Teaching Mathematics to Promote Children's Thinking

Seán Delaney

Marino Institute of Education

24 April 2012

Coláiste Mhuire
MARINO
Institute of Education

Introduction 1

- Who teaches senior classes (3rd to 6th)?
- Who teaches junior classes (J.I. To 2nd)?
- Who teaches learning support?
- Who teaches in a special school or class?
- Who is a teaching principal?
- Who is a mostly administrative principal?

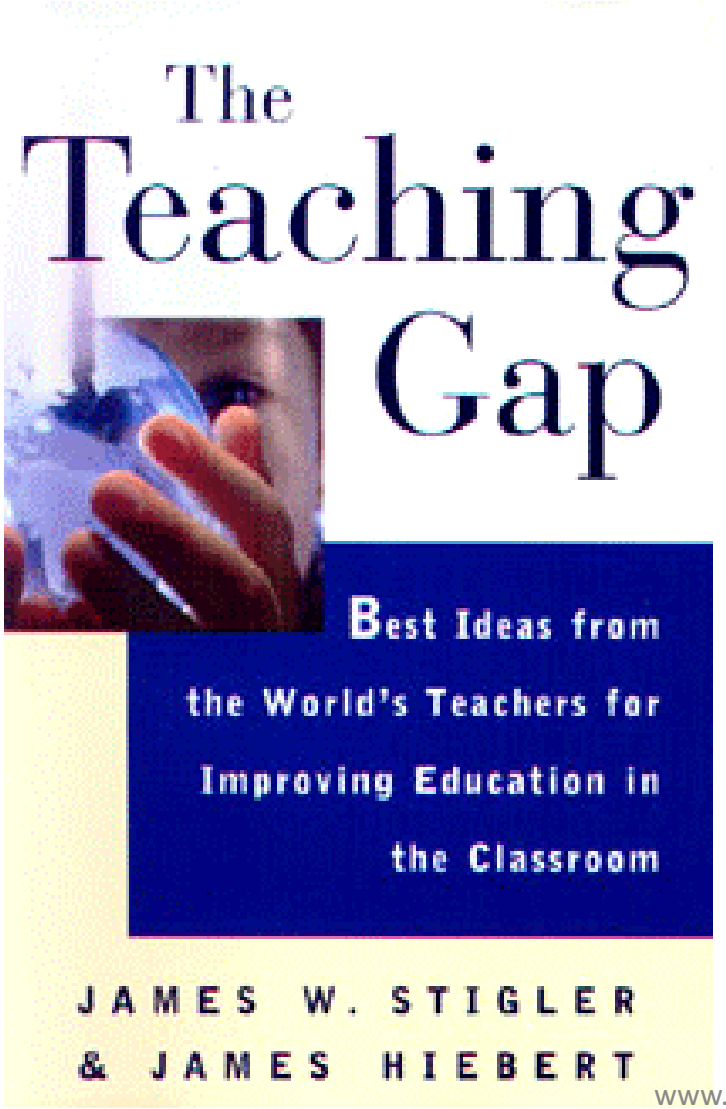
Introduction 2

- What would you like to work on?
- What I say won't apply ***exactly*** to your classroom situation
- You won't be leaving here with resources that you can use in class tomorrow!
- Share some ideas and experiences about teaching maths

Patterns of maths lessons

A	B	C
Review homework or remind children of accomplishments so far	Review the previous lesson with a brief teacher lecture or summary by students	Review previous material: Check homework or engage in warm-up activity
Present the topic and problems for the day	Present the problem for the day. One problem only.	Demonstrate how to solve problems for the day by presenting a few sample problems and demonstrating how to solve them
Students or teachers develop procedures to solve the problem(s) at the board, taking suggestions from other students and the teacher	Students work individually on problems first and then in groups for 5-10 minutes	Practise problems similar to those for which solutions were demonstrated
Practise doing problems similar to those worked on above	Students (selected by teacher) present and discuss one or more solution methods.	Correct class work and assign homework
	Highlight and summarise major points	
GERMANY	**JAPAN**	**UNITED STATES**

“Teaching is a Cultural Activity”



“Some people think that teaching is an innate skill, something you’re born with. Others think that teachers learn to teach by enrolling in college teacher-training programmes. Neither is the best description. Teaching, like other cultural activities is learning through informal participation over long periods of time. It is something one learns to do more by growing up in a culture than by studying it formally.”

“If you always do what you’ve always done, you’ll always get what you’ve always got.”

If what you’re doing isn’t working, try something new.

Mathematical Knowledge for Teaching

$$\begin{array}{r} 35 \\ \times\ 25 \\ \hline 875 \end{array}$$

Coláiste Mhuire
MARINO
Institute of Education

How Did this Student Get this Answer?

$$
\begin{array}{r}
35 \\
\times\ 25 \\
\hline
255 \\
+800 \\
\hline
1055
\end{array}
$$

Example from Deborah Ball

Clip 1: Mathematics Question

How much would ¼ kg of mushrooms cost if the price was €0.62 per 100g?

Image taken from http://whatscookingamerica.net/Mushrooms.jpg

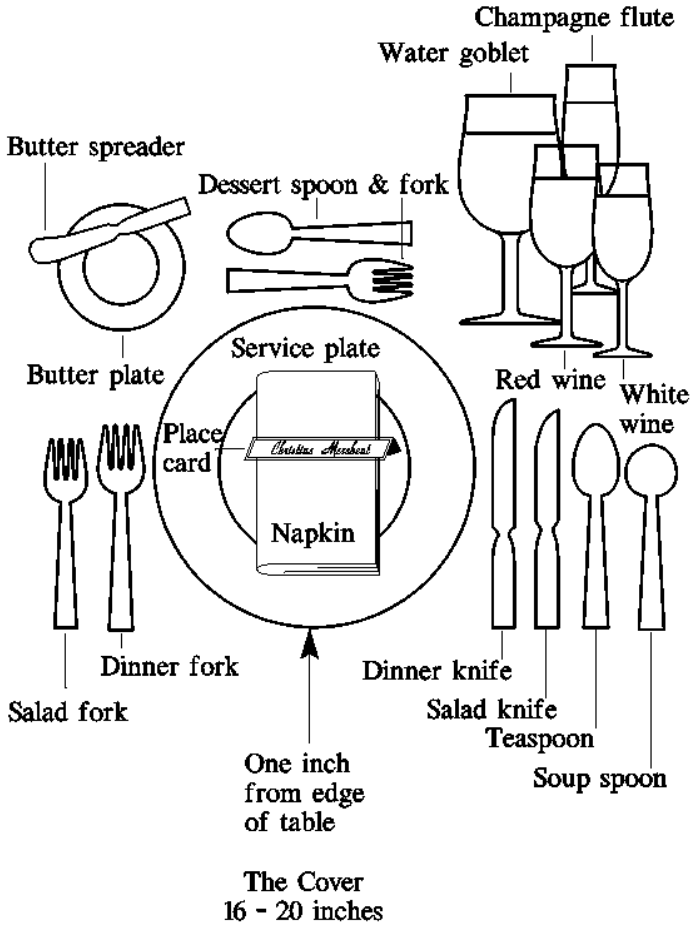
Clip 2: Define an Odd Number

Piaget's Theory of Mathematical Knowledge

- Physical knowledge
- Social Conventional Knowledge
- Logico-Mathematical Knowledge

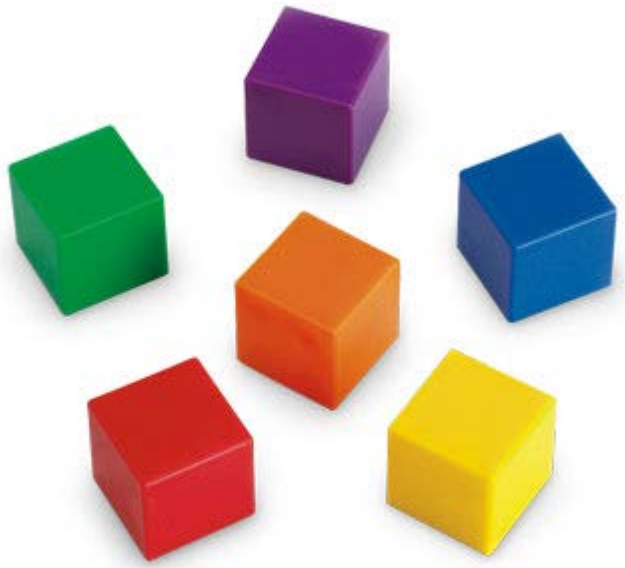
Physical Knowledge

Social Conventional Knowledge



Coláiste Mhuire
MARINO
Institute of Education

Logico-Mathematical Knowledge



Links to Kamii Videos

http://www.youtube.com/watch?v=MCaAeGcZFWI

http://www.youtube.com/watch?v=cz4t51wBGIo

http://www.youtube.com/watch?v=-HEUgHlco_w

The key to improving mathematics teaching is...

...NOT


MATHS
MATTERS
Maths Matters
The Super Sevens
Welcome to the Super Sevens Number Party
Mathemagic 2
Maths for Primary Schools


WE
RECYCLE

BUT...

