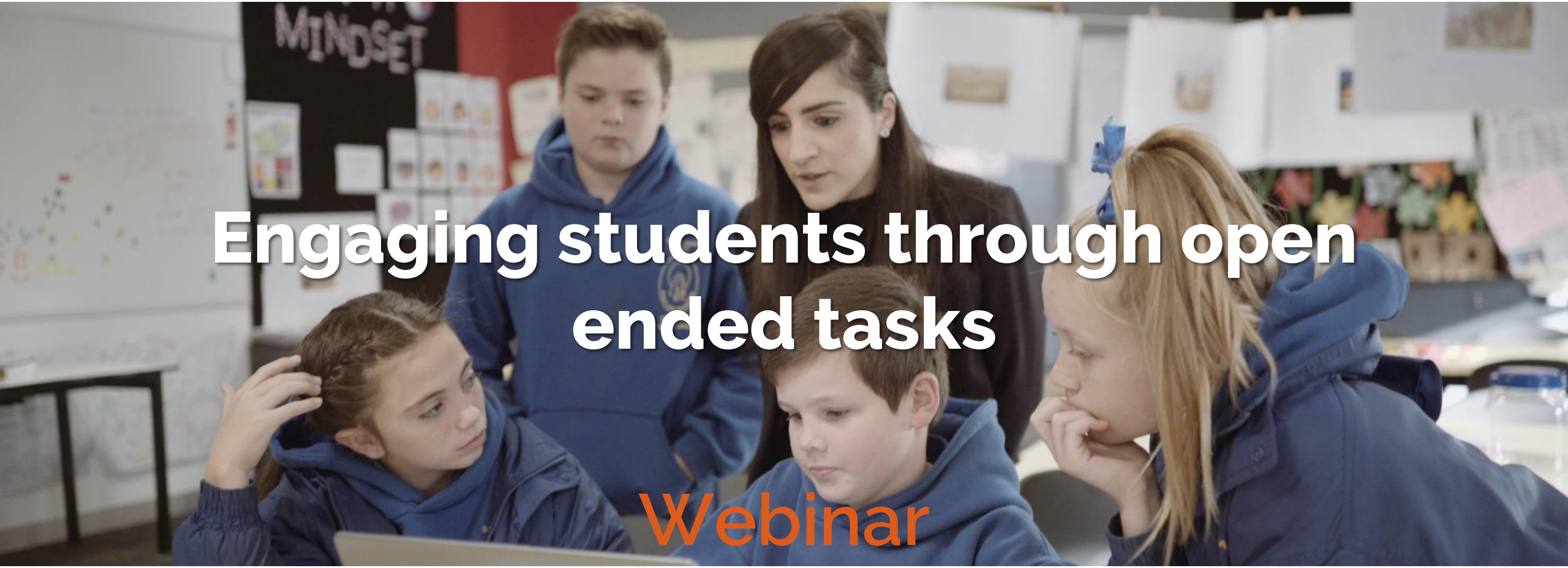
MATHS PATHWAY



Engaging students through open ended tasks

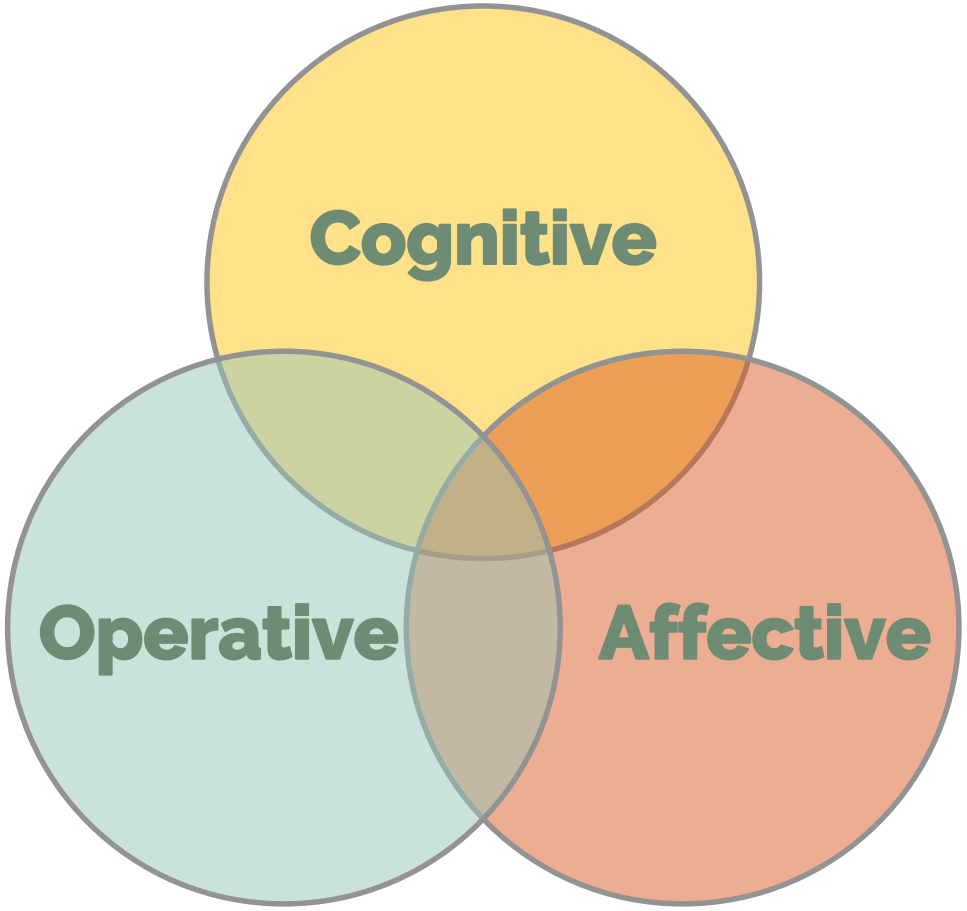
Webinar

