Reasoning and Talking in F-3 Mathematics

MAT Conference Workshop: Denise Neal

This workshop will focus on:

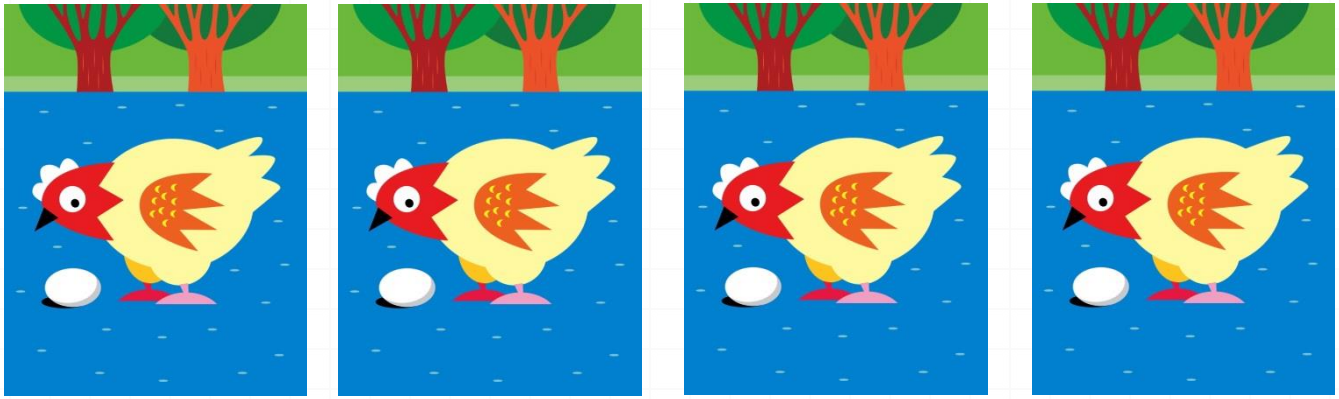
- Why talk and reasoning are important in our classrooms and how they are integral to the Australian Curriculum
- Strategies to build mathematical talk and reasoning

Finding your talk partner

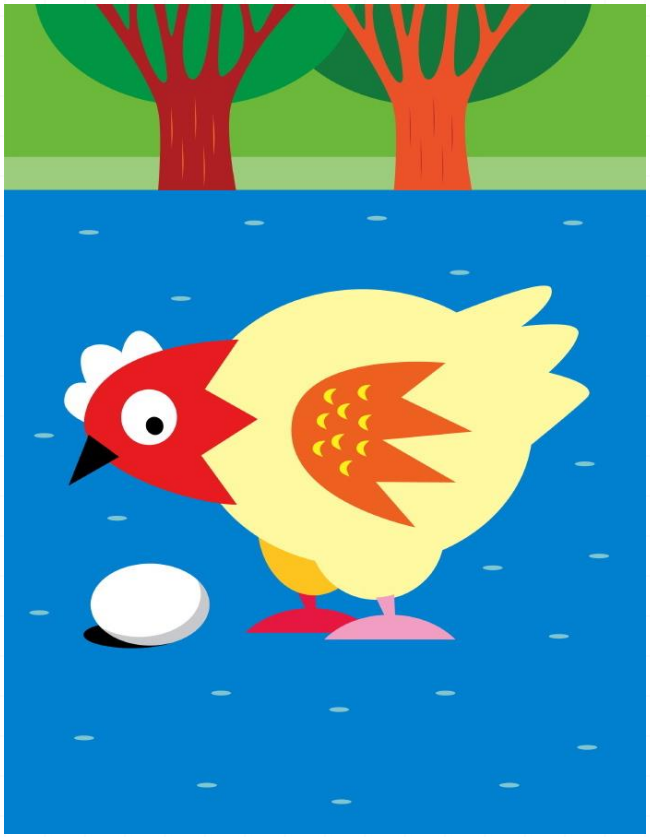
Image sourced from:
http://www.thetickletrunk.com/92-192-single_main/bamboo-ice-pop-stick.jpg

Task #1

A forgetful farmer only has four chickens left in the pen. How many did he once have and what happened to them?'



