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REFLECTIVE PRIMARY MATHEMATICS

A Guide For Student Teachers



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History of difficulties in learning and teaching mathematics

Learning objectives

Having read this chapter you will ...

- Raise your awareness of some of the historical difficulties faced in learning and teaching mathematics
- Begin to compare these with your own experiences
- Consider potential factors that may have contributed to your own perceptions of mathematics

Introduction

The notion of mathematics being difficult to learn is not new. Approaches to teaching mathematics change from time to time, but despite continued efforts to find the best ways of teaching the subject, mathematics education seems to have proved problematic for many years. This chapter outlines the changing face of mathematics education over time so that you can expand your awareness of the wider picture of learning mathematics and of some of the difficulties faced in mathematics education. There are opportunities for you to reflect upon your own mathematical experience and perceptions, allowing you to consider your own thoughts about mathematics teaching and learning and some of the

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difficulties that colleagues and children you will work with may have. Perhaps your own mathematical experience may resonate with those of others. This chapter begins with a case study of a student about to begin initial teacher training who is keen to become a primary teacher but who has her own concerns about mathematics and is worried about being back in a mathematics classroom as a learner herself. The case study is followed by discussion of a history of difficulties in teaching and learning mathematics based on theoretical substantiation and student teachers' descriptions of their experiences.

Case study

Judy was a Bachelor of Arts graduate when she enrolled on an initial teacher training course in the North of England. With several years' experience working in the tourist industry, she had decided to retrain and enter primary teaching. The course for which she successfully applied started with a registration day, at the end of which the group were invited to take part voluntarily in a research project looking into student teachers' perceptions of mathematics.

She was confident in her enthusiasm for her new career, her general academic ability for the course, her communication skills for working alongside adults, patience with young children, her organisational skills for coping with largely online study and time management techniques for fitting the course around her job, which she had arranged to reduce to part-time hours. Mathematics was the one area that Judy was really anxious about. The research sounded interesting as she had concerns about the way she thought of mathematics, but those very concerns discouraged her from getting involved.

Sitting there in the lecture theatre with her new peers she felt inadequate. As the various lecturers had talked about their subject areas and given presentations about what students could expect to cover during the course, she had felt a rising anxiety about the mathematics element. It seemed ridiculous to put herself forward to be involved in the research as she felt such a fraud, but the researcher seemed friendly and approachable and had emphasised that anyone who expressed an interest could back out at any time with no obligation. Judy thought it could be a chance to have some of her own questions answered and so at the risk of being exposed as unsuitable for a primary teaching course, she filled in the slip in her information pack and decided she might as well be sure sooner rather than later if she was going to be able to manage the mathematics part of the course.

The researcher subsequently contacted her and arranged to meet in a café close to Judy's home. Despite her reservations, Judy soon felt at ease as the research interview turned out to be quite therapeutic. She had never really given her full attention to how she felt about mathematics before, or really

thought about the various incidents of learning mathematics and having to do mathematical stuff in public that had happened over the years. It almost felt like a counselling session, as she did all the talking, and there was a lot of nodding and smiling and agreement as she was gently prompted with various questions.

When the interview concluded and the tape recorder was switched off, the researcher talked more herself and explained the reason for the research, now that it wasn't liable to influence Judy's responses. Judy was relieved to realise how valuable her answers were and that she hadn't just talked rubbish for the last forty-five minutes. As she had presumed, people were involved in the research who really liked mathematics as well as people like herself who were worried about it, but it was a huge relief to find out there were many other students like her who didn't feel confident about learning mathematics again and who were anxious about teaching it to children. She learnt more about the course and how she and other students would be supported in learning mathematics for primary teaching and she was given lots of sources of support to brush up on her own knowledge of mathematics.

The main thing Judy came away with, however, was the realisation that maybe it wasn't her. She'd always assumed she was particularly bad at mathematics but now she was beginning to think that learning and teaching mathematics was a problem for a much wider range of people. Although she knew she was going to have to work at it, she felt much less of a fraud and could stop worrying that she'd be the only one on the course struggling with this part of learning to be a teacher. However, she couldn't help thinking that it was even more worrying that this problem seemed to be widespread and was now thinking of the poor kids out there who had teachers who still felt like her.

