

Positive and negative: an exploration of the impact of the personal dispositions of early years practitioners on their teaching mathematics to young children.

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Introduction

One prospect facing early years practitioners is the possibility that if they have negative attitudes to mathematics, these may be communicated to and have a negative effect upon the learning of young children who are at a sensitive stage of their growth and development. This article reports on a study that explored the dispositions and perceptions of a small group of early years practitioners (students on a Foundation Degree in Early Years Care and Education working towards senior practitioner level) in respect of their own feelings towards mathematics and their perceptions of whether these affected their ability to teach children effectively. It examines the role of attitudes and dispositions in the teaching and learning of mathematics through a survey of the literature, and will briefly consider the role of subject knowledge in supporting effective learning and teaching. It will then consider the perceptions of the early years practitioners participating in the project in relation to these issues.

The importance of looking at the dispositions of practitioners in the early years field is particularly relevant because the Early Years Foundation Stage emphasises the need to encourage positive dispositions to learning (DfES, 2007). This raises the question of whether there might be a relationship between an adult's personal values, feelings and dispositions and how children respond, particularly if one of the ways that children learn is through example or by observing role models, and whether there is a risk that they might absorb practitioners' negative attitudes or lack of interest in this area.

Dispositions towards learning mathematics

Much of the literature supports the view that mathematics is a subject that people can respond to in a very negative fashion (Sharpe, 2000: 87; Clemson and Clemson, 1994: 23). Pound (1999: 32) develops this idea and suggests that there are few people who enjoy mathematics and that consequently, they are going to pass on their negative

feelings to those they are teaching, a view supported by others (Clemson and Clemson 1994: 23; Owen and Rousham, 2003: 282; and Gifford 2004: 105). For Pound (2006: 33), there is often a clear link between the 'painful' experiences as children in learning maths and adults' ongoing difficulties in this area. She also links this to an understanding that the brain will not perform well under stress, using this argument to support the view that children's learning should be fun and as stress-free as possible.

The problem with negative dispositions would seem to be that they are part of a cyclical process. Teachers who have themselves been exposed to the poor teaching of mathematics may, as a result, lack confidence in teaching it or have a negative view of the subject, falling back and relying on the way they were taught and thereby transmitting their negative attitudes towards the subject to their own pupils. However, in doing this they are not just transmitting knowledge about the subject, they are also communicating assumptions and ideas about the nature of mathematical knowledge as well (HMSO, 1989: 15; Aubrey, 1997: 144).

It would seem that one reason for this cyclical behaviour is the insecure subject knowledge of the teachers (Owen and Rousham, 2003: 282) and that a lack of confidence in their own ability may cause them to rely on more formal and structured methods and applications (Griffiths, 2005: 170). This may be connected to the suggestion that many children lose any early enthusiasm they have for mathematics once they reach school (Pound, 2006: 14) and leave with deep-rooted feeling of inadequacy and anxiety towards the subject (HMSO, 1989: 7).

However, Suggate et al (1998: 4) argue that an adult who feels confident and positive about their own mathematical ability in a "this is easy" type of approach may also prove unhelpful in supporting children. They suggest that this type of practitioner may feel that such knowledge is easily acquired and may therefore not be sympathetic to the difficulties faced by some children in developing an understanding of mathematical concepts and practice. The ability to support children sensitively would therefore seem to be an important aspect of a successful learning and teaching strategy, particularly as the 'Curriculum Guidance' requires 'practitioners who help children see themselves as mathematicians' (QCA, 2000: 8), suggesting an important role for the practitioner in developing each child's view of themselves as a successful learner.

However if the practitioner does not feel successful or suffers from a negative view of mathematics, it may also be difficult to enable them to overcome these feelings so that they can support children effectively. For the most part, training for early years practitioners seems to rely on giving them ways of exploring mathematical activities with children but does not address practitioners' own feelings. Such an approach implies that, provided practitioners have sufficient subject content to offer the children and ways of offering that content, they do not necessarily need to explore any inherent negative dispositions towards the subject as part of their training. Haylock and Cockburn, in their work for teachers of children aged 3-8, seek to address this gap through their 'sympathetic recognition' (2003: x) of anxiety and by providing some clear guidance on the important foundations that are imperative 'for children's future experience of number' (2003: 25). They argue that for practitioners to approach with confidence the opportunities 'for numbers and patterns in the environment and daily routine' (2003: 26) it is important to ensure their own development of ways of thinking mathematically.