Time to talk again!



Building talk (Askew)

Private paired talk → Whole class conversation

Closely examine one or two solutions

Rehearse- listen carefully and look for solutions which have potential to inform class discussion (not necessarily correct ones). Tell these students in advance that they will be sharing so they can rehearse.

Revoice- students share with the class, teacher seeks clarification

Building talk

- Repeat- as students to paraphrase what has been said
- Rephrase- ask students to explain what they heard in their own words- students who gave the first explanation decide if what is said is accurate
- Build on- teacher asks- Does anyone want to add anything to that method, did anyone do similar to that?
- Comment on- invite more discussion. Spend time talking about one method an reach some general communal understanding…the idea is now the class idea

Building talk

- Making sense of problems by explaining them to someone else, putting them into your own words and comparing your answers with others all helps meaning to emerge.
- Talking mathematics means that mathematical vocabulary becomes part of the classroom discourse- much more than a list of words!
- Askew 2012

Talk to learn

- Research clearly tells us that oral language is crucial for learning and that oral language is the key to reading success. This involves not only speaking but also the capacity to listen. (PALL)
- Vocabulary is another foundation for reading and learning. In the case of mathematics, there is a wealth of vocabulary specific to the learning area that helps build mathematical understanding.

Why reasoning?

As the National Council of Teachers of Mathematics (2000) emphasizes, the ability to reason is essential to mathematical understanding, and should be a primary goal in mathematics education: “By developing ideas, exploring phenomena, justifying results, and using mathematical conjectures in all content areas and — with different expectations of sophistication — at all grade levels, students should see and expect that mathematics makes sense (p.56).

Let's look at the curriculum

Use a highlighter pen to note the importance of talk and the reasoning proficiency

Talk with your partner

- What are the implications of the curriculum emphases for your work?

Task Design

- Tasks need to reflect the proficiencies- if you want to assess for example reasoning and explanation, the task must expect it
- Tasks should be linked to the achievement standard
- Tasks should enable a range of responses
- Tasks you have used in the past can be 'tweaked' to include emphasis on reasoning or an expectation of talk
- Resources: https://www.education.tas.gov.au/documentcentre/Documents/Task-Design.pdf (DoE Staff only)
- http://nrich.maths.org/5662

Classroom culture

- Mathematics classrooms which promote and expect mathematical talk and reasoning have an established culture which views mathematics as a sense making activity in an inclusive community of inquiry- everyone can learn from listening to and talking mathematics.

Deep listening

- *The individual learning and meaning making is a consequence of being part of a community that is striving toward reaching a collective understanding through joint activity and dialogue.*
- *Shared values around the ideas of what makes a good mathematical argument or solution can help learners develop as a community as well as mathematically.*

(Askew, 2012)

Deep listening

We have a lot of talk and attention to speaking and listening and while many classrooms have gone a long way to improving children's speaking in mathematics lessons, I think we still have a way to go in promoting deep listening (Askew, 2012)

Classrooms can support student learning by ensuring that solutions proposed by students are built on.

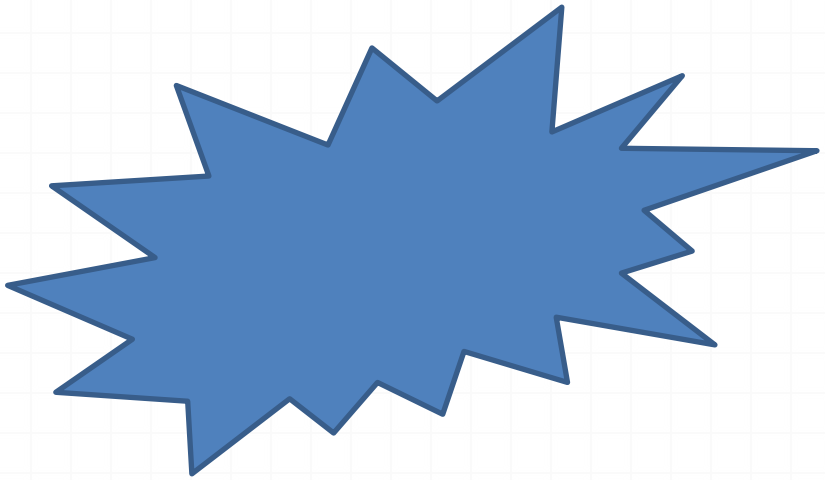
Collective mathematical meaning is built when teachers carefully listen to students and select solutions to be shared which will build and develop collective understanding.