Post-Script: Judy went on to enrol and successfully complete the teacher training course, finding that the mathematics element was tailored to her needs and enabled her to learn a lot about how children learn mathematics, how she herself understood mathematics, how ways of teaching mathematics had changed since she herself was at school and what she needed to develop for her own mathematics subject knowledge and her ability to teach the subject well. Upon completion of her training, Judy secured a full-time teaching post in a primary school and kept in touch with the researcher, who was delighted to hear that she was not only confidently teaching mathematics, but was thoroughly enjoying the experience too.

Difficulties with mathematics education

Judy's case study may resonate with you, as she is certainly not the only new teacher to begin a teacher training course with a degree of trepidation about

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entering a mathematics classroom as a learner again and about having to teach mathematics. As Judy had begun to realise, and would learn more about during her course, mathematics education has been, historically, widely recognised as problematic.

Let's step back in time and think about how mathematics education has developed over the years. During your career as a primary teacher there will no doubt be a time when you organise a school trip or an in-school history day where the children get to experience what life was like for a child in a Victorian classroom, chanting multiplication tables and repetitive practice of arithmetic. Schools in this era operated on an early form of performance pay since, together with attendance, academic results determined the income for schools via government grants. In an effort to ensure successful assessment figures through testing, the content of a Victorian mathematics lesson would be mainly number work with a teaching approach of drilling facts into children who learnt by rote (Sharp et al., 2009).

Reflection points

- Is this approach to teaching mathematics confined to the classroom from over a century ago?
- Do children in twenty-first century classrooms chant number facts or routinely practise arithmetic by rote?
- Are teaching methods in any way similar to the Victorian era?
- In what ways are they different?
- How effective are the different methods you are aware of?
- How do you know they are effective?

It is a natural reaction to say that such an old-fashioned way of teaching no longer exists, yet on reflection such pedagogy is not left so far back in history as we might first surmise. Some student teachers, recounting their own experiences of being taught mathematics far more recently than the nineteenth century, describe a learning environment where they sat separately or in rows and talking was discouraged. They describe mathematics lessons limited mainly to number and remember being required to recite and constantly repeat number facts, such as multiplication tables, in an effort to memorise and be able to recall them. What they describe is a transfer of mathematical knowledge consisting of number from the teacher to the learner using a transmission mode of

teaching dependent on memorisation. Alan, for example, found this method of learning useful as he thought the only way to learn multiplication tables was to keep practising and for the repetition to help the facts 'sink in'.

However, what exactly is it that sinks in? Francesca recalled her father bribing her with extra pocket money to learn her multiplication tables when at primary school as he was alarmed that she did not know them, but she struggled to remember the numbers to be able to recite them as expected by her teacher in class and also to instantly recall a particular fact when asked. She described an example of finding the answer to 7×5 where in her head she would halve the 7 to get 3.5 then multiply it by 10 to get 35. She had developed her own technique that allowed her to mentally work out the answer as quickly as her teacher expected, but without being entirely reliant on her memory. She would later develop an understanding of why her system worked, although at the time she was not sure why and her teacher never asked her since all that was required was a quick and correct answer. It was not until Francesca became a teacher herself that she realised the worth in having children really understand the meaning of numbers and the calculations they could work out, as opposed to the limitations of trying to recall number facts that held no meaning for them. She was able to look back on the ways she had coped in primary school and to analyse how she had used her understanding of number to work out things she did not instantly know the answer to.

Reflection points

- What of your own memories of learning mathematics and your most recent experience observing and teaching in today's classrooms – does rote learning take place where children are presented with mathematical facts and required to memorise and recall them?
- Is it useful to have a set of mathematical facts that you just know and can instantly recall?
- How beneficial is it to understand the meaning behind those mathematical facts rather than being reliant on having simply memorised them?