The role of subject knowledge

Early Years Practitioners have not historically been required to have a General Certificate in Secondary Education (GCSE) in mathematics, although with the development of the Early Years Professional Status (Children's Workforce Development Council, 2006) this requirement is changing, and qualifications at this level are designed to be comparable with graduate teacher status. However, within an average setting providing the Early Years Foundation Stage (DfES, 2007) there is likely to be a large range of subject knowledge. It is important therefore to consider the way subject knowledge affects the view practitioners have of their ability to provide for children's learning.

We know that mathematics is a key area within the curriculum and that it carries deeply embedded values (Clemson and Clemson, 1994: 57). In 1999, these became enshrined in the National Numeracy Strategy (NNS), now the Renewed Primary Framework (Numeracy) (DfES, 2006). In this, the underlying values and principles of mathematics teaching became explicit, with teachers being told not only what to teach, but how to teach. The policy guidance for delivery of mathematical teaching makes it clear that for under 5's, the subject is designed to be embedded across the provision rather than seen as a separate subject (DfES, 2007; Sure Start, 2003). However the guidance may contradict what experience seems to indicate is happening, often as a result of the

increasing pressure on teachers to raise standards, particularly in what are seen as the core subjects of maths and literacy (Pound 2006: 1; McInnes, 2002: 124).

Guidelines for practitioners suggest that appropriate mathematical development in young children is context dependent and that it must make sense to them. Good practice therefore suggests that it should be embedded into daily activities and should support the learning that has already occurred and continues to occur within the home environment (Aubrey et al., 2003: 102). This implies that practitioners need an awareness of the cultural and social environments outside the setting in which children's early mathematical experiences and dispositions are being formed, as well as the knowledge and skills they are bringing with them into the setting.

Aims and research design

This study therefore aimed to analyse early years practitioners' perceptions of their mathematical confidence and their views of how they provide for children's mathematical development. It considers the relationship of practitioners' disposition and personal subject knowledge with the pedagogy of learning for young children. In this context, it is of concern that even though the Early Years Foundation Stage allows for learning through play, the emphasis on preparing children for the next stage of their education journey can lead to very early implementation of whole-class adult-directed learning through the Renewed Primary Framework (DfES 2006; Gifford 2004: 100), which may not be the most effective way for children to develop positive dispositions in these areas. Therefore, practitioners confident in themselves and their understanding of pedagogy will be in a better position to offer positive and appropriate learning experiences for children that will enable them to make a good start in their education.

The design and structure of this research study is interpretative in its focus (Clough and Nutbrown, 2002: 16; Hughes, 2001: 35), looking at how the specific attitudes and behaviours of research participants inform an understanding of the links made between their own dispositions and practice in a specific area, that of mathematics. It sought to draw meaning from their everyday 'taken for granted' practice and is valid within the limits of its locality and specificity (Hughes, 2001: 36). The fact that the approach is interpretative does not negate its value as a contribution to knowledge in this field, since research into maths teaching has generally looked at children and their capabilities, or at qualified teachers and their views and experiences (Caddel, 2003: 1). In addition, in seeking to

establish early years practitioners as research participants, it also touches on a field of current interest and debate as the role of the Early Years Professional is developed (CWDC, 2006).

Research methods

The aim of this study was to listen to the voice of early years practitioners who are currently studying a Foundation Degree and who are therefore embryonic Early Years Professionals, through two focus groups. In order to construct a sample for the focus group (Cohen et al., 2000: 288) and to provide some background data, a questionnaire was designed and sent to all students on the Foundation Degree. These were part time students who are working with children aged 0-8 in a range of settings including day care, pre-school, foundation stage in reception classes, and key stage 1. Some of the students were managers and supervisors of their settings, while others specialised in working as special needs assistants with small groups or single children. The students were studying at a number of centres, including FE colleges and a University. Of the 91 questionnaires sent out, 53 were returned, providing a broad range of participants in the research. The response rate of 58% is also sufficient to allow for some trends to be evaluated (Cohen et al., 2000: 263).

The purpose of this initial anonymous questionnaire was to gather background data about mathematical experience and feelings, so questions were asked about the length of time respondents had worked in the sector, their mathematical qualifications and any specific or additional training that had been undertaken relating to the work place or young children. Consideration of how to establish students' feelings, while also acknowledging the ethical considerations in this sensitive area, led to the construction of an instrument allowing self-evaluation on a continuum of responses (see Figure 1).