...getting children to think and talk mathematically

Asking questions such as...

Why?

Could it be done another way?

HOW DID YOU GET THAT?

Estimate

EXPLAIN

Compare

Tell me about…

Put into your own words

How does that connect with…?

Describe

Do you agree or disagree?

How can you be sure?

Coláiste Mhuire MARINO Institute of Education

Asking questions such as...

Why?

HOW DID YOU GET THAT?

Could i…

…y?

Estim…

EXPLAIN

Compare

Tell me about…

…t into your own words

…does that connect with…?

Do you agree or disagree?

…be

How can you be sure?

...and genuinely engaging with the response.

Help Children Develop their Mathematical Language

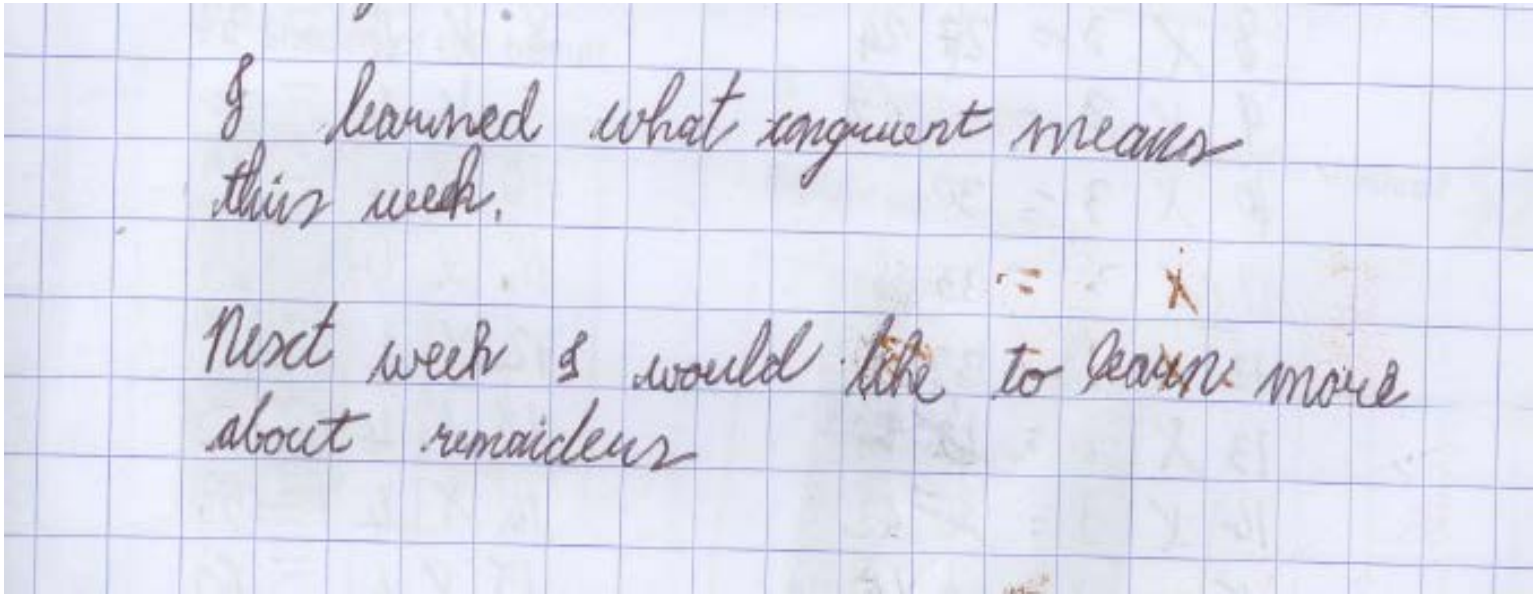
- Factor
- Odd
- Share
- Difference
- Product
- Sum
- Prime
- Face
- Improper …

And Children can **Write** about Maths

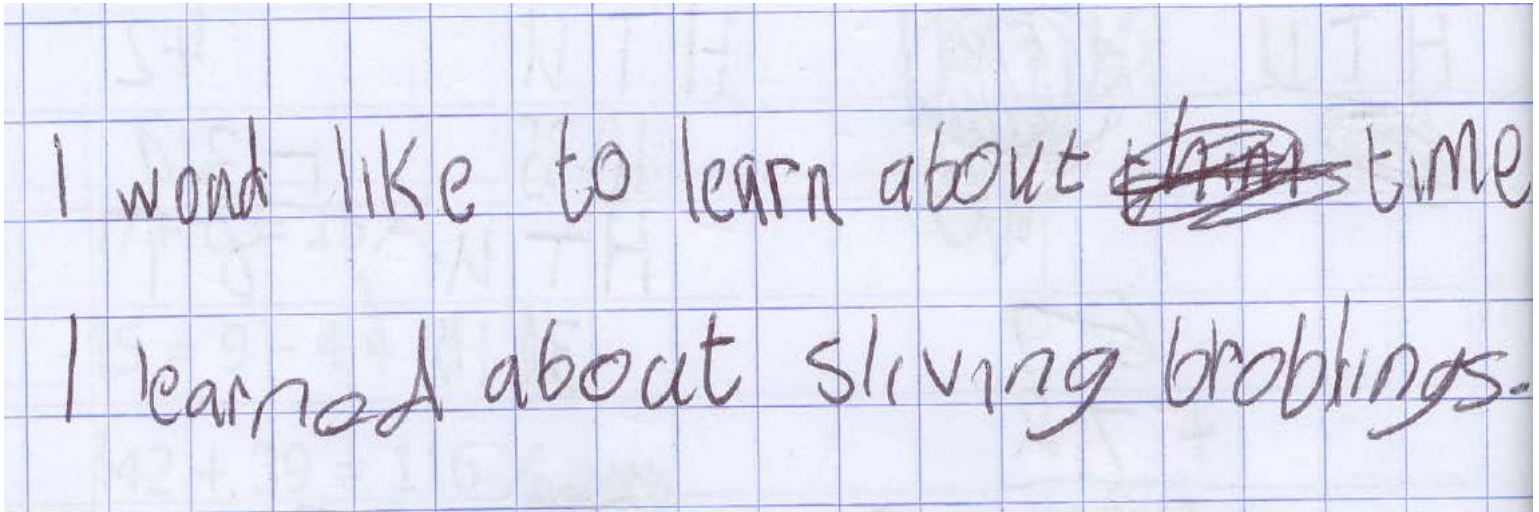
Prompts

- Write down everything you know about...
- Write down what you learned in class today
- Write down one question you still have about...
- After our discussion, write down what you think...
- What would you say to some who thinks that ...?
- Write down what you would like to learn about in maths next week

Some Samples of Children's Writing about Maths

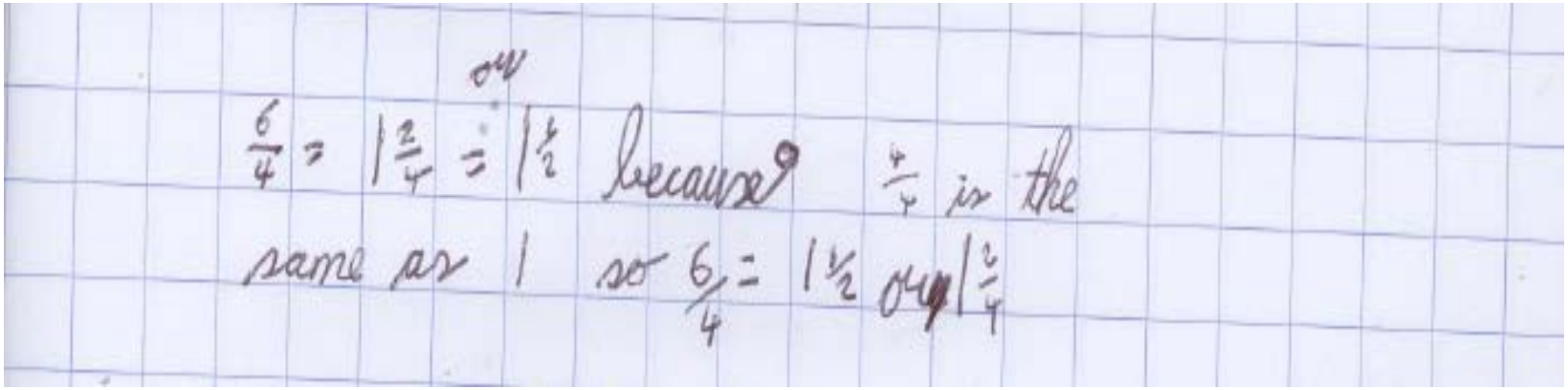

I learned what congruent means this week.

