

# A TRIPARTITE COOPERATION? THE CHALLENGES OF SCHOOL-UNIVERSITY COLLABORATION IN MATHEMATICS TEACHER EDUCATION IN NORWAY

Annette Hessen Bjerke<sup>1</sup>, Elisabeta Eriksen, Camilla Rodal<sup>1</sup>,  
Bjørn Smestad<sup>1</sup>, Yvette Solomon<sup>2</sup>

<sup>1</sup>Oslo and Akershus University College of Applied Sciences (HiOA)

<sup>2</sup>Manchester Metropolitan University and HiOA

*One goal of Norway's new primary teacher education programme of 2010 was improved school placement: the relationship between the teacher education institution, practice schools and pre-service teachers was to be formalized as a tripartite cooperation. However, in the area of mathematics education, cooperation is not straightforward: tensions arise because of pre-service teachers' prior experience and beliefs, and differences between university college training and school practice. This paper reports on questionnaire data and focus group interviews with first-year pre-service teachers and their mentors following school placement. It illustrates the complexity of the partnership and its impact on pre-service teachers' professional development in the area of mathematics.*

## **BACKGROUND: THE SCHOOL-UNIVERSITY-PRE-SERVICE TEACHER PARTNERSHIP**

As mathematics teacher educators in Norway, we are obliged to focus on supporting an idealised tripartite cooperation between teacher mentors, pre-service teachers and our university college (hereafter HiOA). Based on national guidelines, HiOA developed a plan for in-school placement, focusing on how to share responsibility for pre-service teacher education between educators at HiOA and teacher mentors in partner schools. This shared responsibility is underlined by the joint development of the pre-service placement plan by teacher educators, mentors and pre-service teachers.

During the first year of the 4-year programme, the overall focus is on the teacher's role. However, students' personal epistemologies of mathematics – what mathematics is, and how it is developed in teaching and learning – frequently associate it with memorized facts and rules, solution speed as an indicator of ability which is fixed and which cannot be acquired/improved through effort, and the equation of mathematical truth with teacher approval (see de Corte, Op't Eynde & Verschaffel, 2002; Schoenfeld, 1989; Smestad et al, 2012). Such beliefs are associated with 'transmissionist' rather than 'connectionist' styles of teaching (Pampaka et al, 2012).

While the university attempts to challenge such beliefs, the impact of school placement can force a return to earlier embedded ideas, particularly when assessment, testing and accountability are high on the agenda. Both pre-service teachers and teacher educators can experience a number of tensions between school practice and university theory/practice. Nolan (2012) reported on conflict between support for inquiry-based pedagogies at university level, and instrumentalism in practice schools. She argues that

this is not just due to the role of accountability and assessment in schools, but also to pre-service teachers' educational habitus and cultural routines associated with teaching: 'every adult knows what teaching and learning should look like because he or she has spent thousands of hours as a student in school' (Bullock & Russell, 2010, p. 93, cited in Nolan 2012). Allen (2009) also found that beginning teachers privileged what they had learned on placement rather than university theory.

Goos (2009) analyses the gap between what pre-service teachers are taught at university and what they actually do when they teach, focusing on the need to understand how they *interpret* their teacher education programs, how (and why) they *appropriate* certain aspects of those programs, and the nature of the different *influences* on the execution of their teaching plans. So, for example, Arvola (2005), like Nolan, uses the idea of *habitus* as an explanatory device, but in this case to argue that pre-service teachers attend to different aspects of their teacher education programs and make sense of them differently, through the lens of their prior experience of being taught mathematics. Bednarz and Proulx (2005) also suggest that pre-service teachers appropriate different things from their teacher education courses, resulting in different views of what they about, which are in turn reflected in their own teaching practice.

In this paper, we examine the relationship between theory and practice held by the different partners involved in the practicum. We focus on the tripartite cooperation in the early stages of the project, addressing the following research question: How do pre-service teachers and their mentors perceive the connection between what pre-service teachers are taught about mathematics education in University College and their learning from practice within the school placement?

Our analysis discusses the challenges of school placement, from the points of view of both pre-service teachers and their mentors. We will suggest that pre-service teachers do not necessarily take on the intended messages of their university teaching, partly because these are filtered through their prior experience, but also because of the difficulties of translating theory into practice when faced with diverse classroom demands. We also explore how school placement experience plays a role in pre-service teachers' development as they reflect on these tensions.

