, we also present the solutions arrived at by PST, a process we view as a form of professional development.

3.1.1. What to write?

In considering what to write on the blackboard, the PST had to incorporate what the pupils said or answered (Clara-1st[3]). They also tried to remember the fundamental elements described in the lesson plan (Fanny-2nd-T2[4] and Clara-1st): "I try to remember exactly the list of the elements that I'd like to be written, the principal elements" (Clara-1st). They worked on "making quick links with the concepts that need to be handled rigorously" (Richard-2nd). Finally, they said that they must know the subject beyond the planned lesson, because "you never know what question will come your way" (Olivia-3rd-T2).

Some PST found solutions for organizing what to write on the blackboard (see Fig. 3). They used pre-prepared flipchart papers (Fanny-1st-T1), projected a lesson summary identical to the pupils' handouts as advised by a supervisor (Claire-2nd-T1), or drew a structured table with boxes to be filled in (Fanny-2nd-T2). They created fields to be completed with planned words (Claire-2nd-T1) or ideas (Fanny-2nd-T2). Céline (2nd-T1) prepared the board during the break, writing the main concepts for discussion. In this way, the blackboard served as a framework supporting both the pupils' understanding and their own teaching.

PST asked themselves what must be written on the board on the basis of all the pupils' answers, that is, what needs to be preserved, submitted for general discussion and written down for validation. Should they write good answers right away, or should the answers first be validated by other pupils (Clara-1st)? Should they write wrong answers if other pupils could be misled (Noémie-2nd-T2)? Noémie chose in the moment to write the wrong answer, but in another color, in order to submit it to discussion before pupils copied it (see Fig. 4). PST had difficulty with this because they knew that writing an answer means validating it. But how to present it to other pupils without writing it?

In their third year, Fanny and Olivia were less bound by what they had planned:

> We structure the lesson with them. I know what my summary should look like. So, I carry out the whole activity along those lines and I add to it with the children's ideas. (Fanny-3rd-T2)

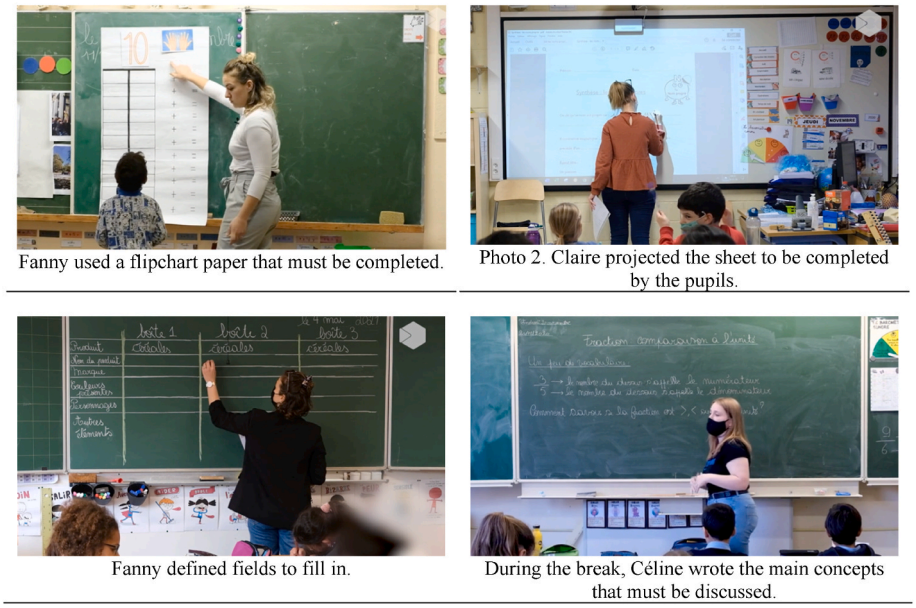
> I'm there to provide a framework and a common thread. I can't foresee everything (…) In fact, they create my lesson themselves. It's on the basis of what they bring to me that I can bounce back and ensure that the lesson is enriching. (Olivia-3rd-T2)

3.1.2. Where to write?

Organizing space on the blackboard was a concern and a problem identified by the PST. In the first year, when she wanted to write something on the blackboard, Clara realized that what she had already written was taking too much space. She had to change what she had planned in terms of the layout of the blackboard. There were two consequences. She had to write short sentences, and she identified a different strategy (see Fig. 5):

> I made a bit of a mess. At that point, I said to myself that maybe I should have written this [what's already on the blackboard] on

[3] Clara - first year.
[4] Fanny - second year-second term.