Next week I would like to learn more about remainders

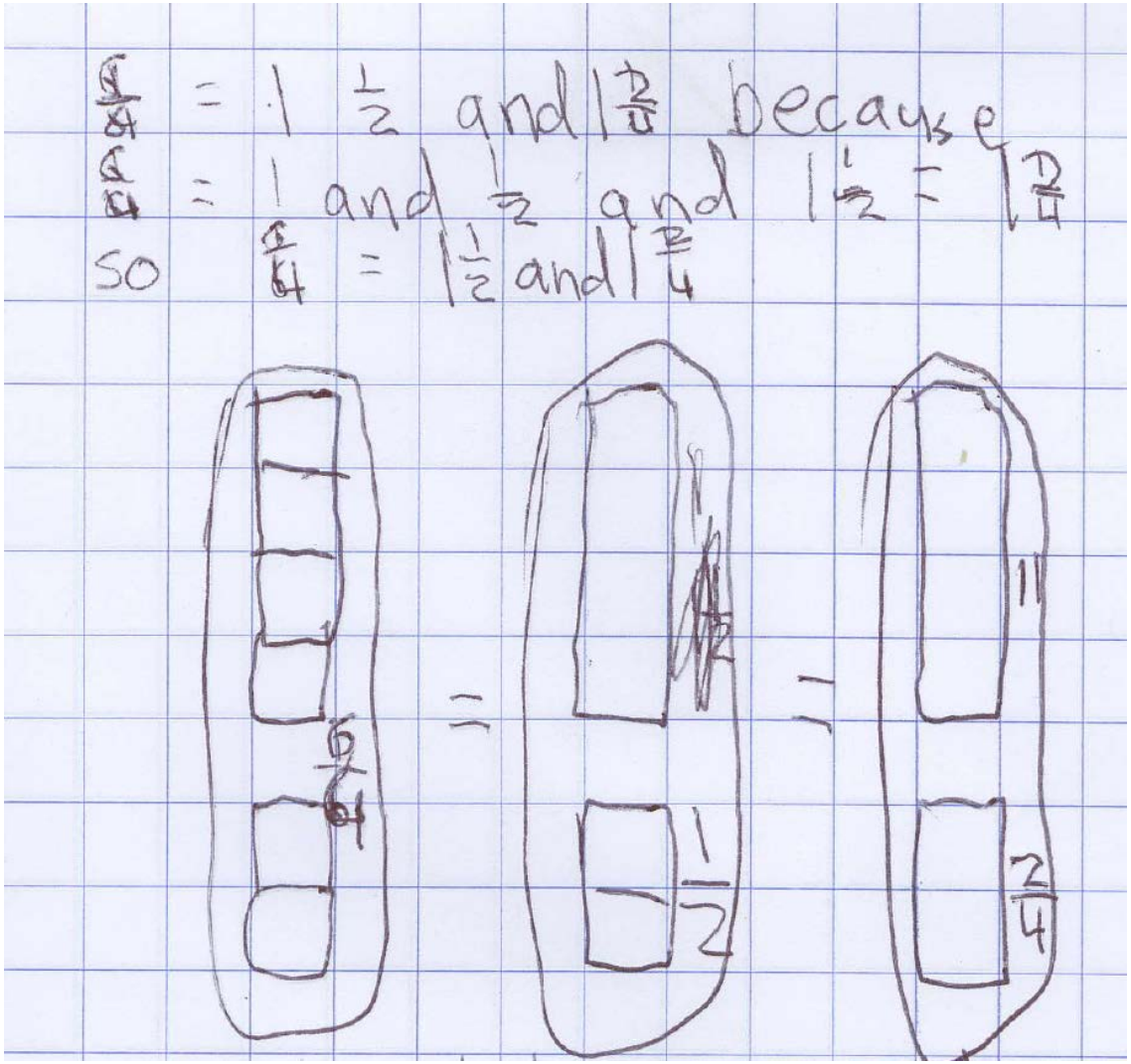

I wond like to learn about ~~time~~ time

I learned about sliving broblings.

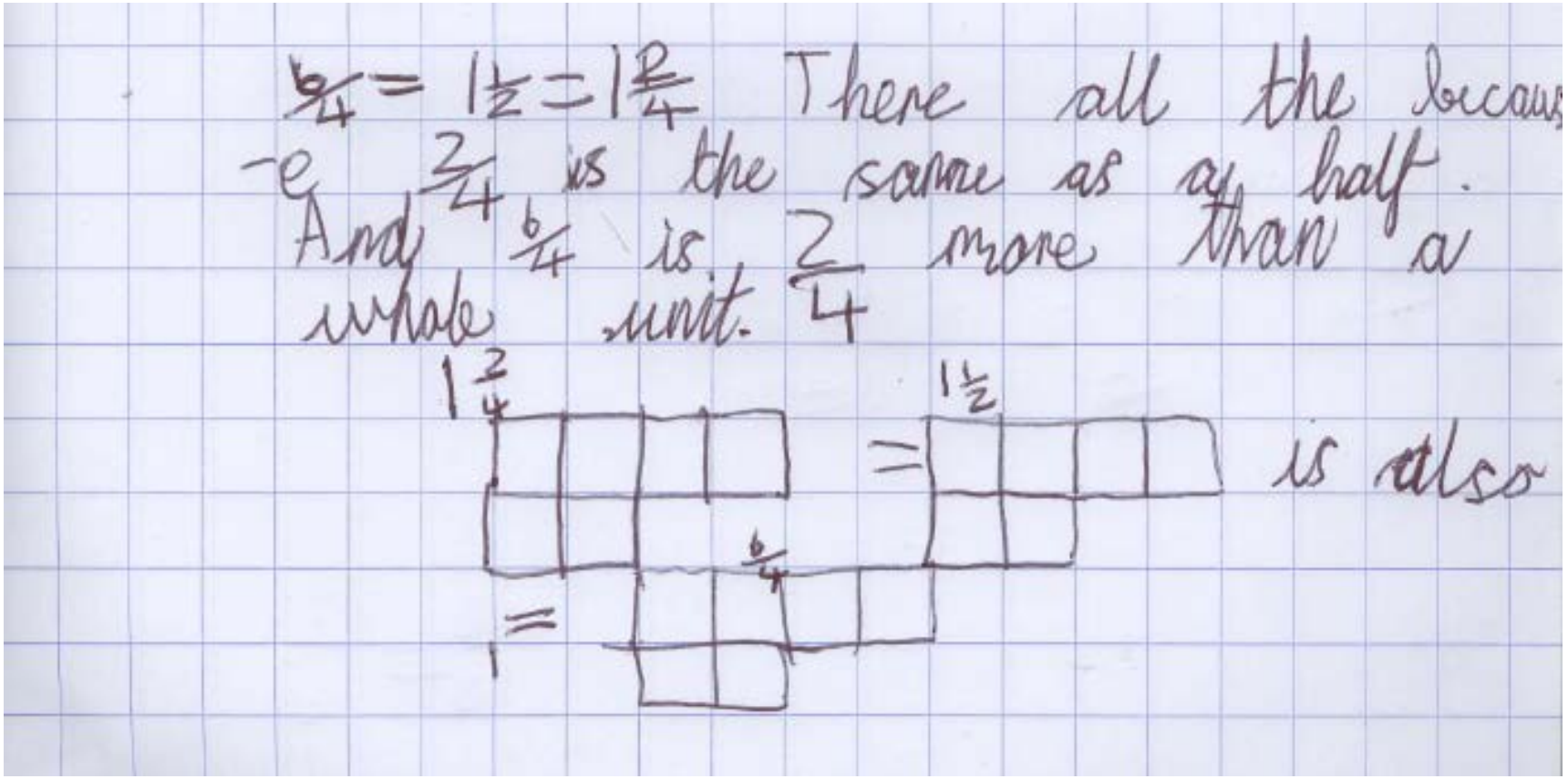
Why would one person get an answer of 1 ½ and another get 6/4 to the same problem?