## **METHOD**

Two hundred and eight first-year pre-service teachers at HiOA completed questionnaires after their school placement in 1<sup>st</sup>–4<sup>th</sup> grade. Information was gathered on the influences of school and HiOA training on their teaching practice, and their perceptions of mathematics and mathematics teaching and learning. For comparison, their 46 teacher mentors completed questionnaires covering their experiences as mentors, and their perceptions of mathematics teaching and learning, and their mentees' performance as teachers. Questionnaires comprised a number of statements requiring 5-point Likert scale responses, and also 3 free-text questions. In these, pre-service teachers were asked to describe a practice situation where (1) they benefitted from learning on their mathematics course at HiOA, and (2) they benefitted from learning from their teacher mentor. Mentors were asked 2 parallel questions

about mentees' use of learning from HiOA and from themselves. Question 3 asked both pre-service teachers and mentors to describe the challenges for pre-service teachers of using HiOA learning in practice.

Fourteen teacher mentors also participated in one of 2 focus groups, in which they were asked to reflect on the teacher mentor role. Similarly, 25 pre-service teachers formed five focus groups, in which they were asked to reflect on the challenges of their school placement, on their own development as a teacher of mathematics and on the role of their teacher mentors. Including focus groups in the methodology enabled a broadening of the analysis to extended reflections about participants' experiences in the placement partnership.

### Analysis

The Likert-scale data were coded on a 5-point scale ("strongly disagree" = 1 and "strongly agree" = 5), and comparisons between pre-service teacher and teacher mentor responses analyzed using Mann-Whitney U tests. The free text data and the focus group data were analyzed thematically, in order to identify the discourses of mathematics learning and teaching which participants drew on, and their perceptions of connections between theory and practice. We blend our analysis of the quantitative and qualitative data in the following sections.

### **Teaching and learning in university college and school**

Following on from the suggestion that pre-service teachers do not necessarily take what teacher educators intend from their courses, we were interested to understand whether pre-service teachers attributed what they learned and did during their placement to their HiOA experience or to their workplace learning with their teacher mentor. We were also interested to explore the university-school partnership link by comparing their responses with those given by the teacher mentors to parallel questions. Analysis of these free text responses and related Likert-scale scores identified some interesting mismatches, two of which we describe here.

The first of these involved mismatches regarding the use of manipulatives (physical models) in teaching. Forty-nine per cent of pre-service teachers recorded this as a technique learned from their HiOA course, and 15% said they had learned it from their teacher mentor. However, teacher mentors took a different view: only 15% reported use of manipulatives as something their pre-service teachers had learned at HiOA, versus 39% who reported that this was something they had taught the pre-service teachers themselves. These mismatches are fleshed out in the focus group data, where teacher mentors commented on the 'gap' as resulting from pre-service teachers' failure to understand how to translate what they learn at HiOA into practice:

I think they [pre-service teachers] need to be better at thinking/using manipulatives when they explain... But they don't even think of it. ... You do work with manipulatives here [at HiOA] but they don't see the usefulness...

Aware that the HiOA educators stress the importance of manipulatives, the teacher mentors felt, however, that they had not managed to teach the pre-service teachers

how, when and why they should use them in their lessons, and that this was something that they themselves made clearer:

I know that [HiOA] operates with manipulatives a lot but not with the transfer...

I think they learn from [...] tying the practical contexts to the theoretical. It is no use [in learning maths] to just bake buns with your pupils, you also have to actually write it down, convert between units of measurement, specify the units.

Pre-service teachers also commented that they were limited in their experience of the practical use of manipulatives:

I think the challenge was the materials [we] worked with, because we were trained to work with [manipulatives], in the introduction of a topic, and there was very little to work with.

The second issue concerned the central role of understanding pupil reasoning. As a major focus of the HiOA course, we had expected that pre-service teachers would be likely to cite this as a beneficial piece of learning from their course. However, only 13% of them (and 7% of teacher mentors) did so, and a further 4% of pre-service teachers (and 22% of teacher mentors) said this was learned from the teacher mentor. This pattern may be related to a series of findings from the Likert-scale data on pre-service teachers' perceptions of mathematics teaching, which indicated a conservatism about teaching and learning and pupils' roles which was not reflective of the HiOA programme intentions. More 'traditional' personal epistemologies of mathematics were reflected in 50% of pre-service teachers' agreement or strong agreement that "Mathematics is a subject for rote learning". They were also more conservative than the teacher mentors in response to completions of the opening statement "When pupils are to learn mathematics, it is important that.....". For example, teacher mentors agreed significantly more strongly than pre-service teachers with the completion statements "...they use their own algorithms", "...they take what they know as a starting point", "...they have to explain what they think" and "...they can use fantasy and creativity in their work" ( $p < 0.01$ ).