Fanny used a flipchart paper that must be completed.

Photo 2. Claire projected the sheet to be completed by the pupils.

Fanny defined fields to fill in.

During the break, Céline wrote the main concepts that must be discussed.

Fig. 3. PST used the blackboard as a frame to support the lesson for the pupils and for themselves.



Fig. 4. Noémie wrote the pupil's wrong answer in red rather than white like the others (the 3 is in red).

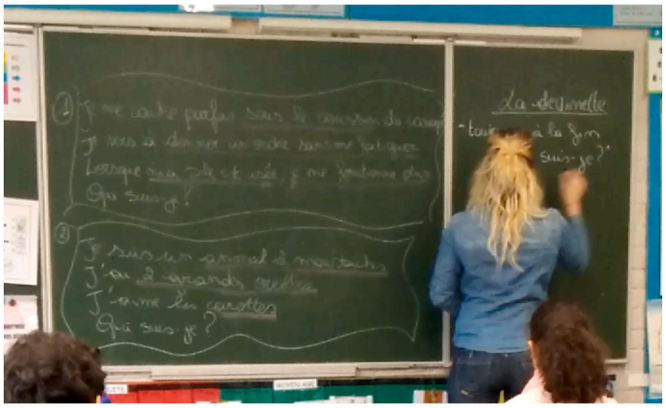


Fig. 5. Clara modified the planned organization of her blackboard by writing short sentences in a smaller space than planned.

> flipchart paper. (…) I could have moved them to the side and had more space. (Clara-1st)

Laurence (1st year) let the pupils place some paper strips on the blackboard. She realized that it was not as she wanted, and she was unsettled. She hesitated and groped, looking for appropriate space to write, but she was not satisfied. When she gave the same lesson 1 year later, before the pupils placed the strips she put one of each kind in the appropriate place to structure the blackboard (see Fig. 6). Here again, we saw how PST learned from their experience.

Two other strategies appeared in the second year based on previous experience. We already mentioned preparing the blackboard during the break (Céline-2nd-T1). The other was to structure the blackboard in the same way as the paper that the children received (Claire-2nd-T2). In that way, PST had a guide for their writing, and the pupils followed the lesson more easily.

Fanny (3rd-T2) divided a box on the blackboard into two horizontal parts to write different kinds of interrogative sentences. One of these sentences was too long for the box, and she had to wrap to the next line for the last word (bell) and the question mark. The problem was that all the interrogative sentences on the board began with a question word. So, a pupil misunderstood and identified "bell" as a question word (see Fig. 7).

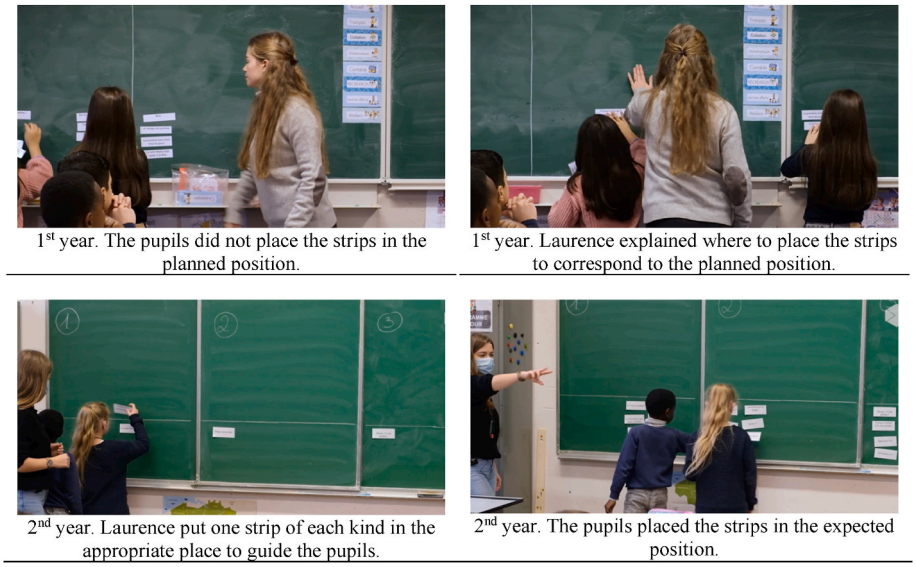
She said: "I could have erased the blackboard on the side and written consecutively, but it also allows them to see that (…) when there isn't enough space for all the words in the sentence, there is a line break" (Fanny-3rd-T2). Fanny transformed a blackboard organization problem into a learning occasion for the pupils.