Thomas Moore & Em Duncan

May, 2018

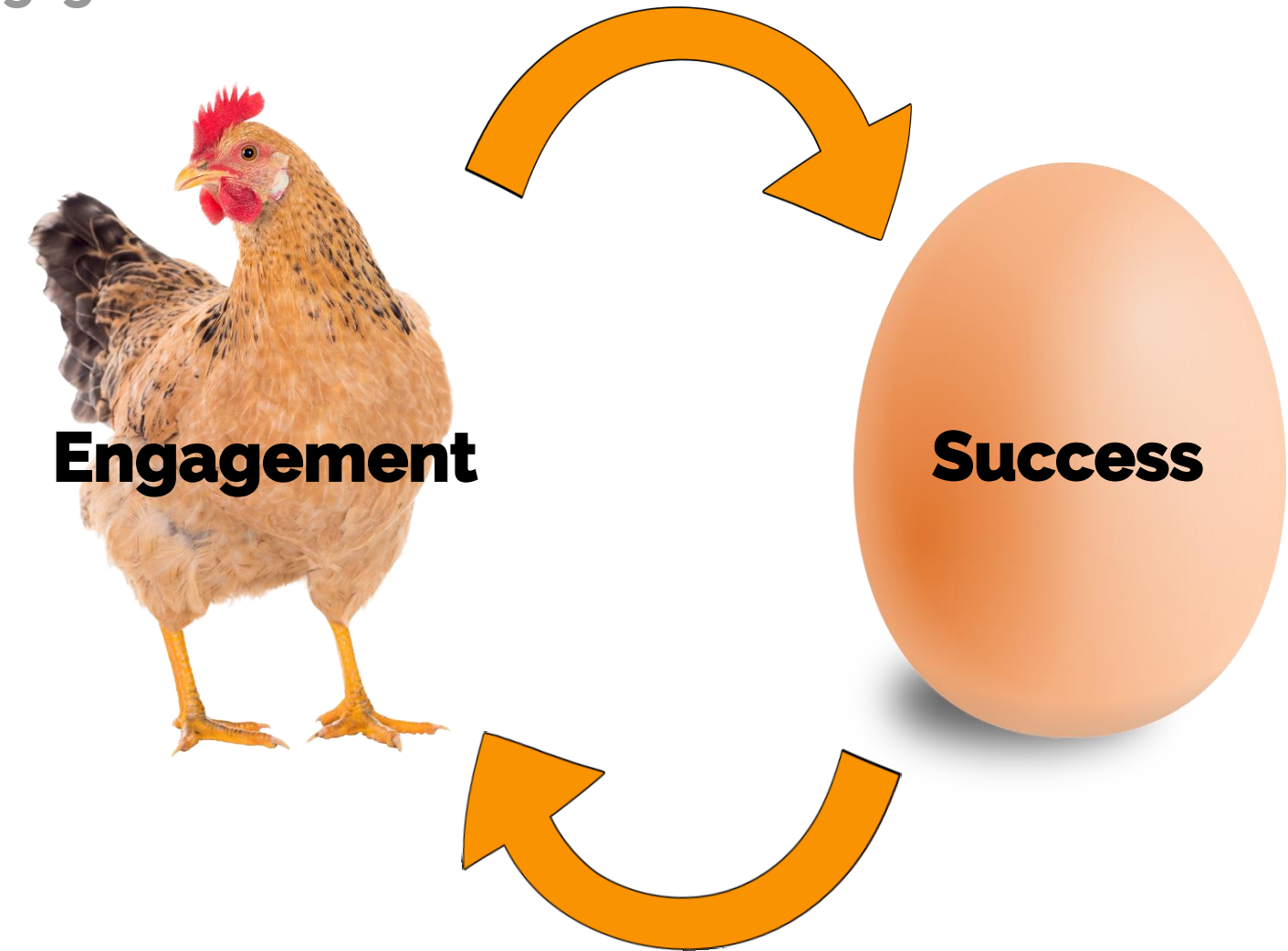
3 modes of engagement

Fredricks, Blumenfeld & Paris (2004); Attard (2012)



