Mathematics Recovery Evaluation

Cumbria Local Authority

October 2007

Mathematics Recovery in Cumbria

Mathematics Recovery is an early intervention programme, to support pupils who exhibit difficulties in numeracy. It has 6 assessments, which are used to provide scored assessment data. The data is used to inform a detailed one to one teaching programme, which is undertaken 3 or 4 times per week for twenty, 30-minute sessions. The pupil is reassessed following the teaching programme. The materials were developed using the research of Les Steffe and Bob Wright and incorporate principles from Dutch research of early number.

The assessment provides information about the following mathematical areas:

- Forward number word sequence (counting, one more than)
- Backward number word sequence (counting, one less than)
- Numerical identification and recognition
- Addition and Subtraction
- Multiplication and division
- Spatial patterns
- Finger patterns
- Use of tens and ones

Cumbria rightly has a high reputation for its work in educating children who are having difficulty in learning to read, write and do maths. The Reading Recovery Programme featured on a recent Channel 4 programme and government officers are closely watching the Mathematics Recovery Programme.

The Mathematics Recovery Programme was developed in Australia, America and the UK during the early 1990's. The programme was introduced into Cumbria in 2003. Teachers and classroom assistants are offered 7 days training. 106 Cumbrian schools are now using the programme. This year a further 49 schools will be trained.

Children who are on the programme are carefully screened to identify which area of mathematics they find difficult.

Mathematics Recovery is a centrally funded programme. Schools have to identify pupils who will benefit from the programme and careful monitor their progress. Results clearly show that children who are struggling with maths benefit from the programme. They make quicker progress than would otherwise be the case.

How is Mathematics Recovery used in Cumbria?

Cumbria LA piloted the materials during 2003 and 2004 with a small group of teachers and LA staff in the Barrow area. The outcomes of the pilot showed pupils gained significant improvement in mathematical understanding.

In 2004 the LA began offering Mathematics Recovery as a professional development course for teachers and teaching assistants. The training course is 7 days during the autumn and spring term, the course has a training cost and no supply is paid to attend any of the training or in-school work. To date 114 teachers and 108 teaching assistants, from 106 schools have completed the training. The training has taken place, in infant, junior, primary, secondary and special schools, all of whom have identified the value of the materials for the pupils within their setting. In 2007/2008 a further 102 delegates from 50 schools will be trained.

During the past 3 years the LA has provided funding to use Mathematics Recovery as a Wave 3 intervention for more than 340 pupils. All funding allocation requires the school to submit pre and post teaching data. This data is analysed annually and has shown significant pupil progress across all the mathematical areas identified above. Furthermore as schools develop their practice the rate of progress achieved by pupils is increasing each year.

Mathematics Recovery analysis of Cumbria LA data, April 2006 to March 2007

Mathematics Recovery is an early intervention programme, which has several assessment tasks that can be used to identify pupils' mathematical difficulties. The outcomes of the assessment tasks can be used to guide the planning of a teaching programme of twenty, 30-minute sessions, 3 to 4 times per week.

Cumbria LA provides funding for pupils who fulfil agreed criteria showing a need for Wave 3 intervention. Data is collected for pre and post assessment for analysis. From analysis of the Mathematics Recovery assessment materials, direct links can be made to National curriculum levels. The LA evaluation data allows evaluation of four of the main assessment areas;

- Forward number word sequence
- Backward number word sequence
- Numeral Identification
- Stages of Arithmetic Learning

Forward Number Word Sequence evaluation

This assessment has 6 identified levels. Level 0 being a child who is unable to count in the range 0 – 10 to level 5 being a child who is able to count beyond 100 and identify 'one more' in this range.

