



HAL
open science

Retrospective reflections on ‘Missions’ as pedagogies of practice

Elisabeta Eriksen, Annette Hessen Bjerke, Camilla Rodal, Ida Heiberg Solem

► **To cite this version:**

Elisabeta Eriksen, Annette Hessen Bjerke, Camilla Rodal, Ida Heiberg Solem. Retrospective reflections on ‘Missions’ as pedagogies of practice. Eleventh Congress of the European Society for Research in Mathematics Education, Utrecht University, Feb 2019, Utrecht, Netherlands. hal-02422514

HAL Id: hal-02422514

<https://hal.science/hal-02422514>

Submitted on 22 Dec 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Retrospective reflections on ‘Missions’ as pedagogies of practice

Elisabeta Eriksen, Annette Hessen Bjerke, [Camilla Rodal](mailto:camilla.rodal@oslomet.no) and Ida Heiberg Solem

OsloMet – Oslo Metropolitan University, Oslo; elisabeta.eriksen@oslomet.no;
annette.hessen@oslomet.no; camilla.rodal@oslomet.no; ida.solem@oslomet.no

Many preservice teachers (PSTs) experience a tension between theoretical input from university and from school placement. What to do about this theory-practice divide is an ongoing debate. In this paper, when investigating the potential of a type of assignment, ‘Missions’, to reduce this divide in mathematics teacher education, we give PSTs a voice in the matter. Their statements connect specific features of the assignments to theory on mathematics pedagogy and to professional practice. Two factors emerge as central to ‘Missions’ bridging theory and practice: PSTs’ lack of familiarity with mathematical investigations and the synergies between several pedagogies of practice – both prior to and during the work on the assignments.

Keywords: Pedagogies of practice, missions, maths preservice teachers, theory-practice divide.

Introduction and background

Preservice teachers (PSTs) often experience a disconnect and tension between theoretical input from university and practice in school placement (Nolan, 2012). When in conflict, PSTs reject theoretical perspectives from university, which highlights that, in their eyes, practice is a highly valued component of teacher education, more important than the university input for their future as mathematics teachers (Solomon, Eriksen, Smestad, Rodal, & Bjerke, 2017).

Nolan (2012) notes that, in mathematics, tension between practice in schools and university’s theorisation of that practice mirrors the conflict between inquiry-based focus at university and instrumentalism in schools, where the PSTs’ habitus plays a pivotal role. Habitus is strongly rooted in experiences from early schooling, and is, for that reason, hard to change (Nolan, 2012). PSTs’ ideas of what mathematics teaching is and ought to be, is influenced by memories from their own years as students (Arvola, 2005). For alternative views to stand a chance, it is important to offer PSTs opportunities to reflect critically over their own experience as students, at the same time as they are offered support in experimenting with less familiar approaches to teaching mathematics (Leavy, & Hourigan, 2016).

As a response to this disconnect between theory and practice, in Norway, the practice component of teacher education is expanded. Researchers within the field are sceptical of such quantitative solutions for qualitative problems (McDonald et al., 2014): it is hard to see that such an expansion on its own can bridge the theory-practice divide, but what the alternative is, is an ongoing debate.

In this paper, we explore the potential of ‘Missions’, a type of assignment developed at our university, to be part of such a solution in mathematics teacher education. We do this through a two-pronged approach: first we analyse the text of the Missions in order to identify how they address theory and practice, and second, giving PSTs a voice in the matter, we investigate how they experience these assignments as part of their teacher education programme, which includes 100 days of school placement.

In the Missions, working in groups of 3 – 5 PSTs, the idea is for the PSTs either to observe and interpret students' strategies and methods within a topic, or plan and conduct an activity with students and holding a specific focus (mathematical or methodological). The chosen activity shall provide opportunities for investigative work (Skovsmose, 1999). In preparation, the PSTs must think through what kind of suggestions, solutions and prior conceptions the students might bring up - and how to meet their contributions. During implementation, the focus shall be on student thinking, communication of ideas, and how the PSTs manage to challenge the students and provide support. After implementation, the process shall result in a written report where, on the basis of theory, PSTs shall analyse and discuss their observations and the work produced by the students. Critical reflection on the process and their own role as mathematics teachers is a crucial part of the report.

Theory

As teacher education is ultimately preparing PSTs for their professional practice, in recent years educational researchers have become increasingly preoccupied with how this is reflected in the design of the programmes. In mathematics teacher education, the inclusion of actual records of teaching, such as samples of student work and transcripts of classroom episodes, have become widespread, as they are seen as “extremely powerful sites for learning” (Boaler, & Humphreys, 2005, p. 4).