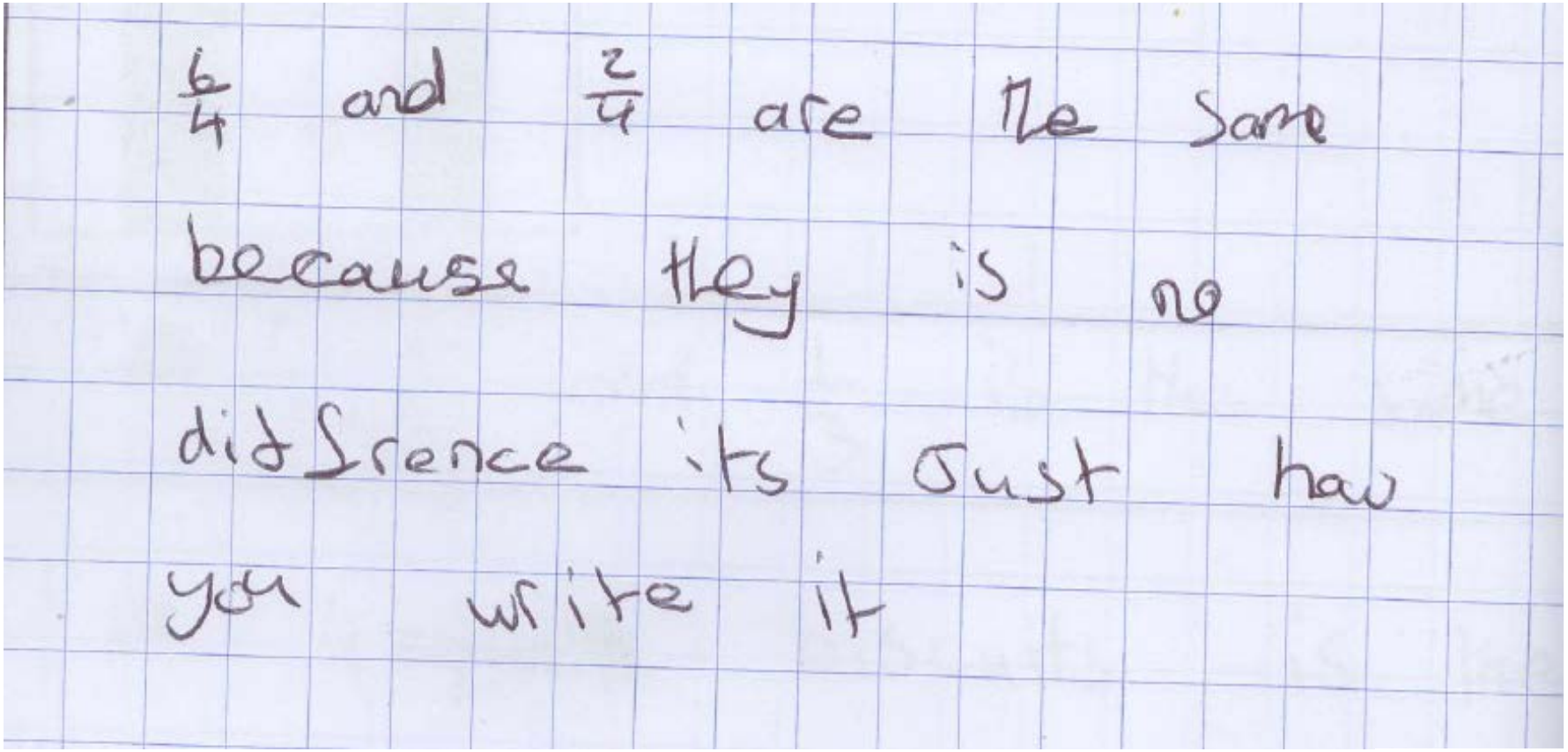
Why would one person get an answer of 1 ½ and another get 6/4 to the same problem?



Why would one person get an answer of 1 ½ and another get 6/4 to the same problem?



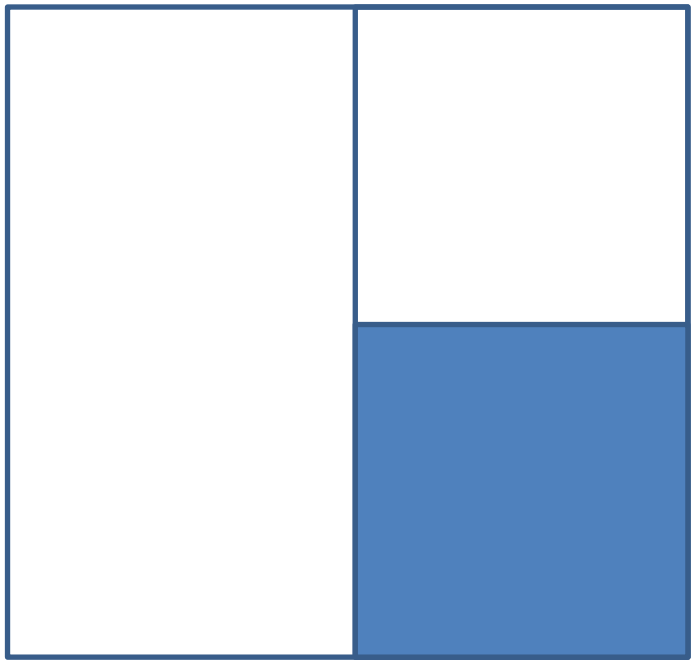
Why would one person get an answer of 1 ½ and another get 6/4 to the same problem?



Common misconceptions/errors in maths 1

- $46 - 28 = 22$
- $50\% > {}^{4}/_{5}$
- $8.35 > 8.5$
- 20 minutes less than an hour is 80 minutes

Common misconceptions/errors in maths 2



1/3 is shaded

9 minutes to 1

Common misconceptions/errors in maths 3

B

A

Parcel B is heavier than parcel A

Principles

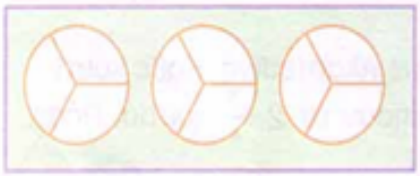
- Making errors is a natural part of learning mathematics
- Errors provide insights into children's understanding of mathematical ideas
- If errors are not made visible, a teacher cannot address them
- Children don't get "confused" by talking about mistakes

Strategies for Responding to Errors

- Encourage language of agreeing and disagreeing with ideas rather than saying that someone is right or wrong
- Thank children for bringing up something that is potentially confusing for others
- If children don't raise potential errors, refer to another class you taught where some children thought that.... Ask: Why might someone think that ....
- Follow up by discussing "how can we help the children in this class to remember that...?"

Worked Example in a Textbook from Cyprus

Constantinos's father bought 3 pizzas for his son's birthday party. The kids ate $1\frac{1}{3}$ pizzas. How many pizzas were left?

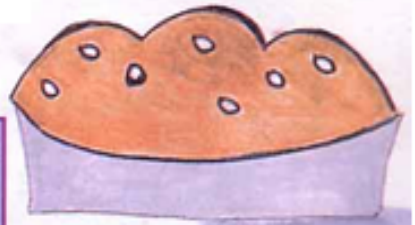


Color the pizza that was eaten.

There were $2\frac{1}{4}$ apple pies in the pan. The kids ate $1\frac{3}{4}$ apple pies.

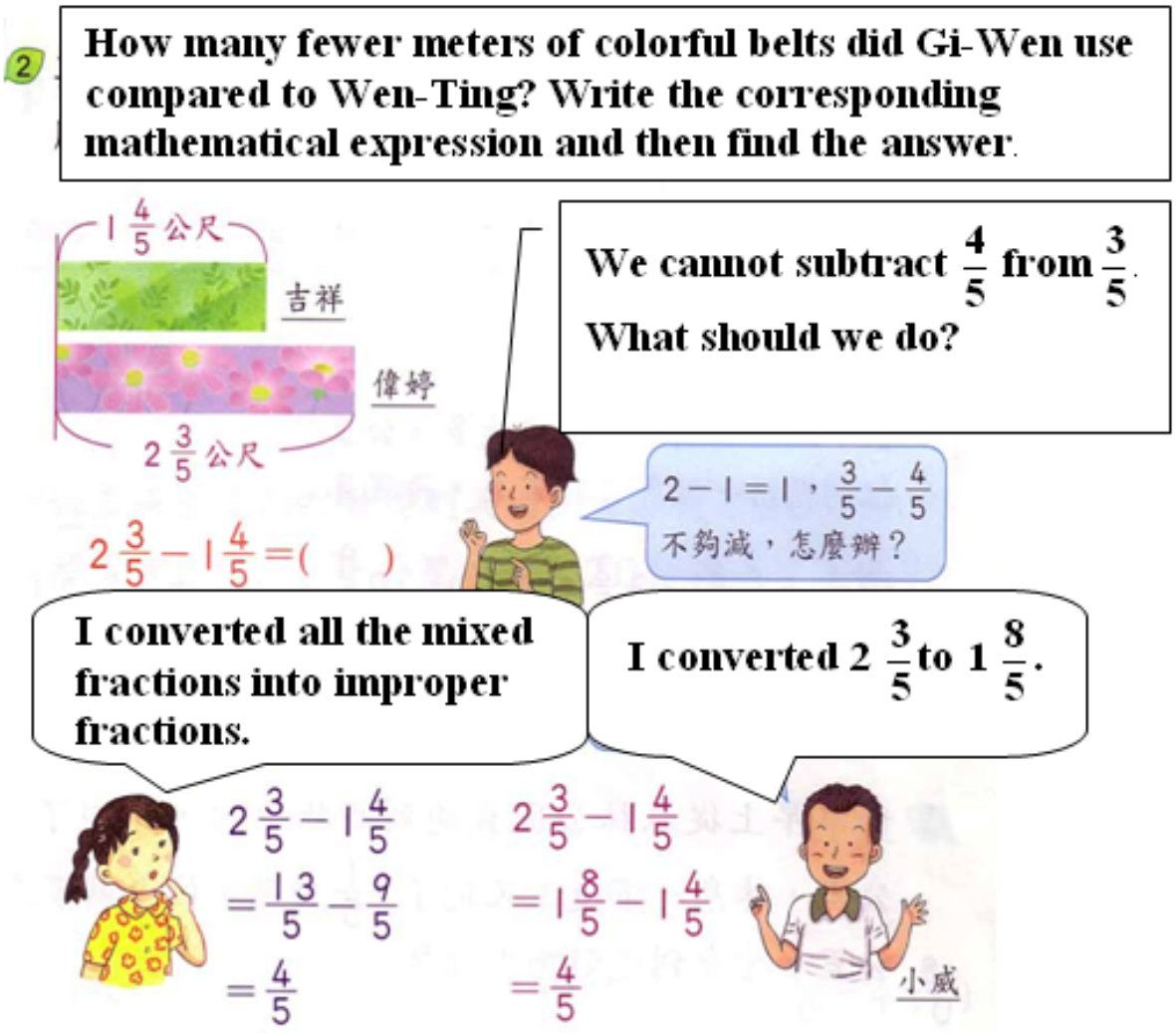
How many apple pies were left?