3.1.3. *Where to stand while writing?*

Fanny (3rd-T1) explained that wherever she stands when she is writing on the blackboard, she blocks part of the blackboard for some of the pupils. She had already searched for solutions, but she was not satisfied. During the interview, she embarked on a process of reflection, telling us that, due to her position, three problems occurred. She did not see the pupils, the pupils did not see her giving explanations and her body was hiding what she was writing on the blackboard. She said: "I'm backing off […] I'm backing off completely," but she was not yet satisfied (see Fig. 8).

3.1.4. *How to write?*

The form of what is written on the blackboard was the next concern. It is divided here into several items.



1st year. The pupils did not place the strips in the planned position.

1st year. Laurence explained where to place the strips to correspond to the planned position.

2nd year. Laurence put one strip of each kind in the appropriate place to guide the pupils.

2nd year. The pupils placed the strips in the expected position.

Fig. 6. Positioning the strips in the first and second years.

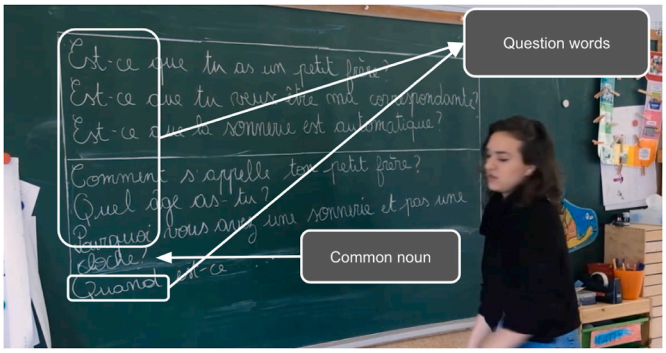


Fig. 7. Fanny wrote a common noun at the same place as a question word, confusing the pupils.



Fig. 8. Fanny, left-handed, hid the board from some pupils when she wrote.

3.1.4.1. Wording. Choosing good words was another challenge: "I know that it's going to be a disaster (…) in terms of sentence structures" (Chloé-1st) or "We're going to try to put this [what the pupils have said] into words" (Clara-1st). It was all the more difficult when, as mentioned above, Clara (1st) lacked space on the blackboard. She was forced to write short sentences in order to have enough space to write them. Laurence (1st-T1) had another problem: she wanted to write a text that suited her, was consistent from column to column in her blackboard organization and could be easily understood by the pupils. She thought blackboard management was going to be easy and neglected that phase in her lesson plan.

> I'm really struggling with the structure of the blackboard. I felt like it's a sure thing, but it's not. And I realize that now, here [during the think-aloud protocol], because I didn't want to think about anything else at the time.

It was the same for Chloé (1st), who said: "It's stressing me out (…) because I hadn't planned to … I hadn't written it down in my lesson plan … I hadn't planned the expected answers."

A concern related to the wording was the time needed to write. During that time, as we will discuss later, PST turned their back to the class. It was then difficult to manage the classroom. Moreover, the children were often inactive, waiting for the teacher. To shorten this time, Frédéric (2nd-T1) decided on the fly to use symbols, organized the text in mind maps, let a child draw symbols while he was speaking to the class and used abbreviations (see Fig. 9).

Fanny (3rd-T2) also saved time by writing only what was necessary in the sentence and using suspension points (see Fig. 10).

Once again, we saw how PST, confronted with concerns and difficulties that they had sometimes not even anticipated, found solutions and grew more skillful.

3.1.4.2. Handwriting. Forming letters correctly on the blackboard was not as easy as it might seem to be.

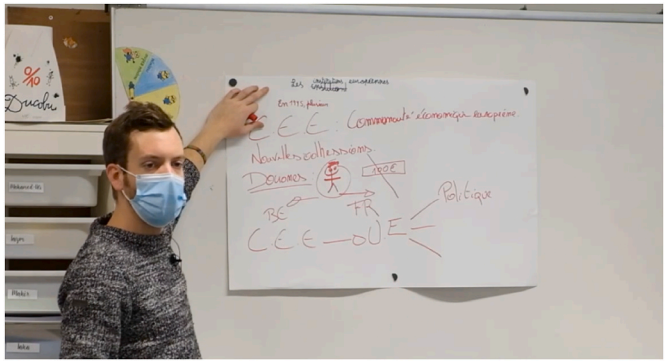


Fig. 9. Frédéric used abbreviations or symbols to shorten writing time.

