Chapter 8
Empowering Teachers as Learners: Continuing Professional Learning Programmes as Sites for Critical Development in Pedagogical Practice

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Introduction

In this chapter we describe our research on a continuing professional learning programme which began in 2009 as part of a national initiative to raise the standard of mathematics teaching in English primary schools by creating 'maths champions' who would influence mathematics pedagogy in their schools, thereby addressing a perceived deficit in teacher subject knowledge and pedagogic skill in the primary sector (see Williams 2008). The version of the Mathematics Specialist Teacher (MaST) programme that we report on here aimed to provide teachers with the necessary skills and knowledge to be able to critically assess and construct pedagogical practices for their own settings. Combining formal input focusing on recent research with participant-led discussion and reflection, it emphasised mathematical problem-solving and enquiry, and participants were required to undertake small research projects within their own school settings that involved posing different mathematical tasks to their pupils. They were then asked to reflect on the children's learning and their own teaching. Teachers were also required to undertake regular critiques of research literature. A reflection of their own practice and current research was assessed through the production of two 5,000 word essays at master's level.

The course was not intended to provide a model of 'best practice' or prototype blueprint for mathematics teaching. Rather, the intention was to provide enhanced reflective skills so that participants could evaluate their developing professional practice to suit their own particular context needs. We know from previous research in continuing professional learning (e.g. Corbin et al. 2003; McNamara and Corbin

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2001; Brown et al. 2007) that it is neither realistic nor necessarily desirable to evaluate programmes in terms of the extent to which they impact on teachers' practice in pre-determined 'ideal' ways, without tension and negotiation. Elsewhere (Barnes et al. 2013) we have explored this issue, arguing that teachers engage with continuing professional learning in a variety of ways which build on their particular professional experiences and contexts, and that programme outcomes need to be understood against the background of teachers' developing professional identities. In this chapter we explore professional development in more detail, examining how the MaST continuing professional learning programme enabled teachers to become more reflective practitioners who are able to critically analyse curriculum and pedagogical practices within mathematics teaching.

Background: Continuing Professional Learning

Questioning the Impact of Continuing Professional Learning Programmes

Evaluating the impact of continuing professional learning programmes is difficult, not least because of the need to agree on what we might expect as a marker of success. Continuing professional learning in mathematics education is frequently assumed to have a goal of moving towards a pedagogic 'ideal' (Tzur et al. 2001), but identifying and measuring this presents a challenge. For example, Farmer et al. (2003) attempted to capture the complexity of improvement in instruction by considering the impact on teachers' fundamental dispositions and beliefs about teaching mathematics. They thus identified three different levels of engagement with continuing professional learning in terms of teachers' perceptions of it: as a source of useful concrete activities and additional mathematics content (level 1); as support or enhancement of their professional principles and understanding (level 2); and as a focus on and challenge to their attitudes and beliefs (level 3). Farmer et al. argued that it was at this third level that continuing professional learning had the most sustained impact on participants' future practice. However, it is worth noting that challenge does not thereby presuppose certain teacher behaviours; rather, it leads to reflection, an issue which we pursue later.

Much research into the effectiveness of continuing professional learning has shown that teachers do not always do what they 'should' in relation to course objectives, and that there is often a mismatch between what a programme recommends in relation to practice and what schools actually require, or what the teacher believes to be 'right' (see Barnes et al. 2013). There are many factors involved, including regulative government policy and teacher resistance to change, or the role of local contexts. As Cochran-Smith and Lytle (1999) suggest, prescriptive continuing professional learning programmes can often de-emphasise differences in local cultures, so failing to address the particular needs of that context or school. But there are more fundamental pedagogic factors at play too: many continuing professional

learning programmes involve merely 'bolting on' new ideas to existing practice, leaving teachers' beliefs in relation to pedagogy unchallenged (McNamara and Corbin 2001). Even when teachers' beliefs about pedagogy *are* challenged, however, further difficulties arise in relation to making adjustments to practice when confronted by new discursive styles and understandings. Drawing on Bourdieu, Nolan (2012) points out that one cannot assume that there will be a straightforward substitution of practice, since changing practice is a matter of changing one's habitus—adopting new ideas and practices is not going to be a 'quick fix'.

