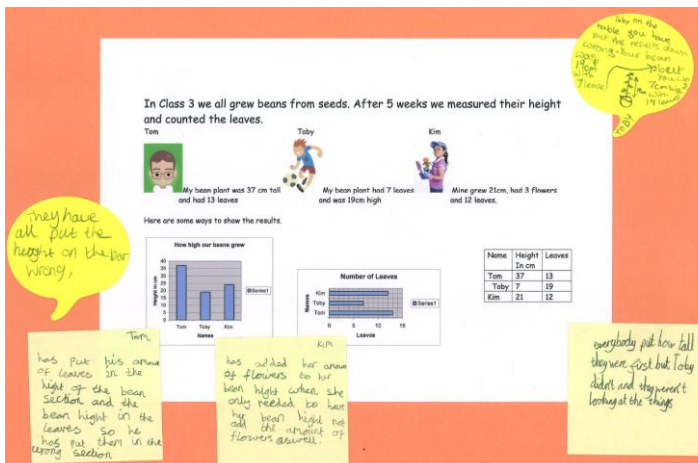
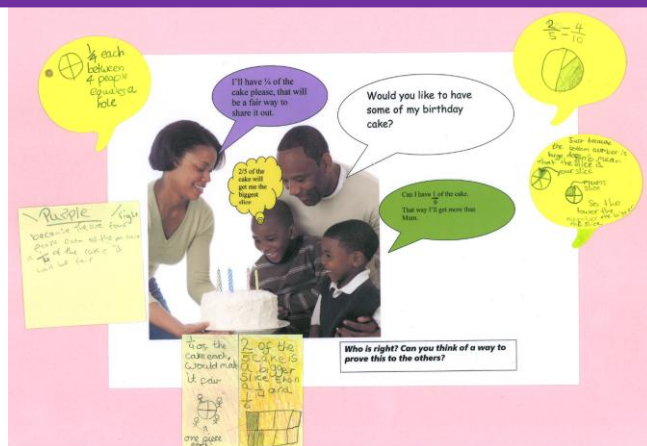




A resource to engage children in discussion based on common errors and misconceptions in mathematics.



DRAFT

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Acknowledgments

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Emma Best	Hester's Way Primary School
Sally Freeman	Prestbury St. Marys C of E Junior School
Jackie Holland	Hempsted C of E Primary School
Alison Peachey	Twynning School
Sarah Rowntree	Meadowside Primary School

Thanks also to Olga Gibbons and her secondary low attainers group for sharing ideas of how the mats could be used in secondary schools.

Introduction

Background

This document arose out of a working party of teachers who had attended a 'Girls and Mathematics' workshop which had explored a small research project by Gabrielle Westland on 'The use of error correction as a strategy for building mathematical resilience'. This research focused on the use of error correction activities within a one-to-one tuition context. Much of the material for this tuition was taken from 'Errors and misconceptions in Maths at Key Stage 2; Working towards successful SATS' by Mike Spooner (David Fulton Publishers, 2002).

For the 'Girls and Mathematics' workshop I had taken the idea of using errors and misconceptions and contextualised them to create discussion mats as a starting point for teachers to work with small groups of pupils to promote mathematical discussion. I had also set up a mini-action research project with a local teacher (Sarah Rowntree) to explore the use of error correction activities with a group of 6, Y5 girls who were failing to make acceptable progress in key stage 2 and lacked confidence in talking about maths. (See appendix A for the outcomes of this project).

The workshop led to a group of teachers contacting me regarding the discussion mats. Some had been trying them out while others were keen to use them and wanted to know if there were more available. This led to the formation of a working party of teachers interested in developing this as a resource.

Key Aim

The key aim of the working party was to create a resource that teachers could engage with and develop to meet the needs of their own class. This is why the discussion mats have been created in PowerPoint to encourage teachers to personalise them with their own pictures and contexts that the pupils they are teaching can relate to. The speech bubbles can also be adapted to reflect common errors and misconceptions teachers pick up through assessment for learning, for a particular group of pupils. In the trials of these mats pupils enjoyed having familiar contexts they could relate to.

As the mats were developed, selections were trialed by the teachers with either their class, another class in the school or smaller groups of pupils. This enabled us to explore effective ways of using the mats and adapt them if necessary. A selection of case studies reflecting their different uses is included in the publication.

How to use the discussion mats

As you will see from the case studies, the discussion mats can be used in a variety of ways;

- Whole class
 - As a starting discussion to a new unit of work, enabling the teacher to assess current knowledge and adapt the teaching of the unit accordingly.
 - As an oral/mental starter. This may be linked to current teaching, class targets or other aspects of mathematics the teacher wishes to address. It may also be used to address misconceptions and errors arising from assessment information.
 - In the plenary. As a tool to assess understanding and move learning forward in readiness for the next lesson.
 - As a mixed ability class activity to encourage mathematical discussion and learning from their peers.
 - As ability grouped activities where different groups may have different mats with errors and misconceptions related to their stage of mathematical development or arising from their own errors and misconceptions.
 - As an end of unit assessment, enabling the teacher to gather information for formative assessments and future planning.
- Group activities
 - With a guided group of pupils identified with similar needs. This may relate to mathematical understanding but could also be used to develop vocabulary and greater confidence with discussing mathematical ideas.
 - Teaching Assistant intervention to boost small groups of pupils based around their own common errors and misconceptions.
- One-to-one tuition
- Pupil conferences
- Evidence collection for Assessing Pupils Progress (APP)

It is important that wherever possible these mats are personalised to reflect errors and misconceptions commonly made by the class or group of pupils being taught and contexts are used that pupils can relate to. It is not always essential to use a discussion mats as teachers can address errors and misconceptions through taking a range of pupils answers to a problem and discussing which one is correct and why but also exploring why the others are incorrect.

