

Reflecting on practice in early years' settings: developing teachers' understandings of children's early mathematics

Jenni Back and Marie Joubert
University of Plymouth and University of Bristol

This paper presents some of the findings of the Researching Effective Continuing professional development in Mathematics Education (RECME) Project which was set up to investigate, amongst other things, the role of research in 'effective' CPD for teachers of mathematics. The focus in this paper is on a CPD initiative that involved a network of teachers and early years practitioners. The Early Years Foundation Stage (EYFS) covers the care and education of children from birth to five years old and the place of mathematics in these settings has historically been problematic (Gifford 2005; Griffiths 1994; Moyles 1994); we suggest this makes this initiative particularly interesting. During meetings, which involved practitioners from a variety of settings, participants carefully considered children's mathematical work, especially their spontaneous mathematical graphics (Worthington & Carruthers 2003). This focus led the practitioners to consider ways in which they might support the children's mathematical development in EYFS settings. We suggest that the professional development of the participants occurred through this collaborative work on researching children's mathematics in the classroom.

Early Years Foundation Stage, children's mathematics, mathematical graphics, professional development, classroom research

Introduction

The RECME project (Researching Effective Continuing Professional Development in Mathematics Education) was a major research project funded by the National Centre for Excellence in the Teaching of Mathematics (NCETM) which focused on analysing data gathered from researching thirty continuing professional development (CPD) initiatives in mathematics education from all phases of education from early years to further education. The RECME project involved a team of five researchers from a variety of research backgrounds and employed a range of research instruments which gave us a rich data set of qualitative and quantitative data. This account focuses on establishing the roles of research in professional development for teachers of mathematics. It outlines our findings and offers one case study initiative elaborating on the responses of one teacher to the professional development in which they were involved.

Amongst our key findings was a suggestion that teachers who gave accounts of changes in practice that they reported as sustained and profound had often been involved in their CPD in focusing on student learning and reflecting on the relationship between student learning and their own professional practice in the classroom. We also found that some of those teachers who were beginning to develop as leaders of CPD themselves were involved in reading and reflecting on educational research findings and it is this aspect on which this account focuses.

The case study initiative was set in the context of Early Years Foundation Stage education in which a group of teachers and practitioners established a network group

in a city in the south west of England. Early Years Foundation Stage involves the education and care of young children from birth to five years old. The network of practitioners was initiated by two researchers, who seemed to be passionate about children's early mathematics, as evidenced by the fact that they ran courses and conferences in the area around a major city. The researchers, Melanie and Lizzy, said that their passion was illustrated by, amongst other things:

- ... our strong desire to help make mathematics more meaningful, challenging, accessible and interesting for young children.
- ... our deep and enduring interest in young children's learning.
- ... our belief in the significance of research.

This had originated in their own teaching experiences as a result of careful research into teaching and learning mathematics and reflecting on their practice over a number of years.

Sarah went on a course run by the two researchers. At the course, Melanie and Lizzy suggested that forming groups at a grass-roots level would help to encourage and support teachers and other professionals in working with children's own mathematics. Sarah acted on this suggestion to form this group. As she said:

I was enthused by Melanie and, having identified a gap in the curriculum in the transition between Foundation Stage (pre-school and reception) and Key Stage 1 (first years of formal schooling), which my own setting was seeking to fill, I was able to pursue the ideas.

Within the school, in which the case study teachers worked, over the previous year or so there had been a significant change in the approach to teaching in the reception year, especially in mathematics, which had been driven by new Early Years Foundation Stage Curriculum¹ guidance.

The leader, Sarah, described the work of the group as follows:

I have introduced practice and understanding from the CPD I received from Penny and fed back to both my own setting and the group. It has made me research an area of the curriculum about which I am strangely passionate, reflect on my own understanding and practice, collect and collate evidence and share this with fellow maths enthusiasts within my school and the group.

So the group was set up partly in response to Sarah's perception of a gap in the curriculum and in provision for transition between Early Years Foundation Stage and Key Stage 1 in the school in which both teachers work, as well as in response to the suggestions made at the course Sarah attended.

¹ In the UK, the Early Years Foundation Stage (EYFS) was introduced in September 2008 and refers to the stage of education for children aged up to five years. In this report we use EYFS to refer to this phase. The revised curriculum for EYFS includes guidance on the kinds of learning opportunities that should be offered and the developmental progression that might be expected. In the context of EYFS settings children are offered many learning opportunities to engage in *problem solving, reasoning and numeracy*. However, unlike the *communication, language and literacy* section of the curriculum which emphasises the importance of mark-making, *problem solving, reasoning and numeracy* does not. The 'learner centred' approach of the Foundation stage curriculum contrasts with a more teacher directed approach that is sometimes characterised by heavily structured and teacher led approaches, for example worksheets and following a template to create artefacts.