In some ways, today's mathematics teaching retains elements of what, on the surface, we would consider outmoded practice. Nineteenth-century mathematics pedagogy must have been sufficient for the needs of the day if the mathematical

understanding required for the advance of industry and technology during and after that period is recognised. However, dissatisfaction with teaching methods led to a wider curriculum in British schools in the early twentieth century, with a move in the 1930s to suggest a prescribed curriculum. This did not come into being, interrupted as it was by war, after which it was not considered to be the best way forward (Mathematical Association, 1955). Instead, it was thought that children should learn mathematics at their own rate through play, talk and experimentation in order to explore mathematical relationships and develop their ability to think mathematically. In contrast to the focus on passing tests linked to government funding from the previous century, the Mathematical Association (1955) advocated mathematics being taught as a necessary language, a scientific tool, for pleasure and for its use in everyday life.

Children learning mathematics through play, investigation and talk and for the purpose of enjoyment and not just necessity may resonate with your recent experiences of observing mathematics in primary schools and it may even surprise you that such a philosophy for teaching mathematics is not a relatively new one. Indeed, student teachers have expressed their confusion regarding the purpose of learning mathematics with Julie, for instance, who questioned its relevance and wondered about what relation mathematics has to the world, surmising that there must be value in learning mathematics, but she could not articulate what that value might be.

Reflection points

- From your observations of mathematics teaching and learning in today's classrooms, what seem to be the main drivers and reasons for teaching this subject?
- Will you teach mathematics solely because it is a core subject in the statutory curriculum or what other reasons are there?

Child-centred perceptions of learning mathematics continued into the 1960s and beyond, with the Plowden Report (DES, 1967, para 9) suggesting that 'at the heart of the educational process lies the child'. Depending on the period in which you were at school, you may recall child-centred approaches with individualised learning. However, the advent of published schemes of work tailored to children's individual progress in mathematics perhaps led to an over-reliance on mass-produced resources. Some student teachers recalled working on their

own through various series of work-cards, sheets or books and describe teaching approaches that were not proactive, with Lois suggesting that she was not actually taught anything, as she remembers having to get on with it herself, working through a series of worksheets that she found very boring.

Reflection points

- What are your recollections of being taught mathematics?
- What was useful to your learning and what did you not find as useful?

By the 1980s there remained dissatisfaction with the quality of children's learning and the depth of their mathematical understanding. A detailed study into mathematics education reported that it was 'a difficult subject both to teach and learn' (Cockcroft, 1982, p. 67) with advice that mathematics should include 'exposition by the teacher ... discussion between teacher and pupils and between pupils themselves ... appropriate practical work ... consolidation and practice of fundamental skills and routines ... problem solving including the application of mathematics to everyday situations ... investigational work' (Cockcroft, 1982, para 243). Previous pedagogical developments had not led to mathematics being learnt sufficiently well and a range of teaching approaches were advocated.

Lee recounted her experience as a teaching assistant working alongside a teacher evidently keen to embrace the findings of the Cockcroft Report and to implement a structured curriculum that replaced the somewhat haphazard approach to mathematical content she had witnessed at her previous school, yet which had scope to teach in proactive ways as advocated by Cockcroft in order to develop children's mathematical understanding. What Lee observed, however, was adherence to the school's existing scheme of work and a reluctance of colleagues to change the whole-school approach of children working individually through a published scheme of workbooks. Rather than children learning in collaborative groups through discussion, practical experience, investigation and problem-solving, Lee recalled the class teacher being informed by the mathematics curriculum leader that was 'not the way maths was taught in that school'. Instead, they were required to continue the children's individual use of textbooks, with what Lee saw as the unavoidable labelling of children dependent on what level of book they reached, and a steady stream of individual children queuing at their sides needing help to know what was required of them.

Lee's critique of practice resonated with the government's 'Better Schools' paper (DES, 1985) that highlighted a lack of approaches to teaching mathematics through practical contexts to aid children's understanding of its use and application.