TIP for creating your own mats – always make it clear the number answers which are right or wrong and encourage the children to explain reasons why the wrong answers may have been suggested.

Case Studies

Who?

I worked with 2 High ability children from Year 1 (1 boy and 1 girl).

Why?

I identified these children as they are able mathematicians but found fractions difficult.

Task and responses

I explained the discussion mat to the children and went through the statements with them. They were then asked to record their ideas on post it notes and choose the correct response. One child had the correct answer but both children realised about the equal parts of the fractions.

19.3.10 - 2 HA-Y1 children LG - Male, KA - Female.
Worked with E. Best.
Maths - Fractions

One child had the correct answer (LG) but both realised about the equal parts of fractions.

① the ^{parts are} the same LG.

② the is half LG.

③ Because it is not the same KA.

④ it is correct quarters LG.

⑤ this is half KA.

⑥ it is a quarter KA.

⑦ the is one loads KA.

⑧ it is not fair KA.

When you've made the cake you can share it between you!

Which of the thought bubbles show the cake being shared in half?

number 3 KA.

number 2 LG.

Future thoughts

I found this an extremely useful way to target errors and misconceptions of specific children. 1 child had a better understanding of fractions than I originally thought but had obviously not understood the fraction questions when tested. As a maths subject leader I would definitely use this again to target areas of weaknesses identified by APP in different year groups as a pupil conferencing tool. Practical work could then be completed with these children.

Who?

I worked initially with a group of year 1 and year 2 pupils who were having difficulty with finding fractions of a number.

Task

I worked with pupils in Years 1 and 2 to see if they could help the pupils who had got confused, we discussed the problem and then they offered some suggestions either by writing on 'Post-It' notes, telling me or in one case getting some cubes out of the cupboard.

Pupil responses

"You need the same amount on both sides. If you put one on one side you will have 11 on the other side and that's just not fair"

"Yes they would all argue and a half means its equal."

"I can see what they have done; they just looked at the number on the top. This person needs to learn that $\frac{1}{2}$ means a half not just numbers written down."

Background to the mat

A frustrated PE teacher explained that he had asked a group of children to put some balls in a hoop only to find them arguing about how many he wanted. Thus the idea for this mat was born. I used older pupils to pose for photographs (with parents' permission) and then used the misconceptions that the teacher had shown me from the pupil's work.

Pupil responses

"This girl has looked at $\frac{1}{2}$ and she thinks the line in the middle means add but that's not really what it means"

"She doesn't understand how to put things into groups, she hasn't read the question and looked at the balls at the top"

Mr Newman has asked us to put $\frac{1}{2}$ of these balls into the skipping circle.



I'm going to put 1 ball into the circle because 1 is the number on the top of the fraction.



I am not sure I can do this because when you cut a ball in half it can't be used any more.



I will get 6 balls because when you put the balls into 2 groups there will be 6 balls



There will be 3 balls in the circle because $\frac{1}{2}$ is 1 + 2.



Pupil responses

"Mr Newman wanted half of all of the balls not half of each ball"

"This is silly, you couldn't cut a ball in half, Mr Newman doesn't have scissors"

"You can't cut a ball it would roll away, if someone held it then you could but only if it's hollow"

Pupil responses

"A half is two equal groups so if you count 1, 2, 3, 4, 5 and the blue one there is 6 and then there is 1, 2, 3, 4, 5, 6 left, that's what he wanted"

"If you want a half of 12 you do it like this..." *Pupil then got counters out and divided them up.* "The only problem is that these counters are not the same as the balls and they might be confused so the best thing to do is to take them outside and do it at playtime"

