

The Language of Mathematical Problem Solving, Reasoning and Fluency

13th November 2018
Tower Hamlets CPD Centre

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NRICH Professional Development

- Being a learner
- Reflecting on the impact tasks have in your classroom
- Personalising for your setting



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Setting the scene

2016-17

Embedding the aims of problem solving reasoning and fluency in primary mathematics

2017-18

Assessing mathematical problem solving, reasoning and fluency



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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

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YOYO time

What do you particularly hope to get out of the project?

Pick one focus that you want to address first, make a note and then write it on a post-it note to give in.

We will share common themes on day 2 to help identify colleagues with the same focus.



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Quad Match (6998)

For the task:

Every member of the team has to end up with a set of four cards in front of them that are related to each other in a similar way.

The task is only successfully completed when everyone on the team has completed their set.

As a team:

Responding to the needs of others

Helping others to do things for themselves.



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Quad Match (6998)

You will need to work in a team of four. If you have a fifth person available - use them as an observer.

In silence:

Distribute the 16 cards randomly amongst the team (four cards each).

How to play

Players pass cards to other team members in order to help one another complete their set.



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Quad Match (6998)

Rules

No one can talk or give non-verbal signals to other members of the team.

Each member of the team starts with four cards in front of them.

The cards in front of each person should be visible to everyone.

Team members can only give cards; they cannot take cards from someone else.

Each team member must have at least two cards in front of them at all times.



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Reflecting for a reason

Once you've tried the task, from your learner's point of view:

- Spend some time capturing what your thoughts were
- Discuss this on your table
- Consider thoughts that other learners might have had (in addition to those that have been voiced already)



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Tweaking the task

Now consider personalising the task for your setting.

What are the opportunities and challenges?

YOYO time first and then talk to those in your group to develop ideas.



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En-counters (6981)

For the task:

Learners must complete the task themselves but with support and advice from other members of the team.

As a team:

- helping others to do things for themselves
- responding to the needs of others - everybody helps everybody
- explaining by telling how



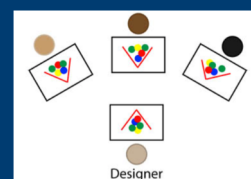
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En-counters (6981)

Everyone needs an identical set of counters.

One person (the designer) makes a design with their counters which is hidden from the others.

Then he/she explains what it looks like so that the rest of the team can make a copy each.



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En-counters (6981)

Team members can ask questions about the design at any time and the designer answers in as helpful a way as possible.

When a team member thinks they have a completed design, they ask the designer to check. If it is right they can then aid the designer in answering questions. If they do not have the correct design the task continues.

Remember that all help has to be given without sight of the enquirer's design.



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En-counters (6981)

2nd version: Three players work together to recreate the designer's idea.

3rd version: Three players work individually again with only one question being allowed from each player after the designer has completed their description.

Reflect on your experience in each case. What helped, what hindered, what did you notice about the vocabulary used, how did you feel, what did you do?



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Stringy Quads (2913)



Try to make a quadrilateral which has exactly one line of symmetry.

Is it possible?

How could you convince someone else that your shape has just one line of symmetry?

Can you make any other quadrilaterals with just one line of symmetry?

Try again, but this time answer the same questions for a quadrilateral with exactly two lines of symmetry ... exactly three lines of symmetry ... exactly four lines of symmetry.



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Which One Doesn't Belong?

Octagon

Triangle

Arrowhead

Can you find a reason to make each card the odd one out?



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Reflection

- What vocabulary was useful?
- How did you feel?
- How did you work?



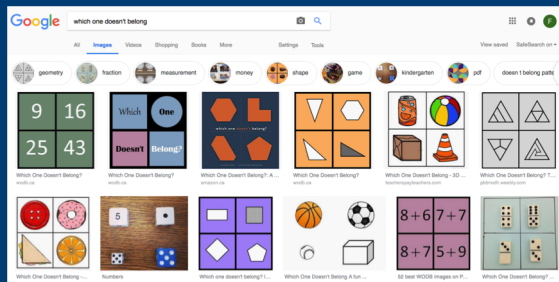
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Which One Doesn't Belong?