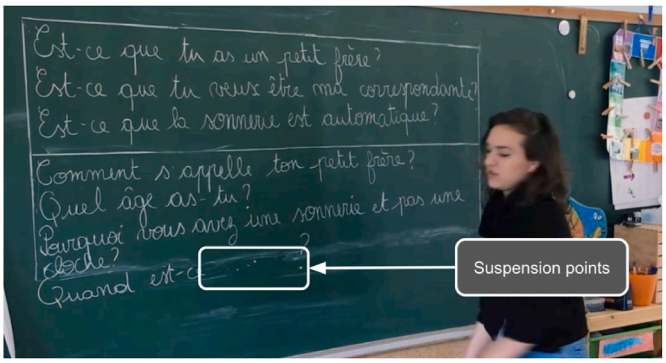


Fig. 10. Fanny used suspension points to avoid writing the whole sentence.

> I also put a lot of effort into my writing (…) it took me a long time to write (…) but I try to make sure that it's [the shape of the lettering] legible for all the pupils, that there are no mistakes and that it's well-rounded. (Clara-1st)

This was made all the more complicated by the fact that hand fatigue was becoming more and more prevalent and interfered with handwriting: "I write a lot, a lot, and it's killing my hand" Claire (1st).

Sometimes, PST needed to rewrite what they had written because they realized it was badly formed (Chloé-1st; Laurence-1st-T1; Fanny-3rd-T2), and sometimes they received comments about their handwriting from the pupils (Chloé-1st; Frédéric-2nd-T1; Fanny-3rd-T2), which they found embarrassing (Chloé-1st). Sometimes, they wrote too big, and overflowed the space provided (Laurence-1st-T1), as shown in Fig. 2 in Section 2.3 or had to divide up sentences (Fanny-3rd-T2), as we already discussed.

3.1.4.3. Spelling. Chloé (1st) and Richard (1st) were concerned about spelling, especially Chloé:

> It stresses me out, because I know I'm not a champion speller (…) I know I'm not a great speller, even though I'm working on it, and it's getting better. But sometimes, even when there are simple words, […] there will always be a moment of hesitation. […] That's the thing I mustn't let show, because I feel I'm undermining my credibility in the eyes of the pupils. Some of them have already come back to me and said: "You made a mistake there." Well, I try to say, "Oh yes, thank you." But when that happens two or three times, it's a bit much and I really have to be careful. It adds to the stress. (Chloé-1st)

This avoidance strategy is interesting, in that developing it and putting it into action is in itself learning how to manage a difficulty over which we have no immediate control or for which we see no short-term solution.

3.1.4.4. Classroom habits. Classrooms are often full of tacit or implicit routines, known and shared by the teacher and pupils. These routines are integrated and become transparent to them. When a PST comes into a class, all of these implicit points can be problematic for them. Claire (2nd-T1) was confronted by this when she realized she did not know the color code used to underline words according to their type. She told the pupils to ask the teacher.

3.1.5. Classroom management during writing

As mentioned above, when the PST wrote on the blackboard, they turned their backs on the pupils. Troubles often occurred: loss of attention, noise, unruly behaviors. PST thought of solutions that would reduce those distractions and let them keep control of the classroom.

In the second year of training, Frédéric (T1) said he talked to the pupils to maintain attention. Céline (T1) asked the children to create a framework on their individual erasable whiteboards within which things were to be written, the same way as she was doing on the blackboard. Claire (T1) asked the pupils to put their hands on their heads when they had finished their copying.

We documented other solutions in the third year. After difficult experiences, Claire (3rd-T1) adapted her behavior and prepared the blackboard during the break:

> I'm doing this a lot this year, because I'm having trouble with classroom management and, if I get my material ready beforehand, it's time I don't waste, where they're talking, where they can (lose concentration). Frankly, if I'd turned round for 5 minutes to do that, it wouldn't have looked as good, and then I'd have found one on the seat next to him, another lying on the floor and another lying on the bench.