Color the part that kids ate.



From Charalambous et al, 2010

Worked Example in a Textbook from Taiwan



From Charalambous et al, 2010

Worked Examples in 2 Textbooks from Ireland

Example 2: $4\frac{1}{6} - 2\frac{3}{4}$

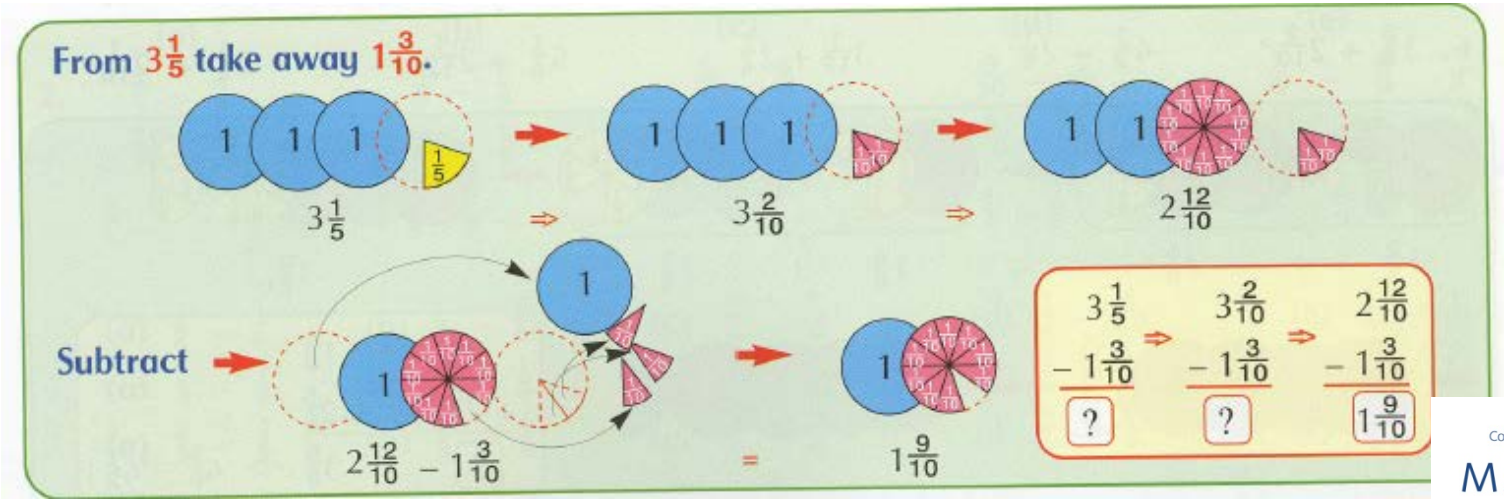
$\frac{1}{6} = \frac{2}{12}$

$\frac{3}{4} = \frac{6}{8} = \frac{9}{12}$

$4\frac{1}{6} = 4\frac{2}{12} = 3\frac{14}{12}$ (by renaming)

$-2\frac{3}{4} = -2\frac{9}{12} = -2\frac{9}{12}$

$1\frac{5}{12}$



From Charalambous et al, 2010

Coláiste Mhuire MARINO Institute of Education

Algorithms for

- Addition
- Subtraction
- Multiplication
- Division

Problem Solving Strategy 1

RUDE

- Read the problem
- Underline the key words
- Draw a diagram of the problem
- Estimate your answer and then solve the problem

Problem Solving Strategy 2

STAR

- Search the word problem (info)
- Translate the words into an equation or picture (plan)
- Answer the problem (solve)
- Review the solution (check)

Problem Solving Strategy 3

LUV2C

- Look
- Underline
- Visualise
- Choose Numbers
- Calculate

Problem Solving in Maths

- Little evidence that such strategies work
- Some evidence that classifying problems into problem-types can be helpful for children with learning disabilities
- Best way to learn problem solving is to practise solving problems
- Skill in problem solving develops slowly over time
- Many textbooks have too many problems, and many of the problems are of poor quality

A Good Problem

- Should leave the solver feeling “stuck” at first
- The maths is what makes the problem problematic
- Relates to the children’s experience
- Connects different maths topics
- Allows children with different attainment levels to achieve success with it
- May take time, even days, to complete
- Requires children to justify and explain their answers and methods

Sample Problem

- I have 10-cent, 5-cent and 1-cent coins in my money box. If I open the box and take out three coins, how much money could I have? How can you be sure that you have found all the possible amounts?

Other Sample Problems

Donal has 6 jelly tots, Diana has 2 and Enda has 4. They want to share them equally. How will they do it? Draw a picture to help explain your answer.

If you did not know the answer to 12 – 7, what are some ways you could find the answer?

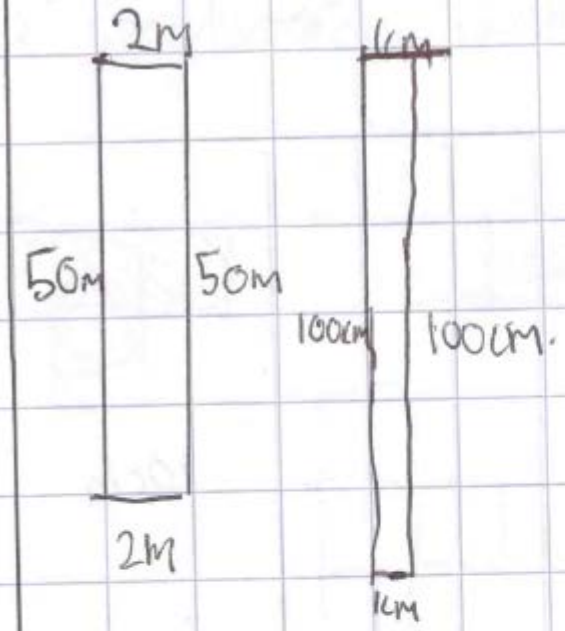
Explain two different ways to multiply 4 x 276 in your head. Which way is easier to use? Would you use a different way to multiply 5 x 98? Explain why you would use the same or different methods.

Source: Van de Walle

Solve this problem

Dublin Zoo has just received two new sheep for the Family Farm part of the zoo. The zoo keeper wants to build an enclosure for the sheep. She decides that the enclosure must be square or rectangular with an area of 100 square metres.

- Which different configurations could she build?
- How many metres of fencing will she need for each possible design?
- Use your copy or some graph paper to draw all the possible rectangular or square designs.
- Include a key to tell how much each unit on the grid paper equals.
- Which configuration would you recommend that the zoo keeper builds? Why?



We ~~(e e)~~ recommend the 20m X 5m because ~~there's~~ enough space for the sheep to move around

And It's not to big and Its not to small.

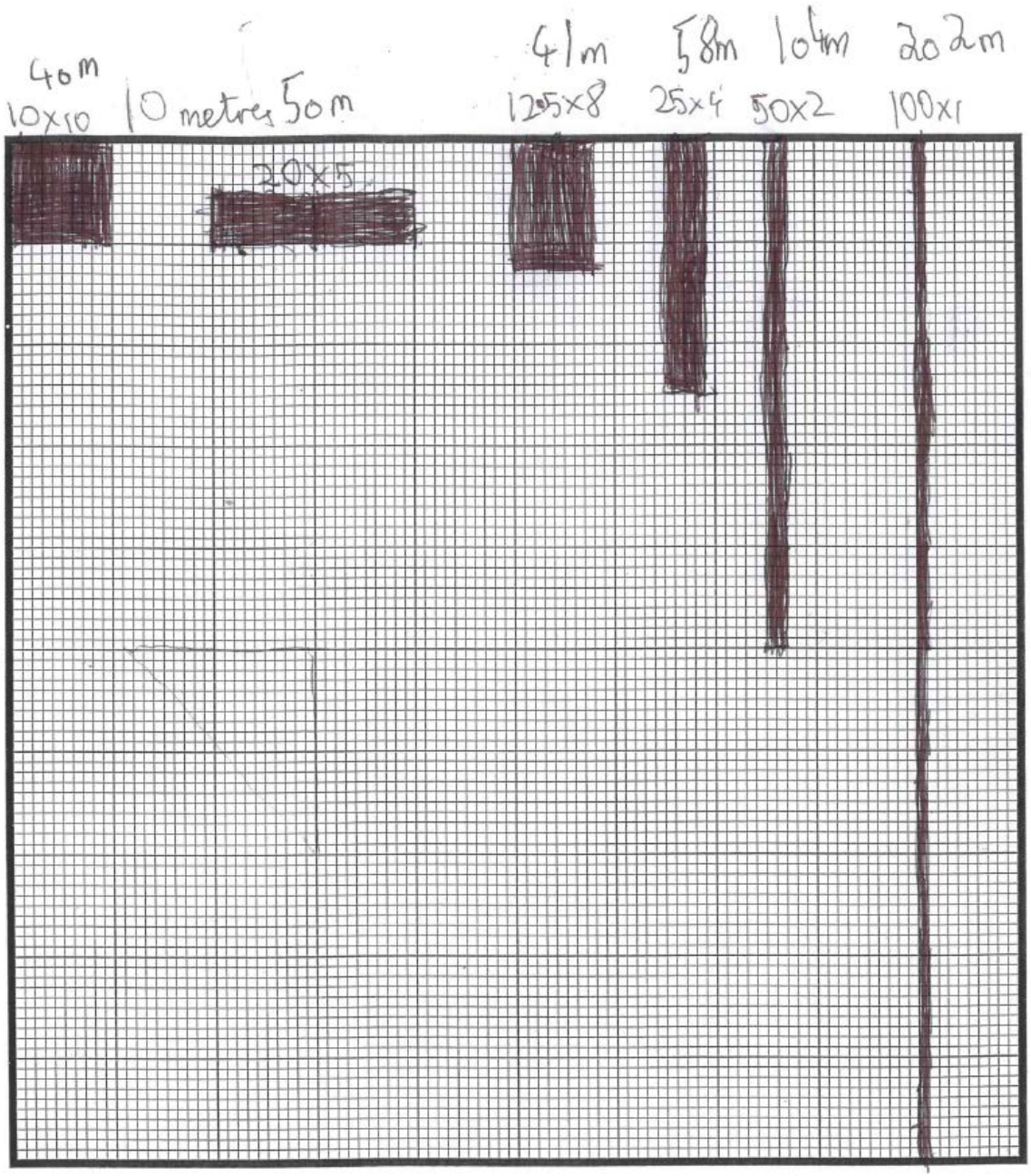
I would pick
10 X 10
because it has lot
of room if you
put more sheep in!

