

The responses of students and teachers to maths disabilities in the
classroom

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Abstract

Maths disabilities tend to be overlooked current educational policy, although their prevalence and impact are similar to those of dyslexia. This study examines the situation of Year 4 children with maths disabilities in the National Numeracy Strategy daily mathematics lesson through focus groups with children of three ability levels and interviews with teachers and learning support assistants. The results indicate that such children struggle and become anxious, engaging in more or less disruptive avoidance strategies. Teachers are aware of the problems but are hampered by a lack of information and support, in addition to national learning objectives which may be inappropriate for maths disabled children.

Introduction

It has become a truism in research on specific learning difficulties in mathematics (dyscalculia) that this learning disability is neglected in comparison with reading disabilities or dyslexia. While efforts are being made to redress this state of affairs in research (see Landerl, Bevan and Butterworth, in prep for a recent review), it is very definitely still the case that dyscalculia is rarely recognised by teachers, educational psychologists, or policy-makers. However, population estimates of dyscalculia suggest that it has a prevalence very similar to that of dyslexia (around 4%, see Lewis et al., 1994) and, without remediation, is likely to have an equally grim impact on the employment and general prospects of those with the disability. (Bynner & Parsons, 1997).

Recent guidance from the Department for Education and Skills defines dyscalculia as “a condition that affects the ability to acquire arithmetical skills. Dyscalculic learners may have difficulty understanding simple number concepts, lack an intuitive grasp of numbers, and have problems learning number facts and procedures. Even if they produce a correct answer or use a correct method, they may do so mechanically and without confidence.”

Under current policy in the UK, children in mainstream schools are taught mathematics within the National Numeracy Strategy, a set curriculum involving up to one hour’s teaching a day. Lessons are encouraged to be fast-paced with fixed objectives, although differentiation is possible within given objectives. For example, a child struggling with concepts relating to fractions in Year 5 may be given fractions work based upon the objectives for Year 4 or below. At this stage, the Strategy has not fully addressed the needs of children of this age group who are still struggling with basic numerical concepts such as counting or number bonds, without which an understanding of fractions is unlikely to develop.

To our knowledge, no study has examined in detail the situation of children with maths disabilities in the classroom, particularly under current policy. However, the issue is an important one, with implications for the prognosis of dyscalculia, for educational policy, and particularly for designing appropriate interventions.

The current study examined this situation from the point of view of children of three different ability levels in maths, class teachers, special needs teachers and learning support assistants (LSAs). Focus groups were conducted with the children, since it was felt that they would be more likely to talk freely in groups than if interviewed one-to-one by an adult. Individual interviews were conducted with the teachers and LSAs. Questions were broadly centred around issues of learning, teaching, the National Numeracy Strategy, and anxiety in the classroom.

Study 1: Children’s focus groups

This study examined children’s motivation, ability to stay on track, and general feelings during and opinions about the daily mathematics lesson. The opinions of children with difficulties in maths were compared to those of average and high ability children in order to examine the impact of maths difficulties on children in the classroom. In addition, the attitudes of children of average or high ability towards their low-ability counterparts were examined.

Participants

The focus group participants were 75 children aged 8-9 from 5 state schools in the London area, covering a range of socio-economic status. Children from 3 different ability levels in maths (low ability, middle ability and high ability) were grouped separately within each school. Thus there were 15 focus groups in total, 3 from each of the 5 schools.

The head teacher or special needs co-ordinator for each school was asked to select 5 very high ability children, 5 average children and 5 of the lowest ability children in maths from Year 4. It was specified that children should be able to speak English fluently. Where possible, children who had been previously identified as having relatively specific maths difficulties (Butterworth et al., in preparation) were included in the low ability groups. While it was not possible to ensure that the low ability groups included only children with specific maths difficulties, it was felt that children with maths disability would face relatively similar problems in numeracy lessons regardless of overall IQ. 5 is a small number of participants for a focus group (Morgan, 1996) but it was felt that with larger numbers it would be difficult to ensure that the children stayed focused on the topics. In addition smaller numbers ensured that ability levels did not overlap.

Materials

A focus group protocol was developed focusing on 4 main areas: motivating factors in numeracy lessons; what factors prompted children to lose track during a lesson and how they reacted to having lost track; attitudes to children with maths difficulties and attitudes towards maths. Probes were used to examine issues in more detail (see Appendix 1 for the protocol). The questions were first asked in an open-ended manner (eg 'what's the best thing about numeracy lessons? It can be anything at all to do with numeracy'): this allowed the children to set their own agenda to some extent. Only when children stopped talking or began to digress to non-mathematical topics were probes introduced.

2 minidisk recorders attached to microphones were used to record the sessions. Each child was told that they would be given a pencil inscribed 'University of London' after the session finished, as an incentive to participate.

Procedure

The moderator contacted the head teacher or special needs co-ordinator at each school, who selected children and obtained consent from parents.