Olivia (3rd-T1) came up with an original strategy when she sent a pupil to the blackboard. While he was writing the answer, she had to manage a quarrel between two other children. She took the time to do it and explained: "The pen makes a noise (when it slides on the IWB) and I can hear that he's not writing at all yet. I'm dealing with the two of them (students arguing) while he's thinking." (see Fig. 11)

Richard (3rd) confronted a group that was difficult to manage. He described another strategy:

> I did it because I'd thought about it two or three times here (in this class). I said to myself that when I'm writing myself on the blackboard, they were doing a lot of stupid things behind my back. While I'm writing, they do nothing and after that, they write. And then I have to wait for them. I thought I'd get them all to write. Well, I was going to dictate. That way you can keep an eye on them. And they're quite big. […] I decided to change my strategy.

Once again, realizing there were recurring problems in a potentially difficult situation, PST used their experience to anticipate these problems and come up with original strategies, which showed progress in their skill development.

3.1.6. Impact of the IWB on blackboard writing processes

New technologies bring new challenges, and the IWB is no exception. In her second year, Claire (T1) began to use it cautiously, like a traditional blackboard. Her supervisor suggested projecting worksheets for pupils to complete in large print, prompting Claire to learn new actions: project, freeze, change worksheets and refreeze. This experience helped her develop skills that transferred to regular blackboard use. Céline (2nd-T2) adopted similar strategies. Richard (3rd) attempted this method, but faced issues: the projected worksheet was too small, or if enlarged, it required multiple steps to display, complicating classroom management.

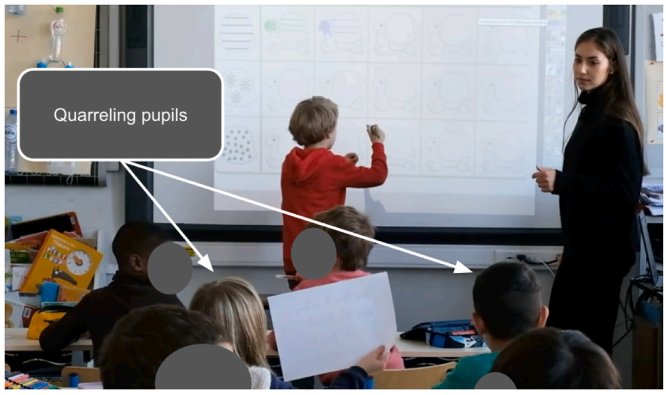


Fig. 11. Olivia did not hear the noise of the pen and took this time to manage a quarrel.

3.1.7. How to get pupils to copy from the blackboard

The final concern for PST was ensuring pupils copied accurately from the blackboard onto their personal media. In her first year, Chloé worried about the accuracy of the copying, but managing varying copying speeds was the main difficulty. Claire (2nd-T1) asked pupils to place their hands on their heads when done, while Judith (2nd) tried pushing slower pupils with limited success.

Fanny (2nd-T2) experimented with solutions, attempting an activity where students simultaneously offered answers and copied, a first for her. Richard (3rd) opted to dictate what was needed, ensuring that pupils paid attention instead of managing copying time with his back turned.

3.2. Two ways of learning

To summarize our findings on learning to use the blackboard, we present Laurence's case, which combines commonalities seen across participants. We observed her teaching the same lesson using the same method in the practicums in her first and second years.

In the first term of her first year, as seen in Fig. 2 in Section 2.3, Laurence struggled with blackboard use. She was unhappy with her large handwriting and the way she wrote an exclamation mark in parentheses. She realized that her notation style, although suitable for personal summaries for her own use, was not appropriate for pupils. She hesitated with the dash and question mark, noting that the space was too short. Over time, during that lesson, she learned through trial and error, saying: "I don't make that mistake any more because I see well that the space is too short" and "I'm learning from my mistakes as I go along, in fact. And in the end, now, I know how I would have done it." In this example, we see (i) how a difficulty, adapting the size of her writing to the space, was overcome by trial and error and (ii) how she used her experience to improve her performance of this professional gesture on future occasions.

One year later, teaching the same lesson in the first term of her second year, Laurence was more attentive to organizing the board and aligning the columns. She explained, "I look at the third column to be sure I begin the sentence the same way." Her experience reassured her, and she felt more confident: "That reassured me about the mistakes I'd made last year. Everything was prepared in my head. I know the blackboard […]. Now I really feel it's stress-free."

