What's For Lunch?
Lesson 4: Defend 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

The lesson begins with evaluating strategies for finding the yearly total number of [sandwiches] using the grid paper representation. These representations show the steps that students followed to calculate their answer and help them find more efficient ways to calculate totals. Students answer the inquiry question, demonstrating their mathematical evidence. They reflect on the feedback given to determine what they did well and how they could improve their presentation and models.

Mathematical purpose (for students)

We use mathematical evidence to convince others of our solution to an inquiry question.

Mathematical purpose (for teachers)

The purpose of making the grid presentation is for students to review and show the steps of their calculation methods and to improve their efficiency. It will also strengthen students' appreciation of the power of arrays. To ensure mathematical depth in explanations, students are carefully prompted to explain the sequence of steps used to calculate the total and refer to their evidence and representations. Examples of student presentations and of the way that representations may develop from the Discover to the Defend phase illustrate how teachers can value different methods and highlight and discuss efficiency of strategies.

Lesson Length 60 minutes (may be broken into 2 lessons)

Vocabulary Encountered

- representation
- annotations
- columns
- rows
- approximation

Lesson Materials

- student workbooks, tablets (optional)
- A3 paper (several sheets per group)
- 1cm grid paper (several sheets per group)
- scissors and glue
- coloured pencils
- Teacher Sheet 1 - Sample Presentation and Teacher Sheet 2 - Discover to Defend (teacher use only)

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

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Examining Grid Representations

1. Inform students that in the Defend Phase they will be assembling their evidence and sharing the strategies they used to answer the question of, '*How many_____ do we eat in one year?*' Students are to use their representations to illustrate and share their answers with the class. They are also to provide feedback on others' presentations, focusing on the mathematical evidence used. In this first section, students provide and evaluate strategies.

2. Select a group with a grid paper representation from the Develop phase (Part B) to share with the class. This work may be incomplete but will provide opportunities to discuss expectations for their final presentations and highlight the strategies used for calculating totals. As students explain their methods and findings to the class, highlight the need for clear representations and showing the mathematics used. Focus on the value of colour coding and annotations so others can read and understand it with minimal verbal explanation.

3. Invite a second group to share their grid paper representation, highlighting similar points. Focus on efficient strategies for repeated addition or skip counting, using arrays, partitioning and grouping. Teacher Sheet 1 – Sample Presentation shows the type of evidence that students might give as they discuss the different strategies they used to calculate the same totals. It also provides sample teacher prompts to draw out the main points.

4. Point out to students how different ways of calculating are discovered as we go along and encourage them to look for them. (E.g. *You may find something more efficient like Louis did when he saw that he could count in tens to reach 400.)*

5. Students now complete their grid representations. As groups work, ask individual students to explain the strategy they used and compare with their other representations. Do the answers match? Has the grid representation helped them find more efficient way of calculating their total number of [sandwiches]?

6. A sample of how students' representations may have developed from the Discover to the Defend phase is given in Teacher Sheet 2 – Discover to Defend.

Presentations Answering the Inquiry Question

7. Now students prepare their group's presentation of their solution to the inquiry question. They should present a clear mathematical solution that is supported with evidence of the mathematical thinking. Each student in the group needs to be able to explain the strategy.

8. Prior to the start of presentations, remind non-presenting groups:
   - to actively listen to and analyse each presentation,
   - to consider whether presenters have used appropriate mathematical terminology
   - to consider whether good mathematical evidence has been given to support their solution
   - to provide constructive feedback on the strengths and weaknesses of the mathematics used as evidence.

9. As groups present their evidence:

   - prompt them to explain in detail, each step of their process, making connections between the mathematics and the inquiry question.
   - involve all group members in the explanation, highlighting differences in their strategies or the times when they combined strategies.
   - focus on the mathematics and mathematical language.
   - prompt for depth of understanding and evidence.

10. Look for patterns in the answers:
    - Compare answers for groups that have a same Day 1 number, regardless of item selected, and compare the strategies used for calculating. Strategies may be the same, similar or different, but the answer must be the same.
    - Have students consider the range in size of the different totals (daily, weekly and by term) and make predictions for the yearly totals. For example, record totals for the different time periods in a table and encourage students to find patterns. If some Day 1 totals are missing from class data, students could estimate them by using the pattern formed by existing totals.

Day 1 total	Weekly total	Term total	Yearly total
2	10	100	400
3	15	150	600
4	20	200	800
5	25	250	1000
6	30	300	1200
7	35	350	1400
8	40	400	1600

Reflection

11. Have groups reflect on the feedback given to them and consider what they did well and what they could do to improve their representations and models.