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Which One Doesn't Belong?



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Which One Doesn't Belong?



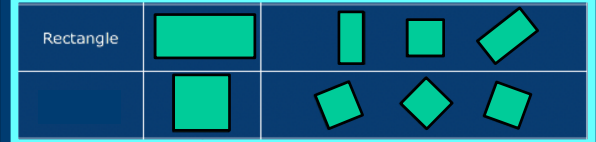
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Shape

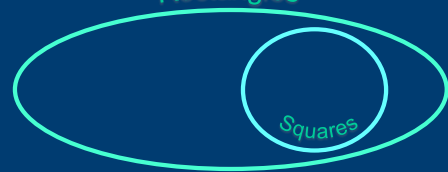
- Parallelogram
- Rectangle
- Square
- Rhombus
- Trapezium

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Rectangle



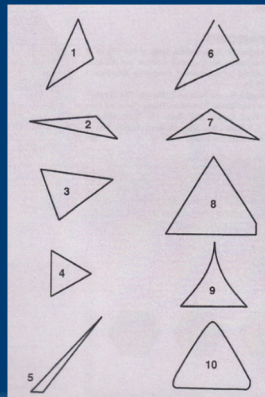
Rectangles



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What are these shapes?

How do you know in each case?



Clements and Sarama (2000) Young Children's Ideas about Geometric Shapes

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Types of triangle

	Equilateral	Isosceles	Scalene
Acute			
Right (angled)			
Obtuse			

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10th November 2017

Improving Mathematics in Key Stages 2 and 3

3

Improving Mathematics in Key Stages 2 and 3...

Learning school with a good GCSE in maths is a prerequisite for progressing into quality jobs, apprenticeships, and further education. The skills we learn at school help us with everyday life too, whether that's putting up a shelf or working out how much money we have left after we've paid our bills. Yet so many of our young people do not make the grade and, as a result, risk social and economic exclusion.

These pupils are disproportionately drawn from disadvantaged homes. Last year, over half of those eligible for free school meals had not achieved the expected level in maths by age 16. There were 16 million young people from low income households who are educationally disadvantaged to some extent and who need careers, as well as to further study. This is not just a personal tragedy for the individual, it's a waste of talent on a national scale and a huge barrier to improving social mobility.

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Improving Mathematics in Key Stages Two and Three – Recommendations Summary

- 1. Use assessment to build a picture of each pupil's strengths and weaknesses, and to inform teaching.**
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Enable pupils to develop a rich network of mathematical knowledge

Teachers use precise mathematical language themselves. Teachers support pupils to recognise mathematical structure, for example by rephrasing pupils' responses that use vague, non-mathematical language with appropriate mathematical language.

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From "Closing the vocabulary gap" by Alex Quigley

"As teachers, we should be using vocabulary we suspect (or know) that our students don't quite know yet, but we surround the unknown word with comprehensible input. If speaking this way becomes a habit, then our students are fortunate: they will be learning new words effortlessly."

Infusing vocabulary into the reading-writing workshop, by Amy Benjamin, P19

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Factor Lines (1138)

1	1	2	3	4	5
2	6	7	8	9	10
3	11	12	13	14	15
21	16	17	18	19	20
	21	22	23	24	25

Arrange the four number cards (1, 2, 3 and 21) on the grid to make a diagonal, vertical or horizontal line.

You can put a number card on a square with:

- the same number
- a multiple of that number
- a factor of that number.

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General thoughts:

- EAL learners may be able to express their ideas, but not in English
- We don't want children to avoid contributing because they think their mathematical language must be polished - there is a professional judgement to be made about accepting all contributions and refining where necessary
- A lack of verbal expression (in mathematics or more generally) is not necessarily an indication of lack of understanding or knowledge of vocabulary
- Quiet by Susan Cain is a very interesting book about the power of introverts

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Teacher Takeaway

- Try a task from today in your setting (and be prepared to talk about it)
- Read the chapter on Talk from Mike Askew's book 'Transforming Primary Mathematics'



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*

This will provide a focus for Day 2.



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