Leadership for Learning Day 1: Problem Solving in the Primary Mathematics Curriculum

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Aims of the Day

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- To explore ways of integrating problem solving into the primary mathematics curriculum
- To consider how to support colleagues in developing appropriate strategies for problem solving in their classrooms.

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Outline of the Day

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|	
9.30-9.40	Welcome
9.40-10.00	Working on a mathematical task together
10.00-10.45	Problem solving unpacked
10.45-11.00	Break
11.00-11.20	Reviewing current strengths/priorities for development
11.20-12.15	Problem solving unpacked cont.
12.15-1.00	Lunch
1.00-1.45	Knowledge quartet
1.45-2.30	Curriculum development work
2.30-3.15	Problem solving unpacked cont.
3.15-3.30	Plenary

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Problem Solving Unpacked

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- Tasks
- Naming and drawing attention to problem-solving skills
- Structuring a problem-solving lesson
- Types of problem
- Objectives
- Recording
- Classroom culture

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Totality (1216)

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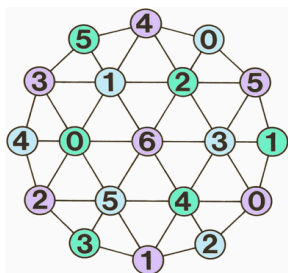
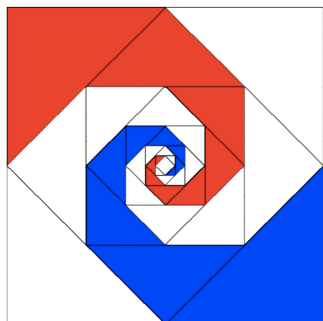## Low Threshold High Ceiling

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- Suitable for whole range
- Low entry point
- Lots of choices in
  - method
  - response
  - recording
- Learners can show what they CAN do, not what they can't
- High 'finish' possible

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Baravelle (6522)

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Rich Tasks

- Have a relatively closed start but offer different responses and different approaches
- Invite own questions
- Combine fluency and reasoning
- Reveal/provoke generalisations
- Encourage collaboration and discussion
- Are intriguing
- May be accessible to all (LTHC)

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Key Problem-solving Skills

visualise

work backwards

reason logically

conjecture

work systematically

look for a pattern

trial and improvement

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Types of Task

- Finding all possibilities
- Visual problems
- Logic problems
- Rules and patterns
- Word problems

From 'Problem solving A CPD pack to support the learning and teaching of mathematical problem solving' published in 2004 by DfES Publications

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Dicey Addition (11863)

Find a partner and a 0-9 dice.

Each of you should draw a blank addition calculation like this:

$$\square\square + \square\square =$$

Take turns to throw the dice and decide which of your cells to fill. You must fill a cell before throwing the dice again.

Each time the dice is thrown, you *both* use that number in one of your cells.

When you have filled all four cells, **whoever has the sum closer to 100 wins.**

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The Problem-solving Process

- Stage 1: Getting started
- Stage 2: Working on the problem
- Stage 3: Digging deeper
- Stage 4: Concluding

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Problem-solving Process

1. Getting started
   - try a simpler case
   - draw a diagram
   - represent with model
   - act it out
2. Working on the problem
   - visualise
   - work backwards
   - reason logically
   - conjecture
   - work systematically
   - look for a pattern
   - trial and improvement
3. Digging deeper
   - generalise
   - verify
   - prove
4. Concluding
   - communicate findings
   - evaluate

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Coded Hundred Square (6554)

This 100 square is written in code. It starts with 1 and ends with 100. Can you build it up?

Start again

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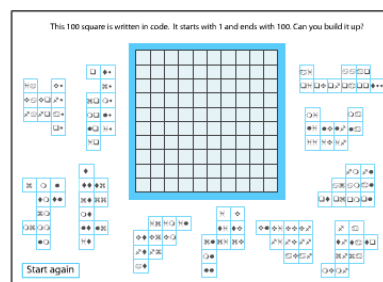
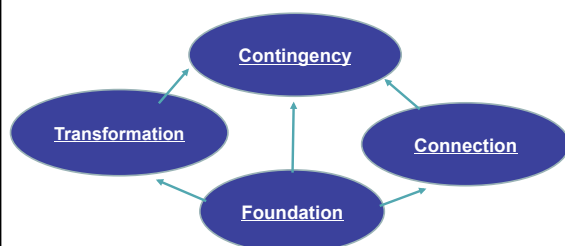**Developing Primary Mathematics Teaching**

Tim Roland, Fay Turner, Anne Thwaites and Peter Huckstep, 2009, SAGE, ISBN 978-1-4129-4848-7

Contingency

Transformation

Connection

Foundation

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The Knowledge Quartet

FOUNDATION

•adheres to textbook; awareness of purpose; concentration on procedures; identifying errors; overt subject knowledge ; theoretical underpinning; use of terminology

TRANSFORMATION

•choice of examples; choice of representation; demonstration; use of instructional materials.

CONNECTION

•anticipation of complexity; decisions about sequencing; making connections between procedures/concepts; recognition of conceptual appropriateness

CONTINGENCY

•deviation from agenda; responding to children's ideas; teacher insight; (un)availability of resources.

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Counting in Fractional Steps

0   1   2

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Fraction Progression

Number: Fractions (including Decimals and Percentages) Reasoning

Number: Fractions (including Decimals and Percentages)

http://www.ncetm.org.uk

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Video Clips

Developing Primary Mathematics Teaching
Reflecting on Practice with the Knowledge Quartet
Tim Rowland et al.
James NQT Year 4 Fractions

Counting stick – fraction counting
Year 2
http://vimeo.com/83486101

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A Bowl of Fruit   (218)

Half the pieces of fruit in the bowl are apples.

There are also three oranges, two pears and a banana.

How many apples are there in the bowl?

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Recording

Look over any recording you have done today as you've worked on the tasks and consider:

- How did you record?
- What were your reasons for recording?

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Reasons for Recording

- to help me remember what I did so that I can repeat it
- to record what doesn't work to keep a track of what I've tried
- it may enable me to see a pattern that helps me solve the problem
- it may help me see a short cut
- it helps me check I have all the solutions
- it helps me externalise my thinking
- it helps me confirm/agree my understanding with others
- it enables me to compare different ways of recording and learn to be elegant, efficient and succinct in the way I record my thinking.

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Different Purposes for Recording

- Recording in the moment
- Recording as thinking
- Recording for another person/time

Recording Mathematics Feature http://nrich.maths.org/9623

Different Representations http://nrich.maths.org/5608

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Classroom Culture

What behaviours do we value and encourage?

- Valuing mathematical thinking
- Everyone's idea counts
- Valuing changing one's mind
- Honourable to be stuck
- Creative climate
- Conjecturing atmosphere
- Purposeful activity and discussion

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NRICH Support

Problem-solving Feature
http://nrich.maths.org/10334 including:

Developing Excellence in Problem Solving with Young Learners article http://nrich.maths.org/10865

Developing a Classroom Culture That Supports a Problem-solving Approach to Mathematics article http://nrich.maths.org/10341

Using NRICH Tasks to Develop Key Problem-solving Skills article http://nrich.maths.org/11082

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http://nrich.maths.org/leadershipharingey

A page on the NRICH site devoted to this project

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Future Dates

Wednesday 3 February
Wednesday 9 March
Wednesday 25 May

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