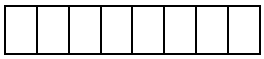
12. As students compare the methods of different groups with their own, and consider the different ways of reaching a total, pose the questions:
    - Which method do you think was more efficient? Why?
    - Would you change your method if you did this activity again? Why?

13. Finally, review the reasonableness of the answers to the inquiry question, and review why the answers are just approximations, recalling the many factors involved (different lunches on different days, absence from school etc).

Teacher Sheet 1 – Sample Presentation

This is a report of a presentation given by the group of Oscar, Louis and Elizabeth, including teacher prompts. It demonstrates how the grid presentation can be used, in simple and more complex ways. Students can discover improved ways, make connections between different methods, and come to appreciate the value of arrays.

Student representation (Elizabeth)



Discussion

Oscar: On *Day 1 our group had 8 pieces of fruit.*

Elizabeth: *I had 2 pieces of fruit, Oscar had 4 and Louis had 2. We added 2+4+2=8*

Teacher: *What was the first thing you did?*

Elizabeth: *I counted 8 squares and cut out the strip. That is our Day 1 number.*

Student representation (Elizabeth)

Discussion

Elizabeth: In a week, we had 40 pieces of fruit.

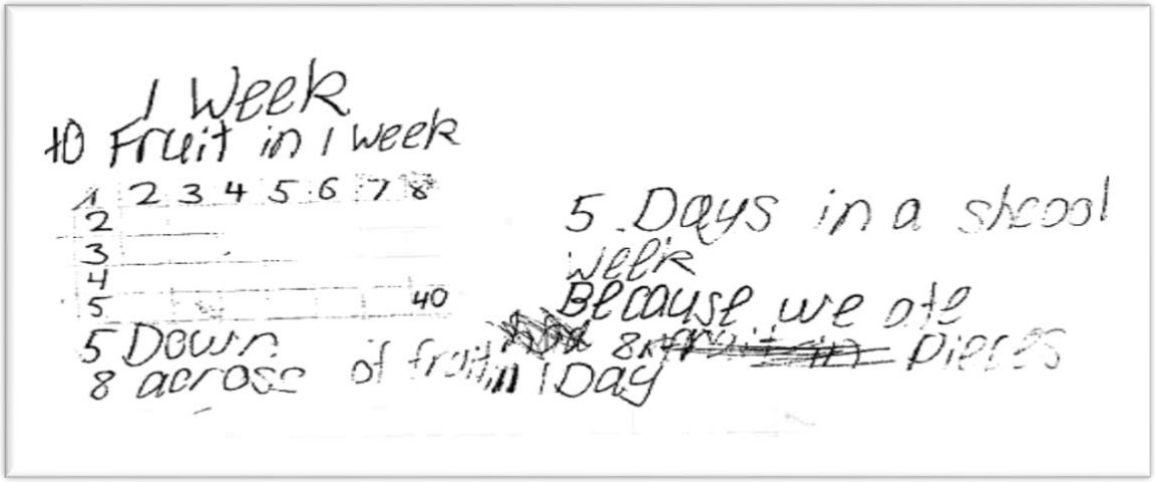
Teacher: How did you calculate that weekly total?

Elizabeth: There are 5 days in a school week and we ate 8 pieces of fruit each day. This shows every day in different colours. We did 8+8+8+8+8=40 by going 8+8=16;16+8=24; 24+8=32; 32+8=40

Teacher: Is this the easiest way to count to 40 on grid paper?

Elizabeth: I counted 40 and it was easy, but I got lost and had to count again. Louis counted 5 rows of 8. That's 5 down and 8 across and that is 40 too. That way was easier to count.

Student representation (Louis)