In our earlier work (Barnes et al. 2013) we have built on this identification of complexity to argue that evaluation of continuing professional learning in mathematics education needs to involve more subtle measures which acknowledge teachers' professional agency and reflection. In what follows we consider in detail what this entails in practice.

Critical Reflection

Recalling John Dewey's (1916) idea that reflective thinking makes education an ongoing reconstruction of experience, we employ the concept of the reflective practitioner to acknowledge the expertise of the experienced teacher who develops and improves their teaching as a result of reflection on their own actions and practices. Recent development of this idea can be seen as a reaction against a view of teachers as mere technicians who service top-down approaches to education reform. As Zeichner and Lui (2010) maintain, if teachers are not to be seen in this way, they need to determine their own agency through a critical and continual evaluation of the purposes, consequences and social context of their work. For these writers, the reflective process not only needs a focus—such as social/personal and academic issues regarding children as learners, or wider social equality issues—but should also challenge rather than reinforce current practices. Thus, reflection should be an intentional act of systematic inquiry (Lyons 2010), an act that looks both backwards and to the future and leads to the learning of new things.

When it comes to actually implementing critical reflection as a practice, a number of researchers report on the importance of collaboration with practitioner colleagues in problematising the teaching and learning process (see for example Loughran 2010). Thus, Barnett and O'Mahony (2006) developed a reflective culture by presenting a 'problem' in continuing professional learning sessions which participants focused on in their own classroom contexts and then reflected on collaboratively in subsequent sessions, discussing and questioning existing practices and sharing collective reflections. Gimbert (2000) found that this kind of environment enabled teachers to develop a culture of challenge towards 'didactic arrangements' in which they were able to critique existing practices rather than accepting 'that is the way it is'. Similarly, Nissila (2005) and Park et al. (2007) report that reflection makes 'tacit assumptions' open to question, and so opens up access to new visions and perspectives as part of professional development.

Central to such reflective practice is practitioners' sensitivity to different elements of their practice. In order to understand the complexity of how teachers gain from professional learning opportunities, and to operationalise our interest in their development of reflective, critical analysis, our focus in this chapter, then, is on 'noticing' (Erickson 2011; Mason 2002, 2002; Sherin et al. 2011). What is noticed and indeed what is observed in the first place (Ghaye 2010), how it is noticed, and why it is noticed are important in shaping the nature of, and response to, reflective practice. We explore the implications of a focus on noticing in the following section.

Developing the Skills of Noticing

While noticing as a component of professional expertise is well documented in association with the multidimensionality, simultaneity and unpredictability of teaching (Doyle 1977), more recently Erickson (2011, p. 18) argued that 'mere years in the classroom did not have a straight relation to improvement in teaching practice', since noticing by teachers without reflection within action is not 'pedagogical experience'. Jacobs et al. (2011) researched 'in-the-moment instructional decision making' as a crucial element of building on children's thinking (Jacobs et al. 2007), and found that the expertise and skill required to focus on and remember pertinent features of particular situations grew only when teachers were engaged in two or more years of professional development experience. Thus, such expertise is not something that teachers routinely possess, requiring, as Mason (2002) argues, the acquisition of a practice (or discipline) of noticing.

However, recognising the impact of teachers' individual trajectories and beliefs introduces a further complexity. Erickson (2006) found that attending to noticing enabled teachers to question habitual or taken-for-granted assumptions about their teaching and the classroom environment, but that the judgements they brought to their noticing were influenced profoundly by their prior experience. Experienced teachers, he found, connected details of the moment to wider issues such as curriculum structure and annual cycles. In addition, however, they sometimes used this ability to combine discrete items of information to construct a coherent interpretive picture that sometimes resulted in unwarranted inferences, since they viewed events through the lens of their own 'philosophy of practice'. These beliefs were concerned with the nature of learners, about important aspects of their subject matter and about the nature of learning.

