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# Self Efficacy and Mathematics

2022 Primary  
Mathematics  
Education  
Conference

June 10 2022

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**Mathematics Curriculum**  
**Consultant**  
**Numeracy Leader**

# Agenda

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Warm up - **Tic Tac Toe**

**Self efficacy - What is it in Mathematics?**

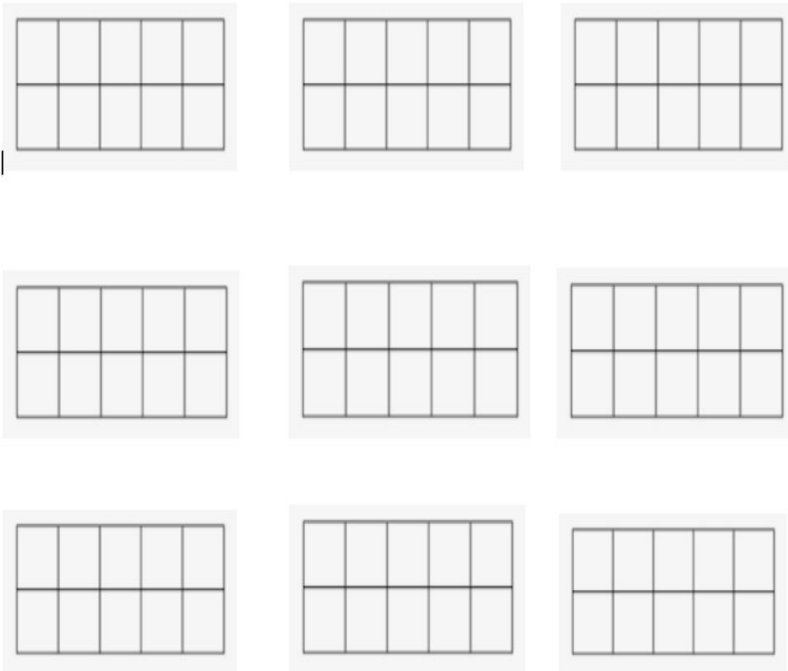
**Explore the 4 factors that affect Self efficacy**

**How do we build self efficacy? (4 ways)**

# Warm Up



## Junior



## Senior

<b>36</b>	<b>12</b>	<b>20</b>
<b>18</b>	<b>24</b>	<b>48</b>
<b>6</b>	<b>10</b>	<b>32</b>

# Self Efficacy in Mathematics



Self-efficacy in mathematics indicates **students' self-belief in their ability to overcome difficulties or obstacles to solving mathematical problems.**

Students with a strong sense of efficacy are more likely to challenge themselves with difficult tasks and be intrinsically motivated.

Self-efficacious students also recover quickly from setbacks, and ultimately are likely to achieve their personal goals. Students with low self-efficacy, on the other hand, believe they cannot be successful and thus are less likely to make a concerted, extended effort and may consider challenging tasks as threats that are to be avoided. Thus, students with poor self-efficacy have low aspirations which may result in disappointing academic performances becoming part of a self-fulfilling feedback cycle

Bandura A. *Self-Efficacy in Changing Societies*. Cambridge University Press

# There are four sources of self-efficacy.



- 1. Mastery Experiences** - Students' successful experiences boost self-efficacy, while failures erode it. This is the most robust source of self-efficacy.



# There are four sources of self-efficacy.

**2. Vicarious experience** - Observing a peer succeed at a task can strengthen beliefs in one's own abilities.

( observations of others as models)



# There are four sources of self-efficacy.



**Verbal persuasion** - Teachers can boost self-efficacy with credible communication and feedback to guide the student through the task or motivate them to make their best effort.



# There are four sources of self-efficacy.



**Emotional state** -A positive mood can boost one's beliefs in self-efficacy, while anxiety can undermine it. A certain level of emotional stimulation can create an energizing feeling that can contribute to strong performances. Teachers can help by reducing stressful situations and lowering anxiety surrounding events like tests or presentations.