Reflection points

- Do you see children in today's mathematics lessons working through a series of books, work-cards or sheets individually without proactive teacher input?
- How much teacher exposition, discussion, practical work, consolidation and practice, problem-solving, everyday application and investigation do you observe in your recent school experience?
- Which of these approaches are more prevalent than others?
- Which approaches are most beneficial for children's learning?
- How do you know they are beneficial?

To address recommendations raised by Cockcroft (1982), the 1988 Education Reform Act (DES, 1988) brought about a statutory National Curriculum in England and Wales in 1989 (DES, 1989) whereby the responsibility for mathematical teaching content was removed from teachers and replaced by a prescribed mathematics curriculum as had been suggested, but rejected, half a century earlier. Although the mathematical content of a school syllabus became statutory, pedagogical approaches were not prescribed and so methods of teaching remained varied, other than a programme of study within the new curriculum devoted to 'using and applying' mathematics which, in response to the Cockcroft Report (1982), attempted to promote the learning of mathematics through means such as problem-solving, developing mathematical communication and children's use of logic and reasoning.

Despite the advent of the statutory curriculum, standards in mathematics continued to be criticised a decade on (Askew, 1998). The National Curriculum had been revised to form a more concise version than the original and, in the interest of developing further mathematical understanding, the 1999 version (DfEE, 1999a) incorporated the use and application of mathematics into the other programmes of study, so as to avoid being seen as a separate teaching element and to instead encourage teaching of the use and application of all mathematical

content, whether number, shape, space, measures or data handling through problem-solving, communication and the use of logic and reasoning.

Reflection points

- Were you at school when the National Curriculum for England and Wales came into being?
- How aware were you of teachers linking mathematics to everyday contexts and developing your ability to communicate mathematically, building in problem-solving to your mathematics learning and encouraging your use of logic and reasoning?
- Were such approaches helpful to your mathematical learning and why?

The non-statutory National Numeracy Strategy (DfEE, 1999b) was also introduced into primary schools, and extended later into secondary schools. While Ofsted (2005) reported that the National Strategies had a positive impact upon teaching and learning, further change was brought about when the National Numeracy Strategy (DfEE, 1999b) was superseded by the Primary National Strategy (DfES, 2003a), at which point the term ‘numeracy’ was replaced by ‘mathematics’ in the strategy’s title.

At this time, the Excellence and Enjoyment strategy for primary schools (DfES, 2003b) encouraged creativity and innovation in teaching, advocating that teachers ‘take ownership of the curriculum’ (2003b, p. 5) to provide a ‘rich and exciting curriculum’ including ‘building and applying mathematical skills’ (2003b, p. 6) and suggesting that teachers ‘have great freedoms to exercise their professional judgement about how they teach’ and that ‘teachers have the power to decide how they teach’ (2003b, p. 16).

The National Curriculum remained statutory with its focus on content, whereas the Primary National Strategy provided more detailed prescription, including age-related learning objectives, recommended calculation strategies to be taught and suggested blocks of mathematical content to be taught in particular time periods. On the one hand, new teachers described feeling more confident in planning as the wider learning objectives of the National Curriculum were broken down into more manageable learning objectives for their short-term planning, and they indicated that learning various mental and written strategies for number calculations was useful. However, student teachers described feeling overwhelmed by the lists of objectives, personal difficulties in

learning mental and written calculation strategies, confusion concerning when they were required to teach particular units of work and worried about meeting children's needs, with May, for example, commenting that she felt sorry for the children she observed in school. She described teachers 'ploughing' through objectives as if they were trying to get to the end of them but May was not convinced that they were necessarily making sure children fully understood before they moved on to the next set of objectives. Her view was that both the children and the teachers seemed to be like 'hamsters running round wheels'.

Experiences such as May's are supported by research into mathematics education at the time. ACME, for example, noted teachers feeling pressured about children reaching certain levels due to a focus on standards, with evidence of teachers focusing on mathematics for a particular year group rather than on overall progression and making connections between different aspects of mathematics, suggesting that 'changes to curriculum guidance and documentation that increase the number of bulleted teaching and learning objectives only serve to decrease the ability of teachers – especially non-specialists – to see this bigger picture' (ACME, 2006, p. 13).