I am not at all confident in maths and feel my subject knowledge is weak	I am reasonably lacking in confidence in my maths ability and my subject knowledge is limited	I am slightly lacking confidence in my maths ability and my subject knowledge is adequate	I am reasonably confident in my maths ability and my subject knowledge is fine	I am fairly confident in my maths ability and feel my subject knowledge is good	I am very confident in my maths ability and feel my subject knowledge is strong
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Figure 1 - Continuum of student experience

The results from this were then used to select two focus groups. The first group to meet were those who had expressed a negative response to mathematics in terms of their confidence and subject knowledge and included a pre-school practitioner, a special needs pre-school practitioner, a teaching assistant in reception and a teaching assistant in year 1, who were 2nd and 3rd year students on the course. The second group were those who had expressed a positive approach to mathematics, but on the day of the focus group only two turned up. These were a pre-school practitioner and a reception class teaching assistant, who were a 3rd year student and a 1st year student respectively. Unfortunately work commitments had meant a third member of the group had been unable to attend and the fourth had decided to withdraw without notification.

The focus groups were set up with a semi-structured schedule that participants had been sent in advance. This had four main questions for discussion:

1. How important is your own mathematical experience to how you view what you are planning/delivering for children?
2. In your view, what should children to be learning?
3. How do you think children should learn these aspects of mathematics?
4. How should this learning be organised?

This approach allowed participants to explore their views and their strengths, as well as considering their own position within the subject. The structure for the focus groups was based on the work done by Aubrey (1997: 126) when she examined the perspectives of teachers of mathematics in the early years. The other influence in thinking about the structure of the focus group was the SPEEL research (Moyle et al., 2002: 130), which emphasises the need for practitioners to be aware of their own thinking and learning processes.

It was anticipated that as these students regularly took part in class-based discussions as part of their learning, the fact that the researcher was also a tutor would not influence the freedom of their responses but encourage the discussion and debate they were familiar with. It must be acknowledged, however, that because of this dual role, there was a potential imbalance of power (Cohen et al., 2002: 123) that may have influenced the responses given.

Discussion of the data

Since the literature had seemed to suggest there was a lot of negativity towards mathematics as a subject, the first surprise from the data was the number of responses that indicated a positive disposition towards mathematics, with 64% expressing confidence in their own ability and possession of appropriate subject knowledge. However, 28 of the respondents who viewed their current mathematical ability as positive also wrote negative comments about their own experience of maths teaching at school. Therefore nearly half of those who responded had been negatively disposed towards mathematics at an earlier point in their lives.

The breakdown of responses to the continuum question, seen in Figure 2, indicates that a majority of students felt reasonably or fairly confident about their mathematics ability and knowledge of subject content, with only 16 students (30%) currently expressing a negative position. It must be recognised, however, that students who felt negative may have decided not to complete the questionnaire because they felt threatened by the subject (Buxton, 1981: 11). The three undecided responses represent students who