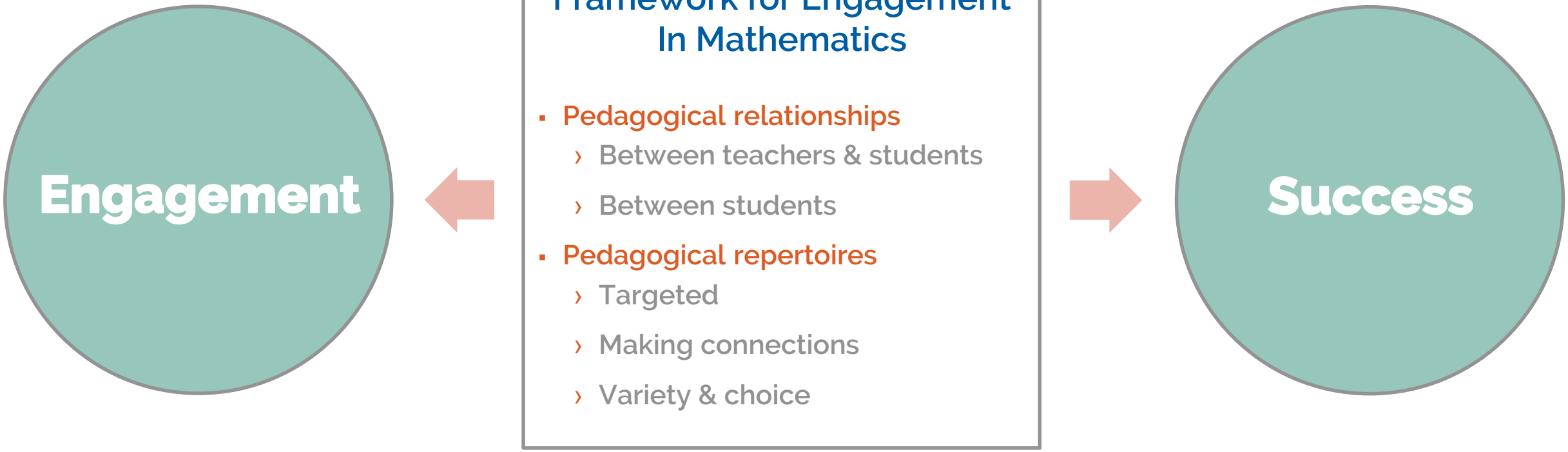
Which comes first?

Cyclic nature of engagement & success



Framework for Engagement in Mathematics (FEM)

Attard (2014)



Engagement in the Maths class

How it looks

Framework for Engagement In Mathematics

- Pedagogical relationships
  - Between teachers & students
  - Between students
- Pedagogical repertoires
  - Targeted
  - Making connections
  - Variety & choice

Opening up tasks

Implementing 'Open learning'

Framework for Engagement In Mathematics

- Pedagogical relationships
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Opening up tasks

Implementing 'Open learning'

Framework for Engagement In Mathematics

- Pedagogical relationships
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  - Making connections
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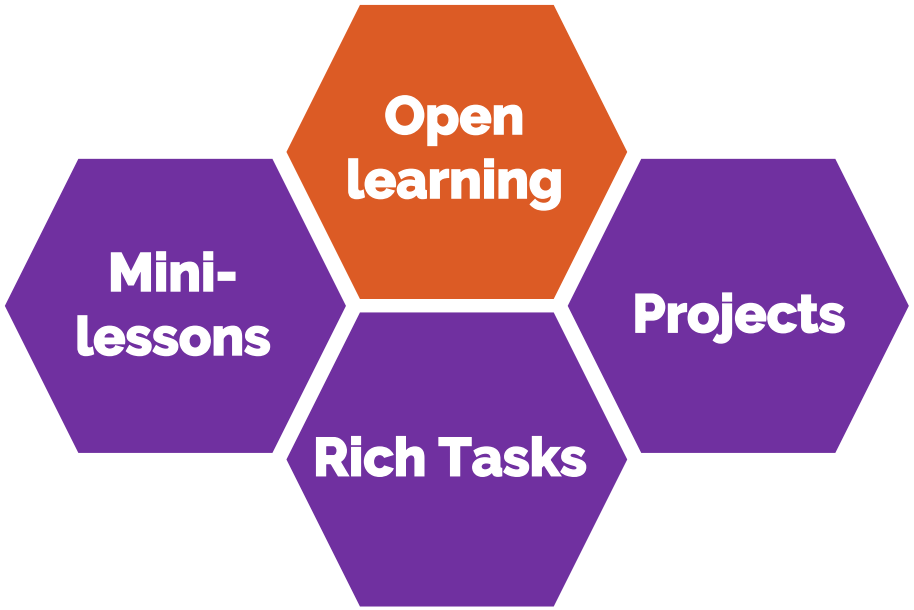
Opening up tasks

Maths Pathway Resources



- Maths Pathway Teacher Portal Resources:
  - teacher.mathspathway.com
    - Mini Lessons
    - Rich Lessons
    - Community Hub
      - Teacher shared resources
      - Weekly videos

Open Ended Questions

Open ended questions

- Characteristics:
  - Focus on process
  - Collaboration and discussion
  - Promote problem solving strategies
  - Many solutions
  - Multiple ways to solve
  - Insight into misunderstandings and gaps

Developing open ended questions

... Strategies to consider!