People who overcome adversity



# 4 Approaches to Building Self Efficacy

Adapted from Fencil & Scheel (2005) and Margolis & McCabe (2006).



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Self-efficacy is built through successful experiences. We can increase the likelihood of successful learning experiences and foster student self-efficacy by

1. Scaffolding Learning
2. Collaborative Learning
3. Effective Feedback
4. Careful selection of tasks and experiences

# 1. Scaffolding Learning - What does this look like?



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- **Clear Directions** Step-by-step instructions are necessary to let students know what they need to accomplish to successfully meet the requirements of the task.
- **A Clear purpose - Learning Intention** The objective of the activity is made clear at the outset or sometimes when you bring the lesson together (learning Intention) so a "big-picture" point of view dominates in each individual activity. Why are we doing this game or task?
- **Identify Successful strategies** Scaffolding can reduce wasted time and **keep students on task** because efficient or successful strategies have been investigated (These can become success criteria) Begin in the ZPD - pushed but not overwhelmed

What is the difference between scaffolding the learning and dumbing down the curriculum?

# Enabling and Extending Prompts



Enabling prompts were designed to support students experiencing difficulty, by allowing students to engage in active experiences related to the initial goal of the task.

It is important, therefore, that the teacher ensures that all students know where the enabling prompts are in the room, and that there is no stigma associated with accessing an enabling prompt

By contrast, extending prompts are designed for students who finish the main challenge, and expose students to an additional task that is more challenging, however requires them to use similar mathematical reasoning, conceptualisations and representations as the main task (Sullivan et al., 2006).

## 2. Collaborative Learning

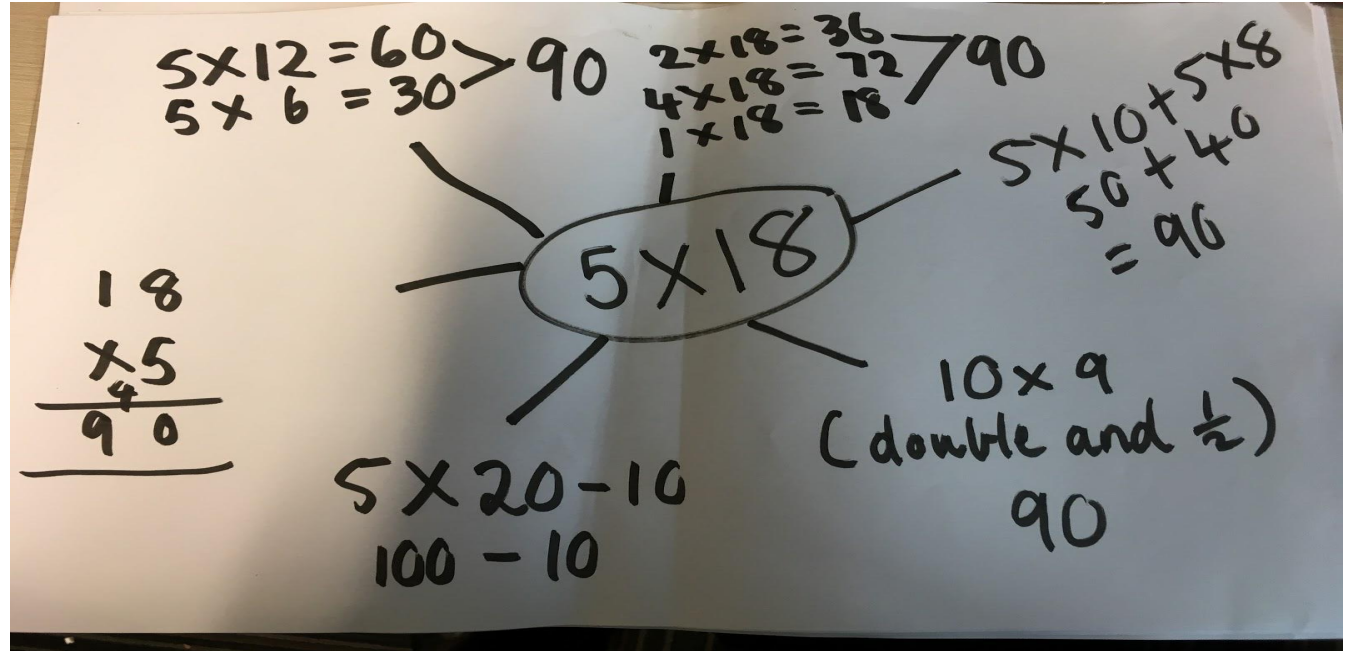
What does this look like?