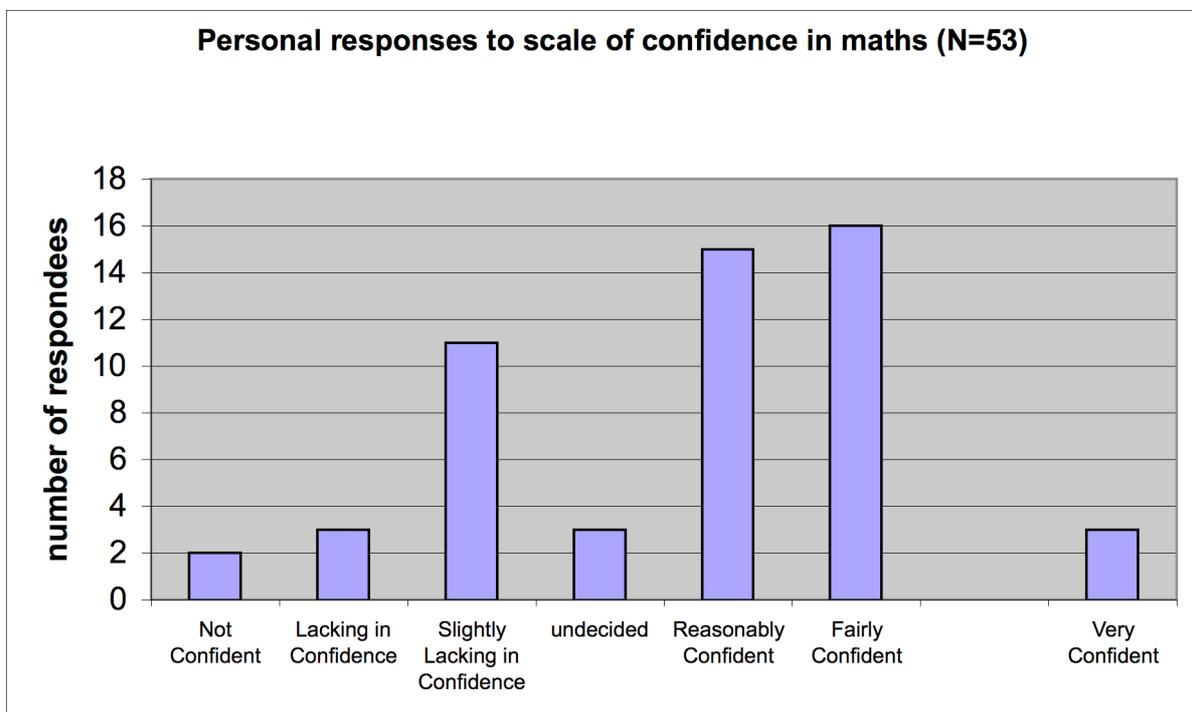


Figure 2 - Participant Responses to Scale of Confidence in Mathematics (N=53)

split the question into two, differentiating between the issue of confidence and that of subject knowledge. These responses suggest that perhaps these two aspects should have

been addressed separately and that further research might usefully be carried out to explore the relationship between subject knowledge and confidence.

Levels of certificated knowledge

In comparing levels of subject knowledge between the two groups through the identification of certificated mathematical ability, 62.5% of those who indicated they might be lacking in confidence had a GCSE grade A-C or equivalent (with 18.8% either retaking or having retaken at that level since leaving school), while 61.8% of those who expressed confidence in their mathematical ability had obtained a GCSE grade A-C or equivalent (with 14.7% having retaken or about to retake since leaving school). There is therefore little difference in students' levels of certificated knowledge, which suggests that confidence is not primarily derived from the level of secondary education qualification. However, there was some evidence from the questionnaires that acquiring a skill at a later date was one way of acquiring confidence. One student who had described her reaction to her response to learning maths at school, using words similar to some of those in the negative focus group, as being *"basically scared ... not confident"*, now talked about how *"having gained a B pass GCSE 2 years ago ... has immensely boosted my confidence ... I can honestly say I love maths."*

Others who now expressed themselves as fairly confident also wrote about *"hating maths"*, and about how their *"experience at school not positive"* and *"feeling couldn't do maths"*. Although they all talked about study as an adult making a difference to their personal perceptions, however, it is not possible to tell whether this was because of the boost given to their self-esteem by achieving the GCSE, or whether it was the subject knowledge acquired that made them more confident, or a combination of both. It may also reflect a perception that achieving the GCSE as an adult had a purpose and value that was not obvious when at school.

Length of time in early years

Another factor that may have influenced the students' own perceptions of confidence and appropriate subject knowledge was the length of time they had worked in the sector. Figure 3 indicates that only 8 participants (15%) had worked in the sector for less than 5 years. The extent of their experience of working with children may therefore have encouraged practitioners to feel confident about their knowledge of the subject and the

methods needed to work with children aged 0-8, which would support Aubrey's (1997: 160) suggestion that teachers gain pedagogical knowledge through practice.