I would recomend

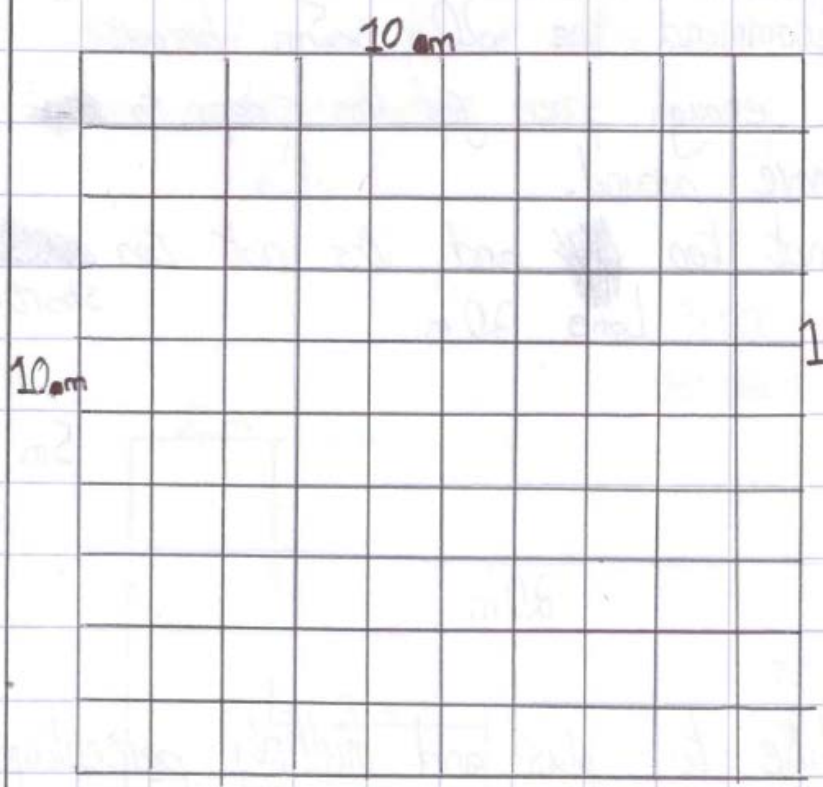
lox lo because it is the

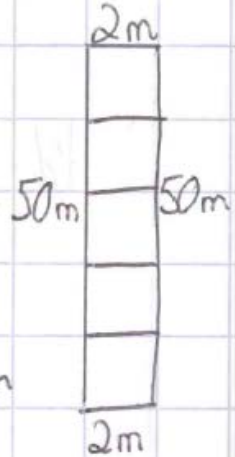
most even one.

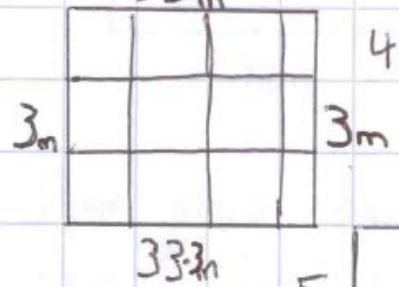
10m x 10m or 12.5m x 8m. The perimeter of the first one is 40m closely followed by the second on (#) 41m. Because these are so short the are less expensive to fence. They also give lots of width for the animals.

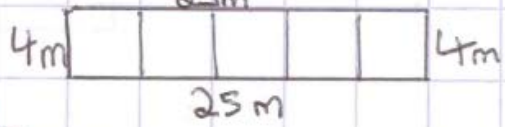


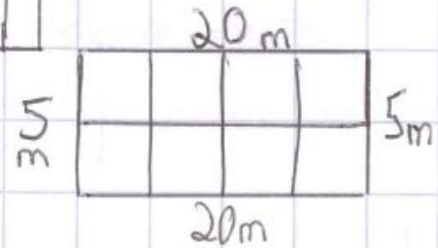
7/5/11











"CONFIGurations" 7/5/11

① 10m x 10m = 100m² →

② 25m x 4m = 100 m² →

③ 20m x 5m = 100 m² →

④ 50m x 2m = 100m² →

⑤ 1m x 100m = 100m² ↗

Sources of Good Problems??

- http://nrich.maths.org/public/
- http://www.nctm.org/

Here was a site that one of you suggested.

- http://nzmaths.co.nz/

Revoicing

- Can you repeat what ..... said?
- Can you put what ..... said in your own words?

Use it to

- Amplify important points
- Check that children are listening
- Clarify what a child is thinking/saying

Aquatics


9FT6IN

Swimming Calculations

- What is the length of our local swimming pool?
- If I swam the following number of lengths, how far would I have swum?

Multiplying

1 length
2 lengths
3 lengths
10 lengths
50 lengths
½ length

Say how you figured out each one.

The numbers you choose here allow you to differentiate among learners in the class. Some children will do them all and more complicated ones. Others will just do some of these. Try to help each child do better than they think they can do.

- If the pool is 25 metres long, how many lengths would I have to swim in order to swim

Dividing

50 metres
100 metres?
250 metres?
500 metres?
a kilometre?
5 metres?

Say how you figured out each one.

Sort this PE Equipment

Could be sorted by

Criteria	(Categories)
• Colour	(yellow, blue, two-colour etc.)
• Type	(cone, bat, ball etc.)
• Material	(wood, plastic, leather etc.)
• Shape	(sphere, non-sphere; round, not round etc.)
• Use	(throwing and catching, hitting, marking etc.)
• Property	(can roll, can stack, can slide etc.)

Principles when setting a sorting task

- Sorting one set of objects in multiple ways is better than sorting multiple sets of objects in one way each
- Children must choose the criteria and categories for sorting
- It’s good if there are some ambiguous categories that require discussion

Figure out the score in points in each of the following GAA matches

Who won each match?
By how much did they win?

This activity introduces children to calculations of the form (a x 3) + (b x 1) = c in a concrete way. This is important for understanding place value and multiplication of 2-digit numbers.

Clarifying link to place value and multiplying

Goals	Points	Score in Points
2	7	(2 x 3) + (7 x 1) =13

Tens	Units	Value of Number
3	6	(3 x 10) + (6 x 1) = 36

$$\begin{array}{r} 23 \\ \times\ 4 \\ \hline 92 \end{array}$$

(4 x 3) + (4 x 20) = 92

Coláiste Mhuire MARINO Institute of Education

GAA score problem

If your team's score in a camogie match was 23 points, what could the score have been in goals and points?

Allows for differentiation

Have you found all the possible solutions?

Some possible solutions to GAA score problem

0 – 23

1 – 20

2 – 17

3 – 14

4 – 11

5 – 8

6 – 5

7 – 2

Could there be other possible scores? Justify your answer.

Could the team have scored exactly 18 points and some goals? Why? Why not?

Do you notice any pattern in the solutions?