One particularly useful tool for analysing the design of teacher education programmes, in this respect, comes from Grossman et al. (2009), who have developed a framework for pedagogies of practice, pedagogies used in the education of professionals in order to connect to their future practice. They have identified three types of pedagogies: *representations*, *decompositions* and *approximations of practice*.

Representations of practice are activities that illustrate facets of practice that allow novices to develop images of professional practice and ways of participating in it, such as portrayals of decontextualized classroom dilemmas that teachers pursue in their ongoing work. *Decompositions of practice* are activities in which teaching is parsed into components that are named and explicated, such as when analysing videos of lessons by using a certain framework. Finally, *approximations of practice* are activities in which PSTs engage in experiences akin to real practice that reproduce some of the complexity of teaching.

In mathematics teacher education, theoretical perspectives are often related to reform teaching. The relative difficulty of reform teaching can cause the teacher to fall back on more traditional, teacher-centred approaches. One way of addressing this during university courses, is through opportunities to experience alternative ways of teaching through *representations of practice* (e.g., by participating in student-centred teaching led by the course instructor), *decomposition of practices* (e.g., by using videos and analysing those based on specific theoretical frameworks), or *approximations of practice* (lesson planning, rehearsals, co-teaching with experienced teachers). In *approximations of practice*, the PSTs are enacting teaching practices, rather than contemplating them (Grossman et al., 2009).

The idea behind the Missions is closely connected to an understanding of teacher competence as something dynamic and action-oriented that needs be developed in close interaction with the field

of practice (Kværne, & Solem, 2012). If the goal is to educate mathematics teachers with such competence, we need to understand what this requires of the components we choose to incorporate in programme designs, such as the Missions. Schoenfeld and Kilpatrick (2008) have developed a theoretical framework for *proficiency* in teaching mathematics that considers both knowledge of theoretical perspectives and competence in enacting teaching practices. The seven categories are: *knowing school mathematics in depth and breadth*; *knowing students as thinkers*; *knowing students as learners*; *crafting and managing learning environments*; *developing classroom norms and supporting classroom discourse as part of “teaching for understanding”*; *building relationships that support learning*; and *reflecting on one’s practice*. The names of the categories are relatively self-explanatory and, for lack of space, we refer the reader to the original source for details.

Methods

This paper reports on a study with a generalist primary teacher education programme for grades 1 – 7 (ages 6 – 13) at a University in Norway. The participants are in their third year of a four-year programme, undertaking a specialization mathematics course that builds on the compulsory 30 ECTS in mathematics methods from the first two years. During each academic year, PSTs spend 30 days in school placement, leaving them with a minimum of 60 days in schools before their first Mission. All PSTs undertaking the course were invited to participate in the study, and ten volunteered.

The ten PSTs were interviewed in pairs. The questions raised in the semi-structured interviews focused on their ideas on two Missions’ purpose and function, PSTs’ perception of the use of theory, and their experiences with these two Missions. Considering their development as future mathematics teachers, we encouraged the pairs to discuss the role played by the Missions and by teaching mathematics in school placement.

The analysis of the two Missions is organised through a comparative perspective. Our analysis of the text of the two Missions is conducted in order to identify references to theory (operationalised through the syllabus of the course) and teaching practice (operationalised through tasks of teaching). Once these two Missions are identified as pedagogies of practice, we proceed to characterize them by means of the framework of Grossman et al. (2009), including an overview of constraints that are a means of reducing complexity.

In order to capture PSTs’ experiences with these two Missions as pedagogies of practice, for our analysis of the interview data, we developed coding categories close to Schoenfeld and Kilpatrick’s (2008) theoretical framework. This framework was chosen because it considers both theory and practice, and the seven aforementioned categories were operationalised in a way that enables PSTs’ statements to be immediately linked to one of the categories, or associated to a category due to the literature in the course syllabus. The authors conducted the coding individually, and coding categories were discussed until agreement was reached.

Findings

To identify the two Missions’ traits as pedagogies of practice, we begin with an analysis of the text of the assignments, before proceeding with an analysis on how PSTs perceive these two Missions

and the university instructors' intentions in employing pedagogies of practice that both resemble normal teaching practice and reduce complexity.

The two Missions

Both Missions are reform-oriented, mathematical investigations (Skovsmose, 1999) as presented in the course syllabus – and requiring PSTs in groups to bring to the classroom activities where the students are challenged to explore, explain and justify mathematical ideas. In both cases a written report was required, a *decomposition of practice* addressing the planning stage, the implementation and the reflection following the lesson. Table 1 displays a comparison of the two Missions.