In a further interview in the second term of her second year, Laurence summarized:

> At one point, in my thoughts, I say to myself: I can see that this isn't working too well. Next time, I'll have to do this and I'll try to bounce off what I think is most interesting. […]. And throughout the lesson, I'm also learning [by saying to myself]: what could I do next time?

As she taught, she adjusted her actions and built her repertoire for future lessons.

4. Discussion: a complex professional gesture that comes with experience

Our results highlight the componential nature and progressive development of pre-service teachers' skills in using the blackboard—a central but often underestimated tool. This study was guided by three main objectives: (i) understanding the complex professional gestures associated with blackboard use, (ii) analyzing the growth of expertise in this domain, and (iii) exploring the learning processes of pre-service teachers.

First, using the blackboard as a tool during the CDR phase of instruction is a complex professional gesture. In this research, we identified the components of this gesture that were relevant to the PST in our study and made it clear that it is, in fact, a concatenation of micro-tasks that must be carried out simultaneously under time pressure, in a complex and dynamic environment (Doyle, 2006; Walton & Rusznyak, 2013). It seems that those micro-tasks have become transparent to experts (Durand, 2008), which perhaps explains the paucity of literature on the subject of using the blackboard (Eilam & Poyas, 2006), and the difference in focus between experts and novices (Blondeau, 2023). While novices face "what to write" and "where to write," for example, expert-related literature focuses on using the blackboard as a marker of the progress of the lesson and a tool for institutionalizing knowledge to support learning (Lepoire-Duc, 2011; Nonnon, 2000).

Second, the analysis of developmental trajectories reveals a clear evolution of skills over the course of the years of training (Blondeau, 2023). The case of Laurence, for instance, illustrates how repeated exposure to the same challenges can transform a task initially perceived as stressful into a mastered professional routine (Blondeau, 2023). In this way, we contribute to the understanding of the mechanisms behind learning during practicum that remain too often unclear (Azéma, 2015).

In their first year, PST often face a shock when using the blackboard during the CDR phase. They prepare rules, examples and answers, but do not know how to organize them and write on the board, or they do not even imagine the difficulty of this task, or do not think it is necessary to anticipate it. Moreover, sometimes, despite their planning, they must adapt to pupils' responses and decide phrasing, spelling and positioning on the spot.

By the second year, PST better anticipate blackboard layouts, reducing on-the-spot adjustments through pre-prepared boards or projected summaries. Symbols and abbreviations save time, and handwriting improves with practice. Lesson content aligns better with their plans, though some PST show flexibility, such as using fill-in-the-blank charts to encourage student thinking.

In the third year, form becomes less problematic. PST pre-plan table use and adapt flexibly. Spelling and handwriting issues fade, and lesson planning becomes more student-centered, acknowledging unpredictable responses and incorporating them into the structure.

Overall, PST evolve from focusing on content presentation to fostering reflection and peer feedback (Rieunier, 2014). While challenges with form diminish, issues such as copying and ideal positioning remain unresolved. The gap between their concerns and the literature about expert use of the blackboard decreases.

Third, the combination of observational and narrative data (Poizat & San Martin, 2020) enriches our understanding of the subjective experience of PST (Theureau, 2006). This approach captures not only visible actions, but also the cognitive and emotional dimensions underlying these actions (Hubault, 1996). It highlights two learning paths for and from using the blackboard: (i) from one experience to the next and (ii) during the activity itself. In both, PST refined their referential systems (Theureau, 2006) when faced with disruptive situations (Romano, 2006).

On the first path, PST learned from past challenges, using prior "bumpy moments" (Romano, 2006) to anticipate issues and adjust their lesson plans. Examples included preparing the blackboard in advance, projecting summaries, and modifying or abandoning copying strategies. While these changes eased classroom management, they also sometimes reduced the blackboard's role in knowledge construction (Rieunier, 2014). Successful practices were often repeated and adapted, such as Fanny's structured table or changes inspired by encountering IWB during a practicum, even though, in general in the field, IWB are most used as a traditional blackboard (Kyriakou & Higgins, 2016; Roland et al., 2016) without enhancing the lesson (Puentedura, 2013).