These issues are followed through in the focus groups, where teacher mentors frequently reflected on pre-service teachers' difficulties with adjusting their teaching plans to fit pupils' needs. They saw this as something that they needed to model in their role as mentors:

... the [pre-service teachers] must try [...] different methods, and it is paramount that they see us as role models. And also [...] see that there are many ways forward, and while they are with us they can find out how pupils think, that they can linger on some things. I think that linger is the right word; for the most part they just go directly on, doing what they have planned. And then they are not so good at assessing afterwards.

Here the same issue is raised but also connected to a perception that pre-service teachers lack subject knowledge:

...when pupils explain how they think, I often feel that [pre-service teachers] fail to follow the pupil and it is certainly a matter of training but I also think it's about their basic understanding of numbers and mathematics [...]. Then I have to get involved, to say "I think I understand how you think", because they [the pre-service teachers] stand there

perplexed, and also the pupil sits there thinking "what did I say wrong?" and often it isn't wrong.

A slightly different angle notes the effect of pre-service teachers' assumptions about the nature of mathematics and related previous experience:

I think maths is also a subject where students are very afraid of doing something wrong, because they think like "oh! it must be done correctly" so that they get hung up on some boring methods sometimes and they don't dare to take a wider view as they do in other subjects.

While mentors alone focus on the need to understand pupils, they share a common concern with pre-service teachers regarding the need to make oneself understood as a teacher. Here a teacher mentor talks about the need to be careful about terminology:

In most mathematical topics you must be extremely careful what terms you use with the pupils, because in front of the class, as soon as you start fumbling, or you let the pupils make a mess of it for each other, it is going to be a problem.

In the following quotation, a pre-service teacher expressed a parallel concern with explanation of her own understanding:

We must try to explain things as simply as possible. This is a challenge because it always goes through a filter, namely the teacher, who understands it.

Returning to the questionnaire data, teacher mentors were less likely to agree that "To become good at mathematics, you need to do lots of exercises" and that "The solution of a mathematics exercise is either right or wrong" ( $p < 0.05$ ), but in the focus groups some nevertheless described their classes in such terms, showing the influence of national testing:

We have been working on [national] assessment tests in mathematics - so very much practicing for the test.

Here a pre-service teacher notices an emphasis on exercises in school placement:

Going through the problems ... on the blackboard. Then we ask the pupils how they would solve this task, we talk a little about the solution. Then the pupils do the work individually.

Although these comments were few, they indicate a potential source of affirmation for deeply embedded traditional views about the nature of mathematics, as well as a further source of potential conflict for pre-service teachers regarding their experience of putting HiOA theory into practice.

### **The relationship between theory and practice**

These results indicate the presence of various mismatches between school and university experience, and between university input and pre-service teachers' attitudes. As we have seen, they revolve around the issue of putting theory into practice, the focus of the third free-text question, which asked about the challenges for pre-service teachers in using learning from their HiOA course in practice. Only 8% of pre-service teachers replied that there were none, while 24% responded that it was difficult to translate theory into practice, and 12% that it was difficult to find the right language.

Several themes emerged, including a perceived absence of HiOA teaching on particular school topics:

It can be difficult to draw connections and parallels between theory and practice. Especially considering that the topics we have used in school practice have not been particularly emphasized at HiOA.

But it was recognised that this could be a translation issue:

Not many situations have come up that can be linked to the topics we've had. And if they have, I haven't thought about them in a way that relates to what I've learned at HiOA.

Thirty-four per cent of students said that mathematics at HiOA was too difficult for them, or was irrelevant for their teaching. Many comments were clearly illustrative of the problems of applying pedagogic principles noted above:

It's not easy to connect what I have learned with [my practice] in the school placement because I feel that much of the curriculum isn't linked to the teaching of first grade, but to further grades.

Teacher mentors recorded fewer barriers, but also cited difficulty in translating theory into practice (20%), difficulty/irrelevance of mathematics at HiOA (13%) and insufficient mathematics at HiOA (9%). In free text responses, 13% said that they did not know what pre-service teachers learned at HiOA. Focus groups also included criticism of pre-service teachers' subject knowledge:

Some have poor background knowledge when they come, I think. I had students in practice [in.] ... fourth grade, and then it was elementary things they did not know, I was quite surprised.

Some comments blamed lack of enthusiasm for uninspired teaching, but others were more indicative of the problem of application of theory into practice:

I had a student who could not explain to the pupils what she intended, she became more and more frustrated.