- Number Talks
- Collaborative tasks
  - Gallery walks
  - Spotighting
- Reciprocal Teaching



# Number Talk

## 5 x 18



A piece of paper with handwritten mathematical strategies for calculating  $5 \times 18$ . The central problem  $5 \times 18$  is circled in the middle. Six lines radiate from the circle to various strategies:

- Top-left:  $5 \times 12 = 60$  and  $5 \times 6 = 30$ , with a large right-pointing arrow  $>$  and the number 90.
- Top-right:  $2 \times 18 = 36$ ,  $4 \times 18 = 72$ , and  $1 \times 18 = 18$ , with a large right-pointing arrow  $>$  and the number 90.
- Right:  $5 \times 10 + 5 \times 8 = 50 + 40 = 90$
- Bottom-right:  $10 \times 9$  (double and  $\frac{1}{2}$ ) = 90
- Bottom:  $5 \times 20 - 10 = 100 - 10 = 90$
- Left: A vertical multiplication problem:  
$$\begin{array}{r} 18 \\ \times 5 \\ \hline 90 \end{array}$$

# Number Talk

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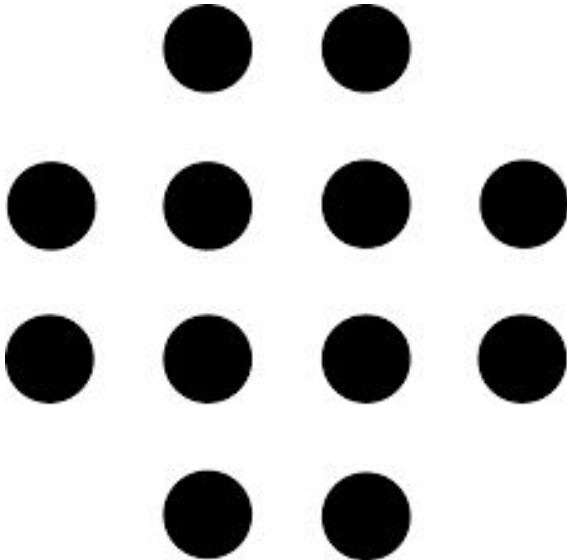
104 - 88



# Number Talks - Juniors - [Youcubed](#)



How Many



Mirror down the middle (6 x 2)

Count by 2s

$$4 \times 4 - 4$$

$$2 \times 4 + 2 + 2$$

# Number talks - Junior



What do you see?

Strategies





# Activating students as learning resources for one another



When students support each other , both those who receive and those who give help benefit, resulting in higher achievement for all!

- Work as a team on games and tasks (Do you agree? Prove your answer to the other team)
- Peer feedback is very effective - start with the positive, use sentence starters (Could be a good idea to model effective feedback)
- Have group goals and individual accountability (Cake)

# Talk Moves



Classroom talk is a powerful tool for both teaching and learning. Rich, dialogic talk supports students in making sense of complex ideas and builds classroom communities centred around meaning making. 'Talk Moves' are tools used by teachers to support rich, meaningful classroom discussion in mathematics.

# Talk Moves



# 3. Effective Feedback

## What does this look like?



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Effective feedback is designed to determine a learner's level of understanding and skill development to plan the next steps towards achieving the learning intentions or goals.

<https://www.education.vic.gov.au/>

### Source?

- pre/post assessment - Essential Assessment, Think boards
- General Observations from every task, games and number talks

# 3. Effective Feedback What could this look like?



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Establish specific, **short-term goals** that will challenge the students, yet are still viewed as attainable and provide the **feedback** needed to know they are on track?