- 18% of pupils made no gain. However, 50% of this group were assessed at the highest Mathematics Recovery level in the pre teaching assessment.
- All pupils who made no gains in forward number word sequence made gains in other areas of the Mathematics Recovery teaching programme
- 81% of pupils made at least one level gain through the programme
- 65% of pupils who made gains are now able to say number sequences between 30 and beyond 100 (level 2 National Curriculum), which means these pupils are no longer having difficulties with teen numbers, crossing decades when counting, and understanding the vocabulary and order of tens numbers
- The remaining pupils made good gains in understanding about teens numbers. They were becoming consistent in their understanding of the

Links between Mathematics Recovery Scores and National Curriculum levels		
Forward Number Word Sequence		
Progress Statement	Mathematics Recovery Level (0 – 5)	National Curriculum Level (P5 – level 2)
I can rote count to 3	0	P5
I can rote count to 5	0	P6
I can rote count to 10	1	P7
I can rote count to 10 and give the number after in 1 – 10 range but I drop back	2	P7
I can rote count to 10 and give the number after in 1 – 10 range without dropping back	3	P8
I can rote count to 30 and give the number after in 1 – 30 range	4	Level 1
I can rote count to 100 and give the number after in 1 – 100 range	5	Level 2

Average gains for forward number word sequence in Cumbria LA April 2006 to March 2007				
No gain	1 level gained	2 levels gained	3 levels gained	4 + level gained
18%	45%	33%	3%	1%

sequence and the distinction between teen and tens with regard to vocabulary and place value. 25% of these pupils, who made no gains within this area, had no one to one correspondence at the beginning of the teaching programme (P5 to P7).

Backwards Number Word Sequence evaluation

This assessment has 6 identified levels. Level 0 being a child who is unable to count backwards in the range 0 to 10 to level 5 being a child who is able to count backwards from 100 and identify 'one less' in this range.

Links between Mathematics Recovery Scores and National Curriculum levels		
Backward Number Word Sequence		
Progress Statement	Mathematics Recovery Level (0 – 5)	National Curriculum Level (P5 – level 2)
I can count back from 3	0	P5
I can count back from 5	0	P6
I can count back from 10	1	P7
I can count back from 10 and give the number before in 1 – 10 range but I drop back	2	P7
I can count back from 10 and give the number before in 1 – 10 range without dropping back	3	P8
I can count back from 30 and give the number before in 1 – 30 range	4	Level 1
I can count back from 100 and give the number before in 1 – 100 range	5	Level 2

Average gains for backward number word sequence Cumbria LA April 2006 to March 2007				
No gain	1 level gain	2 levels gained	3 levels gained	4+ levels gained
14%	25%	39%	16%	6%

- 14% of pupils made no gains, only 1% of these pupils were working at the highest Mathematics Recovery levels when they undertook the pre teaching assessment. The remaining pupils in this group made progress within the level by being more consistent with their understanding about teens, but were unable to bridge across decades from the 30's to 20's. 2% of these pupils were only counting in the range 10 – 0.
- 50% of the pupils who completed a programme regardless of the levels gained still had difficulties with the teens numbers in the backwards count. The Mathematics Recovery teaching programme prescribes an equal amount of teaching for forward and backwards number sequences; but this data would suggest teachers are tending to work on forward number sequences to the detriment of the backwards counting, which in the longer term will lead to pupils having a greater degree of difficulty when undertaking subtraction questions. This

issue is being addressed within training and we hope that we shall see an improvement during 2007/2008 cohorts of pupils

- 86% of pupils made at least one level gain through the teaching programme
- 61% of pupils made 2 or more level gains in the backward number word sequence, compared to 37% for the forward number word sequence. This was because the pupils had a lower starting point from the pre teaching assessment for backwards counting. These pupils can now be assessed as level 2 (national curriculum)
- 50% of the pupils were able to say the backwards-number word sequence in the range 30 to 100. All these pupils showed significant progress in understanding the number sequence in relation to teens and tens, the order of the decade names and an ability to cross decades during a backwards count, or when numbers were given in isolation to the sequence. These pupils generally also made significant gains in their understanding of subtraction beyond the number range of 1 to 10, thereby taking their knowledge beyond the P scales

Numeral Identification

This assessment has 5 identified levels, level 0 to 4. Level 0 being a child who is unable to identify any numerals to level 4 a child who can identify numerals to at least 1000