Consideration of such changes to curriculum were under way, with the Education Act of 2002 (DfES, 2002a, p. 53), suggesting a revision to the National Curriculum for England. Mathematics was to continue to be a core subject with a curriculum including attainment targets and assessment arrangements alongside programmes of study (2002a, p. 57) whereby 'matters, skills and processes are required to be taught to pupils of different abilities and maturities by the end of that stage' (2002a, p. 59), although it suggested that particular periods of time may not be allocated for the teaching of the programmes of study.

Such was the continued concern about mathematics education that a government-initiated review was set up in 2007 resulting in the Williams Report's examination of effective pedagogy for primary mathematics (DCSF, 2008). Although considerable progress was noted in mathematics learning, Williams reported that there remained issues in learning and teaching mathematics and that government assessment targets had not been met. Williams (DCSF, 2008, p. 1) recommended that every primary school should have a mathematics specialist 'who will champion this challenging subject and act as the nucleus for achieving best pedagogical practice'.

There was further feedback from the Cambridge Primary Review (Alexander, 2010), which criticised the National Strategies' emphasis on number and computation for being not so far removed from nineteenth century approaches to mathematics pedagogy, particularly assessment-driven transmission modes of memorisation as opposed to the wider mathematics curriculum of the statutory National Curriculum. While Victorian teaching methods may have largely focused on passing tests to make the most of assessment results and therefore funding, the philosophy of resulting committees (Mathematical Association, 1955) seemed to change the focus to child-centred learning wherein children's

understanding was fostered through more active approaches to learning. However, as Lee commented during her student teacher experience, there is evidence in today's classrooms of teaching being assessment-focused, perhaps not for funding purposes so much as national and parental interest in league tables and Ofsted performance gradings.

In response to the need to ensure effective educational provision for all primary children, the Rose Review was set up (DCSF, 2009). This noted that 'experience from the National Strategies shows that schools are sometimes unaware of all that numeracy should cover and so limit opportunities for children to apply the full range of numeracy skills across the curriculum' (DCSF, 2009, p. 68). It also suggested that the primary curriculum was too prescriptive, stating that 'the trend, usually motivated by the desire to strengthen particular aspects of learning, has been to add more and more content with too little regard for the practicalities and expertise needed to teach it effectively' (DCSF, 2009, p. 3).

Hence, despite attempts to improve mathematics education via the implementation of the National Strategies, dissatisfaction expressed of over-emphasis on number, memorisation, knowledge transmission, lack of application and over-prescription indicated a need for more concentration on the development of mathematical understanding and more effective teaching approaches. A revised National Curriculum to include exploration of the use and application of mathematics was recommended by Williams (DCSF, 2008), with the Rose Report (DCSF, 2009) advocating cross-curricular work to enrich and enliven children's learning. It also recommended a less prescriptive curriculum with 'greater flexibility to meet pupils' individual needs and build on their prior learning' (DCSF, 2009, p. 10).

Such increased autonomy for teachers was further supported in a subsequent British government White Paper which stated that the National Curriculum was too prescriptive (DfE, 2010) and intimated 'allowing schools to decide how to teach' (2010, p. 10), indicating that 'teachers must be free to use their professionalism and expertise to support all children to progress' (2010, p. 42).

Reflection points

- Government reports and guidance are freely available online – access a selection from the reference list at the back of the book for more details of what has been advised for mathematics teaching in primary schools.
- Reflect upon the curriculum you think is needed for children to develop mathematical understanding.

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- What is your understanding of 'the use and application of mathematics'?
- How do you see this being incorporated into the teaching you observe in today's classrooms?
- How do you think it could be further embedded into children's learning opportunities?
- Do you think it is worthwhile to do so and why?