All focus groups were conducted in a classroom, with chairs placed in a circle around a table. Each was conducted by the same moderator, in order to ensure consistency between groups. An assistant moderator took supplementary notes and operated the recording equipment. The moderator explained the purpose of the focus group to the children, stressing that there were no right or wrong answers to the questions, and that everybody's opinion was important (see Appendix 2). The children were also told that teachers and parents would not be told what they had said, and would not be given access to the recording. The moderator opened the focus group by asking children to discuss characters in a recent popular children's film: this helped children to relax and get used to expressing their opinions in the

focus group situation.¹ This practice discussion took about 5 minutes, before the main discussion was introduced. The moderator asked the questions generally in the order they appeared on the protocol, but encouraged digressions as long as they related to mathematics issues. There was a tendency for children to all talk at once: when this happened they were encouraged to 'go round the group' allowing each to express their opinion in turn, and discussing each child's opinion. Focus groups lasted approximately 45 – 60 minutes.

Data analysis

The minidisk recordings of the focus groups were transcribed verbatim. The transcripts were analysed using QSR N5. The coding scheme was originally based on the protocol, and subcategories of themes were coded as they emerged. Additional codes were used for themes which were not specifically covered by the protocol but which frequently arose, such as copying. The frequency with which topics were mentioned was noted.

Attitudes and opinions were compared between schools and between ability levels. Differences between schools which were constant across ability levels were not considered to be of interest (for example in one school children of all abilities were concerned about having to copy sums into their books from worksheets rather than simply filling the sheets in). Differences between ability levels were highlighted only when they were reasonably constant across schools.

Results

Understanding

Although children's understanding of maths was not assessed in the focus groups, low ability groups frequently betrayed confusion over the concepts that they were learning:

School 3 (low ability)

Child 4: We did friction before half term...not friction...

School 2 (low ability)

Child 5: Times is not hard but I think multiplication - I think -

Child 1: Yeah, that's hard.

School 4 (low ability)

Child 5: Oh, there's this really hard thing, about when you're doing times -

Miss S _____ says you can't take away this number, but I keep on taking away, I don't understand one single bit of it.

Child 3: You've got to times it, not take it away!

Child 2: Yeah, I agree with you.

¹ We would like to thank Norah Frederickson for this suggestion and for suggesting the use of pencils as an incentive.

Motivation

There was an interesting interaction between groups regarding what children considered interesting in numeracy lessons. High and middle ability groups gave a variety of answers: common ones included finding patterns with numbers, learning new procedures, playing games and taking part in competitions. Once or twice children in high or middle ability groups remarked that hard things could get boring if they were not understood, but children generally agreed that boring things were almost always things that were too easy:

School 3 (middle ability)

Child 2: I like a challenge, sometimes...some of the things that are really easy, I just think that's just so...it's not very fun and all and I think it's just so boring.

School 1 (middle ability)

Child 1: My worst is - really boring is addition. And it's that they - they give you really easy questions and it's just boring me a lot, and I'm like 'I know the answer to this, I know the answer to that -' I'd rather have more challenging. Rather than 8 plus 8, 16.

Conversely, low ability children specifically equated 'interesting' with 'easy':

School 1 (low ability)

Moderator: Is it boring doing easy things, things that are too easy, or is that OK?

Child 3: Ah, that's fun!

Child 1: Yeah, because I do it so quick.

Others: Yeah.

School 5 (low ability)

Child 3: It wouldn't make sense if it was easy and boring.

Only in one low ability group (School 3) did children mention learning new procedures as interesting:

Child 3: The most interesting thing I did is when I done things like step by step things which helps me learn...understand so that was quite interesting...

This suggests that although low ability children may be capable of being challenged and interested in a maths lesson, in most cases the best they can hope for is that they will be given work that they are able to do.

Losing track

The question 'do you ever lose track in a numeracy lesson?' tended to get a laugh and a chorus of 'yes!' Children of all ability levels admitted to losing track during lessons.

An overwhelming reason for losing track was being distracted by other children talking or 'being silly.' Another reason for children losing track was talking or 'being silly' themselves, although children were less likely to admit to this. There were no differences between groups regarding these factors. However, there were interesting group differences in the other reasons given for losing track.

High ability children reported daydreaming as their main reason for losing track. Daydreaming was associated with boredom or with looking forward to exciting events outside school. They also said that they were often distracted by other children asking them for help or copying their work.

School 5 (high ability)

Child 3: When I'm sitting down, I sometimes think the person's getting really stuck, and I think the person's actually copying me. So I say to them that they shouldn't copy me, and then I move my work and cover it up. So - and then they ask help from me, and then I like have to help them, and then I like -

Moderator: Is that like one of these things that -

Child 4: Yes!

Child 2: So frustrating, that is so frustrating.

Child 1: Yes, it's really annoying.

Middle ability children also mentioned daydreaming, but overwhelmingly reported that they lost track because the teacher went too fast:

School 1 (middle ability)

Child 1: They're like 'blahblahblah' and they fire you loads of questions, and you're like 'oh, could you repeat that please, could you repeat that please' and like you're way behind.