Answer first

- A typical question:
  - If a=3, b=-4 and c=2, calculate:

a) $5a+2c-3b$ b) $4a^2 -2b+3c$ c) b^2-4ac

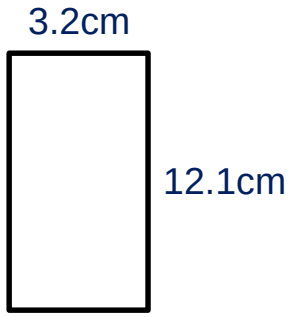
- An open question:
  - If a=3, b=-4 and c=2 are substituted into an equation and it equals 20, what could the equation be?

Answer first

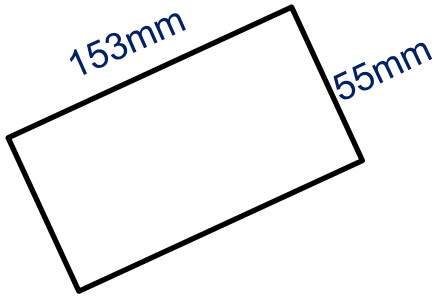
- A typical question:
  - Calculate the area of the following rectangles:

a)

b)



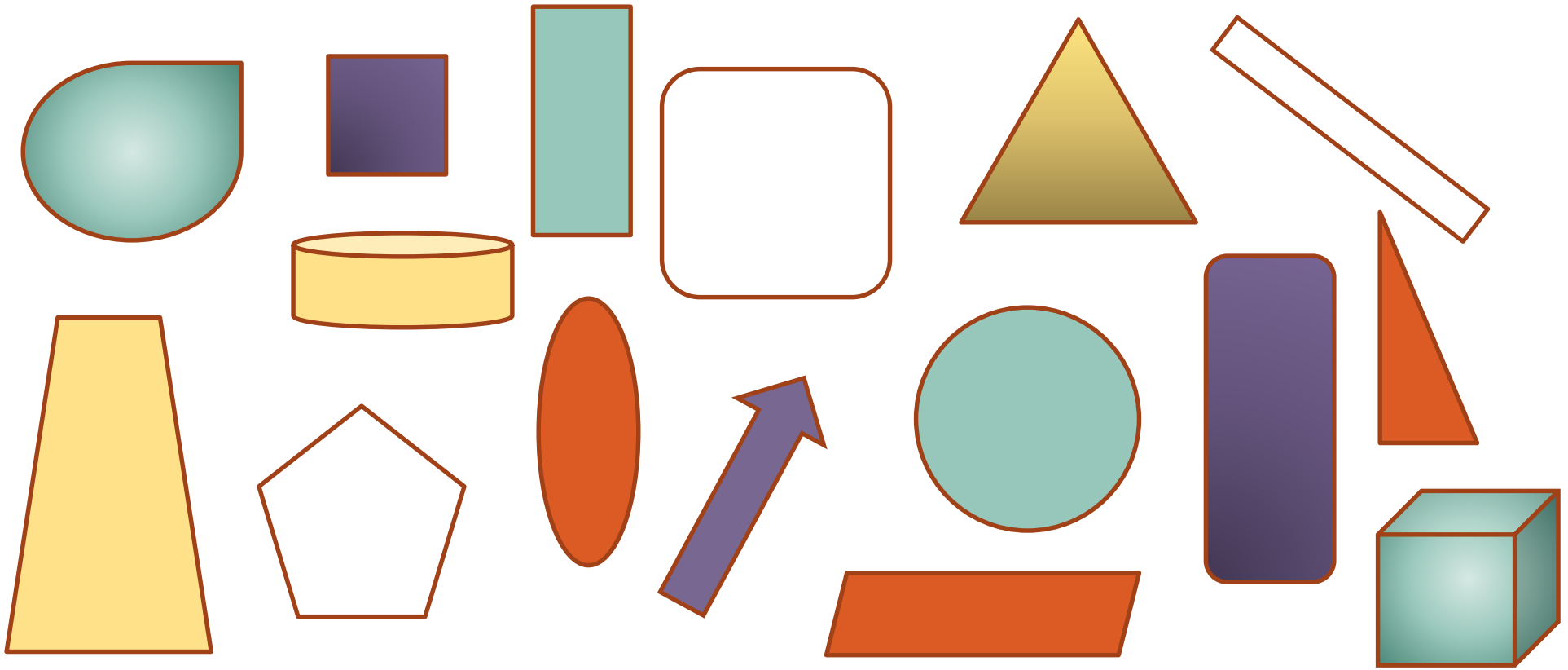
c)



- An open question:
  - The area of a rectangle is 64cm², what might its dimensions be?
  - Can you find them all?
  - Which result will give the smallest perimeter?

Compare, categorise & contrast

- Put these shapes into groups and discuss your answers



Incorrect solution

- Example:
  - Jack was required to simplify $\sqrt{45a^2}$. Below is Jack's response to the question.
    - What do you like?
    - Constructive feedback for Jack?

Simplify:

$$\sqrt{45a^2} = \sqrt{45} \times \sqrt{a^2}$$
$$= \sqrt{45} \times a$$
$$= a\sqrt{45}$$ ✗

How many ways?

- A typical question:
  - Calculate:

  a) 13 - 7 = b) 15 + -2 = c) 9 - - 4 =

- An open question:
  - Explain why 9 - - 4 = 13
  - Can you explain it another way?
  - How many ways can you prove this?

Always, sometimes or never?