Links between Mathematics Recovery Scores and National Curriculum levels		
Numeral Identification		
Progress statement	Mathematics Recovery level (0-4)	National Curriculum level (P5 - level 2)
I know numbers 1 and 2	0	P5
I know some numbers to 5	0	P6
I can identify 1 – 5	0	P7
I can identify 1 - 10	1	P8
I can identify 1 - 20	2	Level 1
I can identify 1 - 100	3	Level 2
I can identify 1 - 1000	4	Level 2A

Average gains for numeral identification Cumbria LA April 2006 to March 2007				
No gain	1 level gained	2 levels gained	3 levels gained	4 levels gained
30%	28%	31%	10%	1%

- 30% of children made no gains in their knowledge of numeral identification. However, 29% of these pupils already being at the highest level in the pre teaching assessment
- Just over one fifth of pupils who made no gains were secure with numbers to 100. However, despite the teaching programme many of these children continued to have difficulties with zero as a place holder in numbers beyond 100
- Pupils who made minimal or no gains in number identification were able to identify numbers in the range 1 to 10 prior to the teaching programme. Following the teaching programme the scores in this assessment are comparable with their improved ability across the other assessments, because prior to the teaching programme they could identify numbers to 10, but post teaching they were now able to apply this knowledge across a range of problems
- 70% of pupils made gains of at least 1 level, almost half of these pupils moved from being able to identify numerals in the range 1 to 10 (P8) to being able to identify numbers to at least 100, (national curriculum level 2)
- 16% of pupils moved from being able to identify numerals in the range 1 to 10, (P scale 8) to being able to identify the teens numbers, (national curriculum level 1)
- 36% of pupils either moved from no numeral recognition to recognition of at least 1 to 10, (P scale 8) or from the range up to 100 to at least 1000, (national curriculum level 2A)

Stages in Early Arithmetical Learning

This assessment has 6 identified stages of arithmetical development, stages 0 to 5. Stage 0 is a child with no addition or subtractive strategies, due to no one to one correspondence; Stage 5 pupils are able to calculate using non-count by one strategies, such as rounding, doubling or using known facts.

Links between Mathematics Recovery Scores and National Curriculum levels		
Stages of Early Arithmetic Learning SEAL		
Progress statement	Mathematics Recovery Stage (0-5)	National Curriculum Level (P5 – level 3)
I can count 2 objects	0	P5
I can count 3 objects	0	P6
I can count 5 objects	0	P7
I can count 10 perceived items but not those in screened collections with correct 1 to 1 correspondence	1	P8 or above
I can add two sets of screened objects but I count from 1	2	Level 1
I can add two sets of screened objects by counting on. I can subtract by counting back	3	Level 2
I know that I can subtract by finding the difference between two numbers	4	Level 2
I can add and take 2 digit numbers by using strategies that do not involve counting in ones	5	Level 2A/3

Data for SEAL Cumbria LA April 2006 to March 2007				
No gain	1 stage gain	2 stages gained	3 stages gained	4 stages gained
9%	21%	41%	18%	11%

- Of the 9% who made no gain: all children made gains in the other 3 areas assessed, 1 of the pupils was from a special school
- All the pupils who were working at STAGE 1 and made no gains were using their fingers to solve calculations. Pupils were not secure with early calculation due to their poor understanding of number sequences. Knowledge of number sequences has improved during the teaching programme, to LEVEL 3 in numeral identification, (national curriculum level 2) and teachers feel the next stage for these pupils will be able to move forward with calculating, now they have understanding of the number sequence and place value
- Pupil self esteem and confidence has been enhanced since completion of the programme, including the confidence to contribute to class teaching.

- Overall 91% of pupils made gains in their ability to add and subtract: From this group two thirds of the pupils began the teaching programme either with no one to one correspondence or only a very limited ability to calculate by using their fingers, (P scales 5 to 7). By the end of the programme all these pupils were able to at least count on in addition tasks and many had gained a range of non-count by one strategies, (national curriculum levels 1 to 3)

Impact on school performance

Mathematics Recovery was developed as an early intervention programme. In Cumbria we have found it to be very versatile to meet the needs of schools and pupils when supporting learning and teaching in mathematics. The LA has developed the programme across Wave 1, 2 and 3. The programme is also used in some infant schools as a whole school-tracking tool. In junior schools Mathematics Recovery is used to complement the PNS intervention programmes. In Key Stage 3, staff use the teaching programme to support disaffected pupils and pupils with significant mathematical difficulties up to Year 9. Several of our special schools use the programme to support pupils' learning and the use of age appropriate resources.