Let's look at an example:
http://www.youtube.com/watch?v=P2Em2O_lAjY

Now it’s time to talk……

Let’s do some more talking and explaining

Always, sometimes, never



How does discussing these mathematical statements focus on reasoning and justification?

Mindful mathematics learning

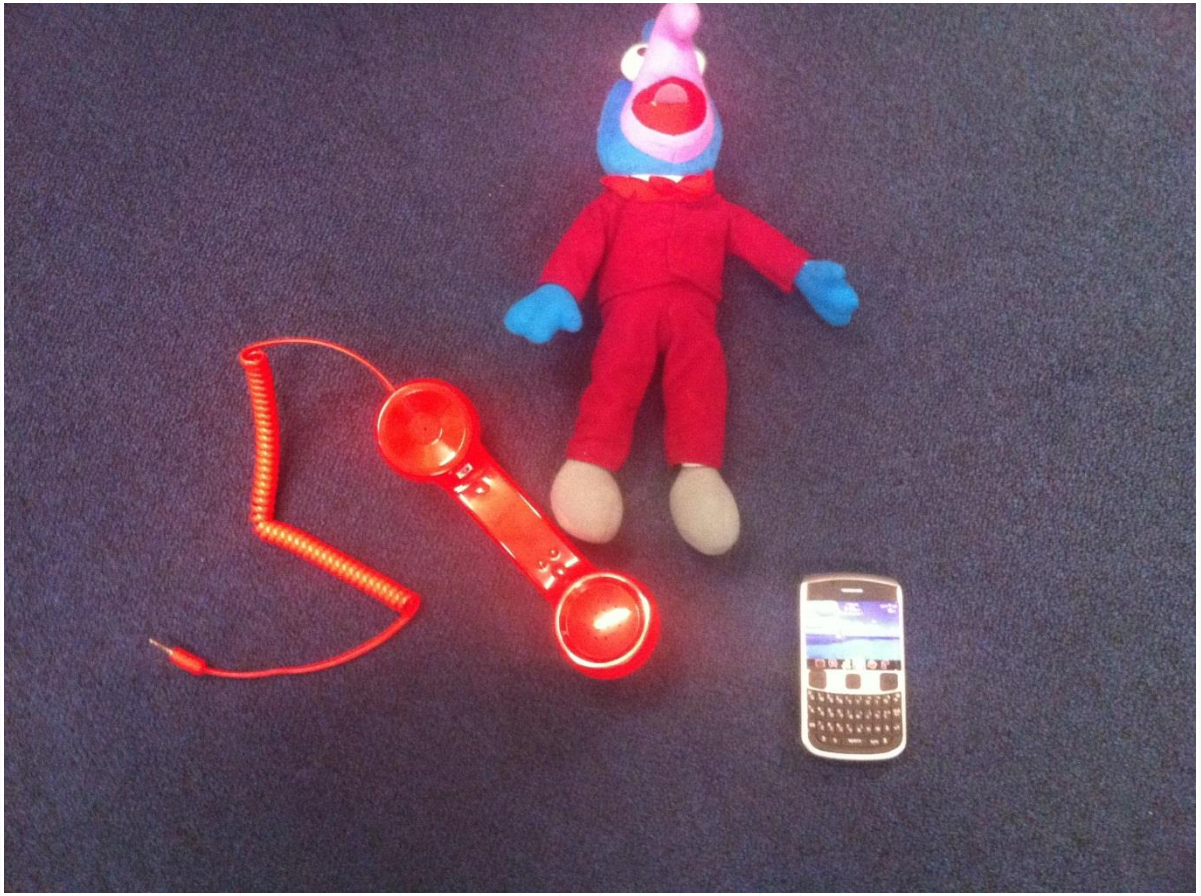
- In mindful mathematics lessons the shift is to:
- Someone explaining
- Everyone following the explanation

- It's not that the teacher never explains, but that everyone in the community gets to be the teacher and learner, whether they are adult or child.
- So…. what does this look like?