Allow students to **make their own choices of areas/goals they need to work on**

Help students lay out a specific learning strategy and have them **verbalize** their plan. As students proceed through the task, ask students to note their progress and **verbalize** the next steps.

## **Ensure you Encourage Students**

Give them consistent, credible and specific encouragement, such as, "**You can do this. What do you know about /see.... That could help you?**"

## **Ensure you give frequent, focused feedback**

Giving praise and encouragement is very important, however it must be credible. When giving feedback on student performance, compare to past performances by the same student, don't make comparisons between students.

# Focus - 2022 one school Feedback Teacher and Student Centred

Allow students to **make their own choices of areas/goals they need to work on**

Help students lay out a specific learning strategy and have them verbalize their plan. As students proceed through the task, ask students to note their progress and verbalize the next steps.

How can you do this?

Reflect Reflect Reflect

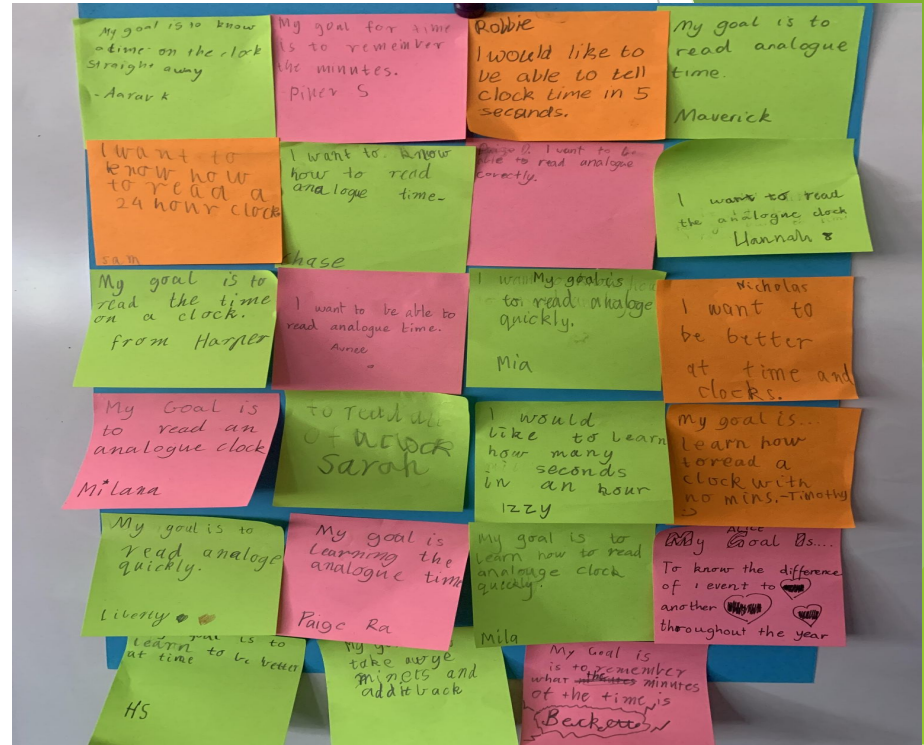
# What levels are doing - SAMPLES

YEAR 6 Traffic light reflection on goals

Academic Goals:

- 1. Reading well and not like a robot
- 2. going up in my spelling group
- 3. learning all my times tables
- 4. Be able to set up a cartesian plane set up
- 5. Get as much work done as possible
- 6. Finish my task
- 7. to learn how to do a side by said bar graph
- Do more gramma in my writing
- Being able to show my darta

YEAR 3 - goals on post its



# Setting Goals

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Learning mathematics is a process. Mistakes happen, but learning from them is part of that process. Provide an example of how a mistake turned into a learning opportunity that helped you later.

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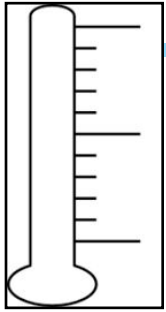
Make one math goal that you'd like to achieve by the end of the school year?