In low ability groups the most frequent reason for losing track was not understanding what was going on.

School 4 (Low ability)

Child 2: I sometimes don't understand whatever she (the teacher) says.

School 2 (low ability)

Child 2: I don't forget it, I don't even know what she's saying.

However, in contrast to the middle ability group, attributing lack of understanding to the teacher going too fast was rare. Another reason that was both common among and unique to low ability children was forgetting what was going on:

School 2 (low ability)

Child 3: When you listen to the teacher, then you turn your head and you don't know nothing ... If I remember something, and then the teacher says 'stop for a second, just listen to me' then as soon as she talks, yeah, and we come back, we do work, and I say 'what do I have to do?' I always forget.

This is likely to be due to difficulty in remembering concepts or procedures which have not been understood.

Ginsburg (1997) suggests that children who struggle with maths may seem to have lower attention spans than others because the more cumbersome procedures

that they use to carry out calculations are more sensitive to distraction. In this study, low ability children certainly seemed to be more affected by distractions than higher ability groups, reporting having to go right back to the beginning after every distraction:

School 3 (low ability):

Child 4: Somebody say 'can you pass me – can you pass the rubber?' 'Can you pass the pencil?' 'Can you pass the pencil sharpener?' and what are you supposed to do? I'm trying to work out and you lose track. You have to do it over and over again and by the time you're finished you've just done the first question and the teacher says 'why have you only done one question?'

Sensitivity to distraction may also be due to the tendency of low ability children to forget what they are being taught:

School 2 (low ability)

Child 2: My mind goes, and comes back.

Moderator: Yeah. Why might that happen? What leads up to that?

Child 2: Because they distract you, and it just goes out of your head.

As suggested above, the forgetting tendency may well be due to failure to understand.

Getting back on track

Again there were important group differences in ways of dealing with losing track in a lesson. High ability children tended to say that they would work out what was going on (for instance by looking back over previous work) and catch up.

School 4 (high ability)

Child 1: Like when we normally all daydream because it's boring, and then like when the – the easy – the slowest people who are like on number 3, then if they were on number 3, we like just go right ahead of them.

High ability children were also more likely to say that they would ignore the fact that they had lost track and would carry on daydreaming or messing around. Middle ability children almost unanimously said that they would ask a friend, partner or teacher to explain what they were supposed to be doing. Applying to others for help was much rarer among low ability children. The most common strategy that these children engaged in was copying other children's work or 'cheating' in other ways:

School 2 (low ability)

Child 3: You look at the person's thing. What he does.

Child 2: That's copying.

School 3 (low ability)

Child 1: I just cheat and look at the chart

Child 5: Sometimes I like – try to like figure out, but then I just look at the chart because I can't do it.

School 1 (low ability)

Child 5: Oh, I hate tests, when we begin maths, the ones we have them at the back of our red books, and when she says one, she says them really fast and then she goes to the next one, and I don't even bother putting the questions down. So I hide my arms, write what she says, and then write the rest – do the answers when she says them out.

Copying as a strategy of low ability children was borne out by others:

School 5 (high ability)

Child 5: Yes, some people, they pretend they're looking for a rubber, but they're actually going round looking -

Child 1: At other people's work.

Low ability children were also far more likely than other ability levels to pretend to be working or to engage in avoidance strategies:

School 3 (low ability) when asked what they do when they've lost track:

Child 2: Going to the toilet all the time

Laughter

Child 3: I would spend my time sharpening my pencil.

Moderator: Sharpening your pencil?

Child 3: Until it gets so tiny I'll have to go and get my other one.

In addition low ability children reported giving up and just sitting there or writing answers at random, although this was relatively rare.

These findings suggest that high ability children are in a sense in control of whether or not they follow the lesson (feeling that they are able to catch up if necessary, or to make the decision that they will not try to do so). Middle ability children are less independent, but their attribution of the reason for losing track (that the teacher goes too fast) suggests that they feel that they could understand the concepts if given the chance. Their main strategy for getting back on track (asking for further explanation) supports this. These children, even if left behind, are making an effort to keep up and to understand the lesson. Low ability children, in contrast, display a range of strategies which indicate that they have more or less completely given up the effort to understand (copying others' work, engaging in avoidance strategies, pretending to be working). These children seem to be doing everything they can to avoid notice in the lesson, but they are not concerned with trying to understand what they are being taught. It is likely that they do not use the middle ability strategy of asking for help because they have little chance of understanding even on a second or third explanation. This suggestion was put forward by children of other ability levels:

School 4 (high ability)

Child 4: Some people go to help from the teacher, because they help them, and then sometimes they don't really understand what the teacher's ... pretend they understand and then they go back to their seat and they still don't know what to do.

Child 3: Yeah.

Child 4: And then, then afterwards, they go copying other people.