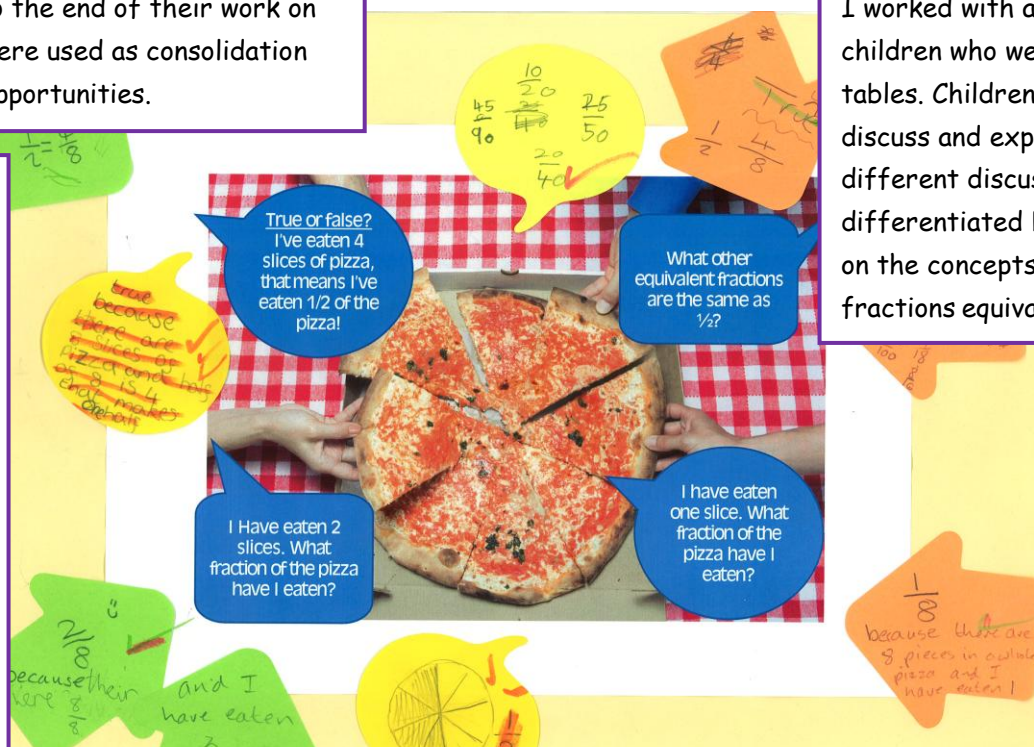
The children were coming to the end of their work on fractions and these tasks were used as consolidation and for using and applying opportunities.

I wanted to focus on children's misconceptions about fractions but in a context they could relate to. I was particularly keen to encourage the low ability children, especially quiet, under achieving girls, to be able to explain their thinking and reasoning and boost their confidence.

They used post-its to write their thoughts, draw diagrams and explain their answers. They then shared each others work on their tables and added to other children's existing post-its.

The tasks really highlighted children who had securely understood fractions and those that hadn't. It provided a great opportunity to see models and images the children use to work out their answers.

I would use more AFL/APP style questioning. TA and teacher could sit and listen to group and use the activity as an assessment opportunity. The mat could be changed to include a wider range of common fraction misconceptions.



I worked with a low ability class of 28 year 4 children who were grouped into similar ability tables. Children worked with talk partners to discuss and explain their thinking. Each table had different discussion mats that were differentiated by questioning. The mats focused on the concepts of finding half and a quarter and fractions equivalent to $\frac{1}{2}$.

Children had the chance to add to post-its on other mats around the class allowing all children to access a range of work set for different abilities.

Children peer assessed using tickled pink and green for growth. Each child had 3 pink ticks that they could give to the post-its that they thought had the best explanations/diagrams/range of answers. They highlighted in green areas that could have been improved.

Who?

I worked with a group of 6 less confident Year 5 girls.

Why?

I used the discussion mat as one of a series of sessions with the same group of children based on error and misconceptions. At the start of the year, I identified a group of girls who were reticent in maths lessons and my aim was to improve their confidence and to allow them to see themselves as mathematicians

Task and responses

The children always enjoy spotting mistakes made by other people and are happy to offer advice. In this situation, I was surprised by their reticence to begin and found they needed encouragement even to decide what type of calculation was needed. Once we had established that, they selected the correct numbers to use very quickly- something I had assumed they would find more difficult to do. Children had whiteboards to record their working and some decided to start with working out the sum themselves, whilst others went straight to spotting mistakes in the examples. With some paired discussion, most errors were spotted, although I was surprised by one response that the number line example could not be correct because it was adding rather than subtracting. This was a good discussion point and allowed us to put right the misunderstanding.

How many runs did England win by?

$$\begin{array}{r} 400 + 20 + 7 \\ - 200 + 80 + 5 \\ \hline 200 + 60 + 2 \\ = 262 \end{array}$$

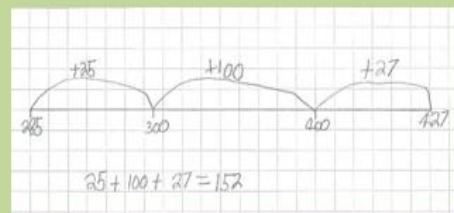
$$\begin{array}{r} 34 \text{ } 8 \text{ } 7 \\ - 2 \text{ } 5 \text{ } 8 \\ \hline 1 \text{ } 6 \text{ } 9 \end{array}$$

$$\begin{array}{r} 285 \\ - 427 \\ \hline 262 \end{array}$$

Australia	3rd ODI Last Innings	England
	CONGRATULATIONS	
	ENGLAND	
39	Overs	40
5	Wickets	8
46	Extras	57
285	Total	427

$$\begin{array}{r} 285 \\ + 427 \\ \hline 712 \end{array}$$

$$\begin{array}{r} 400 + 20 + 7 \\ - 200 + 80 + 5 \\ \hline = 300 + 20 + 7 \\ - 200 + 80 + 5 \\ \hline 100 + 40 + 2 \\ = 142 \end{array}$$



Future thoughts

A follow up to this session could involve a discussion on which method the children prefer to use and why. I would also ask them to offer advice to the children who made the mistakes. Remember to clarify vocabulary and concepts relating to cricket.

