UNIVERSITY OF CAMBRIDGE

The Language of Mathematical Problem Solving, Reasoning and Fluency

13th December 2018
Tower Hamlets CPD Centre

Fran Watson fw279@cam.ac.uk
Liz Woodham emp1001@cam.ac.uk
@nrichmaths

2018-19 Project Overview

Developing mathematical language through the three aims.

13 Nov and 13 Dec – Problem Solving
29 Jan, 26 Feb and 2 Apr – Reasoning
25 June – Fluency

nrich.maths.org/towerhamlets2018

Aims

We asked you on Day 1 to reflect on your focus for attending this six-day programme.

Imagine you were feeding back to a colleague, what would you say the aims of Day 1 had been?

Tasks to talk about

Quad Match (**6998**)
En-Counters (**6981**)
Stringy Quads (**2913**)
Which one doesn't belong?
Quadrilateral Classification
Triangle Classification
Factor Lines (**1138**)

Reflecting on classroom experiences

- What went well?
- Were there any surprises?
- What would you do differently next time, or what additional guidance would you give to a colleague?

New live tasks

Triangle or No Triangle (14041)

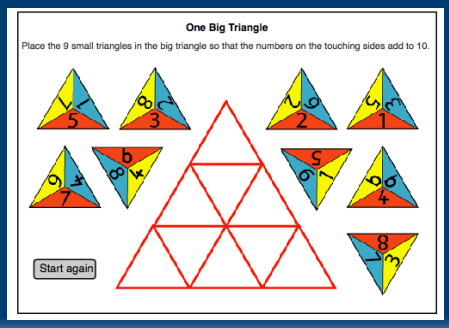
Name That Triangle! (14042)

The Problem-solving Process

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

Stage 1: Getting Started

One Big Triangle (192)



Stage 1: Getting Started

try a simpler case
draw a diagram
represent with a model
act it out

Stage 2: Working on the Problem

Two-digit Targets (6343)

You have a set of digits from 0-9.

Can you arrange these digits into the boxes to make five two-digit numbers as close to the targets as possible? You may use each digit once only.

largest even number	
largest odd number	
smallest odd number	
largest multiple of 5	
number closest to 50	

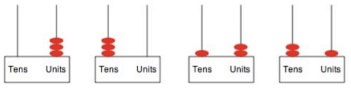
Stage 2: Working on the Problem

look for a pattern
reason logically
work systematically
trial and improvement
work backwards
conjecture
visualise

Stage 3: Digging deeper

6 Beads (152)

If you put three beads onto a tens/units abacus you could make the numbers 3, 30, 12 or 21.



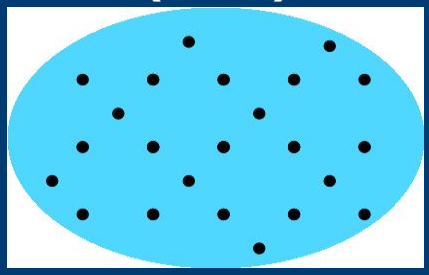
Explore the numbers you can make using six beads.

Stage 3: Digging deeper

generalise
verify
prove

Stage 4: Concluding

How Would We Count? (8123)



New EYFS resources

- Subitising article (14004)
- Two new activities:
  Hidden Jewels (14002)
  Number Talks (14005)

Stage 4: Concluding

communicate findings
evaluate

Problem-solving Process

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

Which Scripts? (774)

There are six numbers written in five different scripts.

Can you decipher the scripts?

What are the six numbers?

Problem-solving skills

	EYFS	KS1	KS2
Trial and improvement			
Working systematically			
Pattern spotting			
Logical reasoning			
Visualising			
Working backwards			
Conjecturing			

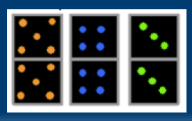
Tasks to talk about

Quad Match (6998)
En-Counters (6981)
Stringy Quads (2913)
Factor Lines (1138)
Triangle Classification
One Big Triangle (192)
Two-digit Targets (6343)
6 Beads (152)
Which Scripts? (774)
How would we count? (8123)

Which one doesn't belong?
Quadrilateral Classification

Reading reflection

Using NRICH tasks to develop key problem-solving skills (11082)



Developing good team-working skills (8277)

Common themes from your input:

- Embedding mathematical talk into classroom practice
- Developing opportunities for all children to reason mathematically
- Differentiation with a difference
- Nurturing children's confidence (in the context of mathematics and/or more generally)
- Teaching problem solving skills
- Embedding problem solving, reasoning and fluency into every day practice
- Nurturing children to be independent learners and thinkers
- Sharing of good practice (with immediate colleagues, school-wide and beyond)
- Considering language when assessing

Transforming Primary Mathematics by Mike Askew

Talk that supports collective mathematical activity is characterised by:

- *Emphasising listening as well as speaking*
- *Recognising the difference between discussion and dialogue*
- *Focusing on mathematical reasoning as much as answers*

"Conferring in a math workshop is not about helping learners to get a correct answer to the problem in hand… it is about supporting the *development of a young mathematician* to become a better, more competent mathematician."

from '*Conferring with young mathematicians at work*' by Cathy Fosnot

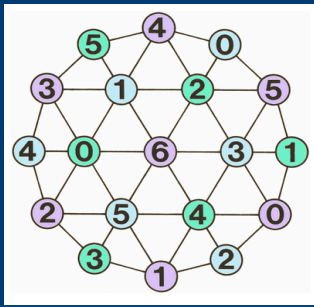
"I was less curious in understanding my students' ideas than I was in the attractive sheen of correctness"

Dan Meyer
26.07.18
blog.mrmeyer.com

Thank you game

Challenges and opportunities

Totality (1216)



Low Threshold High Ceiling

- 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

Possible Pieces (13832)

We are going to look at possible jigsaw pieces.
The kind of jigsaw we're looking at is rectangular, with straight edges.

Some of the most common jigsaw shapes are a bit like these three pieces below:

So, for each jigsaw piece we start with a square template, then some sides have a peg.
The edge pieces of the jigsaw have one or two straight sides.

We will only use pieces that have at least one peg and one hole.

Rich tasks

- Can have a relatively closed start but offer the opportunity for different responses and different approaches
- Invite questions to be asked
- Combine fluency and reasoning
- Reveal/provoke generalisations
- Encourage collaboration and discussion
- Are intriguing!
- May be accessible to all (LTHC)

Reflection

- What's the same?
- What's different ?
- Classroom practice implications?

Suggested plan for dissemination

After	Trialling NRICH tasks with:
Day 1	Your own class
Day 2	Your own class + 1 other
Day 3 (and before Day 5)	Colleagues (staff meeting input + feedback/reflections)
Day 5	TBC for feedback on Day 6

Don't forget to share published solutions from NRICH site with your children

Why not submit *your* children's solutions to our live tasks?

Teacher Takeaway

- Try a task from today in your setting, invite a colleague to do so too and then talk about the outcomes.
  (and come to Day 3 prepared to discuss)
- Read NRICH articles (**11082**) & (**8277**)

References

Fosnot, C. (2016) *Conferring with young mathematicians at work.* New London, CT, US: New Perspectives on Learning, LLC.

Askew, M. (2016) *Transforming Primary Mathematics. Understanding classroom tasks, tools and talk.* Abingdon: Routledge.

Dan Meyer
blog.mrmeyer.com

nrich.maths.org