Could be applied to rugby (try, conversion, penalty)

Number Facts/Tables

Take a Minute or Two to Memorise these Addresses and Work Places

Charlie David lives on George Avenue

Charlie George lives on Albert Zoe Avenue

George Ernie lives on Albert Bruno Avenue

Charlie David works on Albert Bruno Avenue

Charlie George works on Bruno Albert Avenue

George Ernie works on Charlie Ernie Avenue

From Dehaene (1997) *The Number Sense* (p. 127)

Coláiste Mhuire
MARINO
INSTITUTE OF EDUCATION

The Sentences are Roughly Equivalent to:

- 3+ 4 = 7
- 3 + 7 = 10
- 7 + 5 = 12

Charlie David lives on George Avenue

Charlie George lives on Albert Zoe Avenue

George Ernie lives on Albert Bruno Avenue

- 3 x 4 = 12
- 3 x 7 = 21
- 7 x 5 = 35

Charlie David works on Albert Bruno Avenue

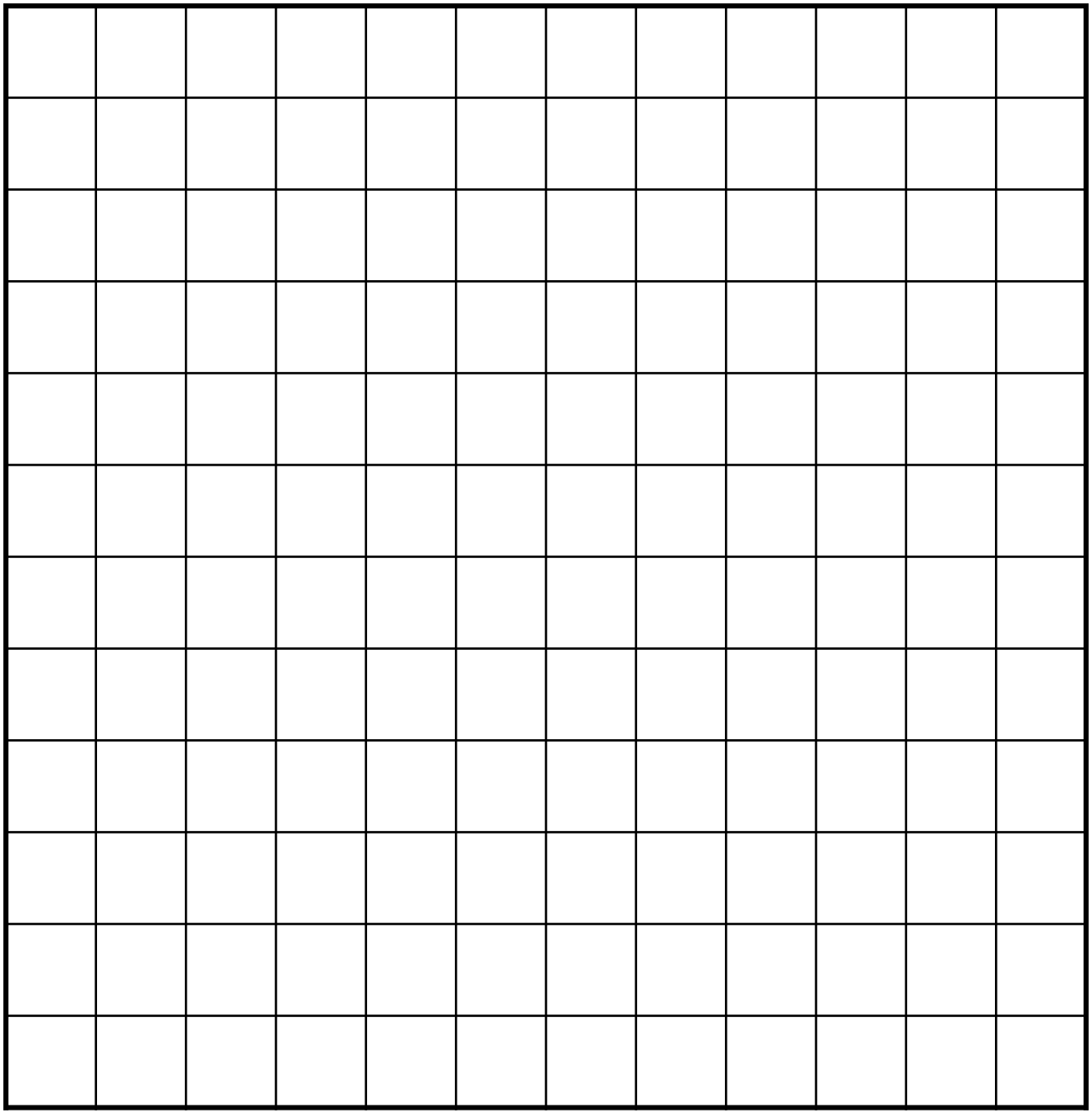
Charlie George works on Bruno Albert Avenue

George Ernie works on Charlie Ernie Avenue

Addition and Multiplication Number Facts

ADDITION NUMBER FACTS IN FIRST CLASS

Start with a blank 12x12 grid



Show the children how the addition square works by giving some examples e.g. 1+

+	0	1	2	3	4	5	6	7	8	9	10
0		1									
1		2									
2		3									
3		4									
4		5									
5		6									
6		7									
7		8									
8		9									
9		10									
10		11									

Or 6+

+	0	1	2	3	4	5	6	7	8	9	10
0							6				
1							7				
2							8				
3							9				
4							10				
5							11				
6							12				
7							13				
8							14				
9							15				
10							16				

BUILD UP THE REST OF THE ADDITION SQUARE

+	0	1	2	3	4	5	6	7	8	9	10
0	0	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10	11
2	2	3	4	5	6	7	8	9	10	11	12
3	3	4	5	6	7	8	9	10	11	12	13
4	4	5	6	7	8	9	10	11	12	13	14
5	5	6	7	8	9	10	11	12	13	14	15
6	6	7	8	9	10	11	12	13	14	15	16
7	7	8	9	10	11	12	13	14	15	16	17
8	8	9	10	11	12	13	14	15	16	17	18
9	9	10	11	12	13	14	15	16	17	18	19
10	10	11	12	13	14	15	16	17	18	19	20

MAKE THE ADDITION FACTS EASIER BY ELIMINATING THE …

COMMUTATIVE PAIRS

+	0	1	2	3	4	5	6	7	8	9	10
0	0	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10	11
2	2	3	4	5	6	7	8	9	10	11	12
3	3	4	5	6	7	8	9	10	11	12	13
4	4	5	6	7	8	9	10	11	12	13	14
5	5	6	7	8	9	10	11	12	13	14	15
6	6	7	8	9	10	11	12	13	14	15	16
7	7	8	9	10	11	12	13	14	15	16	17
8	8	9	10	11	12	13	14	15	16	17	18
9	9	10	11	12	13	14	15	16	17	18	19
10	10	11	12	13	14	15	16	17	18	19	20

…THE +0 FACTS

0+0

1+0

2+0

3+0

4+0

5+0

6+0

7+0

8+0

9+0

10+0

+	0	1	2	3	4	5	6	7	8	9	10
0	0	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10	11
2	2	3	4	5	6	7	8	9	10	11	12
3	3	4	5	6	7	8	9	10	11	12	13
4	4	5	6	7	8	9	10	11	12	13	14
5	5	6	7	8	9	10	11	12	13	14	15
6	6	7	8	9	10	11	12	13	14	15	16
7	7	8	9	10	11	12	13	14	15	16	17
8	8	9	10	11	12	13	14	15	16	17	18
9	9	10	11	12	13	14	15	16	17	18	19
10	10	11	12	13	14	15	16	17	18	19	20

…THE +1 FACTS

1+1

2+1

3+1

4+1

5+1

6+1

7+1

8+1

9+1

10+1

+	0	1	2	3	4	5	6	7	8	9	10
0	0	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10	11
2	2	3	4	5	6	7	8	9	10	11	12
3	3	4	5	6	7	8	9	10	11	12	13
4	4	5	6	7	8	9	10	11	12	13	14
5	5	6	7	8	9	10	11	12	13	14	15
6	6	7	8	9	10	11	12	13	14	15	16
7	7	8	9	10	11	12	13	14	15	16	17
8	8	9	10	11	12	13	14	15	16	17	18
9	9	10	11	12	13	14	15	16	17	18	19
10	10	11	12	13	14	15	16	17	18	19	20

…THE +2 FACTS

2+2

3+2

4+2

5+2

6+2

7+2

8+2

9+2

10+2

+	0	1	2	3	4	5	6	7	8	9	10
0	0	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10	11
2	2	3	4	5	6	7	8	9	10	11	12
3	3	4	5	6	7	8	9	10	11	12	13
4	4	5	6	7	8	9	10	11	12	13	14
5	5	6	7	8	9	10	11	12	13	14	15
6	6	7	8	9	10	11	12	13	14	15	16
7	7	8	9	10	11	12	13	14	15	16	17
8	8	9	10	11	12	13	14	15	16	17	18
9	9	10	11	12	13	14	15	16	17	18	19
10	10	11	12	13	14	15	16	17	18	19	20

…THE TEN AND FACTS

10+3

10+4

10+5

10+6

10+7

10+8

10+9

10+10

+	0	1	2	3	4	5	6	7	8	9	10
0	0	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10	11
2	2	3	4	5	6	7	8	9	10	11	12
3	3	4	5	6	7	8	9	10	11	12	13
4	4	5	6	7	8	9	10	11	12	13	14
5	5	6	7	8	9	10	11	12	13	14	15
6	6	7	8	9	10	11	12	13	14	15	16
7	7	8	9	10	11	12	13	14	15	16	17
8	8	9	10	11	12	13	14	15	16	17	18
9	9	10	11	12	13	14	15	16	17	18	19
10	10	11	12	13	14	15	16	17	18	19	20