- A typical question:
  - Convert the following fractions to decimals:

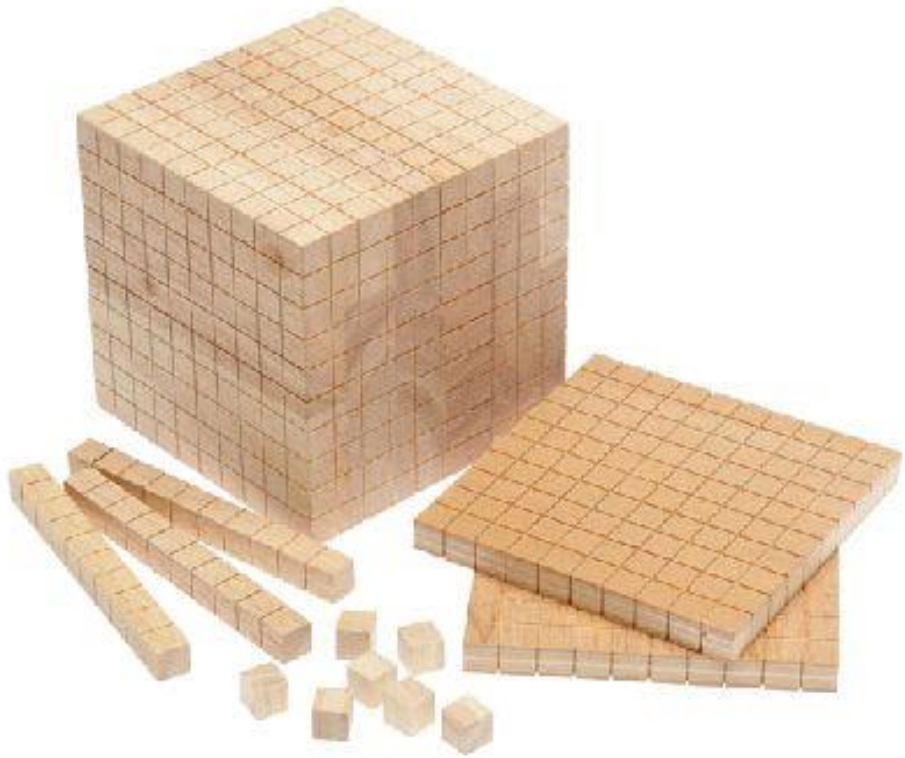
a) = $\frac{7}{10}$ b) = $-\frac{3}{5}$ c) = $\frac{12}{7}$

- An open question:

Using manipulatives

- A typical question:
  - Calculate 12 x 13:

- An open question:
  - Using MAB show 12 x 13.
  - Can you explain how to do it without using the MAB?
  - Can you explain the relationship between the model and the algorithm?



Open ended questions

Key strategies to consider:

- Incorrect solution
- Work backwards from the answer
- Categorise, compare & contrast
- Solve a problem in multiple ways
- Always, sometimes or never?
- Use of manipulatives

Simplify:

$$\sqrt{45a^2} = \sqrt{45} \times \sqrt{a^2}$$
$$= \sqrt{45} \times a$$
$$= a\sqrt{45}$$ ✗

IS A FRACTION:
ALWAYS / SOMETIMES / NEVER
LESS THAN 1?

Enabling & Extending Prompts

Enabling & Extending Prompts

	Enabling Prompts	Extending Prompts
Purpose		
Strategies		
Do		
Don't		

Sullivan, Mousley & Zevenbergen (2006)

Enabling & Extending Prompts

	Enabling Prompts	Extending Prompts
Purpose	Modification to allow students access	Promote further challenge for students
Strategies		
Do		
Don't		

Sullivan, Mousley & Zevenbergen (2006)

Enabling & Extending Prompts

	Enabling Prompts	Extending Prompts
Purpose	Modification to allow students access	Promote further challenge for students
Strategies	- Change the numbers - Bring in manipulatives - Ask metacognitive questions	- What happens if? - How many solutions? - How do you know when you have found them all?
Do		
Don't		

Sullivan, Mousley & Zevenbergen (2006)

Enabling & Extending Prompts

	Enabling Prompts	Extending Prompts
Purpose	Modification to allow students access	Promote further challenge for students
Strategies	- Change the numbers - Bring in manipulatives - Ask metacognitive questions	- What happens if? - How many solutions? - How do you know when you have found them all?
Do	- Give every student the same question initially - Start with 5 mins of silent working - Allow for struggle - Use these to differentiate - Discuss strategies as a class (throughout & at end)	
Don't		

Sullivan, Mousley & Zevenbergen (2006)