	Mission 1	Mission 2
Lesson type	Investigation	Investigation
Topic and activity	Algebra - The Border Problem (Boaler & Humphreys, 2005)	Not set
Grade, class size, timeframe	Not set	Not set
Methodical considerations	Follow closely the model in Boaler & Humphreys (2005) or make different choices as long as the investigative nature is preserved	Lead the lesson so that the investigative nature of the task is preserved
Collect documentation	Proof of the students' inquiry processes. Focus: The emergence of important algebraic ideas, students' use of representations as theorised in Boaler & Humphreys (2005)	Proof of the lesson being a true investigation as defined in Skovsmose (1999). Focus: The nature of teacher-student and student-student communication as theorised in the course literature (i.e., Solem and Ulleberg (2013))

Table 1: Comparison between the two Missions

In both cases, work on the Missions was preceded by teaching sessions at the university. In addition to introducing theoretical input, these sessions included a sequence of a *representation of practice* and a *decomposition of practice* directly relevant for each of the two Missions. Specifically, the course instructor opened each session by conducting an investigation with the PSTs (“The Border Problem” prior to Mission 1, and a selection of different investigative activities prior to Mission 2), collecting artefacts – *representations of practice*. Next, the course instructor introduced a theoretical perspective and then presented the PSTs with opportunities to participate in a *decomposition of practice*, using theoretical perspectives in analysing artefacts from their own work, as well as from examples of implementations in primary and middle school classrooms. For Mission 1 an additional opportunity for the PSTs to engage with *representations* and *decompositions of practice* was provided. Boaler and Humphreys (2005) is compulsory reading and includes a video recording of a classroom implementation of The Border Problem, as well as an in-depth discussion of that session.

In Mission 2, the PSTs were free to choose the activity; although they could choose one where *representations* and *decompositions of practice* were available (e.g., the activities used by the course instructor), overall, support is reduced compared to Mission 1, and so the complexity is higher.

We argue that the two Missions ensure that the PSTs engage in *approximations of practice*. The assignments, as set by the course instructors, require planning and enacting a lesson, and are therefore proximal to the practice of teaching. At the same time, the complexity of the teaching situation is reduced by narrowing the scope to the specific traits of investigations, to the concept of variable introduced by translating between representations and to communication in the mathematics classroom, respectively. Additionally, complexity is reduced as the PSTs are only required to select some pivotal moments for discussion, and may simply ignore others. Rather than being evaluated based on how ‘successful’ the lesson has been in terms of learning goals for the students, the written report – a *decomposition of practice* – will be evaluated based on the manner in which PSTs connect observations from the classroom with the theoretical input from their course, as well as their reflections on the implementation. This gives room to experiment in a safe environment - reflections on ‘failures’ such as reducing a student’s opportunity for productive struggle, or on misinterpreting a student idea are welcome in the report, and will be regarded by the instructor as a positive learning experience for the PSTs. Finally, as the PSTs are required to work in groups, this provides them with a type of support unusual for the practice of teachers - at least in Norway.

PSTs’ reflections on the two Missions

The rationale of using pedagogies of practice is that they are simultaneously proximal to actual practice, and have reduced complexity. In the eyes of the PSTs, the main reason why the course instructor has chosen to give these two Missions is because enactment makes theory meaningful: “...a very good opportunity to understand what is expected of us as teachers, the contrast [between theory and practice] is not so great when I can try out what I’d learn about” (PST1).

Specifically, the contrast between the analytical stance of a *decomposition of practice* in isolation and the combination of *approximation* and *decomposition of practice* emerges as the PSTs reflect on how the two Missions supported their understanding of the concept of mathematical investigations:

One could for sure just say: “Be careful, don’t deprive [the pupils] of this opportunity [to figure things out themselves]”, but this was something else entirely. It gave me a completely different awareness, by allowing me to experience it (PST2)

In both statements, the presence of the course instructor is noticeable - “what is expected”, “one could [...] say”, indicating they perceive the two Missions to be part of teacher education, pedagogies of practice rather than pure professional practice.

In other statements, however, the perspective of professional practice emerges, with its demand on the PSTs’ knowledge of the depth and the breath of mathematics: “you go deeper [in the mathematical ideas], and learn more about *why* it is like it is” (PST5).