Returning to the issue of change, then, we note Mason's (2011) argument that noticing involves the development of a *collection of practices* designed to sensitise oneself to the teaching and learning context, so as to notice opportunities for future actions which are new rather than automatic and determined by habit. Echoing other research on noticing and reflection, he thus underlines the importance of noticing as an intentional act which challenges current practice. It is active rather than passive,

and reflexivity (reflection) necessarily concerns what we focus our energy and attention on. As Sherin et al. (2011, p. 3) ask 'where do teachers look, what do they see and what do they make of what they see?'.

Applying Noticing in Mathematics Education and the MaST Programme

There are multiple benefits for mathematics education of developing teacher noticing. It has become a central tool in the implementation of mathematics teaching which aims to engender a greater depth of understanding in a subject which has been prone to rote learning and transmission teaching. As recommended by the National Council of Teachers of Mathematics (NCTM 2000), mathematics teaching needs to be adaptive and responsive to pupils' needs, such that teachers are required to make decisions as the lesson unfolds. This style of teaching is therefore reliant on what teachers notice on a moment-by-moment basis. Furthermore, Sherin et al. (2011) argue, noticing supports teachers' own professional development as they learn to learn from the cycle of noticing/paying attention to a particular aspect of their teaching, responding to it, and attending to the results. At the micro-level, noticing provides a language of description for 'decomposing' practice (Sherin et al. 2011, p. 6), that is, for being able to identify and describe salient features.

Exploiting this latter idea, Mason's (1988) approach used video as a stimulus for recall and analysis of related incidents from teachers' own practice (thus avoiding direct normative analysis of the video material itself). Teachers were asked to choose a salient moment and describe it to colleagues, reducing judgements or emotive terms to a minimum. Participants developed a 'collective vocabulary' and a 'rich web' of shared incidents which provided a foundation for recognition of similar incidents in their practice and enabled them to avoid habitual responses and act in a different way, drawing on a collection of alternative actions. Mason felt that this was the essence of the discipline of noticing, in which an 'inner witness or monitor' is developed. Through the development of an 'awareness of awareness' (Gattegno 1987), the practitioner may start to ask themselves such questions as 'Why are we doing this?'.

The philosophy of the MaST continuing professional learning programme as it was designed and delivered at this particular university—whereby the practitioner acted as a researcher identifying, reflecting and reporting back on problems within their own context—provided an opportunity for the teachers to practise the act or discipline of noticing. The programme employed Barnett and O'Mahony's (2006) 'reflective culture design', and instead of using video required participants to carry out and discuss short teaching research projects in their own locations. Session time was then given to analysing reflections on these short teaching sessions. This process of withdrawing from action, and then intentionally reflecting on and reconstructing the action and its effects, is advocated by Simon and Tzur (2004) as increasing the possibility of a fresh response rather than a habitual reaction (Korthagen and Vasalos 2010). In the rest of this chapter we focus on the impact of MaST on participants in terms of their empowerment as learning professionals, as opposed to passive

receivers of a 'MaST philosophy'. In researching their responses to the programme through the lens of noticing, we were interested to enquire whether they were seeing the previously 'invisible' elements within their practice and the classroom, and if this resulted in a shift in their perspective and practice. More fundamentally, however, we were also interested in exploring whether the MaST programme had provided them with a new, empowering language of description, which would take them beyond their immediate context and personal histories, rather than a series of 'tricks and tips'.