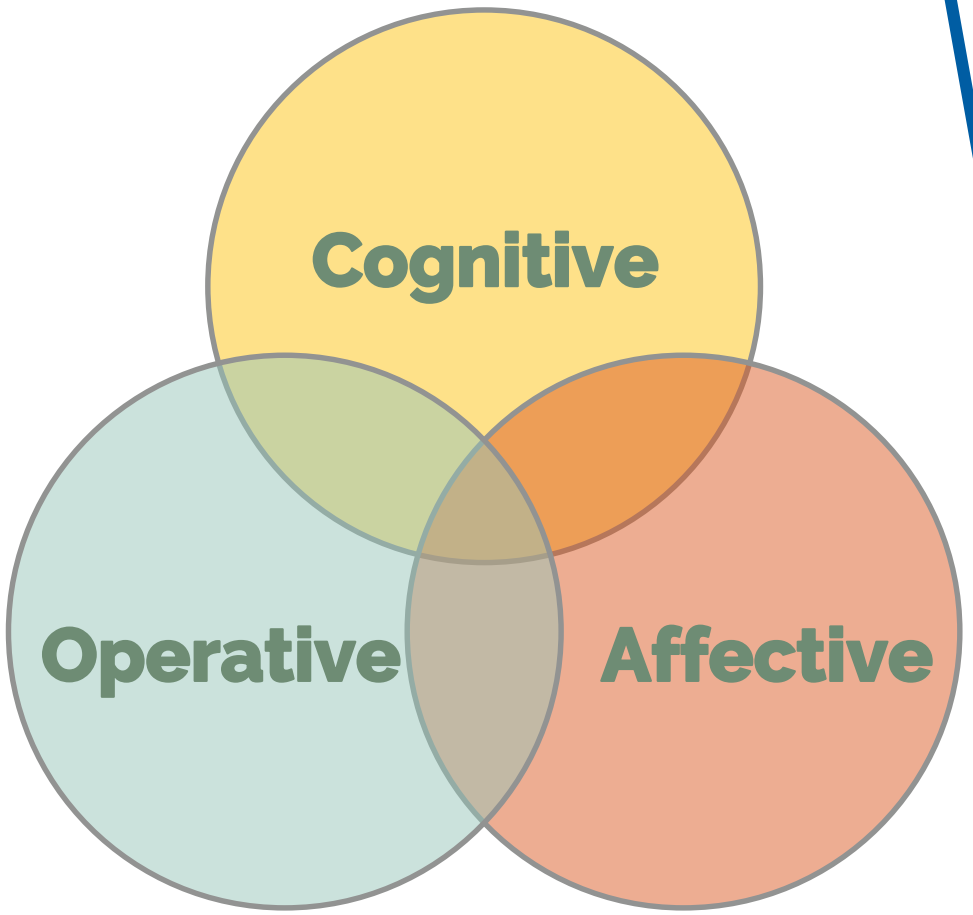
Enabling & Extending Prompts

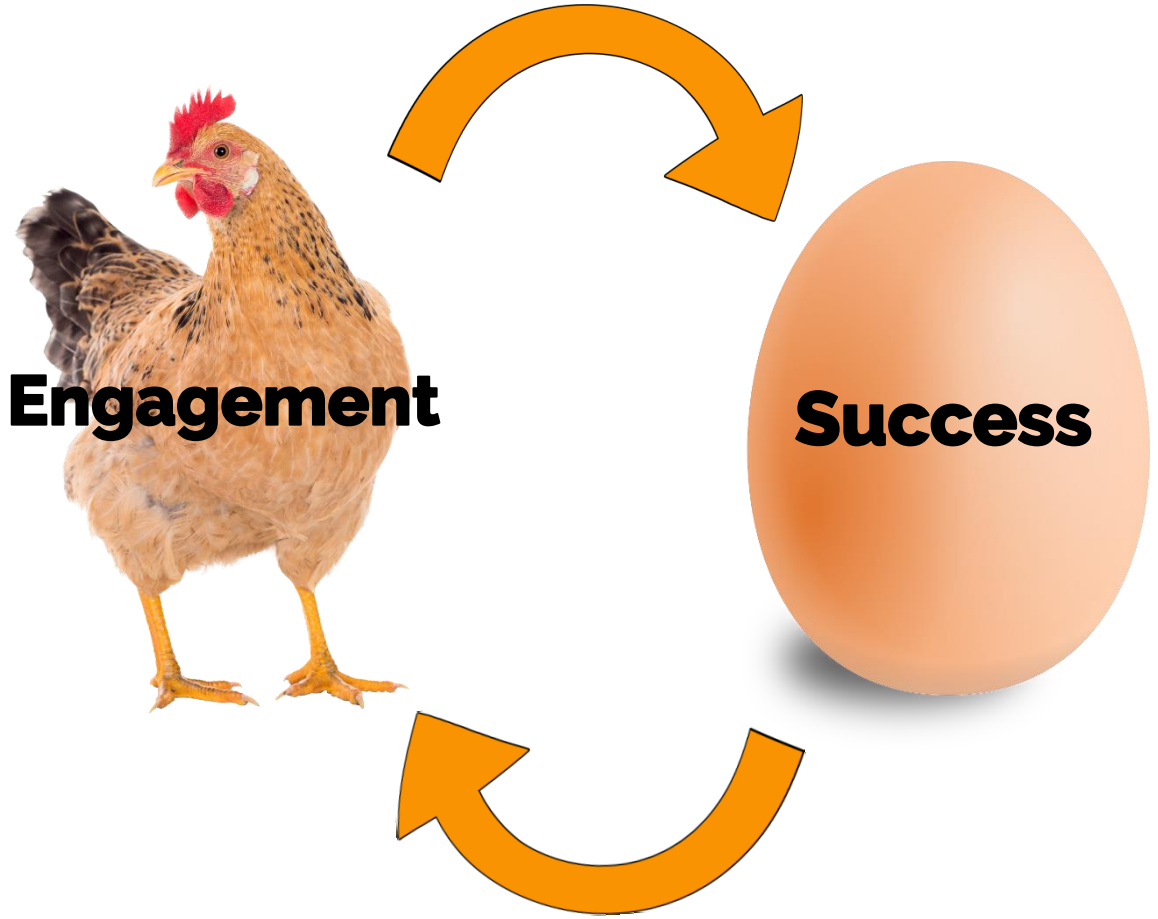
	Enabling Prompts	Extending Prompts
Purpose	Modification to allow students access	Promote further challenge for students
Strategies	- Change the numbers - Bring in manipulatives - Ask metacognitive questions	- What happens if? - How many solutions? - How do you know when you have found them all?
Do	- Give every student the same question initially - Start with 5 mins of silent working - Allow for struggle - Use these to differentiate - Discuss strategies as a class (throughout & at end)	
Don't	- Change the task entirely - Jump too quick to giving enabling/extending prompts - Give away the answers	