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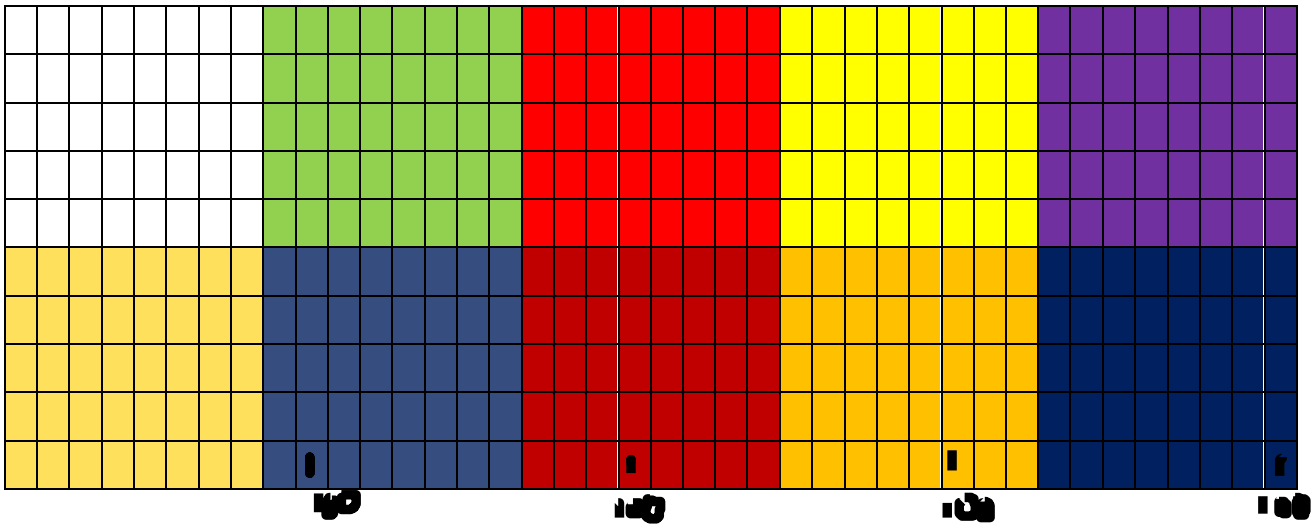
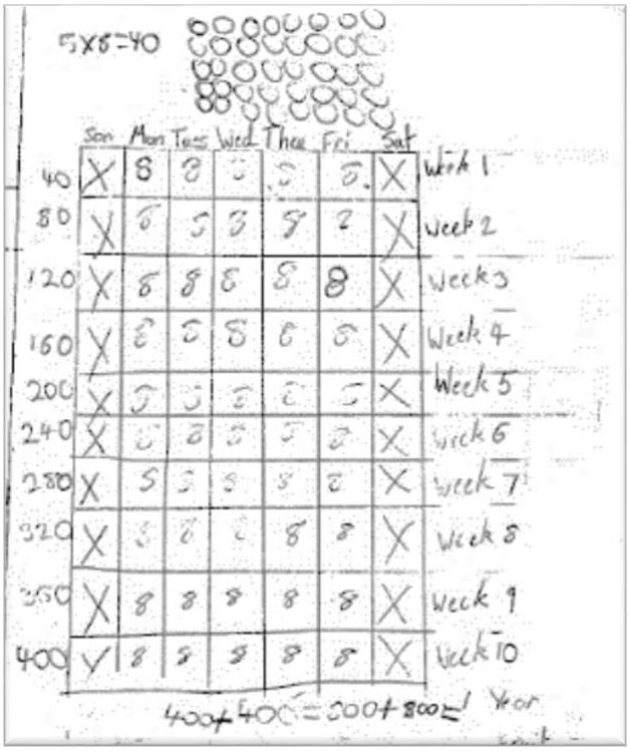
Discussion

Louis:	40 is 5 down and 8 across of fruit. We ate 40 pieces of fruit in a week.
Teacher:	I can see rows and columns of numbers all set out in a rectangle. What do we call the way it is represented? Why is it easier to count?
Louis:	An array. Arrays are easier to count because we can count a row and then count the next row. We could even write an 8 at the end of the row and then we wouldn't forget.
Teacher:	It is easier to draw too, because you can make the rows the same size. You do not always have to count the 8.

Student representation (Elizabeth)



Student representation (Oscar)



Discussion

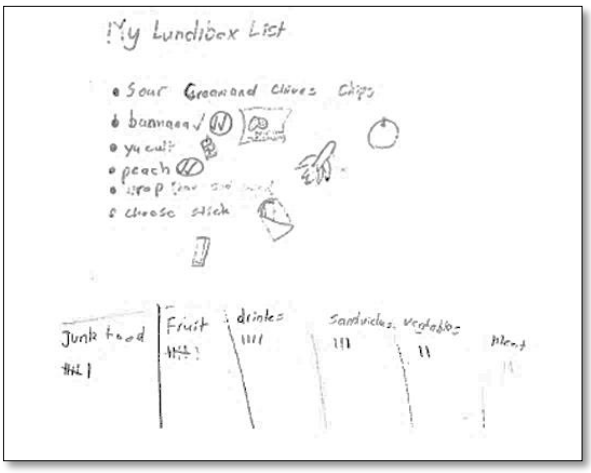
Teacher:	How did you calculate your term total?
Elizabeth:	There are 400 in a term. We got the same answer both times even though we counted it differently.
Oscar:	We calculated our term total in a different way to how we did it first. When we made the array, we saw that there were 10 rows of 40. We counted the columns in 10s to 100 and that was easier than adding 40 each time like we did in the table.