Making sense of mathematics is an experience included even in *representations of practice*, such as the investigations led by the course instructor during the session at the university; however, planning for an actual lesson (i.e., an *approximation of practice*) is significantly different, forcing PSTs to consider not only themselves, but also the students:

It takes a lot - preparing for all possible answers that might come, and all possible questions. You end up pondering imaginable scenarios and preparing how you could explain it from there (PST8)

The theme of *knowing students as thinkers*, their possible ways of approaching the tasks, and their possible questions, as well as the theme of *knowing students as learners*, what might be a helpful way of meeting their contributions, recur again and again as central to the assignment:

Normally, if the students had given the wrong answer you would just think “OK, that’s wrong”. But as it is [in Missions], you have to think what might be the thought behind the answer (PST5)

PST7 relates her first-hand experience with the difference between *knowing students as learners*, and actually successfully *crafting and managing a learning environment* that aligns with that knowledge:

You had gone through [The Border Problem] quite thoroughly, you knew there were six ways [of thinking] and possible misconceptions and so on, you had seen quite a lot of examples [...] so you got started on Mission 1 from a position of strength. [...] But] how we prepared [for the lesson in Mission 1] and how we put it across to the students did not help them as we thought it would. When we left the classroom we were thinking “Damn, we should have done a lot better!” We knew what to do – we had been through it all [at uni] – but we haven’t dug deep enough (PST7)

As investigative work is at the heart of these assignments, the learning environment was often discussed in terms of characteristics of this approach:

I still remember the maths classes where you practiced algorithms and if you asked why it worked, the teacher said “It’s just the way it is”. I can see it’s tempting to say that... The Missions give us a chance - no, force us - outside the “It’s just how it is”- box, since they are made so that the tasks don’t work unless you actually understand. It’s probably [their] the most valuable quality (PST4)

The comparative freedom in Mission 2, got mixed receptions:

On the first assignment, you got very clear constraints on what to do. On the second one, my group chose to do several tasks, and then we didn’t get the depth we needed, we sailed more on the surface of what an investigation should be (PST4)

My group designed the activity [for Mission 2], and we found it gave us more ownership of the lesson. It was ours, and it was easier to learn from it. [Working with a given task in] Mission 1 was necessary to show us how to [investigate] (PST3)

Regardless of the risk of failure, the PSTs regard the two Missions as opportunities to think deeply about what happens in the interaction with the students:

When you plan a lesson, teach it and then write about it, you become more aware of how you react to what the students say - it's not just that you ask them something, they say something in return and you don't think too much about the answer. You actually reflect on the conversation! (PST10)

The *classroom discourse in mathematics* appears often in PSTs' reflection. This could be in part due to the explicit focus on communication in Mission 2 (Table 1), that retrospectively spills over in what they remember from Mission 1, but could also be in part a direct consequence of having communicated with children, and being required to document it. *Establishing classroom norms* are mentioned in connection with these assignments as well: "The assignments contributed [towards the awareness that] it's not just what you teach, but how you teach it, too!" (PST1). However, this code appears less frequently, perhaps given that PSTs spent a short time with students during Missions.

In comparing the *approximations of practice* in Missions 1 and 2 with those of mentored teaching in school placement, some PSTs expressed the value they placed on school placement because it offered something unique: the teacher mentors' insight in building relationships that support learning - "[the mentors] know the children, and know how they need to be taught" (PST9). One mentor made a lasting impression on PST1 because of her awareness of mathematics teaching as more than a collection of isolated moments: "My mentor wanted us to reflect on our role, what makes us teachers ... She wanted us to take a long term perspective, more than just the weeks we were there, or the year" (PST1). Except for this relational aspect, and the opportunity to develop norms over time, the value of teaching in school placement did not connect to mathematics specifically:

[In school placement] we were two in charge of a class - lots of teaching! There wasn't much time for either seeking advice or getting feedback (...) So [teaching in school placement] is something else [than the Missions] entirely but now I feel much better prepared for lesson planning - at least in maths, after having done the Missions. You start thinking in another way than before (PST2)

Time creates a constraint on reflection in school placement. By contrast, as we have seen, PSTs valued the opportunities that Missions 1 and 2 give them to *reflect on their own practice* by requiring them to plan as a group, and to hand in *decompositions of practice*:

You get an opportunity to think things through - what shall we do? And why should we do that? And what do we want to achieve in the end? (PST2)

We could just as well had had three Missions and no school placement, if you are thinking in terms of mathematics. School placement is good practice, but you don't get much of the subject-specific reflection, more about the organisational aspects...The subject specific ends up neglected (PST3)

Discussion and concluding remarks

PSTs see the two Missions as *approximations* and *decompositions of practice* - close to teaching practice, enacting and analysing a practice of reduced complexity. As indicated in the introduction, the divide between theory and practice is an issue of great concern for researchers and teacher educators (Nolan, 2012); bringing theory into practice has proven difficult (Solomon *et al.*, 2017).