Children also suggested that low ability children avoided asking for help because of the stigma attached to failing in lessons:

School 5 (high ability)

Child 3: Some people – some people, the teacher asks 'anybody who doesn't understand?' And they don't put their hand up, because they think that – they're – they're too shy.

Child 2: They're too frightened, that someone will tease them.

In summary, it seems that children with serious difficulties in maths are almost inevitably left behind. Once this has happened all that they can do to preserve their self-respect is to try to keep others from noticing this.

Stress

It was clear that numeracy lessons could be stressful for children of all ranges of ability. Even a few high ability children reported feeling inadequate compared to higher achieving peers in maths, and there was a feeling that this competition was more intense in numeracy than in other subjects.

School 1 (high ability).

Child 3: Well what I don't like about maths is that sometimes it's really difficult, because in literacy you - none of you really know much more than the others, because it's just difficult to - I mean you could be a spelling whiz, but that still wouldn't mean that you were better than someone else at literacy.

Middle ability children also reported feelings of stress or anxiety. However, such feelings were much more common and more pronounced in low ability children.

School 1 (low ability)

Child 5: I feel like screaming and saying 'why are you doing this, why are you doing this?' and I feel like punching the teachers!

School 3 (low ability)

Child 5: It makes me feel left out, sometimes.

Child 2: Yeah.

Child 5: When I like - when I don't know something, I wish that I was like a clever person and I blame it on myself –

Child 4: I would cry and I wish I was at home with my mum and it would be - I won't have to do any maths -

School 5 (low ability)

Moderator: How does it make people feel in a maths lesson when they lose track?

Child 1: Horrible.

Moderator: Horrible? ... Why's that?

Child 1: I don't know.

Child 3 (whispers): He does know.

Moderator: Just a guess.

Child 1: You feel stupid.

This situation was borne out by high and middle ability children, who frequently reported that low ability children would cry or get angry in numeracy lessons:

School 2 (high ability)

Child 1: She's like – she's like all upset and miserable, and she don't like being teased.

Child 4: Yeah, and then she goes hide in the corner – nobody knows where she is and she's crying there.

School 5 (high ability)

Child 5: They sometimes - sometimes you can see them cry.

Child 3: Some people get cross, and like -

Child 1: Sometimes when people get like really hyper like Gary. He goes 'oh no!' and he shouts across the room.

Disruption to class

The quotes from the previous section demonstrate that emotional outbursts on the part of frustrated low ability children can cause disruption to the class, and therefore to the learning of other children. There was also a sense among middle and, in particular, high ability children that low ability children held up the lesson, particularly during the introduction:

School 3 (high ability)

Child 4: I hate – well I don't like doing it when my – when my teacher tells me that – everybody what they have to do, and we have to wait for [the lower group] to do their part first, yeah, we have to wait a long time because they don't understand it that well, and then they keep asking questions, and then we have less time to do our work, and sometimes we don't finish all of it.

School 5 (high ability)

Child 5: I think it starts to get boring at the start, because the teacher explains, then you understand it, and some people don't understand it –

Several voices: Yeah!

Child 1: And they have to go through it all over again!

Child 2: All over again!

High ability children also disliked being partnered with low ability children.

School 1 (high ability)

Child 3: And sometimes what happens is Miss J gives us partners –

Child 5: Which is the worst.

Child 3: And you get really exasperated, because, you know, they might not know the answer, and you think ‘oh, come on! You know the answer!’

Child 5: You usually get someone who’s not so clever.

Another area of irritation for high ability children which emerged with great regularity was copying, which was cited as a reason for losing track, and could also lead to general class disruption:

School 5 (high ability)

Child 3: When I was like counting to this really big number – I had to like add up these numbers to make this number, this person starts copying me, so I get really annoyed, and I say ‘stop copying me’ and then I’ve completely forgotten what I was doing. And then I have to start all over again.

School 4 (high ability)

Child 4: And then people see that they’re copying and they get really mad, and they start shouting at them, and it’s wasted so much time.

Stigma

Possibly partly as a consequence of the disruption described previously, there was a lack of sympathy among high ability children for children who struggled with maths. They were often referred to mockingly:

School 3 (high ability)

Child 4: They’re like “oh man, I need to get to the highest group,” and they’re like working working working. And then they just realize “I’m going too fast. I done nothing!”

Several voices: Laughter

In addition, all groups admitted that teasing of low ability children took place, taking forms such as publicly asking questions the victim was unable to answer, calling names (‘dumb,’ ‘loser’) and laughing at low test scores.

School 3 (low ability)

Child 3: He just comes up to us and says ‘ha ha - you don’t know anything - you are so dumb’ and then he asks me, like, questions like ‘thousand times thousand’ which he knows and I don’t know...which is very hard for us -

School 5 (high ability)

Child 5: I’ve seen people go up to these people that don’t really understand, or anything, or are like really stuck, and then when they’ve like finished, they go up to them and they

and they say 'oh my gosh, you're not finished, that bit's so easy' and I think that's really disturbing them as well.

