## The BitL tool - mathematics years F-2

### Fluency: Years F-2

**What can you recall?**
This is about remembering facts:
- being able to name and identify numerals, simple shapes, symbols (such as +, =, –) recognising counting sequences, recognising Australian coins by value, being able to count forwards and backwards to 20/100/1000 (F/1/2) starting from any point; and being able to recall language related to time/duration (eg days of the week, months of the year, seasons).

**Can you choose and use your mathematics flexibly?**
This is about choosing and using an appropriate action or appropriate mathematical information and language.

**How can you interpret?**
This is about creating meaning from the problem that has been presented. It is useful to have the students describe (in their own words) what they have been asked to do. Descriptions of the task could be oral or written, dependent on the students and the task. Students should be encouraged to pose basic problems about their immediate world.

**Pedagogical questions:**
- How could you record that mathematically?
- What words could you use to describe…?
- How could you record that mathematically?
- Choose a way to (eg count/estimate/rename/draw/record) that?
- What words could you use to describe…?
- What mathematical words can you use to describe…?
- What would be an efficient way to...(count/add on/calculate/draw/record) that?
- What words could you use to describe…?
- Can you choose and use your mathematics flexibly?
- What mathematical words can you use to describe…?
- What information is helpful?
- What information is not useful?
- Close questions can be useful to check if the student has accessed the information given in the question, for example: How many…?
- How much…?
- Whem…?
- (These questions will vary depending on the context of the problem).

**Examples**
You have told me that there are twelve balls there.
- What is the value of… (a calculation that you would expect automatic recall of, eg number pairs to 10, to 100 etc)?
- How many…?
- What is the value of…?
- What words could you use to describe…?
- Can you remember the name of that… (shape/number)?
- What would be an efficient way to...(count/add on/calculate/draw/record) that?
- What mathematical words can you use to describe…?
- What words could you use to describe…?
- Can you choose and use your mathematics flexibly?
- What mathematical words can you use to describe…?
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### Problem solving: Years F-2

**Students benefit from working in a problem solving context in many aspects of the curriculum.**

**In what ways can you solve and check?**
This is the mechanics of problem solving, the doing of calculations (the counting/adding/subtracting/sharing/grouping/building), and checking how appropriate the answer.

**Pedagogical questions:**
- How can you… (count that/add those numbers together/subtract that amount)?
- Does that seem right to you?
- How can you check your answer?
- Do other people think that too?

**Examples**
Choose a way to find out what day of the week counters there are?
- Choose a way to arrange your counters, so that someone else can look at them and count them quickly/efficiently, or just see how many?
- Notice that this fluency could have been developed as a result of students experiencing problem solving questions such as:
- Are there ways of arranging collections of counters, that make it easier to see at a glance how many counters there are?
- Choose a way to find out what day of the week it will be on the first of April this year.

**Pedagogical questions:**
- Can you represent the information in a different way?
- Can you represent the information using numbers and symbols?
- What information is not useful?
- What information is helpful?
- What are you being asked to find out or show?
- How can you... (count that/add those numbers together/subtract that amount)?
- Does that seem right to you?
- How can you check your answer?
- Do other people think that too?

### Reflect

**Students need to reflect on how reasonable their answer is and also on the method that was used.**

There are different ways to solve problems and different ways to explain your thinking. At every stage of development, students benefit from sharing and reflecting on the strategies and reasoning of others.

**Pedagogical questions:**
- If the sharing is happening part-way through the problem solving process:
  - Would you like to change your mind and try something different?
- If the sharing is happening at the end of the problem solving process:
  - Would you use a different strategy next time?
  - How efficient was this strategy?
  - Which was easiest for you to understand?
  - What did you like about…?
  - What would you do differently now?
Understanding: Years F-2

What patterns/connections/relationships can you see?
This is about noticing the characteristics of familiar shapes, objects, quantities and patterns that show similarity and difference, then using these characteristics to sort and order quantities, shapes and objects. It is about looking for patterns in everything—looking for patterns in number, in shape and in data.

Can you answer backwords/inverse questions?
This is about working flexibly with a concept.

Can you represent or calculate in different ways?
This is about representing amounts, patterns, shapes and data in different ways.

Pedagogical questions:
- How are these… (volumes, number sentences/shapes) the same as each other?
- How are these… (volumes, number sentences/shapes) different to each other?
- What is the connection between…?
- Which is the odd one out?
- What if… (change something), is it still…?
- Which is greater/bigger/larger/taller?*
- Which is less/smaller/shorter?

* Asking closed questions such as these can allow the teacher to see the connections that the student does not make, even if the student can’t articulate the connections. These questions can help the teacher identify the root of the misconception.

Examples
Change the object or the physical arrangement, but keep the quantity the same (e.g., marbles/5 basketballs) and vice versa. What’s the same/different?

Like 10 flip tiles; 6 orange, 4 grey. What if… (turn an orange to grey) is it still 10?

When we ask this type of question, we need to observe if the student recalculates or if they build on their understanding.

Pedagogical questions:
- If the answer is… what might the question have been?
- What is missing… (in this number/sentence/from this graph/in this pattern)?

Examples
I’m thinking of an addition sum and the answer to my sum is 10. What might the questions have been?

I need 10 children to help me, but so far we only have 8. How many more volunteers do I need?

The answer is ‘A SQUARE’. What might the question have been?

You could use puppets for this activity. eg Today Mr Maths (puppet) can only say ‘A square’. What question can you ask him so that he can answer you?

What else could it be?

Starting with 10 orange tiles, what if… (turn an orange to grey) is it still 10?

Further reasoning (generalising):

Examples

Pedagogical questions:
• Why are these always the same/different?
• Is there a rule that we could use to describe…?
• Is there a rule that always works?
• What makes these the same?

Reasoning: Years F-2

In what ways can you prove…?
This is about convincing yourself and others of your mathematical thinking. At this stage proof would involve using equipment, drawings and simple calculations. It is important to evaluate different ways of proving the same idea and justify the choices that are made.

Pedagogical questions:
- Prove that…
- Convince me, yourself or someone who thinks differently…
- Try not to ask me if you are correct, but instead try to tell when you KNOW that you are correct. Then share how you know that.
- What else could it be?

Examples

Pedagogical questions:
• What is the connection between…?

Examples

Pedagogical questions:
• How come…?
• Explain it/why? (To a peer)
• Can you show me how that works?
• Why did you choose to…?

Examples

Pedagogical questions:
• Prove that…
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