re(Solve) MATHS BY INQUIRY

MATHEMATICAL INQUIRY INTO AUTHENTIC PROBLEMS

What's For Lunch?
Lesson 2: Devise Phase

Australian Curriculum: Mathematics (Year 2)

ACMNA027: Recognise, model, represent and order numbers to at least 1000

ACMNA028: Group, partition and rearrange collections up to 1000 in hundreds, tens and ones to facilitate more efficient counting

ACMNA030: Solve simple addition and subtraction problems using a range of efficient mental and written strategies

ACMNA031 Recognise and represent multiplication as repeated addition, groups and arrays

Lesson abstract

Students identify the mathematical knowledge they need to find how many of the selected items they eat in a school year (e.g. number of days in a school week, weeks in one term and terms in a year). Students devise a plan to calculate or otherwise demonstrate the total number, using grouping, partitioning and repeated addition strategies. They refine their plans with ideas from a Checkpoint where they share strategies and methods.

Mathematical purpose (for students)

We will plan how to find the number of approximately [sandwiches] our group would eat at school in a year.

Mathematical purpose (for teachers)

Students plan how to calculate the number of sandwiches eaten in a year. Strategies include counting, partitioning, repeated addition, grouping, and prepresenting with arrays. They apply a combination of known and invented strategies to make calculations involving large numbers.

At the end of the Devise phase, groups will be able to:

- explain the strategies they will use to answer the inquiry question,
- adjust their plan if necessary, using feedback and suggestions from their peers.

Lesson Length 60 minutes

Vocabulary Encountered

- evidence
- represent
- approximately
- method, strategy
- justify

Lesson Materials

- student workbooks
- calendars for some students
- digital camera(s) on any device
- Maths Investigator poster (print for class display)
- concrete materials such as markers, blocks, MAB, number lines, grid paper (selected by students)
- Teacher Sheet - Checkpoint Prompts (teacher use, optional)

We value your feedback after these lessons via https://www.surveymonkey.com/r/CV2TXTT

Mathematics by Inquiry is an initiative of, and funded by, the Australian Government Department of Education and Training

Australian Academy of Science

aamt

How Many Do We Eat at School in a Year?

Introduce the mathematics needed

1. In the same groups of three, students revisit their list of categorised lunchbox contents from the previous lesson and confirm the item they selected for the inquiry question.

2. Invite students to consider how many sandwiches they would they eat in 2 days (then 3 days) if their group eats 3 sandwiches in one day. Explain that we can use the data gathered for one day to work out **approximately** how many sandwiches we will eat in a year. Discuss the term 'approximately' (add to word wall). Remind the students of the earlier discussion (Discover) about why the number will be approximate.

3. Through discussion, list the information students may need to know to answer the question. At this stage, be careful not to give too many examples (or suggest calculating one week first) as this could reduce the chance of them formulating their own strategies.

   Identify how many days in a school week (5), one term (10 weeks in one term), one year (4 terms in a year). **List** this information **and display** for students to refer to as they devise a plan to work out the number of [sandwiches].

   Students may suggest months, but this becomes very complex for Year 2 as months have differing number of days. Provide a calendar if you wish to support this. Some students may want to use 365 days in a year. If so, revisit the inquiry question which specifically mentions 'at school.'

4. Show the Maths Investigator poster. Explain to students the importance of collecting evidence when they are working on an inquiry (add 'evidence' to word wall). Just like a detective looks for evidence so they can solve a crime, we need mathematical evidence to answer the question and show the class that we have a reasonable answer. When we work on an inquiry question, we need to **find** the maths, **do** the maths, and **share** the maths. When students **share (and explain)** the maths, visual representations help make their thinking clear to others.

5. Discuss the different ways their thinking could be represented and **list** these on a chart (noting new terminology on the word wall) for students to constantly refer back to:
   - Drawings and diagrams
   - Concrete materials including MABs
   - Number lines
   - Colour coding
   - Words and numerals and number sentences
   - Arrays

   Encourage students to solve the problem using whatever techniques they wish and use words, pictures, colours, models and numbers to explain their process. Suggest students photograph any representations made with concrete materials so they have a record.

Planning strategies for finding yearly total

6. Have groups devise and share ideas for strategies to find out how many [sandwiches] they would eat in a year. Allow time for students to collaborate before offering prompts. Move around the class observing each group, to ensure all members are contributing. Ask individual students to explain their thinking while other group members listen. Methods at this stage may not be fully formed or feasible but will continue to be developed during the Develop stage. As individual students may have different strategies, encourage all students to share within their groups and carefully consider the strategies they might use. Avoid making suggestions or favouring any particular method. Encourage students to explain, build on, and justify their ideas with their peers. As many students will have valuable ideas and invented strategies, encourage them to follow their chosen strategy. Groups can choose to work together on one favoured strategy or individually.

