Main Title Only

Mathematics Workshop

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Let's work together.

Get into small groups and briefly discuss one activity you have done recently that worked really well.

Whakataukī

Nā tō rourou, nā taku rourou ka ora ai te iwi

With your food basket and my food basket the people will thrive

“Good” (Open-ended) questions

Differentiation by question

Good questions

Open-ended problems have no fixed answer, rather many possible answers.

Open-ended problems are accessible to all students and can be solved many different ways and on different levels which makes them good for differentiation.

Open-ended problems provide opportunities for students to make mathematical decisions based on their own mathematical thinking and you the opportunity to listen to their thinking, then probe and prompt.

Open-ended problems help the development of reasoning and communication skills.

Characteristics of good questions

Require more than remembering a fact or reproducing a skill.

Students can learn from answering the questions; teachers can learn about the students (less teacher talk and more teacher listening).

May be several acceptable answers.

Have the potential to make students aware of what they know and what they don't know. Students will hopefully seek ways to improve their knowledge to complete the task.

Considerations

Know your mathematical focus and the relevant curriculum level your students should be working at (teach to that level and fill in gaps rather than teaching them where you think they are).

Make sure your questions have the right amount of ambiguity.

- Is it vague enough to be interesting and allow for a range of response, but not too vague that it is unattainable.

Plan for two types of prompts:

- Prompts to help student start working
- Prompts to extend early finishers

Ideas to open up questions

Jeopardy. Give the students the answer and ask for the question (within boundaries if needed).	**Same, same but different.** Give the students two numbers, shapes, graphs etc. and ask them to discuss the similarities and differences.	**How, Why, What?** Get students to explain their ideas, working, decisions when working on a problem.
Creating a sentence. Ask students to create a mathematical sentence that includes certain numbers and words.	**Closely does it.** Remembering it is not all about equals. Using words such as “close” or “almost can provide a variety of responses.	**Discussion.** Create a scenario where students have to have a discussion.

Jeopardy

Start with the answer to a closed question.

Closed	What is half of 20?
Open	10 is a fraction of a number what could the fraction and the number be?
Closed	Round 10.96 to the nearest whole number.
Open	My coach said that I ran 100m in about 11 seconds. What might the numbers on the stopwatch have been?
Closed	Calculate the mean and median of 1, 3, 5, 6, 7
Open	Create a data set in which the mean is greater than the median.

Jeopardy

Try these ones in pairs or individually:

Closed: Find the difference between 23 and 7.

Closed: Round 3.65 to 1dp

Closed: There are 24 bananas in a bowl and some on the bench. In all there are 60 bananas. How many bananas are on the bench.

Compare your questions with another pair.

Same, same but different.

How are 95 and 100 alike? How are they different? What are some possible answers? (Full sentences please)

What are the similarities and differences in these equations.
5+a=10 14=9+a 8+a=14

Anyone got any examples of how they have used this?

Which one doesn't belong is a great website to start with.

How, why, what?

Compare two fractions with different denominators. Tell how you compared them.

4 is a factor for two different numbers. What else might be true about both numbers.

A scatterplot has a couple of outliers, but the two variables that are graphed seem to have an almost linear relationship. What are two possible scatterplots?

What other equations say the same thing as this one
32+a=51?

What are some other examples?

Creating a sentence.

Create a sentence that includes the numbers 5 and 7 along with the words “more” and “and”.

Create a sentence involving ½ and 64 and the words “less” and “twice as much”.

Closely does it.

You multiply two numbers and the product is *almost* 600. What could the numbers be? Explain.

Add two numbers whose sum is *close* to 450. What can the numbers be? Explain.

Try rewriting this question using soft words:
Create a triangle with an area of 20 cm squared.

Discussion.

Sione and Aroha each measured the width of the gym. Sione said it was 21 rulers long. Aroha said it was 21½ rulers long. How could this happen? *(This is a great way to encourage discussion before doing a practical activity.)*

An experiment involves using a spinner and die. Create a situation for which the combined probability is ½ or more.

Discussion.

Think of a situation you are interested in where someone might use information from a survey to make a decision that affects many more people that were surveyed. For example, a commercial gym might ask some clients about what hours they would prefer and assume other clients would agree. Once you have decided on your situation, discuss how many people and what people you would survey to be a **representative sample**.

Share your ideas here

How do I support my students into these problems I hear you say.

Sometimes more open-ended problems can be challenging for students when they are first introduced to them.

Have a read of this blog about Depth of Knowledge post to give you more understanding of how to scaffold students.

The Depth of Knowledge Matrix also gives you an opportunity to check if you have enough challenge or cognitive demand in your questions.

How can I introduce good questions to my lesson.

1. Pose the question to the class (on the whiteboard or on paper).
    - Don’t assume the students understand, allow them to ask questions and get some students to repeat the question in their own words.
    - This is not a time for you to tell the students how to do it.
2. Students work on question
    - Best in groups initially.
    - Your job is to roam, provide clarification and prompts, and listen.
3. Whole class review
    - Get each group to suggest response and explain their thinking.
    - Write this on the board (while listening for misconceptions and gaps)
    - If the response is not suitable - discuss it to identify the difficulty
4. Teacher summary
    - Summarise the discussion, emphasis and explain key points.

Task

Think of a lesson you are going to be teaching this week. Develop some open ended questions/activities for this lesson.

Get them critiqued by a colleague.

Some of my best ideas come from other people.

Most of the ideas (and examples) above I found in this blog post in 2014. I have used most of the ideas again and again.

Sometimes on a rainy day allow yourself to go down a rabbit hole (and don't disregard it if it says they are a primary teacher!). Just make sure it is about improving teaching and learning and not the rabbit hole of the many worksheets available online.

Good websites for examples of open-ended questions

Mathcraft - Anthony Haradane (AUST)
You Cubed - Jo Boaler (USA)
Maths for love - Dan Finkel (USA) Coming to NZ this year (Fangirl!)
3 Act Maths - Dan Meyer, Kyle Pearce and Jon Orr
NRich - UK
Open Middle - Robert Kaplinsky

Plus… (this is where you add your ideas)


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