Child 3: I think that it makes them a bit upset inside, because they're like - people are saying -

Child 5: Yeah, and then they waste their time crying.

The focus groups reported that only a small number of children (ranging from about 2-5) in each class bullied others about their failures in maths. Children who bullied were usually middle or high ability, although in one school they were other low ability children. Victims were usually low ability, but occasionally middle ability. Although children did not admit to bullying themselves, there was a high level of agreement between groups from the same schools regarding the kind of bullying that took place and which children engaged in it. There was only one disagreement, in which a child who had enumerated many reasons for not bullying was named as a bully by other groups.

All low ability groups contained children who said that they were frequently bullied. Not all low ability children were bullied (popular children were avoided as targets), but being of low ability in maths clearly made children vulnerable to bullying. This may help to explain why low ability children seemed to put all their energy into avoiding notice in class.

Attitude to maths

All the groups agreed that maths is necessary for getting a good job. Middle and high ability children tended to list jobs with reasons why maths was necessary to do them:

School 3 (high ability)

Child 1: The least thing I like is doing graphs with the 'x's and different ones, well those graphs do come in useful when you become a doctor or somebody like that. And that's from in maths as well, so –

Child 2: When you're like a big businessman, and you earn quite a lot of money, and then you've got to add up all the money.

...although some children suggested that maths was not necessary for people in non-mathematical careers, such as writing books or being a pop singer. Low ability children also said that maths was necessary for getting a good job, but tended to cite this as a fact rather than giving reasons why it should be the case:

School 3 (low ability)

Child 1: You might forget what the teacher has taught you –

Child 3: All you can be is a dustbin man.

School 5 (low ability):

Child 2: If you don't learn, yeah, you won't have a good job and you'll be a dustbin man.

High and middle ability children were also more likely to suggest that maths is necessary in everyday life. The main reasons given were shopping and paying bills

(although several children felt that maths was only a backup for situations in which credit cards have been lost or tills have broken down).

This suggests that in general children can see the application of the maths that they are learning, but that low ability children are less aware of these applications. This is in keeping with their lack of understanding of the procedures and concepts that they are being taught, but is unlikely to add to their motivation to learn.

Discussion

In summary, the results of this study suggest that children with maths difficulties are left behind in lessons under current policy, failing to understand what is going forward, and without strategies for dealing with the situation constructively. They fall back on avoidance strategies which are frequently disruptive to the class. Higher ability children are frustrated by this, and also by attempts by teachers to redress the situation, which may involve long careful explanations in the introduction to the lesson, or partnering low ability children with higher ability children. The exasperation felt by higher ability children who believe that they are being held back may contribute to the aura of stigma surrounding failure in the numeracy lesson. Children with maths difficulties may be teased or criticised by other children, as well as feeling that the teacher is unsympathetic. These experiences are likely to encourage avoidance behaviour, thus distracting the child from any genuine learning opportunities that may arise, and causing further class disruption. The children are trapped in a vicious circle, and whatever they may be learning, it is unlikely to be primarily numerical.

Study 2: Teachers' interviews

Teachers' views of the situation of children with mathematical disabilities in the classroom were examined. The issues focused on were identification and teaching of children with maths difficulties, particularly in the context of current policy. The issue of stress and anxiety in children with mathematical difficulties was also discussed.

Method

Participants

6 state schools from the London area (5 involved in the focus group study and 1 additional school) participated in the study. 25 teachers (15 class teachers, 5 special needs teachers and 5 learning support assistants) were interviewed. Number of years as a teacher ranged from 1 to 33, and the year groups currently taught by the teachers ranged from Year 3 (ages 7 to 8) to Year 7 (ages 11-12).

Materials

An interview protocol was developed focusing on 3 main areas (see Appendix 3 for the protocol). The first was teaching issues in general including resources and the National Numeracy Strategy. The second area focused on children with mathematical difficulties, including identification and teaching of these children. The

third area focused on the emotional effects of mathematical difficulties in the classroom. Teachers were also asked to raise any other issues which they felt were relevant.

A minidisk recorder attached to a microphone was used to record the interviews.

Procedure

The head teacher or special needs co-ordinator was contacted and requested to ask teachers currently teaching numeracy in the school whether they would be willing to be interviewed. A time was then arranged for the interviewer to visit the school to meet them.

Interviews were conducted individually at the schools, in a quiet room free from interruptions. Each was conducted by the same interviewer. The interviewer explained that the purpose of the interview was to get an idea of teacher's views and experience in teaching children with maths difficulties. Interviews lasted between 30 and 60 minutes, after which teachers were given an opportunity to ask any questions.

Data analysis

The minidisk recordings of the interviews were transcribed verbatim. The transcripts were analysed using QSR N5. The coding scheme was originally based on the protocol, and subcategories of themes were coded as they emerged. Additional codes were used for themes which were not specifically covered by the protocol but which frequently arose, such as the need for support in the classroom.