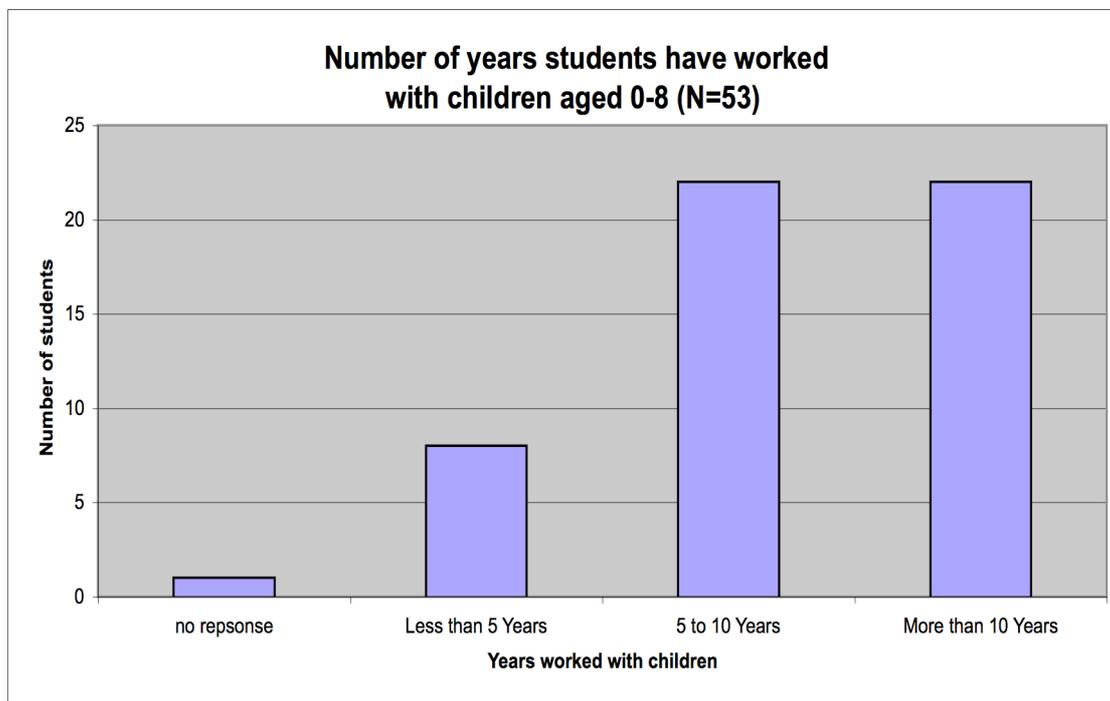


Figure 3 - Number of years worked with children aged 0-8 (N=53)

Focus groups responses

What was particularly revealing were the comments that students in the focus group made about their feelings towards the subject, using language to express their feelings that was very powerful and indicated deep-seated reactions to the subject as the literature suggests (Pound, 2006: 5). Students used words like “hard”, “scary” and “panic”, with one participant in particular talking about a “fog” or “curtain” that came over her when she was asked to do mathematical activities. Overwhelmingly, these students pointed to their own experiences of learning maths as being a major contributor to their negative feelings, often drawing not on their very early maths experience but later learning experiences at upper primary or secondary school, feelings that were often linked to events such as moving school and having a new teacher, or one who taught in a different way. These examples suggest there might be additional factors, besides the subject itself, that contributed to the student's emotional response to the subject, a phenomenon that Evans (2000: 225) describes as the ‘situation context’ in his study of adults mathematical thinking and emotion.

It was also recognised that a good teacher has the ability to pass on positive dispositions through the manner in which they present and explain the subject: “if you have

someone who is a really good maths teacher they can make it so you can see what's happening". This comment about a good maths teacher appears to be more about the teacher's ability to unpick and explain a subject rather than their necessarily having a positive disposition towards it, a skill related to the teacher's understanding of the subject and level of knowledge. This observation was supported by other comments that indicated participants' understanding of a pedagogical approach when working with children who might be struggling in this area; comments such as *"building on what they know"*, *"putting it into small achievable steps"*, showed awareness of the need for children to be able to achieve success in order for confidence to develop.

It appeared that all members of the focus groups felt children these days were taught in different ways from how they had been taught and that this might result in more positive dispositions. This view was expressed by one student who observed that *"now... they teach it very differently"* and by another who commented that *"it seems children pick it up better now because there are better ways of teaching"*, the main difference in their view being that today, mathematics teaching makes much more use of practical work, with less emphasis on pen and paper exercises. At the same time, however, they all gave examples of children (either their own or those they teach) who were already struggling with learning maths and did not appear to recognise that, even if teaching methods are now different, there are other factors that may contribute to negative feelings or a child's struggle with subject knowledge acquisition.