Who?

I worked with my entire Year 6 class, covering a wide range of ability.



1 person is correct. Who do you agree with?

Future thoughts...

I would do this again as a whole class activity but instead of whiteboards I would use smaller copies and Post-it notes in pairs to record some of their thoughts and reasoning before discussing as a whole class. This would then provide evidence of individual misconceptions and help with APP tracking. The activity really helped me to hone in on where my class needed to go next with their understanding of measures.

Why?

I wanted to use this discussion mat to assess their present level of understanding on measures before embarking on the next block of work. I used it as a 'starter activity' on the IWB to confirm my assumptions about their current level of understanding. This allowed me to build more effectively on their knowledge.

Task and Responses

The children enjoyed identifying the mistakes in a non-threatening atmosphere as it was not personal - all abilities felt confident to talk to their buddies and as a class. The picture was of our own playground, which the children could immediately identify with. They used whiteboards to prove who was correct and why the other statements were not. It was the average ability children who were able to confidently explain their reasoning; the less able latched onto the maths symbols. The discussion became quite heated as they could identify why one was correct, but misconceptions (across the whole range of abilities) became apparent when justifying why the others were not correct! I realised I had assumed too much!

Links

Links to year groups and APP levelled assessment criteria including examples of discussion mats

Algebra

Discussion mat	Suggested year group/KS	APP link
Simple Sequence	Lower KS2	L3 Alg 1 – Recognise a wider range of sequences
Balance Scale 1	Y2/Lower KS2	L3 Alg 2 –Begin to understand the role of '=' (the 'equals' sign)
Balance Scale 2	Y2/Lower KS2	L3 Alg 2 –Begin to understand the role of '=' (the 'equals' sign) L3 Calc 5 – Use mental recall of addition and subtraction facts to 20 in solving problems involving larger numbers
Coordinates	Upper KS2	L4 Alg 2 – Use and interpret coordinates in the first quadrant L4 SSM 3 – Reflect simple shapes in a mirror line, translate shapes horizontally or vertically and begin to rotate a simple shape or object about its centre or vertex

Two people are correct:

I think one of the missing numbers is 23.

I don't have enough information to work out the missing numbers.

...38, 33, —, —, 18...

18 and 33 are both in the 3 times table, so it must be jumping in 3's.

I think the last number will be zero.

I think the sequence is about subtraction.

Simple Sequence

I think we could have 8 on the left so $8 = 2 + 6$.

I think we could put two weights on the number 3 to still make 8. $3 + 3 = 8$.

I think this balance shows that $5 + 3 = 2 + 6$.

I think I could take off the 2 and the 6 and just put a weight on the 8 so $5 + 3 = 8$.

Sarah says that the equals (=) sign always has to come at the end of the number sentence so $2 + 6 = 8$. Is she right?

Who's is wrong?

Balance Scale 1

Balancing Scales

100 = 23 + 87

Which answer would you choose to evenly balance these scales?

111 110 90

The answer is 100 because I know that $20 + 80 = 100$.

The answer is 111 because I know that $20 + 80 = 100$ And $3 + 8 = 11$.

Balance Scale 2

Which two are correct?

The coordinates of point A are (6,4).

The coordinates of point B are (6,6).

The mirror line is $y=5$.

If I reflect the triangle in the mirror line the new coordinates will be (4,1), (6,1) and (6,4).

If I translate the triangle its new coordinates could be (4,1), (6,1) and (6,4).

Coordinates

Numbers and the number system

Discussion mat	Suggested year group/KS	APP link
Cake Fractions 1	KS1	L1 NNS 4 – begin to use the fraction one-half L2 NNS 3 – Begin to use halves and quarters and relate the concept of half of a small quantity to the concept of half of a shape
Playground Balls 1	KS1	L1 NNS 4 – begin to use the fraction one-half L2 NNS 3 – Begin to use halves and quarters and relate the concept of half of a small quantity to the concept of half of a shape
Playground Balls 2	Y2/Lower KS2	L2 NNS 3 – Begin to use halves and quarters and relate the concept of half of a small quantity to the concept of half of a shape
Place Value	Y2/Lower KS2	L3 NNS 1 – understand place value in numbers to 1000
Pizza Fractions 1	Lower KS2	L3 NNS 4 – Use simple fractions that are several parts of a whole and recognise when two simple fractions are equivalent.
Chocolate Fractions	Lower KS2	L3 NNS 4 – Use simple fractions that are several parts of a whole and recognise when two simple fractions are equivalent.
Cake Fractions 2	Lower KS2	L3 NNS 4 – Use simple fractions that are several parts of a whole and recognise when two simple fractions are equivalent.
Smarties Fractions	Lower KS2	L3 NNS 4 – Use simple fractions that are several parts of a whole and recognise when two simple fractions are equivalent.
Tricky Sequence	Upper KS2	L4 NNS 1 – recognise and describe number patterns
Pizza Fractions 2	Upper KS2	L4 NNS 4 – Recognise approximate proportions of a whole and use simple fractions and percentages to describe these

Cake Fractions 1

When you've made the cake you can share it between you!