Sullivan, Mousley & Zevenbergen (2006)

Bringing it all together

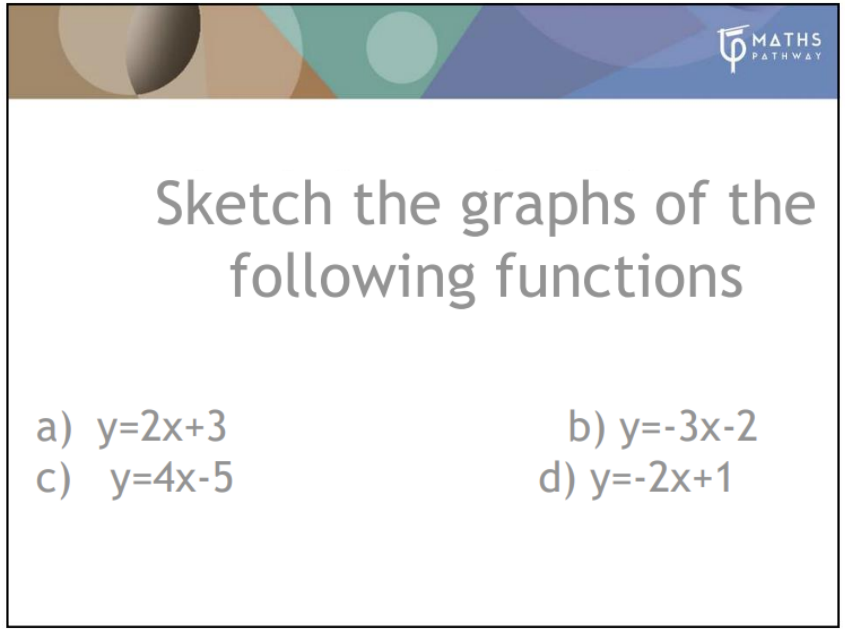
Engagement & Success

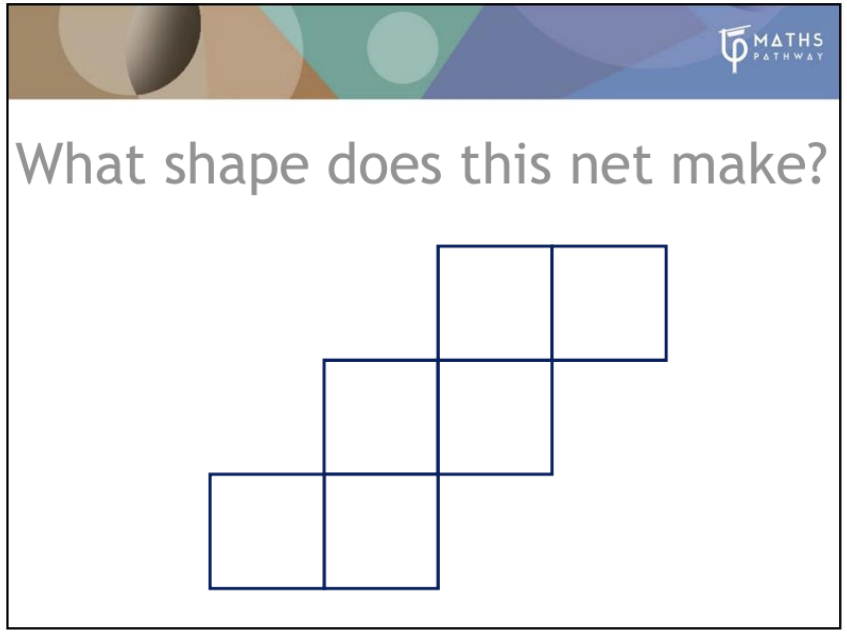




Questions lead to creativity

- Anyone can be creative
  1. Can I open the question up using one of the following strategies:
     - Incorrect solution?
     - Starting with the answer?
     - Compare, categorise & contrast?
     - Solve a problem in multiple ways?
     - Always, sometimes or never questions?
     - Using manipulatives?
  2. How will I enable/extend students?
  3. How else can I engage students (Cognitive, Affective & Operative domains?