Those students who expressed a lack of confidence also seemed to be struggling to find an explanation for this that was external to them, such as the way in which they had been taught. In contrast, however, those students who were positive towards the subject concluded that there may be a strong genetic factor that helps in mathematical ability - *"some children will flow with that and be natural mathematicians"* - and that part of the educator's role was to recognise *"there is something everybody is not good at"* and that children should be praised for what they can do. The discussion also recognised the importance of individual differences, however, and there was some indication that these students had a view of child development that suggested a readiness or staged aspect to learning (Clemson and Clemson, 1994: 6). Their comments also seemed to suggest that if an individual has confidence in their ability to teach a subject, whatever it may be, they might be able to view it more creatively and expansively, identifying opportunities for

learning all around them and thereby making it more easy for children to learn by embedding it not only across the curriculum and but in children's play.

In trying to examine whether there was any correlation between the way a practitioner views a subject and their ability to make effective provision for children's learning, the focus groups were encouraged to discuss and provide examples of how they supported children's learning and what they thought was necessary to enable children to learn. In doing so, students focused not only on their own practice but also that of the teachers some of them worked with. Both focus groups were explicit in their statements about the need for children to learn through play, although they were not necessarily able to explain this since they found it difficult to articulate concepts and skills, or ways of learning, that were not adult-directed. Some even classed the activities as play, although it would not fit the definition given by Bruce (1999: 39) who makes a distinction between adult-led tasks and spontaneous play that may be adult supported.

The process of supporting and providing for children's learning seemed to be more about providing opportunities that allow children an active approach to the task - "*if you give them something practical it actually means something doesn't it?*" - rather than seeing children's self-determined play as a vehicle through which a more experienced 'other' can support and develop mathematical skills (Nutbrown, 1999: 65; Bottle and Alfrey, 1999: 61). This reflected the findings of the SPEEL research (Moyle et al., 2002), which indicted that:

play was at the root of practitioners' thinking and principles but ... adult involvement and engagement in children's play is not well understood or utilised as a vehicle for learning (2002: 131).

Thus there was little evidence of awareness of the potential for mathematical learning that might be occur in the context of child-initiated play, or the role that adults might play in supporting and extending this. This is a critical finding since so much of the good practice guidance for very young children talks about the balance between adult-directed and child-initiated activities and also about the vital role of the practitioner in establishing 'effective interaction' and 'sustained shared thinking' with children (Sylva et al., 2003; Aubrey et al., 2003: 93).

Those working in pre-school settings recognised that there was plenty of opportunity for the learning of maths in all aspects of the daily routine, including greeting time, snack time, singing and planned small-group activities. However, the learning of numbers and counting was, almost without exception, given as the main example of this and it usually had a strong emphasis or value placed on children understanding the ordinal and cardinal value of numbers, which would support the direction in which the curriculum documents have developed (QCA, 2000, Gifford, 2004: 100) and would support the view that curriculum mathematics emphasises the functional or everyday aspects of the subject (Pound, 2006: 2).

Shape and measure were mentioned particularly in a discussion about terminology but no one talked about the importance of pattern (Pound, 2006) or symbolic representation (Worthington and Carruthers, 2003), both of which are identified in the literature as important aspects of developing mathematical ideas and understanding. Although it cannot be assumed that this is something that is missing from practitioners' ideas about concepts, it does perhaps offer an insight into what is uppermost in practitioners' minds when considering how to provide experiences for learning mathematics. Since there was no apparent difference between the focus groups in this respect, and the students who considered themselves confident did not demonstrate a greater breadth of approach to mathematical concepts, it may be important therefore to consider aspects of maths such as this, which are currently missing from their thinking, as areas requiring further practitioner development.

Responses in the focus groups from practitioners who work in schools also indicate a great reliance being placed on the teacher as the source of knowledge and understanding. This was true whether the participant felt confident in their subject knowledge or not. The comments seem to emphasise the role of the teacher as the transmitter of knowledge and the early years practitioner in this case as a facilitator of children's learning. It therefore supported the view of these early years practitioners working in school feeling they had a sufficient depth of subject knowledge to be effective in their role.