The Primary National Strategy is now decommissioned and a revised statutory National Curriculum (DfE, 2013) was implemented in September 2014. This includes a 'mathematics' as opposed to 'numeracy' section and a breadth of mathematical areas, although there remains an emphasis on number in that 'the principal focus of mathematics teaching in Key Stage 1 is to ensure that pupils develop confidence and mental fluency with whole numbers, counting and place value' (DfE, 2013, p. 101). Despite suggestion of developing understanding of number as opposed to memorisation of fact through, for example, the use of resources, there is indication that practice, as opposed to developing understanding, might be advocated since it is proposed that 'by the end of year 2, pupils should know the number bonds to 20 and be precise in using and understanding place value. An emphasis on practice at this early stage will aid fluency' (2013, p. 101) as well as a requirement to memorise number facts since it states that 'by the end of year 4, pupils should have memorised their multiplication tables up to and including the 12 multiplication table' (2013, p. 113).

While less prescriptive than the National Strategies, it is more prescriptive than the former National Curriculum, in that it sets out programmes of study for year groups as opposed to the previous key stages. Despite this age-related content, however, there is specific information provided regarding the use of these as guidance in terms of schools introducing 'content earlier or later than set out in the Programmes of Study' as well as schools introducing 'key stage content during an earlier key stage if appropriate' (2013, p. 100). It is stated that progression through the age-related content should 'always be based on the security of pupils' understanding and their readiness to progress to the next stage' (2013, p. 99).

Although it is advocated that those children achieving conceptual understanding are 'offered rich and sophisticated problems' (2013, p. 99), there remains an emphasis on practice in that the new National Curriculum states that 'those who are not sufficiently fluent with earlier material should consolidate their

understanding, including through additional practice, before moving on' (2013, p. 99). Assuming that a child who is not sufficiently fluent is a child who needs to expand their mathematical understanding of a concept, there is apparent suggestion that additional practice may fulfil this need, iterated in the stated aim 'to ensure that all pupils become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately' (2013, p. 99) suggesting an emphasis on fluency related to practice is the prerequisite for development of problem-solving and conceptual understanding.

The notion of 'using and applying' mathematics previously identified as crucial is included in the new curriculum in that children are to be engaged in problem-solving 'by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions' and encouraged to 'reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language' (2013, p. 99). Although it states that pupils are to be taught to apply their understanding within number, measurement, geometry, algebra and probability and to apply mathematics to problems (2013, p. 9) with some reference to problem-solving within some of the various programmes of study for different year groups, this is not universally included. For example, there is no indication of specific problem-solving for measurement and geometry in Year 1; for fractions, geometry or statistics in Year 2; for measurement, geometry or statistics in Year 3; for geometry in Years 4 and 5; nor for algebra, geometry and statistics in Year 6, which is unusual given the apparent importance previously stated for applying mathematical understanding.

However, the new National Curriculum does recognise mathematics as 'an interconnected subject in which pupils need to be able to move fluently between representations of mathematical ideas' (2013, p. 99) with the recommendation that mathematical connections are made and that mathematical knowledge be applied to other areas of the curriculum, stating that 'teachers should use every relevant subject to develop pupils' mathematical fluency' and 'develop pupils' numeracy and mathematical reasoning in all subjects', although their rationale for this is for pupils to 'understand and appreciate the importance of mathematics' (2013, p. 9) as opposed to a means to develop mathematical understanding in a wide range of relevant contexts for the learner.

Pedagogy is not prescribed, with an indication for teacher autonomy in how the content can be taught as it provides 'an outline of core knowledge around which teachers can develop exciting and stimulating lessons to promote the development of pupils' knowledge, understanding and skills as part of the

wider school curriculum' with schools being 'free to choose how they organise their school day, as long as the content of the national curriculum programmes of study is taught to all pupils' (2013, p. 6).

Reflection points

Access the new National Curriculum –

- What are your initial thoughts regarding its content?
- What do you think you need in order to be able to effectively teach the National Curriculum?