Results

Resources and policy

Although resources used in numeracy varied between schools, teachers and LSAs generally reported that they had access to a range of resources. Only one teacher considered a lack of general resources a problem or limiting factor. Several teachers felt that they would benefit from more resources specifically geared to very high or very low ability children.

KD: More ideas for the differentiation would be useful, and to push them the other end as well.

Teachers reported that during lessons they followed the structure of the National Numeracy Strategy closely. The Strategy itself was almost unanimously endorsed by teachers as an approach to teaching. Some remarked that they had been dubious at first but had been convinced by the improvement they had seen in the maths ability of classes moving up the school. The conceptual approach of the strategy was widely considered a great improvement over the previous widespread use of textbooks. However, teachers were almost unanimously of the opinion that the Strategy is not appropriate for children with maths disability. Teachers explained that the pace was too fast for these children, and that they were expected to teach relatively advanced concepts (such as fractions) to children who still lacked a basic sense of number.

CW: ... although you are trying to differentiate within that objective, for a child who hasn't got the basics, you almost feel like that instead of doing fractions and decimals, they just need to sit and be able to work out the value of numbers.

ML1: ...when they're in the introduction for maths they're not - they're just sitting there basically."

Identification

Identification of children with maths difficulties, particularly specific maths difficulties, was clearly a problem. The majority of teachers, although very aware of dyslexia, were not aware of specific maths difficulties or dyscalculia as a condition, and were unclear about whether they had taught such children.

GD: There's certainly children who have more problems with maths than with English, yeah. I won't say there's anyone who's very good at English and not at all good at maths. I haven't come across that. As far as I can think. Although I might have done.

JT: It's funny, you tend to think that if they're good at one thing, they're good at the other, but it isn't always.

Where teachers were aware of the condition (generally special needs teachers), they stated that they needed more information about it:

LS: ... there is a – not dyslexia – there is a maths condition.

Interviewer: Dyscalculia.

LS: Yes, which I'm not sure about that at all, I don't have read anything about that at all, so maybe we need to know a bit more about that, so we can actually follow up if some of these kids have got it.

Quite apart from the difficulties involved in intervention when identification of children with mathematical disability is difficult or impossible, there seemed to be a potentially worrying labelling issue: teachers frequently seemed to make an assumption that children struggling with maths were automatically 'low ability' in general. While this may be true for many children, it is unlikely to improve the academic prospects of children who do have specific mathematical difficulties. However, it also seemed to be possible for children to slip through the net:

LS: ... or tend to sort of copy the child next to them and sort of blag their way through things and it's only when you get a test or the end of year tests that they flag up that they're – you know, that they are having a problem but you have probably never noticed.

Teaching

There was a high level of agreement among teachers concerning the conceptual problems of children struggling with maths. The most salient difficulties were with learning number bonds or times tables, and with place value. Teachers remarked that with little understanding of these basic concepts children could not be expected to understand more advanced concepts such as fractions. They also agreed that less numerical concepts such as shape and space or data collection were not necessarily a problem for these children.

In terms of teaching the children, many teachers said that they found concrete objects helpful. However, apart from this, there was a sense of helplessness.

Although teachers tried to differentiate work to the level at which children with maths difficulties could attempt it and succeed, they found this very hard:

RS: They make it clear what they mean, but it's not easy to do it. In terms of really addressing the children who have the difficulties. Because if the bulk of the class are going to be doing one level, it's not always easy to scale it down. And to the right level for those who are having difficulty with basic concepts.

KD: ...if they forget really basic things from the beginning, then there's no way you can use those further down the line, so if they're really struggling with taking away, and knowing it's the difference or whatever, you can't do exchanging or whatever because it's – they can't even do the basics.

Moreover, many teachers expressed the opinion that trying to differentiate within objectives was not helping the children, who needed to spend time reinforcing basic concepts:

CW: You almost feel like that instead of doing fractions and decimals, they just need to sit and be able to work out the value of numbers, and do some basic adding and subtracting and multiplying and dividing, and then, once they've got the foundations in place you can move them on.

A number of teachers went so far as to suggest that being taken out of the Strategy altogether would be more helpful for the children.

CP: I think in some way there could almost be a separate program of work for those children. That – 'don't progress to this level until this has been achieved' so that it makes a bit more sense.

MM: The gap will get bigger and bigger unless they give them a chance to catch up, and there's not – So I think for them, I would prefer them not to have the Numeracy Hour, but just to focus on those basic skills.

Opinions like this were most strongly held by special needs teachers and LSAs, perhaps because they have greater contact with children with particularly severe learning disabilities.

Giving children appropriate work was seen as important not just in order to enable them to learn during that particular lesson, but to avoid the added barrier of an emotional block.

Emotional block

Teachers generally recognised the emotional problems attendant on constant failure in class:

LS: I think they tend to get very frustrated, if they can't understand anything.

SW: ... some of them have got an emotional thing about it, just – they're just scared of maths.