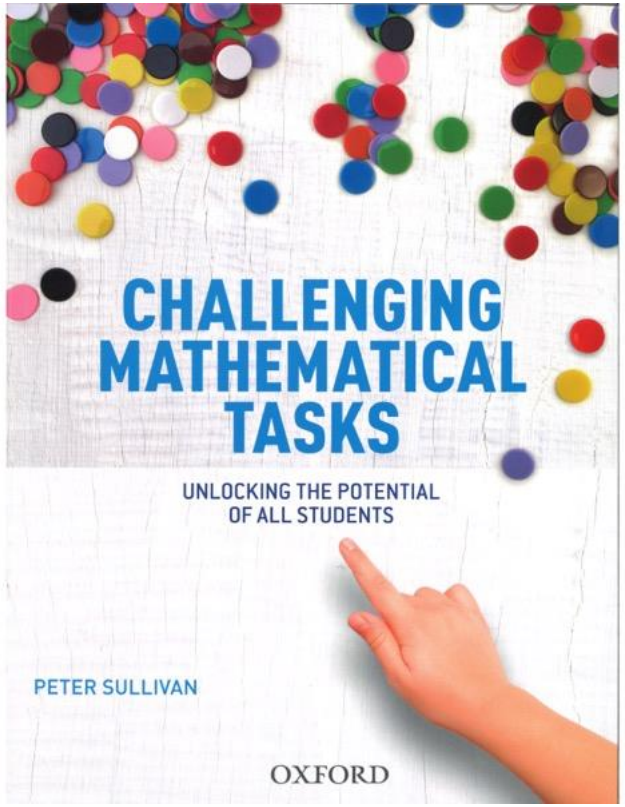


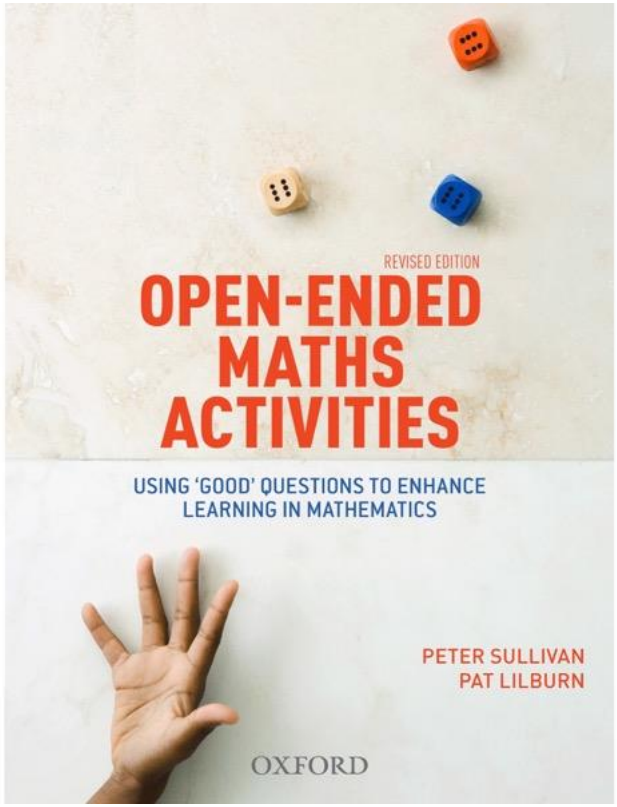


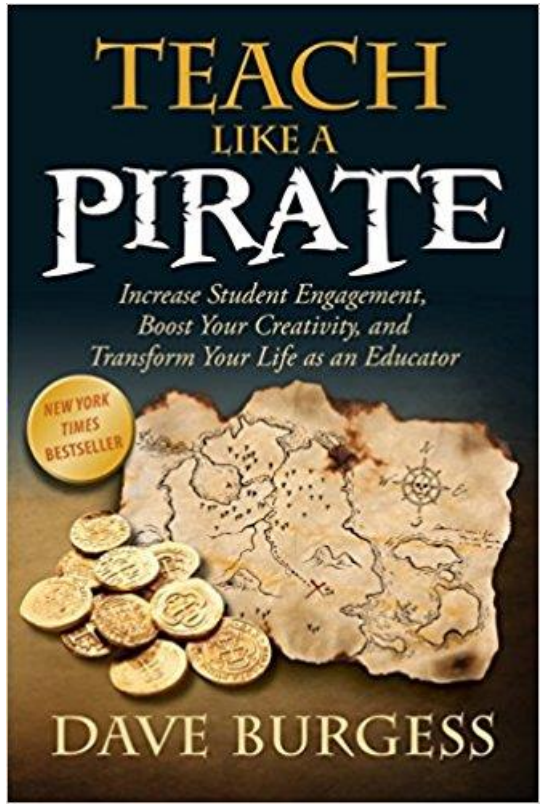
Today's webinar

- We have discussed:
  - 3 forms of engagement
  - Strategies for opening up questions
  - Enabling and extending prompts

Other resources...







Thank-you

Contact details

- Maths Pathway
  - Slides: http://maths.pw/openendedtasks
  - Maths Pathway Information: mathspathway.com

- EngageME Mathematics
  - Email: t.moore@engagememathematics.com
  - Linkedin: www.linkedin.com/in/thomas-moore-maths

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