Changes over time show that there have been and still are difficulties in the way mathematics is taught and learnt and mathematics education continues to be subject to review. Both student and qualified teachers continue to work in a difficult sociopolitical climate with regard to quality mathematics provision for children and at a time of frequent policy and curriculum change. The new curriculum appears to address a sense of progression in children's mathematical learning but has a previously criticised focus on age-related objectives, no longer contains the previous Attainment Targets by which children's learning was measured in what was denounced as an assessment-driven curriculum, recognises the need for a range of mathematical connections to be made beyond an emphasis on number, recommends cross-curricular mathematical links and advocates the use and application of mathematics through problem-solving, reasoning and language. In terms of teachers having the expertise to put this into practice in order to develop mathematical understanding, it indicates a degree of autonomy in line with previous recommendations (DCSF, 2009). However, as was recognised by ACME (2006, p. 5), putting curriculum content into practice effectively 'is reliant on teachers' ability and attitude' whereas a lack of confidence has been seen in primary teachers of mathematics (ACME, 2006, p. 23) and mathematics is known to not always be 'embraced with enthusiasm and confidence' (DCSF, 2008, p. 1). So, we have the new curriculum, but are left with the question of how to implement this with confidence and efficacy.

While pedagogy has been identified as an underlying reason for the problem with mathematics education (Ryan and Williams, 2007), addressing this issue is not straightforward, as shown in over a century of changing approaches to teaching mathematics that have not as yet resulted in successful results for

learners of mathematics. It is apparent that difficulty in teaching mathematics is international (Goulding et al., 2002), with MacNab and Payne (2003) suggesting that insecurities in teaching mathematics are widespread globally. Elements contributing to teachers' practice are many for, as so aptly described by Desforge and Cockburn (1987, p. 2), 'the problem of mathematics education is a many headed monster'. To attempt to tackle this decades-old problem with its underlying multi-faceted aspects is, therefore, no mean feat, but necessary when one considers the raw deal that children may be facing in some classrooms, since, as Bibby et al. (2007, p. 16) purport, 'something is going wrong for learners in mathematics classes and ... this needs remedying'. Mathematics education remains a concern today, a thought that may not be encouraging to you as a new recruit to primary teaching, but which may reassure you in the sense that if you are somewhat apprehensive about teaching primary mathematics effectively, you are not alone.

This may not be a comfort; you may be feeling even more apprehensive, thinking that if the many who have gone before you have apparently not entirely succeeded in providing mathematical education that is up to scratch, then what hope do you have? What you *can* do, like Judy in the case study, is strive to be the best teacher of mathematics that you can be, because the children you will teach deserve it. To do that, you can begin with raising your awareness of the factors that may contribute to what has evidently been an historical problem. You have started with awareness of the ongoing difficulties with mathematics teaching and learning and it is intended that subsequent chapters will help you to develop your thinking further.

Chapter summary

In this chapter, changes in approaches to teaching primary mathematics have been explored alongside reflection on the impact on learners of mathematics, from the perspective of drill and practice a hundred years ago, through movement to encourage mathematical thinking in the early twentieth century, child-centred provision of the 1960s and suggested development in the 1980s for practical application, investigation and problem-solving. Associated changes in curriculum have been outlined to include the National Curriculum, National Numeracy Strategy, Primary National Strategy, government recommendations, independent reviews and the most recent version of the National Curriculum.

Mathematics education has proved difficult for over a century and continues to be a subject for review and development in terms of provision for learners. Considering pedagogy as a reason for these difficulties is not straightforward and, as such, subsequent chapters in this book will seek to encourage you to

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develop your awareness of learning needs relating to mathematics and ways to work on developing mathematical understanding.

As a student teacher reading this book, however, don't be disheartened. Maybe, like Judy in the case study, you are starting out on teacher training with some apprehension regarding your mathematical ability for the course and teaching children or perhaps you work alongside colleagues who share those anxieties and you are in a position to support them. Anyone experiencing concerns about teaching mathematics in the future and learning mathematics on an initial teacher training course can be reassured that they are not alone. The ensuing chapters in this book will guide you through various aspects of mathematics education to help you form your own philosophy of teaching and learning mathematics and to consider how you can fulfil your aspirations as a teacher of primary mathematics.