The second path documented real-time adaptations. As a response to an environmental disruption (Poizat et al., 2024), PST transformed their practices during activities, such as by following pupils' reasoning, using icons or abbreviations for speed, reorganizing the blackboard, or delegating writing to pupils. They were thus forced to change their behavior in action and, further, their systems of references (Theureau, 2006). Notable examples included using colors as signals and turning a blackboard issue into a learning opportunity. Laurence demonstrated clear on-the-spot changes, improving her practice progressively and gaining

confidence for future lessons.

Over time, PST placed greater importance on understanding the subject rather than strictly following lesson plans. Over-planning blackboard use could hinder knowledge construction, underscoring the need for experience to balance spontaneity and preparation. This shift allowed PST to distance themselves from rigid plans and focus more on teaching dynamics.

5. Conclusion

This study explored how PST develop expertise in using the blackboard during the CDR phase of lessons. This pivotal teaching moment, where knowledge is clarified, validated, and institutionalized, requires mastering a tool that, although seemingly simple, presents significant challenges for novice educators. The research focused on understanding a complex professional gesture through the main difficulties PST encountered, the strategies they developed to overcome these obstacles, and how these experiences contributed to their professional growth.

The research identified six main difficulties PST face during blackboard use: deciding what to write, organizing space, positioning while writing, ensuring clarity in text and handwriting, managing the classroom during writing, and facilitating accurate student copying. These challenges often act as triggers for learning, prompting PST to adapt and develop effective strategies. The findings demonstrate that disruptions encountered during blackboard use often act as levers for professional development. For instance, some PST preemptively prepared blackboard layouts, while others used symbols or color codes, or aligned blackboard content with student materials to create a structured and supportive learning environment. These strategies enabled PST to construct a repertoire of increasingly effective teaching gestures.

Skill development relies on adaptive strategies and iterative learning. It follows a progression marked by experimentation, reflection and adaptation, moving from the shock of discovering the complexity of using the blackboard to its effective use as a tool to structure the lesson and to support learning. This allows PST to refine their practices in two ways: on the spot by a quick adaptation, or from one lesson to the next, using reflection on events and planning.

Beyond these specific strategies, this study also emphasizes the importance of taking into account the subjective and often invisible dimensions of teaching activity, which can lead to more targeted and effective training. By understanding the disruptions and the reflective adjustments they provoke, we gain insight into how PST navigate the complexities of their initial teaching experiences.

Despite these valuable contributions, the study has certain limitations. The research focused on a small and specific sample of French-speaking Belgian PST, which restricts the generalization of findings to other cultural or educational contexts. Moreover, while the emphasis on traditional blackboards remains relevant, it does not fully account for the growing significance of technological tools such as IWB or collaborative applications in modern classrooms. Although the study examined skill development over several years, it did not explore the long-term impact of these training experiences on professional teaching practices. Additionally, the reliance on qualitative data from self-confrontation interviews and video analyses, without triangulation through other methods such as large-scale surveys or external classroom observations, further narrows the scope of the findings.

These limitations open avenues for future research. Comparative studies could investigate the differences between traditional blackboards and technological tools, shedding light on how these approaches influence teaching and learning dynamics. Long-term tracking of PST could help determine how the skills acquired during initial training evolve and are sustained in professional practice. Exploring intercultural variations would also provide a broader perspective, assessing whether the challenges and solutions identified are universal or context-specific. Finally, analyzing how students perceive and engage with blackboard use during the CDR phase could offer complementary insights, deepening our understanding of the interactive dynamics in classrooms.

The implications of this research for teacher training are significant. Structured reflection and feedback, based on the subjective experience of PST, must become integral components of training programs. This will enable PST to analyze their errors and gradually master essential teaching tools such as the blackboard. At the same time, it will enable teacher trainers to understand the growth of skills based more on PST perceptions from teaching situations, and less from the expert's extrinsic point of view, which can overwhelm the novice's experience without taking it into account. Moreover, fostering the effective combination of traditional and digital tools would ensure that PST are better equipped to navigate diverse teaching environments and meet the demands of contemporary education.

In conclusion, this study underscores the importance of blackboard use not only as a teaching tool, but also as a key driver of professional growth for PST. The challenges they face serve as critical opportunities for learning, prompting them to develop adaptive strategies and refine their professional practices. By emphasizing reflection, experimentation and the integration of traditional and modern tools, teacher training programs can better prepare future educators to succeed in the dynamic and complex world of teaching.

CRediT authorship contribution statement

Marc Blondeau: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Catherine Van Nieuwenhoven:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data will be made available on request.

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