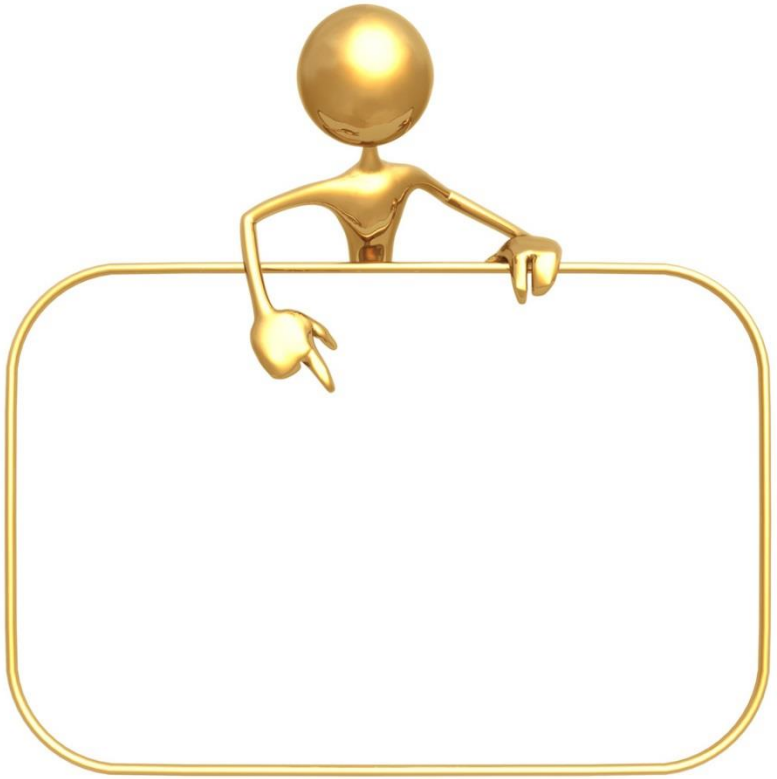
How might we build such a culture?

- Maths talk time- turn to your maths talk partner and chat about this
- Sharing or reflection time- built into the planning of a lesson
- Plan for explicit teaching and use of subject specific vocabulary in each sequence

Props



Prompts



Other ideas

- Mystery box/bag
- Barrier games
- Sort and classify then justify e.g. into hoops or Venn diagram
- Maths journal- whole class or individual
- Word walls, class maths dictionary, “maths talk words”
- Group problem solving- every child has a clue and contributes to the conversation (see next slide)
- Use ipad or phone to record thinking/language and use as evidence of understanding/mathematical thinking
- ?????

Problem How many children come to Sam's birthday party?	
Clue: He invites: 10 boys and 10 girls.	**Clue:** 2 girls can't come. 3 boys can't come.
Clue: Sam then invites 2 more boys.	**Clue:** 1 girl does not reply to the invitation.

http://www.cornwall.gov.uk/idoc.ashx?docid=b40d58ce-1723-4369-b8b0-ce9722661ca7&version=-1

Reasoning and NAPLAN

Cassie cut all these oranges into **quarters**.

How many quarters does she have altogether?

4	5	10	20
○	○	○	○

NAPLAN Year 3, 2008, Source www.improve.edu.au

Conclusion

- Good maths classrooms are talking classrooms!
- Effective talk requires thoughtful planning and careful listening
- Students should be expected to reason and explain from the early years and can be assessed on their capacity to reason and justify using mathematical language
- The mathematical proficiencies help us to plan for tasks , to make assessment judgements and to build mathematical behaviour and dispositions

Keep on talking!

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