Which of the thought bubbles show the cake being shared in half?

Mr Newman has asked us to put $\frac{1}{2}$ of the balls into the skipping circle.

Playground Balls 1

Mr Newman has asked us to put $\frac{1}{4}$ of the balls into the skipping circle for the next group.

Playground Balls 2

Daisy, Kyle and Luke have been learning about adding tens to three-digit numbers

When you add 10 to a three-digit number the hundreds digit always stays the same!

I think when you add 10 the units digit always stays the same.

I'm not too sure...what do you think?

Place Value

354
364
374
384

Pizza Fractions 1

CHOCOLATE CHALLENGE

- How many pieces would half be?
- Write a fraction for this chocolate bar that is an equivalent to $\frac{1}{4}$
- What fraction of the bar would 2 squares be?
- Describe a quarter of this bar?
- Describe a third of this bar?

Even harder!!
What is the maximum number of people I could share this bar with?

Chocolate Fractions

2/5 of the cake will get me the biggest slice

Would you like to have some of my birthday cake?

I'll have $\frac{1}{4}$ of the cake please, that will be a fair way to share it out.

Can I have $\frac{1}{6}$ of the cake. That way I'll get more than Mum.

Two people are right? Can you think of a way to prove this to the others?

Cake Fractions 2

Convince me that this child is wrong:
6 Smarties are blue so that means: $\frac{6}{15}$
is the fraction of blue Smarties here.

There are 21 Smarties

What fraction of the Smarties are green?

Draw a diagram to convince me that the fraction of green Smarties is bigger than the fraction of red Smarties.

What is this child doing wrong?
 $\frac{21}{4}$
Fraction of red Smarties
Explain what you would do to help.

Smarties Fractions

I think 88 will be in the sequence

Only one person is correct.

I think the missing number after 33 is $25\frac{1}{2}$

The difference between 33 and 18 is 15 so it must be counting in steps of $7\frac{1}{2}$

The first negative number in the sequence will be -3

What do you think the two missing numbers are?

Tricky Sequence

I've eaten 10 slices so I must have eaten $\frac{8}{10}$ of a pizza!

Only one person is right...who do you think it is?

I've eaten 4 pieces of pizza so I must have eaten $\frac{1}{4}$ of a pizza!

I've eaten ten slices of pizza, that means I've eaten $1\frac{1}{4}$ pizzas!

I've eaten 6 slices so I guess I've eaten 60% of the pizza!

Pete's pizza are always cut into 8 equal slices.

Pizza Fractions 2

Calculating

Discussion mat	Suggested year group/KS	APP link
Purses	Y2/Lower KS2	L2 calc 3 – use mental calculation strategies to solve number problems including those involving money and measures
Starburst	Y2/Lower KS2	L2 calc 3 – use mental calculation strategies to solve number problems including those involving money and measures
Make 50	Y2/Lower KS2	L3 Calc 2 – add and subtract two digit numbers mentally
Toy Shop	Lower KS2	L3 Calc 5 - Use mental recall of addition and subtraction facts to 20 in solving problems involving larger numbers L3 NNS 5 – Begin to use decimal notation in contexts such as money
World Cup stickers	Lower KS2	L3 Calc 5 - Use mental recall of addition and subtraction facts to 20 in solving problems involving larger numbers L3 Calc 6 – Solve whole number problems including those involving multiplication or division that may give rise to remainders
Chocolate box	Upper KS2	L4 Calc 3 – use efficient written methods of addition and subtraction and of short multiplication and division
Cricket Scores	Upper KS2	L4 Calc 3 – use efficient written methods of addition and subtraction and of short multiplication and division
Calculator	Upper KS2	L4 Calc 5 – solve problems with or without a calculator (interpret a calculator display) L5 SSM 6 – Solve problems involving conversion of units and make sensible estimates of a range of measures in relation to everyday situations
DVDs	KS2	No specific APP link as a range of mathematical topics are covered.

Which purse shows the correct amount?

Lucy's purse

Peter's purse

Susie's purse

Shaman's purse

Purses

Which coins would you use to buy a packet of Starburst costing 38p?

Starburst

Only two are correct. Which ones are they?

What needs to be added to each cylinder to make 50 ml?

34 ml

35 ml

65 ml

Make 50

Who is correct?

£2.64

£1.90

£2.36

Can you work out if any of these children worked out their answers correctly? If they have made mistakes how could you help them?

If I buy one of everything it will cost £7.90.

£1.90
£3.36
+ £2.64
0.10
1.80
6.00
£7.90

If I buy two slinky toys it will cost me £2.18.

