Mathematical Reasoning

A presentation from a staff meeting given by Greg McGill one of the Enigma Maths Hub Primary Mastery Specialists.

Is there a shared understanding of mathematical reasoning at your school?

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Context of the session

- School focus on reasoning due to the need to increase the need to think mathematically and increase their use of mathematical vocabulary through a deeper understanding.
- Some professional development with the subject leader and other teacher leaders at a TRG.
- Staff meeting for Maths Leaders to use with colleagues.
- Gap task to enquire whether mathematical reasoning is embedded into classrooms.
- As a result Mathematical problems are worked through logically and pupils are able to explain and justify a solution.

Mathematical Reasoning

Aims and intended outcomes for this session:

- to consider the current position of ‘mathematical reasoning’ in your school and in the schools that you are working with.
- to explore a progression in reasoning skills.

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Mathematical Reasoning

What is reasoning?

- justifying and proving, convincing
- Children would see this as problem solving
- Good number sense
- Forming lines of enquiry to make generalisations thinking logically
- Understanding what you need to do
- Finding effective strategies

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Mathematical Reasoning

What is reasoning?

Is there a difference between thinking and reasoning?

Watch the video clip.

http://buildingnumbersense.blogspot.com/p/number-talks.html

- Did you see children thinking?
- Did you see children reasoning? When?

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Mathematical Reasoning

What is the standard of mathematical reasoning currently in your own school?

-Talking in full sentences

-Environment of proving, explaining and convincing

- How do you know?
- What are the enablers to promoting effective reasoning classrooms?

Mathematical Reasoning

How do we record reasoning?

-Maths journals
-talking in full sentences
-Bank of stem sentences
-using TA's effectively

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Mathematical Reasoning

...reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language

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Progression in Reasoning

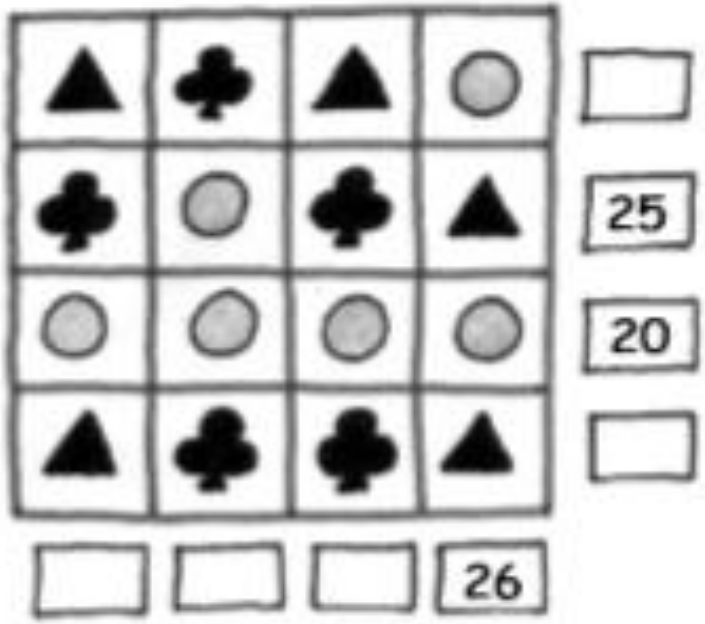
- ***Step one*:** Describing: simply tells what they did.
- ***Step two*:** Explaining: offers some reasons for what they did. These may or may not be correct.
- ***Step three*:** Convincing: confident that their chain of reasoning is right and may use words such as, 'I reckon'. The underlying mathematical argument may or may not be accurate yet is likely to have more coherence and completeness than the explaining stage.
- ***Step four*:** Justifying: a correct logical argument that has a complete chain of reasoning to it and uses words such as 'because', 'therefore', 'and so', 'that leads to'
- ***Step five*:** Proving: a watertight argument that is mathematically sound, often based on generalisations and underlying structure.

Taken from NRICH - https://nrich.maths.org/11336

Shape puzzle

Each shape stands for a number.

The numbers shown are the totals of the line of four numbers in the row or column.



Find the remaining totals.

Mathematical Challenges for Able Pupils (NNS)

Give each small group a chance to complete this mathematical challenge

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Now use these sentence openers…

The first thing I did was ……..
I already knew ……so ……
I noticed that ……
Once I found out……I could then……
It didn't work when I……so I……
The part I found most difficult was…. because ……..
The part I found easiest was…… because…….
It could be……because …….
It couldn't be …….. because …….

Describe how you completed the mathematical challenge using these sentence openers.

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Working through and *working on* questions

The first describes the child who does a few questions, takes a break, copies a bit from a friend, and ends up with no overall sense of the exercises as examples of anything or what they are about.

Contrast this with the child who is doing the exercises asks themselves what is similar about the questions and what is different, what is about the context which enables the technique to work, what sorts of difficulties might the technique encounter in different situations, etc. That pupil is working on the exercises.

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Working through and *working on* questions

Working-through minimises effort through minimum involvement. It is unreflective and unmathematical.

Working-on minimises effort mathematically, by trying to locate underlying structure and so reduce memory demands.

Question?
What resources do you use to develop reasoning?

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