Currently we have 90 schools that use the programme regularly with Key Stage 1 pupils. 73% of these schools have improved their Key Stage 1 results and are above the national average. Furthermore of the 27% that are below the national average, 46% of these schools are less than 5% below the national average. The LA percentage for schools achieving above national expectations is 70%

The impact of Mathematics Recovery at Key Stage 2 cannot be accurately assessed as yet because many pupils who have participated in Mathematics Recovery teaching programmes have still to take Key Stage 2 assessments. It is anticipated that these figures will change once Mathematics Recovery pupils have been assessed at Key Stage 2.

Head teachers and staff comment on the excellent CPD the training provides for teachers and teaching assistants. Mathematics Recovery provides a framework to guide teachers about the learning needs of children in order to become proficient mathematicians.

Impact on pupil performance

The data collected from pupils who have completed a funded Mathematics Recovery programme has been used in analyses of Key Stage 1 results. All pupils who are funded are either school action or school action plus.

Key Stage 1

During 2005/2006 33 Year 1 pupils had funded Mathematics Recovery programmes. During 2006/2007 28 Year 2 pupils had funded Mathematics Recovery programmes. 20% of the schools had funding for both year groups. The attainment for the End of Key Stage Assessment 2007 for these pupils are summarised in the following table:

KS1level in 2007	Pupil funded whilst in Year 1	Pupil funded whilst in Year 2
2b+	27%	14%
2c+	70%	50%
1	24%	50%
W	6%	0%

The data suggests:

- 60% of pupils who were on the school SEN register at school action or school action plus during Key Stage 1 went on the gain Level 2+
- Discussion with a sample of teachers concluded that a significant number of pupils who undertake a Mathematics Recovery teaching programme during Key Stage 1 move from being at Wave 3 to Wave 2 and in some cases to Wave 1.
- This discussion also highlighted that pupils who still required Wave 3 intervention at Key Stage 2 were better equipped and more confident to learn using the materials supplied by the primary strategy or further Mathematics Recovery teaching.
- Head teachers believe, and the LA results confirm, that Mathematics Recovery is having a significant impact on the quality of teaching and learning for pupils who are working at Wave 3 in Key Stage 1. The benefit of using this early intervention is the need for significantly less financial resources such as teaching assistants for the school and increased self esteem for pupils as they enter Key Stage 2.
- The use of Mathematics Recovery in Year 1 appears to have an increased benefit on pupil achievement and attainment by the end of Year 2. These results, whilst statistically small appear to confirm the benefits of early intervention during Key Stage 1. This issue needs further research and consideration when reviewing LA funding policy.

Key stage 2

During spring term 2007 the Mathematics Recovery team undertook a small scale project for funding Year 6 pupils prior to End of Key Stage Assessments. The aim of the project was to consider whether Mathematics Recovery teaching principles could be used to 'boost' children prior to taking the end of Key Stage assessments in May. All pupils completed pre and post teaching assessments and were given 20, 30 minute teaching sessions. End of Key stage 2 teacher assessments were collected prior to undertaking the teaching and the actual Key Stage 2 results were collected in July. 36 pupils were used for the project.

KS2 level	Teacher Assessment	Actual SAT level July 2007
4	0%	50%
3	89%	39%
2	11%	5.5%
Below 2	0%	5.5%

The data suggests:

- Mathematics Recovery teaching programmes can be used as a Year 6 Wave 3 intervention and can have significant impact on a pupil's achievement and attainment, with regard to achieving age related expectations.
- Discussion with staff highlighted the increased understanding pupils gained regarding numbers and the number system and calculation methods following a 10-hour teaching programme.
- Whilst a small scale project, the results show 18 children, who were not assessed by teachers to meet age related expectations will be entering secondary school more confident mathematicians and working at age related expectations.