Methodology: Researching Noticing

In researching noticing in our programme, we note Sherin and Star's (2011) comment that teacher noticing has multiple meanings in the literature, and that trying to capture and analyse teacher behaviour and reasoning is a complex process. Focusing on infrequent events is one strategy, when teachers see something that stands out because it is surprising or seems important—'noticing as recognising noteworthy classroom phenomena' (ibid., p. 68). Using this approach, however, narrows the focus to the non-routine, while in fact it is the routine aspect of teachers' work which may be precisely what needs to be captured. An alternative is a 'focus on a subcomponent of the larger systems'(ibid., p. 69), in which the teacher—who is bombarded with what the psychologist and philosopher William James famously described as 'blooming, buzzing confusion' (James 1890)—attends to, and selects, particular element(s) which become the 'noticed thing'. Having interpreted and made sense of the 'noticed thing', in relation to its connection with broader principles of teaching and learning and current context, the teacher takes some action leading to modification of the 'blooming, buzzing confusion' (Sherin and Star 2011, p. 70).

There are difficulties associated with noticing 'intuitive' behaviours, however. For example, Sherin and Star (2011) note that all teacher noticing is active—because what the teacher sees in the world is strongly driven by their knowledge and expectations. In addition, since perception is active, the teacher does not just see but actively *looks*. Furthermore, the teacher has an active role in shaping what occurs within the classroom to produce certain kinds of events, and for some of these events, may have established interpretations in advance.

Ten of the 170 MaST course participants from the first cohort of the programme were involved in the study. All participated in interviews with the authors which were designed to encourage them to talk about their personal beliefs about mathematics education and their confidence and subject knowledge about mathematics, together with the impact of MaST on these issues and on their practice in general. We discuss these interviews in terms of the impact on their practice in Barnes et al. (2013). In this chapter, we focus on classroom observation and post-observation interviews with two teachers, Liz and Bernie, whom we selected for follow-up on the basis that they demonstrated a high level of enthusiasm and motivation during the MaST taught sessions and were interested in participating further in our discussions. Although

Bernie and Liz are representative of the MaST participants, we cannot say that these teachers are representative of primary teachers in general as they were part of a group of teachers who self-selected to take part in the two-year MaST programme and were therefore particularly committed to improving their maths teaching. The observations and interviews were conducted by the first author, a tutor on the MaST programme and well known to both as a fellow professional and practitioner. Each teacher's lesson was videotaped and used as a prompt in the interview, in which they were invited to discuss their changing practices, what they noticed in their classes, and how they responded to children in terms of enhancing their mathematics understanding.

In terms of our ultimate focus on teachers' acquisition of an empowering discipline of noticing and language of description, we aimed to analyse the interview and video data to find answers to a range of questions: Were they more reflective and reflexive? What, and how often, were they noticing about their own practice and children's thinking and understanding? Were they (more) aware of how they responded to questions or devised activities? How were they responding to what they noticed? In short, were they demonstrating an 'awareness of awareness'?

Data Analysis

We analysed the video material in order to establish teaching style and content, in terms of the type of activities which the children were set, the particular concepts which were modelled in the lesson, the use of resources, the teacher's exposition of the concept and tasks, the type of questions which were asked, and the content and nature of responses made to children's answers. We also looked for instances where the teacher's responses appeared to demonstrate increased critical reflection in relation to their own practice and student understanding. Our analysis acknowledges the close relationship between noticing and reflection and teachers' subject knowledge and beliefs about mathematics, and their professional identities. We thus aimed to take into account, and make part of our analysis, the fact that their attention would be focused on issues that they believed to be important and of high priority. In particular, we sought to address this issue in part by noticing ourselves any matches and mismatches between the teachers' reports on their practice, and our own observation of it. We thus begin with their reports of noticing.

Reporting Noticing

Like the other teachers in our study, both Liz and Bernie reported that the MaST programme had led to changes in their practice as a result of critical reflection which involved noticing how and what the children were learning. For example, Bernie explained that she had developed a more experiential teaching approach, so that:

> . . . now I back off, I just give them an opportunity, I let them talk about it and they teach each other and I only input where necessary. I just provide a forum and I provide the materials they need, basically, to do that.