Summary

The data produced by this study have enabled consideration to be given to whether practitioners' dispositions towards mathematics might have an impact upon the provision of effective learning and teaching opportunities for young children. This examination of

practitioners' perceptions of their personal disposition to the subject suggests that they do not feel it affects their ability to support children's mathematical development; rather, they feel that understanding of pedagogy for young children is sufficient to develop effective practice. Although this would seem to contradict the literature, which emphasises how much children pick up in terms of values and attitudes from those around them (HMSO, 1989: 62; Pound, 2006: 5), it would suggest these early years practitioners feel they have the ability to be sensitive in their understanding of children and to embed appropriate activities into the daily routine, thereby creating a foundation for positive early maths experiences. In contrast to the literature, it would appear that for the respondents in this study, an awareness of their own lack of confidence meant they approached those children who struggled with more empathy and a desire to enable a positive experience to occur.

Discussion indicated that practitioners have a clear pedagogical understanding of how children should learn and that play is an essential part of that learning process; however, they were less confident at demonstrating how they supported children's mathematical development outside of adult-led activities, or how child-initiated play contributes to this area. While recognising that opportunities for learning mathematics could be all around, they focussed mainly on the children's early acquisition of numeracy and did not make use of examples of other underpinning mathematical knowledge.

The students were not confined to the pre-school setting but worked across a range of settings delivering both Foundation Stage Curriculum and Key Stage 1. They therefore had differing expectations in terms of their roles and responsibilities, and perhaps even different views of themselves in relation to planning for and teaching young children. Although this led to some interesting discussion about differences in practice, it does make it more difficult to generalise from these findings and further research might usefully focus specifically on the level of pre-school practitioners, where not only there is clearly a greater responsibility for curriculum implementation, and therefore an even greater requirement for good subject knowledge, but also there is usually no qualified teacher present on a daily basis.

These data also suggest that there are some variables in students' acquisition of mathematical dispositions that should be considered when developing continuing professional development (CPD) opportunities for potential Early Years Professionals,

since this small study suggests that the possession of a GCSE qualification in maths does not guarantee a confident mathematical practitioner. Although there was some evidence to suggest that early negative dispositions could be reversed by a subsequent positive experience, such as achieving a GCSE, or a practitioner's success in mastering the mathematics they needed for daily life, there are still significant numbers of practitioners with negative dispositions. Clearly the length of time many had worked in the sector was a significant contribution to feelings of confidence in how to approach children's learning, but these data suggest that strategies for the development of reflective practitioners should consider other factors that might help to overcome negative dispositions. Helping practitioners in this way might also provide opportunities for them to look at ways in which they can use this knowledge to support those children who may not find maths easy and who may therefore struggle to learn once they start school.

This findings of this study also suggest that there are aspects of subject knowledge that could helpfully be included in any syllabus developed for supporting CPD in early years practitioners, such as recognising the importance of issues of shape, measurement and pattern in the learning of mathematics, which were less obvious in discussion. There is also a need to ensure that pedagogy for mathematics considers and enables the practitioner to develop effective 'sustained shared thinking' (Gifford, 2004: 109) and discussion with individual children, not only during planned activities but in everyday opportunities for mathematical development that occur in a range of settings. In particular, fostering practitioners' ability to support children's mathematical development through child-initiated play is an important area for development. In addition, since the training that participants in this study had received apparently focused on providing activities for children's learning without considering in any depth the processes through which children develop mathematical understanding, this is also an important area for development.

In terms of further research there are obviously many issues emerging from this study that could be looked at in more depth and it would clearly be useful to explore practice as well as perceptions. In particular, the use of observation would add to the richness of the data gathered and would enable data to be triangulated, which was not possible given the methods used for this research. It would also be interesting to explore further the use of mathematical language between adults and children, since this appears to be a key element of effective learning and is also an area where there are divided views about what terms be used and how. A study of language and sustained shared thinking would also

help to understand the quality of interactions that are occurring between practitioners and children and reveal the extent to which, as this study suggested, the main focus of mathematical language and learning is on numeracy and, therefore, whether further work needs to be done on subject-knowledge development in other key mathematical areas. It would also help to understand how adults support children's mathematical development across the curriculum and not just in planned mathematical-based activities.

This findings of this study suggest that even though some early years practitioners may have a negative disposition towards mathematics, this can be overcome in later life through experiences of success. The establishment of effective pedagogy for early years learning seems to be a prime factor in encouraging confidence in practitioners, even in areas of subject knowledge they are not confident about at higher levels. However, it is imperative that those who are the trainers and educators of developing early years professionals should go beyond simply giving them subject knowledge by finding ways of helping them to become successful learners in all aspects of professional practice.

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