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Student Signature: \_\_\_\_\_ Teacher Signature: \_\_\_\_\_ Date: \_\_\_\_\_



# Encourage Reflection



Use this to show the degree of effort you put into today's task

Ask Questions

Traffic Light Hot Dots

Exit Tickets

Rubrics

icy pole sticks

Game Reflections - Catherine Attard

Self assessment check lists

## 4. Task choice - What does this look like?

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**Rich tasks** have a range **of** characteristics that together offer opportunities to meet **the different** needs **of** learners. On its own a **task** is not **rich**, it is how **the task** is used **in the** classroom that may make **it rich**. ... **challenge** learners to think **for** themselves.  
([nrich.org](http://nrich.org))

# Rich Task

Sam had to work out the following equation but his 4 was broken on his calculator how could he do it?

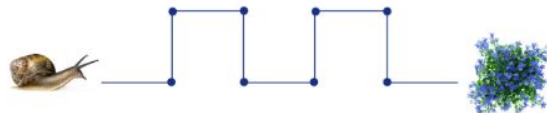
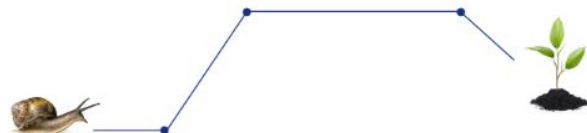
$$341 + 276$$

$$441 + 246$$

$$12\ 441 + 23\ 632$$

## Snails

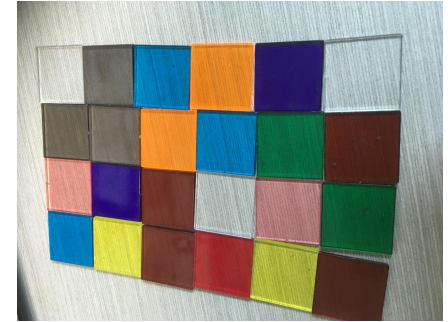
Sally the Snail crawls 2cm each minute. She needs to rest at each dot for 5 minutes. She wants to take the shortest time to reach a plant. Which path should she take?



# 24 square counters

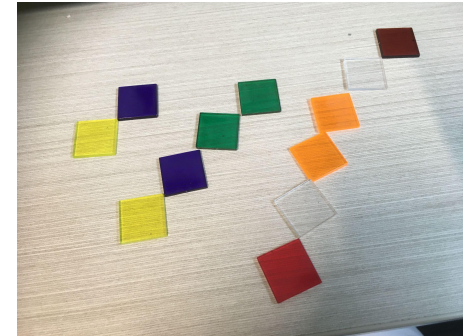
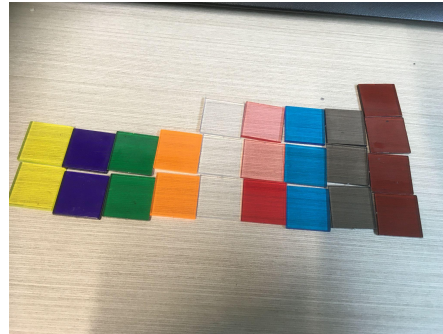
Area  
Perimeter  
Patterns  
Multiplication  
Division  
Division with remainders  
Addition  
Subtraction  
Graphing  
Chance

Area, perimeter,  
Multiplication  
Division



Growing patterns

Graphing

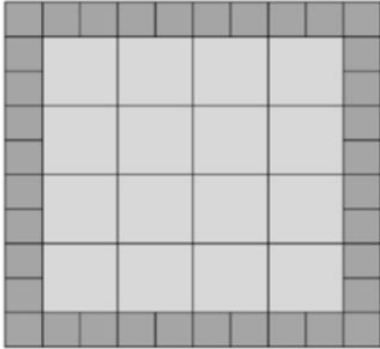


# Rich Tasks

## The tiler - from [reSolve](#)

This activity aims to engage students in a multiplicative reasoning task with multiplicative thinking and is based on [The tiler problem solving task from reSolve](#).