…THE DOUBLES

3+3

4+4

5+5

6+6

7+7

8+8

9+9

+	0	1	2	3	4	5	6	7	8	9	10
0	0	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10	11
2	2	3	4	5	6	7	8	9	10	11	12
3	3	4	5	6	7	8	9	10	11	12	13
4	4	5	6	7	8	9	10	11	12	13	14
5	5	6	7	8	9	10	11	12	13	14	15
6	6	7	8	9	10	11	12	13	14	15	16
7	7	8	9	10	11	12	13	14	15	16	17
8	8	9	10	11	12	13	14	15	16	17	18
9	9	10	11	12	13	14	15	16	17	18	19
10	10	11	12	13	14	15	16	17	18	19	20

…THE NEAR DOUBLES

3+4

4+5

5+6

6+7

7+8

8+9

+	0	1	2	3	4	5	6	7	8	9	10
0	0	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10	11
2	2	3	4	5	6	7	8	9	10	11	12
3	3	4	5	6	7	8	9	10	11	12	13
4	4	5	6	7	8	9	10	11	12	13	14
5	5	6	7	8	9	10	11	12	13	14	15
6	6	7	8	9	10	11	12	13	14	15	16
7	7	8	9	10	11	12	13	14	15	16	17
8	8	9	10	11	12	13	14	15	16	17	18
9	9	10	11	12	13	14	15	16	17	18	19
10	10	11	12	13	14	15	16	17	18	19	20

…THE TEN AND NINE FACTS AND FIVE AND FACTS

6+4

7+3

6+3

5+3

+	0	1	2	3	4	5	6	7	8	9	10
0	0	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10	11
2	2	3	4	5	6	7	8	9	10	11	12
3	3	4	5	6	7	8	9	10	11	12	13
4	4	5	6	7	8	9	10	11	12	13	14
5	5	6	7	8	9	10	11	12	13	14	15
6	6	7	8	9	10	11	12	13	14	15	16
7	7	8	9	10	11	12	13	14	15	16	17
8	8	9	10	11	12	13	14	15	16	17	18
9	9	10	11	12	13	14	15	16	17	18	19
10	10	11	12	13	14	15	16	17	18	19	20

…THE THROUGH TEN FACTS

7+4

7+5

8+3

8+4

8+5

8+6

9+3

9+4

9+5

9+6

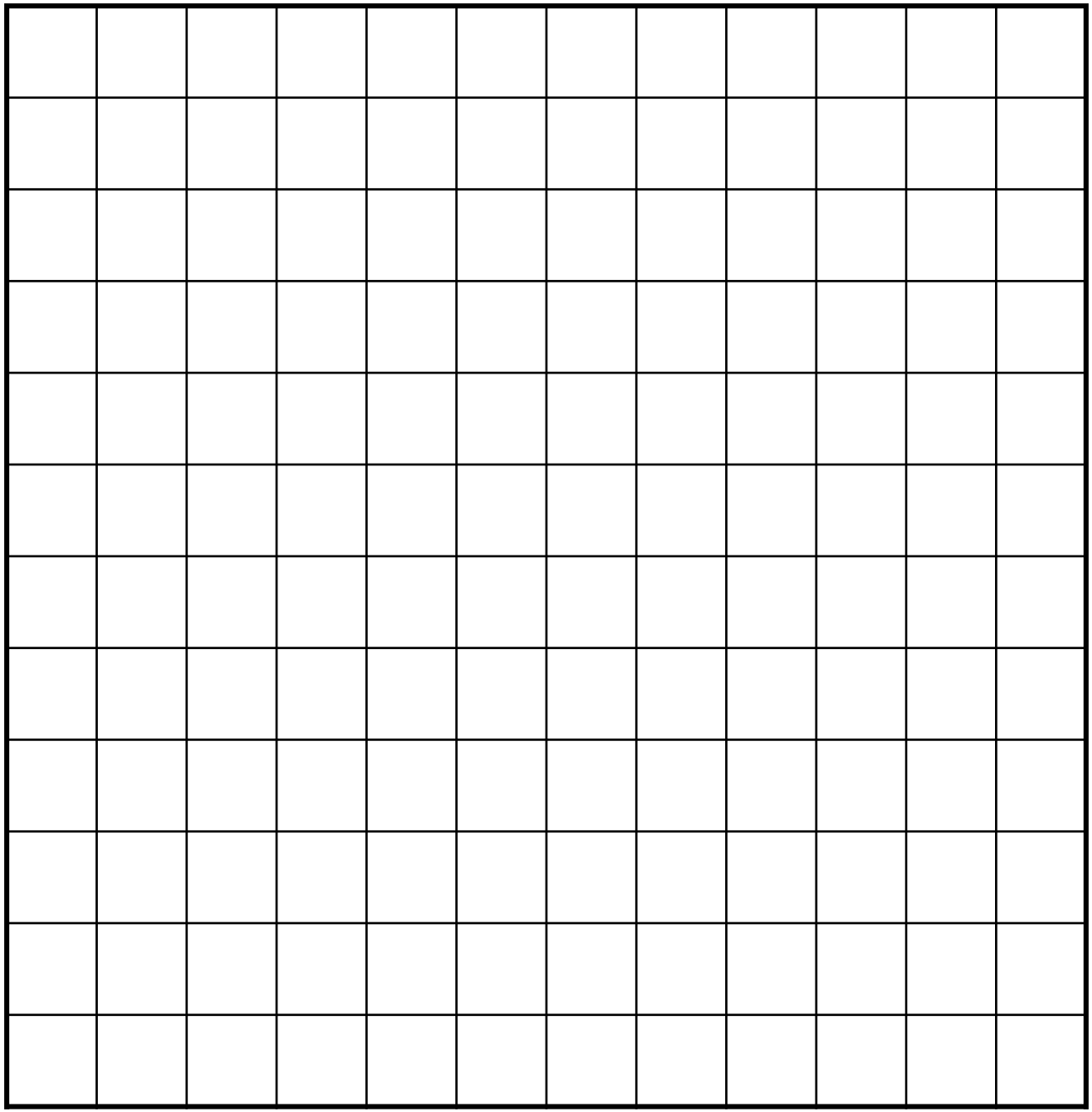
9+7

+	0	1	2	3	4	5	6	7	8	9	10
0	0	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10	11
2	2	3	4	5	6	7	8	9	10	11	12
3	3	4	5	6	7	8	9	10	11	12	13
4	4	5	6	7	8	9	10	11	12	13	14
5	5	6	7	8	9	10	11	12	13	14	15
6	6	7	8	9	10	11	12	13	14	15	16
7	7	8	9	10	11	12	13	14	15	16	17
8	8	9	10	11	12	13	14	15	16	17	18
9	9	10	11	12	13	14	15	16	17	18	19
10	10	11	12	13	14	15	16	17	18	19	20

Multiplication

MULTIPLICATION NUMBER FACTS IN THIRD CLASS

Start with a blank 12x12 grid



SHOW THE CHILDREN HOW IT WORKS BY GIVING SOME EXAMPLES

Eg. 3x

x	0	1	2	3	4	5	6	7	8	9	10
0				0							
1				3							
2				6							
3				9							
4				12							
5				15							
6				18							
7				21							
8				24							
9				27							
10				30							

SHOW THE CHILDREN HOW IT WORKS BY GIVING SOME EXAMPLES

Eg. 6x

x	0	1	2	3	4	5	6	7	8	9	10
0							0				
1							6				
2							12				
3							18				
4							24				
5							30				
6							36				
7							42				
8							48				
9							54				
10							60				

BUILD UP THE REST OF THE MULTIPLI-CATION TABLE

x	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

PROMOTE UNDER-STANDING OF MULTI-PLICATION FACTS BY POINTING OUT:

COMMUT-ATIVE PAIRS

x	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

PROMOTE UNDER-STANDING OF MULTI-PLICATION FACTS BY POINTING OUT:

ZERO FACTS

x	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

PROMOTE UNDER-STANDING OF MULTI-PLICATION FACTS BY POINTING OUT:

ONE FACTS

x	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

PROMOTE UNDER-STANDING OF MULTI-PLICATION FACTS BY POINTING OUT:

TEN FACTS

x	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

PROMOTE UNDER-STANDING OF MULTI-PLICATION FACTS BY POINTING OUT:

TWO FACTS

x	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

PROMOTE UNDER-STANDING OF MULTI-PLICATION FACTS BY POINTING OUT:

FIVE FACTS

x	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

PROMOTE UNDER-STANDING OF MULTI-PLICATION FACTS BY POINTING OUT:

NINE FACTS

x	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

PROMOTE UNDER-STANDING OF MULTI-PLICATION FACTS BY POINTING OUT:

FOUR FACTS

x	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

PROMOTE UNDER-STANDING OF MULTI-PLICATION FACTS BY POINTING OUT:

THREE FACTS (2 TIMES, ADD ONE MORE)

x	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

SIX, SEVEN AND EIGHT FACTS REMAIN.

x	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

For slides

www.seandelaney.com

sean.delaney@mie.ie

Coláiste Mhuire
MARINO
Institute of Education