The aims of the CPD, the intended professional development and change

Melanie and Sarah described the aims of the group as involving developing teachers' and other practitioners² professional understanding of young children's understandings of mathematics and to supporting them in developing strategies to develop and support children's early mathematical development. They particularly focused on considering examples of children's work and reading relevant research literature related to this focus such as the work of the course leaders (Worthington and Carruthers 2003). This led them to observe children's spontaneous mathematics closely particularly in terms of mark making, problem solving and communication and to consider carefully the ways in which children make sense of mathematics in the early stages of recording it.

Melanie and Sarah hoped that the participants' practice would move away from imposing mathematics on children and work towards supporting children in developing their own mathematical understandings and representations in meaningful contexts. This in turn would support children in adopting conventional symbols, such as the numerals, by working with the children's own representations and understandings.

Content and processes of the CPD initiative

The group was informal and met about once every six weeks. It involved teachers and nursery nurses from a number of different primary and nursery schools in the local area. In most cases more than one teacher participated from each school. Meetings were held after school and the venue changed from school to school. They lasted an hour and a half, with refreshments provided by the host school. The leader of the group, Sarah, intended to delegate more responsibility for convening the meetings and managing the discussion to others in the group and welcomed participation at all levels from everyone. The group was observed to be supportive, open and egalitarian in its structures. For example, at the observed meeting Sarah did take the lead, but all the participants brought their own contributions and all commented freely on each others' observations without Sarah dominating the meeting. Towards the close of the meeting another member of the group offered to host the next meeting and the agenda for the following meeting was collaboratively decided upon as an outcome of the observed meeting. One of the participants said that colleagues from another school had seemed interested and the group decided that they should be included in the next meeting.

The group received no funding from the schools or any other source, except in the supply of venue and refreshments by the host school. The agenda and content of each session was decided upon co-operatively by the whole group, which meant each participant was supported in their participation by the relevance of the content of each session and the collegial support from their peers. During the observed meeting, the participants all contributed examples of children's spontaneous mathematical problem solving which they had observed in their own settings. These examples were shared with the group and the scenarios from which they had arisen were discussed. The topic had been chosen at the previous meeting in response to the focus of the Revised

² As well as teachers, a number of other groups of early years practitioners, who have professional training in child care and child development, work in EYFS settings including nursery nurses. A number of early years practitioners were participants in this group as well as some teachers.

Numeracy Strategy and in the Early Years Curriculum Guidance on problem solving. Sarah described this as follows:

At the group meetings we share examples of our children's mathematical learning supported by photographs, quotes, samples of work etc. We are currently working towards a shared file of examples of children's problem solving as a resource for all members of the group. Sharing our experiences, children's work, information from Melanie, other CPD training and ideas, adds to our collective knowledge of teaching mathematics.

This sharing of children's work formed the substance of the observed meeting and included variety of examples which had been carefully analysed by the professional presenting it. In many cases, these examples involved accounts of what the children had done, examples of their productions in terms of marks made or artefacts created and photographs of the children in action. The group discussed in detail the mathematical aspects of each example and talked about how they could support the mathematical thinking that it represented.

Sarah's experiences

Sarah was an experienced teacher with a post graduate teaching qualification and had studied mathematics to GCSE level. She specialised in teaching in Early Years and Key Stage 1 and took a leading role within her school for provision within the reception year, and so managed the transition from EYFS to Key Stage 1.

Actual professional development

For Sarah the main gain from the group was in:

... enabling me to continue to keep abreast of current thinking, be reflective and share my ideas and experiences with fellow early years practitioners, teachers and nursery nurses in the private and maintained schools, in a safe, supportive, non-threatening environment.

Her involvement in the group and attendance at various conferences in the area run by Melanie and Lizzy had developed her understanding and enthusiasm and she was in the process of becoming a researcher in her own classroom. This is evidenced by the following comment:

I have done additional research to promote children's mathematical graphics and problem solving, which are the main things that the group has focused on so far.

Sarah had read research articles about children's mathematical graphics and problem solving and felt that this was important:

I liked knowing that I am aware of current thinking, research and best practice.

Sarah's participation in the group had made a significant contribution to her professional development. She had become more confident, as she said:

I feel more confident in my teaching of mathematics and proud of my school's early years team's development in this area. The group is a lot of extra work for me but I find it personally rewarding, professionally exciting and socially enjoyable. It has been great to visit other settings as we take it in turns to host the meetings – and the next meeting will be chaired by the person hosting the meeting, so I might feel less responsible!

For Sarah, one of the key outcomes of involvement was the opportunity to discuss ideas related to EYFS teaching with colleagues from within her school and other schools, and to share examples of good practice as well as current guidance and issues arising from practice.