They were also strongly in agreement as to the knock-on effects of such emotional problems on future learning. Although relatively few teachers felt that serious behavioural problems resulted, the vast majority agreed that 'opting out' or the 'I can't' syndrome (in which children simply refused to take in what the teacher was trying to explain) was common. Many teachers felt that this emotional block was as serious a barrier to teaching children with maths difficulties as the condition itself.

RQ: As I said, the fact that they have already labelled themselves as weaker achievers doesn't help matters, you know, you get the 'I can't' syndrome then; 'I can't do this, I can't do that', the self-defeatist attitude.

KP: I think some of them literally just think they can't – they can't do maths, so they kind of have a block up, as soon as we get to starting to do it. Then they seem to just kind of phase out.

Teachers felt that this refusal to attempt to understand undermined their efforts to teach.

CP: I think a child who's struggling is either likely to be disruptive or to be – or to opt out.

MB: We've been trying since he was about in Year 1 to do number bonds to ten and he still really doesn't know them. I don't think.

Interviewer: Why do you think that might be?

MB: Well I think – it's gone on now, he's got this hang-up about maths.

Most teachers said that they tried to deal with the issue of anxiety by attempting to provide a relaxed and comfortable atmosphere to enable children to ask questions without anxiety. However, this was clearly difficult to do whilst attempting to hold down a class.

CP: I mean an ideal scenario would be to have a – to have that extra adult in your room, so that when you wanted to spend some time with chil – you know, children that you knew were struggling, you could give them some, you know ... TLC.

Avoidance behaviour

Teachers were generally aware that children who were struggling were trying to hide the fact.

JL: ...lots of times they're trying to cover it up. And sometimes they'll cover it up – they'd rather be told off for being naughty than being told off that they're thick.

Avoidance behaviours, such as copying or avoiding asking questions were also described by teachers.

AS: He doesn't have any self-confidence in asking, and he's – and it all compounds itself, you know, one difficulty leads to the other.

RS: I think there's an awful lot of copying, too.

Teachers on the whole seemed to be well aware of the difficulties the children were having and the ways in which they tried to deal with the situation. However, teachers also described 'limiting factors' preventing them from teaching the children as they would like to.

Limiting factors

As described above, teachers reported that the expectation to differentiate within age-appropriate objectives caused problems. In addition to this, two major themes emerged as 'limiting factors' in teaching children with maths difficulties. The first of these was the need for extra support.

ML1: They – in a class of thirty I've got six. You've got a lot of problems. And when I'm on my own, I don't – I really feel very guilty that I'm not giving them the attention they need.

VW: It's like being stretched between the two really, if I could just focus on them that would be fine. And if I could focus on the others that would be fine as well, but trying to split - be split between the two is quite hard really.

The other important limiting factor was a lack of specific information, ideas and resources for addressing maths disabilities.

CP: There isn't enough grounding almost as it were, in how to start those children off, and get them to catch up, really. But there needs to be some sort of - I think more guidance really, for yeah, teachers that -. Because all teachers have got children that struggle."

MB:... and how we can help them, as we've helped them with the multi-sensory with - for dyslexia. I'm sure the teachers would be very willing to - because it's really a big big problem, the maths, isn't it?"

Several teachers suggested that the National Numeracy Strategy should include more guidance:

LS: ...they do say you can go back to the year before, or go down, you know, a unit. But I think perhaps it needs to be more specific for children with special needs and also give ideas on what to use, resources you could use, that would be useful, and where you could get them from.

Discussion

In summary, teachers are in general aware of the problems, both academic and emotional, which are faced by children with maths disability. However, they are finding it difficult to address those problems directly, due to a number of factors. There is a lack of information and resources for identifying children with maths disability, and a corresponding lack of information and resources for addressing the problem. Even if these were available, due to large class sizes and a lack of extra support, it would be difficult for teachers to find time during the lesson to focus on relatively small groups of maths disabled children. Finally, we can speculate that children with specific maths disability may in some cases be held back in other subjects by being labelled 'low ability' in general.

General Discussion

Teachers' and children's views of the situation of children with maths disability in the classroom were generally in good agreement. Teachers as well as children of all ability levels were aware of low ability children's failure to keep up with lessons, of the emotional effects of continued failure, and of the avoidance strategies engaged in. However, from the child's perspective the teacher was seen as in control of or causing the situation, while teachers themselves felt relatively helpless to improve it substantially, with minimal information and weighed down by class sizes and the expectation that they need to follow the objectives of the National Numeracy Strategy. Although children sometimes implied that teachers were blind to the problems they faced, this did not seem in general to be the case, except possibly in the area of stigma. While teachers were aware of the stigma children with maths

disabilities themselves attached to their failure, they tended not to mention bullying as a factor affecting children's anxiety towards maths, while it was an important concern among the children themselves.