Liz told us that her use of mathematical vocabulary and language had developed so that she was more aware of highlighting and explaining possible misconceptions during her teaching:

> I have been prompted from MaST to use the 'language' of maths—'what is an angle?' 'What are parallel lines?' I wouldn't have gone down the route I did today had it not been for listening to other people. . . . [I] would have said before MaST 'It is an angle' 'an obtuse angle is over 90 and less than 180' and left it at that. When discussing parallel lines I wouldn't have done the little diagram and asked 'is this a parallel line?'. I wouldn't have explored it to that extent.

However, in addition to reporting these new developments in their practice, both Bernie and Liz told us that they saw MaST as providing validation for their pre-existing pedagogic approaches and beliefs, thus fitting with Erickson's (2011) and Sherin and Star's (2011) observation that noticing is filtered through the lens of prior experience. Bernie therefore talks about her development of noticing children's skills as something which builds on her prior beliefs:

> Because I have developed my own practice now. I've always been interested in the fact that I really believe that children have skills that we don't really take notice of when we're teaching them. We don't build on the knowledge, we try to impose knowledge on them. . . The fact that I can recognise in them that they've got skills of their own that I've got to develop and channel, so not me telling them, it's them the person they are, they bring a lot to the classroom.

Liz also reported that the MaST course had provided her with the evidence to develop a pedagogical style which she already believed in:

> The lesson today was really broad and I did know that I wanted to get certain vocabulary in and I did know that I wanted to do measuring with protractors, but the rest of it the children took that learning and that's something that I wasn't as comfortable with prior to doing MAST . . . Trying it and doing it for myself has proven this—actually they have learnt more than if I had done it my 'old' way and having the confidence to do that more often.

Both teachers' reports of their new reflections on teaching and the role of MaST in their practice led us to look closely at these particular aspects of their lessons when the interview was over. In the next section we describe the lessons and explore what turned out to be mis-matches between their reports and our own understanding of what we observed.

Exploring Practice: Observing Bernie and Liz

Bernie's Lesson: Developing Experiential Learning?

As we have seen, Bernie had stated that her teaching philosophy encompasses the belief that the children bring to the context their own skills and understanding which

need to be channelled and built upon. During her lesson, all the children were required to work on a real life investigation. The more able children within the higher ability groups were presented with the task with minimal intervention by Bernie. They worked collaboratively within small groups, coped well with the tasks and articulated their findings clearly to the rest of the class. For other ability groups, however, Bernie introduced the investigative tasks with a more direct teaching approach, providing explicit instructions for the children to follow whilst undertaking the tasks. We also observed that these children found the tasks extremely challenging, both in terms of understanding what was required within the investigations and also being able to cope with the mathematical procedures that the tasks demanded. Clearly, providing suitable investigative tasks for a class of children working at a wide range of ability levels is very challenging for any teacher. In some instances they may not be able to meet the demands of noticing children's responses to questions, or how they approach and tackle a particular problem, and important aspects regarding children's understanding can go unnoticed. As a consequence, although an experiential style of teaching was adopted for the higher ability children, the rest of the children were presented with a more direct transmission teaching approach which did not appear to build on their existing knowledge.

This appears to indicate a mismatch between Bernie's account of her practice, and what was actually observed. From this point of view, we might conclude that the MaST programme had not had the impact that Bernie claimed, or that we had hoped for. However, Bernie herself was under no illusions about this. Commenting on this part of her lesson, she recognised that not all of the children had been involved in experiential learning. In addition, she also observed that her aim to provide opportunities for experiential learning did not mean that she did not employ direct teaching of skills: "I'm not saying that every day I do that [experiential learning] because I teach them skills". She was reflective about why she had included skills teaching, arguing that this was a particular area where some of her children need further input: "A lot of the children have spends, they know what money is, they know what change is but they can't always record it. So you have to teach them how to record it. . . ". She was, then, aware that she had to make compromises and was unable to practice what she advocated in every instance.