In this study, we explored the potential of the two Missions to bring together theoretical perspectives with teaching practice. The framework used for the analysis (Schoenfeld, & Kilpatrick, 2008), with its double orientation towards theory and practice, allowed us to examine the two Missions' contribution to these two elements of mathematics teacher education in the PSTs' retrospective reflections. PSTs consider the two Missions as contributing to both dimensions, and, furthermore, they complement the contribution of teaching in school placement. Both the two Missions and school placement are *approximations of practice*. While the two Missions provide the mathematics-specific focus lacking from the school placement, the long-term aspects, such as building relationships with the students, are mostly lacking from the two Missions, – although they provide at least an opportunity to appreciate that certain classroom norms are worth attempting to establish.

The PSTs' reflections highlight the synergies between several pedagogies of practice. The interaction with real children (*approximation of practice*) and a focus that - by their own account - forces PSTs outside their comfort zone mathematically, as well as in terms of teaching methods. PSTs value the requirement of group work, and of submitting a *decomposition of practice*, a written report including a reflection drawing on theory. The progression from Missions 1 to 2 gives an opportunity to develop further. Everyone appreciated the role of Mission 1: it allowed PSTs to enact an investigative lesson by 'imitating' Humphreys' video (Boaler, & Humphreys, 2005). The two Missions form a 'chain' of *approximations of practice* with an increasing degree of complexity from periods of mentored school placement, via a Mission 1, to a more open Mission 2. While some PSTs willingly took off the training wheels in Mission 2 and experimented with self-chosen activities, others stuck with the familiar examples from the class at the university (*representations of practice*). Habitus is strongly rooted and hard to change (Nolan, 2012), and these approaches to teaching mathematics are unfamiliar to many PSTs. However, if new approaches should stand a chance, these opportunities to try out less familiar investigative activities are of great importance (Leavy, & Hourigan, 2016).

References

- Arvold, B. (2005). *Goals embedded in tradition: Springboards for mathematics teacher education*. Paper presented at the 15th ICMI Study on the professional education and development of teachers of mathematics, Brazil.
- Boaler, J., & Humphreys, C. (2005). *Connecting mathematical ideas: Middle school video cases to support teaching and learning*: Portsmouth, NH, Heinemann.
- Grossman, P., Compton, C., Igra, D., Ronfeldt, M., Shahan, E., & Williamson, P. (2009). Teaching practice: A cross-professional perspective. *Teachers College Record*, 111(9), 2055–2100.
- Kværne, L., & Solem, I. (2012). *Hva ser lærerstudenter av elevers læring i matemaikk? En drøfting av studenters utvikling av læringsavdekkingskompetanse med hovedvekt på matematikk som*

aktivitet. Paper presented at the Fou i Praksis, rapport fra konferansen om praksisrettet FOU i lærerutdanningen, Trondheim.

- Leavy, A. M., & Hourigan, M. (2016). Using lesson study to support knowledge development in initial teacher education: Insights from early number classrooms. *Teaching and teacher education, 57*, 161–175.
- McDonald, M., Kazemi, E., Kelley-Petersen, M., Mikolasy, K., Thompson, J., Valencia, S. W., & Windschitl, M. (2014). Practice makes practice: Learning to teach in teacher education. *Peabody Journal of Education, 89*(4), 500–515.
- Nolan, K. (2012). Dispositions in the field: Viewing mathematics teacher education through the lens of Bourdieu's Social Field Theory. *Educational Studies in Mathematics, 80* (1-2), 201–216.
- Schoenfeld, A. H., & Kilpatrick, J. (2008). Toward a theory of proficiency in teaching mathematics. *International handbook of mathematics teacher education, 2*, 321–354.
- Skovsmose, O. (1999). Undersøgelseslandskaber. In O. Skovsmose & M. Blomhøj (Eds.), *Kan Det Virkelig Passe? : LR Uddannelse*.
- Solem, I. H., & Ulleberg, I. (2013). Hva spør lærere om? En modell for å undersøke spørsmål som stilles i klassesamtalen i matematikk. In H. Christensen & I. Ulleberg (Eds.), *Klasseledelse, fag og danning* (pp. 139–155): Gyldendal Akademisk.
- Solomon, Y., Eriksen, E., Smestad, B., Rodal, C., & Bjerke, A. H. (2017). Prospective teachers navigating intersecting communities of practice: early school placement. *Journal of Mathematics Teacher Education, 20*(2), 141–158.