Rather than offer direct suggestions, use prompting questions when groups encounter setbacks. Listen carefully to the full explanation before prompting as students may approach the task with a strategy which may initially appear to be incomplete but will actually answer the question.

7. Have every student write a statement explaining how they will answer the question, *'How many [sandwiches] do we eat at school in a year?'*

Checkpoint: Sharing Ideas and providing enabling prompts.

8. Students share initial ideas with the class. If students are struggling to formulate a plan, this checkpoint should offer a place to start. Make it clear that it is acceptable for students to use the ideas of others if it will help them to improve their plans. Building on the ideas of others is a valuable skill which needs to be encouraged.

    - Groups should explain the mathematical strategy they have chosen. Note these on the word wall and **review** as each strategy is suggested. Strategies that should be brought out include grouping, adding, repeated addition, skip counting and arrays. Add any important strategies that are not suggested.
    - Groups should present any challenges they are facing and require assistance with, describe what they will need to do next to answer the question and explain how they are going to represent their thinking.

9. Sample prompts for the discussion are provided on Teacher Sheet – Checkpoint Prompts.

    The ideas shared are likely to be vague. Prompt groups with insufficient detail to consider the steps they will follow. It is not expected that students will answer these prompt questions at this stage. The purpose of these prompts is to encourage discussion within groups as they consider how they might address these issues when they refine their plans.

10. Allow groups time to consider prompt questions asked during the Checkpoint and record ideas that will improve their methods. Some groups may not realise their ideas are incomplete or ineffective. Some groups may want to change their plan completely if they have heard something they feel is more efficient. This will be valuable experience as they begin to implement their strategies in the Develop phase. Allow time for each student to re-write or refine the strategy they will use. Ensure each student shares their own refined strategy within their group.

Teacher Sheet - Checkpoint Prompts

Student:	*Using the Day 1 number, I will draw it over and over again until I have enough for a whole year.*
Teacher:	*How many times will you need to draw your Day 1 number? How can you work that out?*
Student:	*Using the Day 1 number, I will use a number line and do jumps.*
Teacher:	*How many jumps will you need to make? How big will your jumps be? How did you know? How did you work that out?*
Student:	*We will jump in fives because we had 5 sandwiches on Day 1. We will need to jump 5 times because there are 5 days in a school week. Then we'll need to make bigger jumps with that number and jump 10 times for the number of weeks. Then we jump 4 times with that number for the number of terms.*
Student:	*Using the Day 1 number, we will add it 40 times for four school terms.*
Teacher:	*How did you come up with the number 40?*
Student:	*We did 10 weeks plus 10 weeks plus 10 weeks plus 10 weeks and that gave us 40 weeks, so we know there are 40 school weeks in one year.*
Teacher:	*I can see your Day 1 total is 3 and the number of weeks in a year is 40. I'm wondering if you have missed a step.* (Repeat their steps for the class to consider – they are not using the weekly total). *Can anyone see something they might have missed? Discuss this with your group to find what's missing.*
Student:	*Using the Day 1 number which is 4, repeated addition for a week, 5 times. Repeated addition 8 times.*
Teacher:	*I can see how you will repeatedly add your day 1 total of 4 pieces of fruit to get your weekly total. Can you explain why you are adding this 8 times?*
Student:	*I can't remember.*
Teacher:	*Your group will need to refer to our list and think about what you'll need to do next. After you have your weekly total, what is the next thing you might need to find?*
Student:	*Think 5 days for one week, think 10 weeks for one term. That's easy, count in fives 10 times (50 days), think 4 terms for one year. So, 50+50+50+50 is 200 days.*
Teacher:	*What have you calculated? Let's go back to the inquiry question. Does your strategy tell me how many sandwiches your group ate?*
Student:	*No, we have calculated how many days there are in a year. We need to see how many sandwiches are in the year, so we ate 3 sandwiches on every day and there are 200 days, so we can do 200+200+200.*
Teacher:	*Now I understand what you are doing. Did everyone in your group think that was the best way to work this out? Can they all explain it the way you did? Check to see everyone understands your strategy.* (NB: Strategies need to be understood by everyone in the group.)

Mathematics by Inquiry is an initiative of, and funded by, the Australian Government Department of Education and Training

Australian Academy of Science

aamt

A Maths Investigator

- FINDS THE MATHS
- DOES THE MATHS
- SHARES THE MATHS