Liz's Lesson: Focusing on the Language

Liz's expressed interest lay in what she had learned about mathematical language during the MaST course, and her lesson—about the properties of 2D shapes—reflected this. The structure of the lesson involved an extended exposition in which she modelled various 2D shapes by folding a piece of paper. The children followed throughout, copying with their own pieces of paper. A short independent group activity followed, in which the children were required to construct a 2D picture or pattern from their folded 2D shapes. In line with her interview, Liz paid attention to the mathematical vocabulary and language used both by herself and the children. She also paid careful attention to her own questioning and the children's answers in order to anticipate

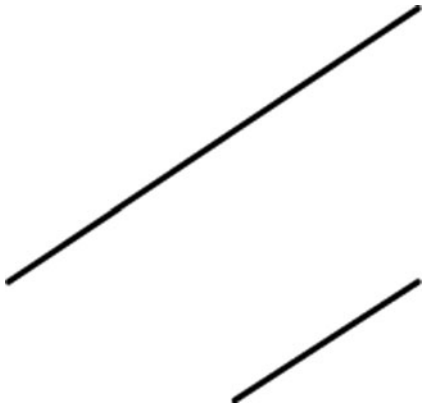

Fig. 8.1 Parallel lines example drawn by teacher

opportunities to uncover typical misconceptions. Thus, when a child responded to her question 'What is meant by parallel lines?' by providing the answer 'it means that they look the same', she responded by drawing two lines of different lengths on the whiteboard and inclined at the same angle of 45 degrees, as shown in Fig. 8.1.

In whole-class discussion, Liz elicited agreement that these lines were parallel, but that they were in fact *not* the same as they were of different lengths.

Although the activity was practical in nature and allowed for a focus on mathematical vocabulary, Liz's teaching was highly structured, with each step carefully teacher-led. The children had very few opportunities to discover concepts for themselves and, in contrast to Liz's interview responses, did not in fact 'lead the learning'. When this opportunity did arise, their task was to design a picture or pattern with their shapes, but this appeared to be a fairly low level task for the children to undertake, given that they had demonstrated a very competent level of the understanding of properties of 2D shapes throughout the lesson. However, during the plenary, Liz identified further mathematical ideas, one of which arose from the children. This consisted of identifying where children had constructed 'new' 2D shapes (hexagons) which had not been modelled during the teacher input. She also pointed out to the class where a series of shapes had fitted together without gaps and had therefore tessellated.

Although Liz's teaching could be said to be in the 'batch processing' style identified by Erickson (2011), based on the questionable assumption that learning is taking place just because the class is working in an orderly way or is 'raising their hand enthusiastically', she was careful to pay attention to the responses made by children to her questions. Liz also carefully checked their understanding by probing for further clarification where necessary and taking the opportunity to highlight possible misconceptions. Again, while Liz's teaching appears on the face of it not to be following the 'MaST way', it nevertheless illustrates a type of noticing defined by Erickson (2011) as 'instrumental', in that the noticing was made in order to act—something was done right away by Liz regarding what she noticed.

Noticing Noticing

Examining teaching through the discipline of noticing allows for fine-grained changes in practice to be uncovered. It provides evidence that a continuing professional learning programme has had some impact, but these changes are necessarily small and subtle. While changes did not occur 'across the board', both of these teachers were reflective and were 'noticing' more about their practice. In order to unpack this more, we return to Liz and Bernie's interviews, to look more closely at what they say about how they have changed. As we have seen, both have paid attention to issues which are central to their particular pedagogic beliefs—in Liz's case to the importance of language, in Bernie's to the idea of recognising and developing children's existing knowledge. We know from research such as Erickson's that we should not be surprised by this. However, one way of understanding these patterns, and Liz and Bernie's references to having new confidence as a result of MaST, is in terms of the programme as providing an explicit language of pedagogy which in turn legitimises ideas which they have, until now, been unable to reflect on or articulate. This effect is clearly described by Bernie:

> I needed a mirror for myself and it allowed me that opportunity... it gave me that forum... I'm not always the most confident person but I've got ideas, you know what I mean, and it just gave me that opportunity to use them.