Changes in practice

Sarah was now committed to practice focused on children's mathematics as a result of her extended study of children's mark making and problem solving. Sarah described this as a complete change from the worksheet- and textbook-based approach that used to exist in her school.

Evidence of this way of working was observable in Sarah's classroom. Examples of the children's spontaneous mathematical work were displayed in annotated form on the walls and in their books. The environment offered a range and variety of resources for mathematical investigation which were all freely available to the children. Sarah voiced her enthusiasm and passion for the CPD and her work in leading it but also expressed the sense of pressure that taking on a commitment to leadership of the group had engendered. She said she would like to:

I would like to feel less pressured all the time so I could really get down and focus on the children, their understanding and interests and then work with them to develop their mathematics within a balanced and meaningful curriculum.

This quotation illustrates that for Sarah's belief that children's mathematical learning develops from the children's interests and she would like to spend more time considering their understanding and the meaning that they attach to their mathematical productions. Sarah voiced her frustration at finding it difficult to find time for this work that she regarded as important.

Student learning

Evidence of children's learning of mathematics was displayed on the notice boards around the classroom as well as in the children's books and they were able to articulate their mathematical understandings clearly. As Sarah said:

The children in our classes have a positive attitude to sharing and representing their mathematical thinking. They are developing confidence in their mathematical graphics which are valued, they are developing fluency and a willingness to talk about their thinking. By focusing on problem solving they are identifying meaningful problems, rising to the challenge and developing a sense of achievement and satisfaction in finding a solution. They are sharing ideas and drawing on prior experiences to inform their strategies. Hopefully this positive attitude to mathematics and problem solving will stay with them. The children are able to demonstrate their individual ability and explore concepts beyond the normal curriculum.

The displayed work, both within children's books and on the walls, demonstrated the detailed observations and analysis that Sarah made of evidence of the children's mathematical thinking and understanding on a day-to-day basis. It also illustrated the importance of mathematics for the children in this class.

In a recent communication with the RECME team she said:

It has been interesting that some practitioners have said that they feel it is "contrived" to encourage the children to make mathematical graphical representations so I suggested that they focus on WHY WE do it e.g. to help our thinking, to help us remember, to show someone else, to bring inside from the garden or share with another class, to take home etc. What was more interesting really was that the same practitioner felt perfectly comfortable getting her Nursery aged children to write speech bubbles.

This illustrates the role that Sarah had begun to take in supporting the professional development of her colleagues.

Conclusions

The changes that the teachers reported, including Sarah, made in their practice were fully in line with the aims of the CPD. We would suggest, from the evidence that we gathered from this initiative as well as others, that ways of working with teachers that facilitate their mutual support and offer them ownership of the content, purpose and direction of their CPD may be particularly effective in supporting radical changes in professional practice.

Participant ownership of this initiative helps to sustain involvement and that the members support one another in sustaining this passion and enthusiasm. Overall, the initiative supported the participants in their professional change by giving them a space for the detailed and joint consideration of children's mathematical thinking. It supported them in following up research sources that would support their analysis of the children's mathematical graphics and enabled them to encourage children to take charge of their own mathematical activity. It also offered them a supportive and encouraging arena in which their professional concerns and difficulties could be discussed.

Another significant feature of this initiative was its focus on careful consideration and analysis of children's mathematics, and the ways in which professionals can support and encourage the children's mathematical thinking and reasoning. We were struck by the emphasis on observing and analysing children's spontaneous mathematical activity. This emphasis seemed to shift the teachers' focus from teaching to learning and to give them the opportunity to consider the children's mathematical understanding and thinking. The teachers were then able to use this to support the children in their mathematical development and to plan appropriate adult-led activities that would help the children build their mathematical thinking and reasoning, such as the counting.

In conclusion this initiative involved opportunities to learn, experiment and reflect with colleagues about children's mathematical thinking and learning. It also exemplified compatibility between the ways of working with children and ways of working in the PD context in the sense that in both contexts the points of view of the participants were treated with respect and valued for their authenticity. There was a key place in the CPD of a deep engagement with processes of student learning and an element of respect for the professional practice of all those involved in the PD. It also involved the teacher as a researcher/observer in their classrooms and we suggest that this element may be very important in developing commitment to sustained change in professional practice as well as improved student learning through its focus on learning rather than teaching.

References

- Gifford, S. 2005. *Teaching Mathematics 3 -5: developing learning in the foundation stage*. Maidenhead: Open University Press
Griffiths, R. 1994. Mathematics and Play. In *The Excellence of Play*. ed. J. Moyles, 170-185. Maidenhead: Open University Press
Moyles, J.,ed. (1994) *The Excellence of Play*. Maidenhead: Open University Press
Worthington, M., and E. Carruthers. 2003. *Children's Mathematics: Making marks, making meaning*. London: Sage