£1.90 + £1.90 =
£1.00 + £1.00 = £2.00
9 + 9 + 18
£2.00 + 18 = £2.18

If I buy a robot and pay with £10.00 I will get £8.46 change.

I know this is right because a robot costs
£2.64 and I used my number bonds.

There is a half price offer on for this week only. I think that for £5.00 I can buy one of each toy.

Toy Shop

Two friends are collecting World Cup stickers

I can fill 6 pages with 8 stickers on each page so I have 48 stickers

I have 37 stickers and if I put 12 on each page I will have 3 full pages with one left over.

Stickers cost 50p for 6 stickers so it has cost me £4.00 to buy my stickers.

If we add our collections together we will have 75 stickers.

One of the statements is wrong!

World cup stickers

There are 36 chocolates in a layer. How many are in the whole box?

One person is correct. Who do you agree with?

Chocolate Box

How many runs did England win by?

Which answer is correct?

Cricket Scores

The calculator shows the answer to a question. What could this mean?

3kg and 8g

38mm

£3.80

£3.08

3 litres 80ml

Two are correct.

Calculator

I have 24 DVDs. Which two of these statements are correct?

I have a rack that holds 100 so I need to get 86 more to fill it.

4 of these are too young, 1/3 of them are too old. So I can only watch 10 of them.

Mum said that 1/4 of these are made by Disney so that is 3.

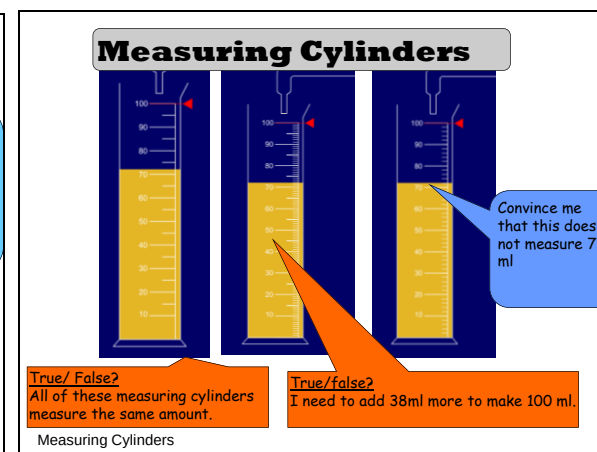
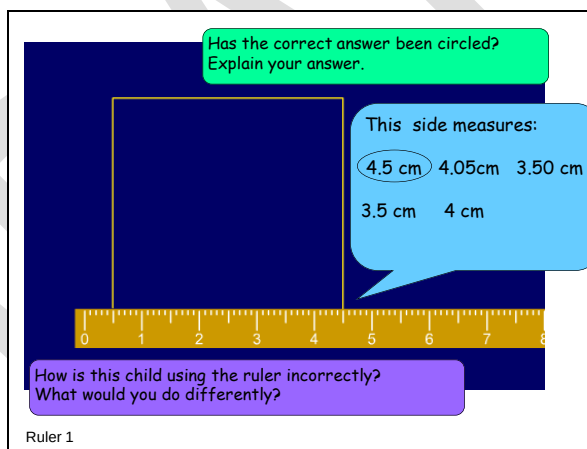
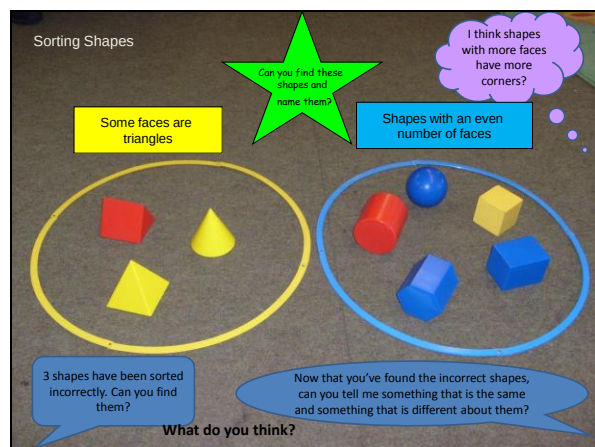
Shrek the Third takes 90 minutes so if I start watching at 6.35pm I will finish before my bedtime at 8.15pm.

DVDs

Shape, Space and Measures

Discussion mat	Suggested year group/KS	APP link
Sorting Shapes	KS1/Lower KS2	L2 SSM 1 – use mathematical names for common 3-D and 2-D shapes L2 SSM 2 – Describe their properties, including number of sides and corners L2 HD 1 – Sort objects and classify them using more than one criterion
Ruler 1	KS1/Lower KS2	L2 SSM 5 – begin to use a wider range of measures including everyday non-standard and standard units to measure length and mass
Measuring Cylinders	Lower KS2	L3 SSM 5 – Use a wider range of measures including non-standard units and standard metric units of length, capacity and mass in a range of contexts L3 Calc 2 – add and subtract two digit numbers mentally
Flapjacks	Lower KS2	L3 SSM 5 – Use a wider range of measures including non-standard units and standard metric units of length, capacity and mass in a range of contexts