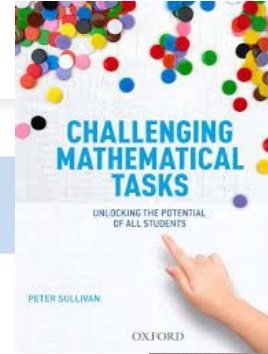
Students are presented with the problem (Refer to [Appendix 2](#)):



A tiler was asked to pave a small courtyard. He drew up plans of the different tiling designs he could use and calculated the cost of the tiles. Would it be cheaper to tile the courtyard with all smile tiles or with all large tiles?

The cost to buy the exact number of tiles needed:

- Small tiles: \$360
- Large tiles: \$640



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# 4. Task choice



## **Capitalize on students' interests**

Tie the investigations or concepts to student interests such as sports, popular collectables, movies or technology.

## **Use moderately- difficult tasks when enabling**

If the task is too easy it will be boring or embarrassing and may communicate the feeling that the teacher doubts their abilities; a too-difficult task will re-enforce low self-efficacy. The target for difficulty is slightly above the students' current ability level.

## **When Extending** Use more expansive numbers

Justify Why does this work?

Impress Me - What do you know because you know this?

Have you found all the answers?

# Rich task Websites

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<https://www.resolve.edu.au/teaching-resources>

<https://www.mathematicshub.edu.au/>

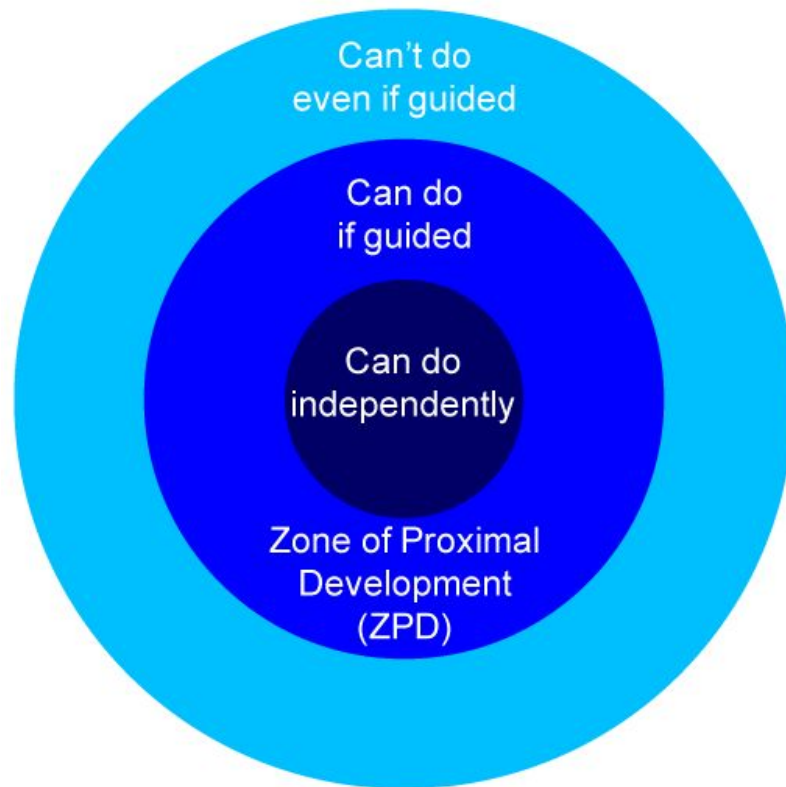
<https://nrich.maths.org/>

<https://nzmaths.co.nz/>

[Mathematics Curriculum companion](#)

# Zone of Proximal Development

The Learning Zone (I can do it with a little help and persistence) is in between the Comfort Zone (I can already do it) and the Frustration Zone (I can't do it)





# Growth mindset

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We learn from our mistakes

Value risk taking

Safe environment

juggling

[www.teaching kids to thrive.com](http://www.teachingkids to thrive.com) (Statements)

# Activating Students as owners of their own learning



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Teachers do not create their own learning: only learners create learning. What teachers can do is create the circumstances within which learners learn.  
(William, D. Leahy S 2015)

# Which will you investigate?



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