At all events, teachers' concerns about the failure of children with maths disability to learn, and the construction of emotional blocks to future learning, are borne out by the children's self-report, as well as the testimony of children of other ability levels. Another area of concern raised by the focus groups is the level of disruption caused, directly or indirectly, to children of other ability levels by struggling children. Children reported that disruption was caused directly through attempts at copying and through temper tantrums in the classroom, as well as indirectly through monopoly of the teacher's attention.

In summary, the results of this study suggest that under current policy children with maths disability are struggling in the classroom, often learning little but avoidance strategies, whilst being subjected to a good deal of stress and anxiety. Some higher ability children are also suffering, feeling that they are being both held back and distracted by children who struggle. Finally, teachers are being put under extra pressure by the need to differentiate within objectives whilst trying to ensure that children of all ability levels are given work that they are able to do. In addition teachers are suffering from a lack of guidance and information on dyscalculia and appropriate interventions, as well as a lack of support that would allow them to concentrate on struggling children, or alternatively, on higher ability children.

Numeracy is a vital skill in our society, but at present children with severe difficulties in maths are not being given sufficient opportunity to progress. If this situation is to improve, various changes need to be made. It is imperative that maths disability should be recognized and diagnostic tools regularly used in the educational system to avoid labelling of dyscalculic children as 'low ability' and to give them access to the kind of support that is available to dyslexic children. The development of effective interventions for maths disability is crucial, and research in this area is badly needed. Finally, educational policy must make better provision for children with maths disabilities, giving teachers access to more information and greater flexibility in how they teach children who struggle to master basic numerical concepts.

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Appendix 1: Focus Group Protocol

1: Teaching methods

What have you been doing in numeracy lessons recently?

What is the thing you like most about numeracy lessons?

What is the thing you like least?

Probe 3-part numeracy lesson, working in pairs/groups/individually/ whole class

Do people ever use blocks or number lines or things you can move around?

Which ones? Do they help? Which ones help most? How often do you use them? How do you feel about using them?

What was the most interesting thing you've done this term in maths?

What did you like most about doing it?

What was the most boring thing?

What might have made it better?

What did you think was hardest?

What other things do you think are hard in maths? Why are they hard? What might make them easier?

2: Losing track & emotional responses

Is it sometimes hard to keep track of the lesson?

Why? How often does it happen to you?

How does it make people feel?

What do people do for the rest of the lesson when that happens?

Does the teacher notice? What does the teacher do?

How do you think people who are not very good at maths feel about it?

How does the teacher treat them? What about parents?

3: Ideas about maths

If you were a teacher what would you do in maths lessons?

Is learning maths important for when you're grown up?

Appendix 2: Introduction to Focus Groups

I'm from University College London, and I'm working on a project to try to find ways of making maths teaching better, especially for people who find it very hard. I've asked you people to come to talk to me about it, because you are sort of experts on what it's like to be taught maths these days: it's something you do every day. I'm going to be asking you some questions about maths lessons, because I want to find out what you think about them. This isn't like a lesson. In lessons teachers ask you questions that they already know the answer to, because they are trying to find whether you know it. But we're going to be talking about something that you know about and I don't, so I'm going to be asking questions that I don't know the answers to. I want you to help me by telling me what your answers are. So there's no right or wrong answer. You might all have different answers, but they would still all be right, because everybody in this room has an important opinion that I want to hear.

Rules

It doesn't matter if you all disagree

We want to hear everything you say, so don't all talk at once.

We're not going to tell your teachers or your parents anything you've said

Say whatever you think

I'm very pleased that you've come along to help us out, and we're going to be giving you each a pencil at the end just to say thank you.

Appendix 3: Protocols for teacher interviews

Interview for teachers

Maths teaching

Which standard teaching aids do you use?

Do you supplement them with anything?

What kind of teaching strategies do you use? General or specific

National Numeracy Strategy

How has this changed what you do?

Has it helped?

How do you think it might be improved?

Teaching children with reading/maths difficulties

Have you taught reading or maths disabled children?

Do you treat them differently, or have different approaches?

If yes, how and why?

What do you think seem to be the main problems they have in maths compared with other children?

What strategies work best with these children specifically?

What limits the way you would like to teach children with maths or reading disabilities?

Anxiety

Do you think children with children with maths or reading disabilities are more anxious or badly behaved than other children (in or out of lessons)

If yes: What do they do? How do you deal with it?

Interview for special needs teachers

Which standard teaching aids do you use?

Do you supplement them with anything?

How are children with reading or maths difficulties assigned to you?

What kind of difficulties in maths do they have?

How often do you see them and for how long?

What kind of teaching strategies do you use? General or specific.

Why?

National Numeracy Strategy

How has this changed what you do?

Has it helped?

How do you think it might be improved?

Teaching children with reading/maths difficulties

What strategies work best with these children specifically?

Is there any approach you think might be usefully applied in classrooms?

What limits the way you would like to teach?

Do you think children with children with maths or reading disabilities are more anxious or badly behaved than other children (in or out of lessons)

If yes: In what ways?