Cake Time	KS2	L3 SSM 6 – Use standard units of time
Ruler 2	Upper KS2	L4 SSM 5 – Interpret, with appropriate accuracy, numbers on a range of measuring instruments
Temperature	Upper KS2	L4 SSM 5 – Interpret, with appropriate accuracy, numbers on a range of measuring instruments
Playground Measures	Upper KS2	L4 SSM 5 – Interpret, with appropriate accuracy, numbers on a range of measuring instruments
Timetable	Upper KS2	No specific link to APP assessment criteria



Making Flapjacks
Here is a recipe for 18 Flapjacks

Ingredients
75 g butter
30ml golden syrup
75g light brown sugar
150g porridge oats
50g raisins

Thought bubbles:
 - I only want to make 6 flapjacks – I can't do it!
 - If I add the amount of butter to the porridge oats I will have $\frac{1}{4}$ kg
 - If I have 1 kg of raisins I can make two batches of flapjacks because there are 100g in 1kg
 - There is half as much sugar as porridge oats in this recipe.

Flapjacks

Cake Time

Thought bubbles:
 - I think twenty to four is 03:40
 - I wish I'd paid attention at school...is twenty to 4 04:20
 - The cake takes an hour to cook so we'll need to put it in at **twenty to four** so it is ready for tea time.
 - Twenty to four... that's when the cooker clock says 20:4

What do you think?

Ruler 2

Thought bubbles:
 - Two answers are correct. Which two would you choose? Explain your choices.
 - This line measures: 6.5 cm 6.05 cm 65 mm
 - To make it 10cm, I need to add: 4.05cm 4 cm 4.5 cm 3.5 cm
 - Only one answer is correct. Which would you choose? Explain your choice.

Temperature

Thought bubbles:
 - The first thermometer's temperature is 2.5°C because if you count up from 0 it is 2.5 more.
 - Which statements do you agree with?
 - I think all of these thermometers have the same temperature reading.
 - The middle thermometer's temperature is only 1°C because it is 1 more above 0°C

Playground measures

Thought bubbles:
 - This is 26,400 cm
 - The perimeter of our playground is 264.59m
 - I think this is $> 2\text{km}$
 - I need another 51cm to make 265m
 - This number means 264m, 5cm and 9mm
 - I think this is $< 1\text{km}$

1 person is correct. Who do you agree with?

Timetable

Bristol to Gloucester, Cheltenham Spa, Worcester and Great Malvern
Mondays to Fridays

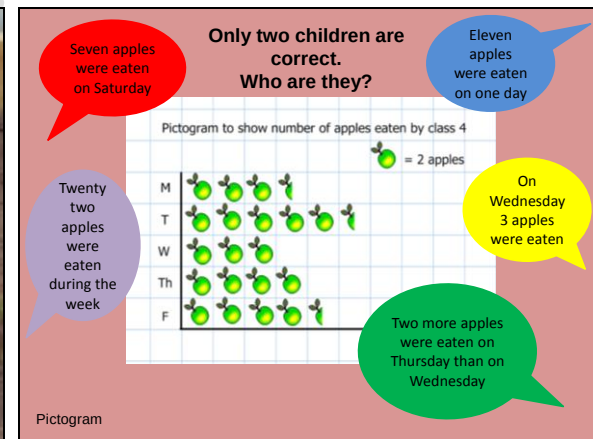
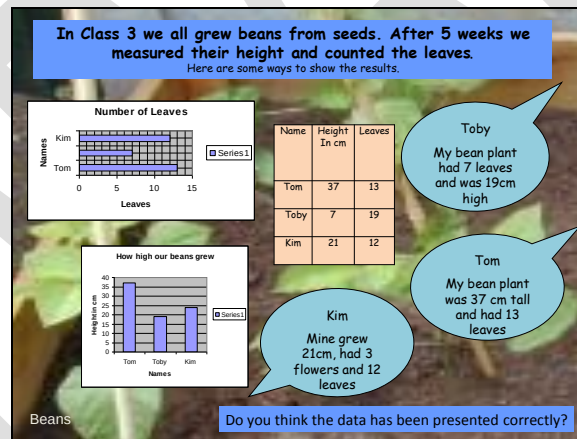
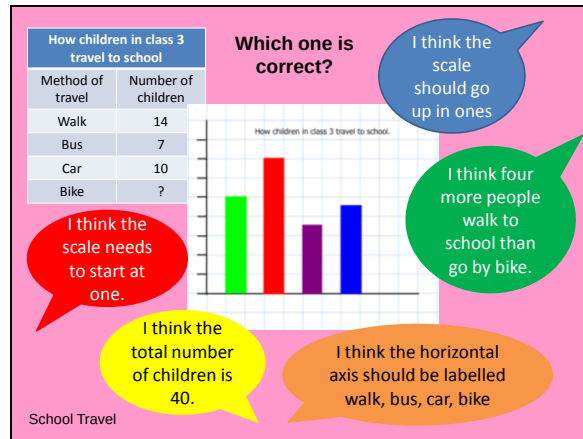
Operator	Notes	XC	GW	XC	XC	XC	LM	GW
Facilities		⊕	⊕	⊕	⊕	⊕	⊕	⊕
Wootton Bassett	d	1240	1310	1340				1410
Bath Spa	⊕ d	1300	1319	1335	1400		1415	1435
Bristol Temple Meads	⊕ d	1330	1341	1400	1430		1441	1500
Filton Abbey Wood	d	1348	1357				1448	1457
Bristol Parkway	⊕ d	1340	1352	1410	1440		1452	1510
Yate	d	1401					1501	
Cam & Dursley	d	1413					1513	
Gloucester	⊕ a	1430					1532	
Gloucester	⊕ d						1513	1537
Cheltenham Spa	d	1412	1442	1459	1512	1525	1548	1542
Ashchurch for Tewkesbury	d					1532	1555	1555
Worcester Shrub Hill	⊕ a					1552	1622	1622
Worcester Foregate St	⊕ a					1552	1622	1622
Malvern Link	⊕ a						1642	1642
Great Malvern	⊕ a							
Birmingham New Street	⊕ a	1456	1526	1545	1556			1626
Train continues to		DEE	MAN	NOT	GLC			MAN