Some of the language and legitimacy was provided by MaST requirements to read academic journals and research literature, which also gave Liz the opportunity to be more reflective:

> I have always been quite reflective but the good thing about MaST is that it gave you time to really think about it.

Participation also enabled teachers to think about practice as individual; Liz did not see MaST as prescriptive, but, rather, as being about developing one's own practice and pedagogical style:

> It taught me a lot in terms of other peoples' teaching styles... Every time we came it was a different challenge that we all took on board but in different ways. So it just makes me think that people going back to school won't teach like I do and I don't teach like they do so we don't have to conform to any methods so they weren't going back to school and thinking 'Well I've got to achieve the same as everyone else'.

Having worked with Bernie and Liz over the course of the two-year continuing professional learning programme and during the research process, it was apparent to the first author that their pedagogical commitments differed. Bernie's belief that teaching mathematics through challenge and real life situations, with the teacher as a force moving the children on from behind rather than leading from the front, was evident throughout the interview process. She reported that the MaST course had provided her with the validation to embrace this pedagogical approach more fully. Liz exhibited a preference for a more direct, instructional, pedagogical commitment in the lesson observation. She reported, however, that the MaST programme had allowed her to appreciate that pedagogical practice is very individual and that there is

no one best practice model that can be advocated and followed. It had also provided her with the confidence to take more risks within her own teaching and develop flexibility in her own teaching approach. Despite the mismatch which we have seen for both teachers between their lessons and interviews, we would argue that both demonstrated that, through the discipline of noticing, their skills in critical self-reflection had developed. They now had a language that allowed them to articulate the choices they made.

Conclusion

Assessing the impact of continuing professional learning is difficult, and expecting a clear 'before and after' picture over-simplifies the complex process of teaching development. Our research has sought to focus on teachers' development of an empowering discipline of noticing to develop critical reflective skills. In the interview and observation process, both Bernie and Liz's reflections demonstrated an increased awareness of their own pedagogical practice and student thinking and understanding. This led to small, incremental changes being made to their practice, which included such things as the attention paid to mathematical language and vocabulary, deepening understanding of pupil learning and misconceptions, and the confidence to embrace a more experiential teaching approach. While we recognise the difficulty in disentangling the particular impact of the MaST programme from that of engagement in our research process, we suggest that a major source of development for both teachers was the integration of a research process into the MaST programme itself—to some extent, MaST participants are working in a 'third space' (see Williams and Ryan 2013) in which teacher and researcher roles are hybridised. The programme gave them an opportunity to reflect with others (fellow teachers and their university tutor), with that reflection built around a small research task in every formal session. Our later discussions with Bernie and Liz undoubtedly acted as further stimulus for development, but we see this as part of an ongoing process which clearly began during the programme.

What this suggests about workplace learning is that programmes need to provide opportunities to research one's own practice and to reflect, stand back and question over a period of time, with a knowledgeable other or group. Although there was some mismatch between what was reported at interview and what we observed during classroom episodes, both teachers demonstrated that they had developed a 'language' that allowed them to articulate and critique the choices they made within their practice. This particular development is perhaps indicative of an internalisation of the reflective process—their ways of explaining their particular practice foci were unique to them, and tailored to their concerns. Most importantly, we consider that through the exercise of their ability to critically self reflect—described by Mason (2002) as an 'awareness of awareness'—they had gained agency as professional decision-makers as part of ongoing practitioner development. Any claims regarding the 'success' of the programme, in terms of its stated aim of impacting directly on

mathematics pedagogy at school level, would need to go beyond Williams' (2008) original goal of enhancing deep subject knowledge. Our research shows the more fundamental and sustainable role of continuing professional learning as addressing the teacher as researcher-practitioner.

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