This could include not having the confidence to depart from the lesson plan:

... they think it's hard to meet the challenge [when] they get a lot of input from pupils [...] to use the input for further teaching ... it seems that they do not dare to do so [...], "What I have written, I'll execute!"

In terms of the partnership itself, the questionnaire data showed that 91.6% of pre-service teachers agreed that "Experiences from practice have been important in the rest of the programme". Indeed, a number of them were critical of the HiOA course in their focus groups:

... there's nothing wrong with theory, but we must learn how to combine it with practical methods. It needs to be explained to us, why, how and when. ... It is the practical work that I remember best.

While these and other comments suggest that many pre-service teachers see university college and school placement as very separate, others were more reflective about how the two together contributed to their development as professionals:

I've heard several of the class who talked about what they have done in practice, but said they had not used what they had learned here [at HiOA], but it was exactly what we learned here that they had. I think you don't quite connect, I think that reflection days are very good for becoming more aware of that.

Some reflected on the difficulties of this stage of their development, and the need to learn from HiOAs' aim to teach pedagogic principles as opposed to 'recipe-following' teaching tips:

Math teaching at HiOA focuses on our awareness of how we think when we do various calculations. I find that difficult, and have not come so far in the process yet that I feel I can take advantage of this when teaching.

Others noted the difficulties of being a novice but also the importance of reflection:

It's easy to forget to use one's knowledge in some situations. But in retrospect, one thinks of what was done and finds that there was a much better option.

One has to reflect along the way to learn by experience.

## DISCUSSION

Previous research indicates that pre-service teachers will inevitably draw selectively from university programmes, through the lens of their own experience and beliefs. This is an effect which can be reinforced in school placement. In addressing our research question, this study has illustrated the complexity of the tripartite partnership involved in school practice. We have found that many of our pre-service teachers had missed the point of much of HiOA's input, and that their experience of the school placement is one of learning concrete practice from their mentors which they see as more informing than their university programme. For their part, mentors are often critical of their mentees' subject knowledge, but see themselves as acting as important translators of theory into practice. Additionally, pre-service teachers' learning in both institutions is mediated by their prior experience and perceptions of the nature of school mathematics.

These findings indicate some ways forward in enabling pre-service teachers to make the most of their school placement and for the University College-school partnership to be strengthened, including better communication with mentors, and more opportunities for reflection on the nature of mathematics and on the relationship between course content and placement experience.

## References

- Allen, J. (2009). Valuing practice over theory: how beginning teachers re-orient their practice in the transition from the university to the workplace, *Teaching and Teacher Education*, 25, 647–654.
- 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, Águas de Lindóia, Brazil.

- Bednarz N., & Proulx, J. (2005). *Practices in mathematics teacher education programs and classroom practices of future teachers: From the educator's perspectives and rationales to the interpretation of them by the future teachers*. Paper presented at the 15th ICMI Study on the Professional Education and Development of Teachers of Mathematics, Águas de Lindóia, Brazil.
- Bullock, S. & Russell, T. (2010). Does teacher education expect too much from field experience? In T. Falkenberg & H. Smits (Eds.), *Field experiences in the context of reform of Canadian teacher education programs* (2 vols., pp. 91–100). Winnipeg, MB: Faculty of Education of the University of Manitoba.
- de Corte, E., Op't Eynde, P. & Verschaffel, L. (2002). "Knowing what to believe": the relevance of students' mathematical beliefs for mathematics education. In B. Hofer & P. Pintrich (Eds), *Personal Epistemology: the psychology of beliefs about knowledge and knowing*. Mahwah, NJ: Erlbaum.
- Goos, M. (2009). School experience during pre-service teacher education from the students' perspective. In Even, R. and Ball, D.L. (Eds.), *The Professional Education and Development of Teachers* (pp. 83–91). New York: Springer Science.
- 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.
- Pampaka, M., Williams, J., Hutcheson, G., Wake, G., Black, L., Davis, P. & Hernandez Martinez, P. (2012). The association between mathematics pedagogy and learners' dispositions for university study. *British Educational Research Journal* 38 (3), 473–496.
- Schoenfeld, A. (1989). Explorations of students' mathematical beliefs and behavior. *Journal for Research in Mathematics Education* 20, 338–355.
- Smestad, B., Eriksen, E., Martinussen, G., & Tellefsen, H. K. (2012). Lærerstudenters erfaringer med – og holdninger til – matematikkfaget. In F. Rønning, R. Diesen, H. Hoveid & I. Pareliussen (Eds.), *FoU i Praksis 2011*. Trondheim: Tapir.