Thought bubbles:
 - I need to get to Worcester Shrub Hill for 4.30pm. I'm not sure which is the best train to get from Gloucester!
 - The half past one train from Bristol Temple Meads takes 82 minutes to get to Cheltenham Spa.
 - What is the shortest journey time from Bath Spa to Birmingham New Street?
 - I don't think the 2 o'clock train from Bristol goes to Birmingham!

Can you help?

Handling Data

Discussion mat	Suggested year group/KS	APP link
School Travel	Lower KS2	L3 HD 2 – Construct bar charts and pictograms, where the symbol represents a group of units
Beans	Lower KS2	L3 HD 4 – Extract and interpret information presented in simple tables, lists, bar charts and pictograms
Pictogram	Lower KS2	L3 HD 4 – Extract and interpret information presented in simple tables, lists, bar charts and pictograms



Appendix A

Improving girls' confidence and mathematical progress through the use of error correction activities and guided group work.

An action research project, undertaken by Sarah Rowntree (Meadowside Primary School).

Aim: To develop guided group work in a class based context using error and misconception activities and evaluate its impact on pupils' mathematical progress, resilience and attitude.

Target group: Six Y5 girls were chosen. These were quiet girls who were reluctant to make eye-contact in math lessons and their progress in math since KS1 had been poor. The girls were informed that they would be working together as a group once a week to help develop their confidence in math.

Actions undertaken:

- At the start of the project data was collected;
 - Attitude to math survey
 - Mind map – as a group the girls came up with the math headings for the mind map and then traffic lighted them for how they felt about each area of math.
- Group work was undertaken weekly but not always on the same day.
 - The focus was on using errors and misconceptions materials linked to the maths work being undertaken that week.
 - Material was taken from 'Errors and Misconceptions at KS2 (Mike Spooner) and also from errors and misconceptions identified by the teacher in previous lessons. Additional materials were also used such as Talk it, Solve it, and the Talking Real Maths posters to develop the girls confidence with talking about math.
 - The group work involved lots of talk and not too much writing. The girls always worked with a partner or as a group for this session.
- Pupil conferencing (December) – this group took part in the pupil conferencing that the school undertakes termly.
- The group returned to the mind map at Christmas and ticked, with the traffic light system, anything that had changed.
- In the summer the group were given a new blank mind map and asked to circle any aspect of math you're now better at and feel less worried about. The group also repeated the attitude survey.

Evaluation:

The mind maps and the attitude surveys all showed an improved attitude to maths and increased confidence in a range of mathematical areas. The girls are now more engaged in whole class questioning.

In pupil conferences the girls commented that;

‘Spotting mistakes in other people’s work helps us.’

‘I’m not as scared at getting things wrong.’

‘Maths is like marmite, I hated it, now I love it.’

In conversations (Feb 2010) with the group about how they feel the group work has helped them, the following comments were made;

‘I used to hate maths but now I love it.’

‘I’m not as good at maths as English but I like the challenge.’

‘I can’t believe I put decimals in red.’

One child also had the confidence to challenge the answer of a ‘more able’ child in the class and was correct.

Progress:

Child	KS1	Entry to Y5 (sublevel progress)	April 2010
A	2a	2a (0)	4c
Mi	2a	3c (+1)	4c
S	2a	3c (+1)	4c
Me	2a	3b (+2)	4c
L	2b	3c (+2)	4c
T	2b	3c (+2)	4c

N.B. Expectation is for 2b (2a) to achieve 3b (3a) by end of year 4

Whole class data was analysed to look at progress made from September to Easter (4 terms).

- Children who had received no additional support, over and above the maths lessons, on average had made **1.44** sublevels progress.
- The girls in the guided group had made on average **3** sublevels progress.
- The group receiving additional support with overcoming barriers, from January, had made **1.6** sublevels progress.

Appendix B

Contents of the CDRom

Talking Real Maths Booklet (24Word)

Discussion Mats (PowerPoint)

Examples of Secondary discussion mats (PowerPoint)

Pictures (to inspire teachers to create their own mats) (PowerPoint)