Teacher Sheet 2 - Discover to Defend

Progression from Discover to Defend

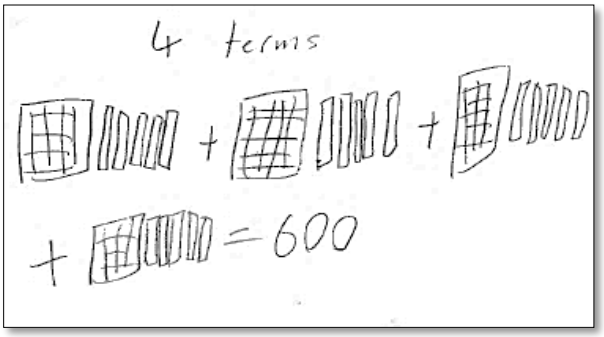
These work samples illustrate the evidence that several groups provided through the four inquiry phases to support their answer to the inquiry question.

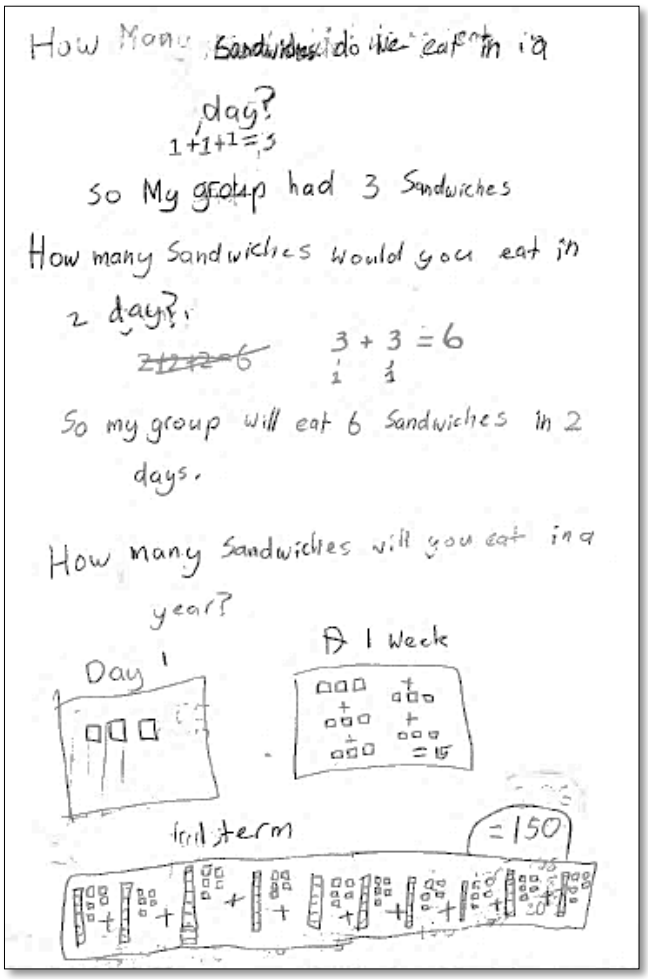
Discover phase:



Devise and Develop phases:

Here we see evidence of working which the students later referred to for explaining their strategy. They used drawn representations of MAB to represent 150, four times. They counted in 100s and then 10s to 100. 100+100+100+100=400. Then there are 10, 20, 30, 40… 100 and then another 10, 20, 30 40… 100. So, 400 and another hundred is 500, and another hundred is 600.





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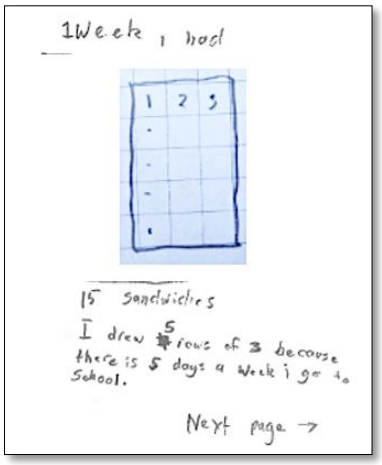
Defend phase:

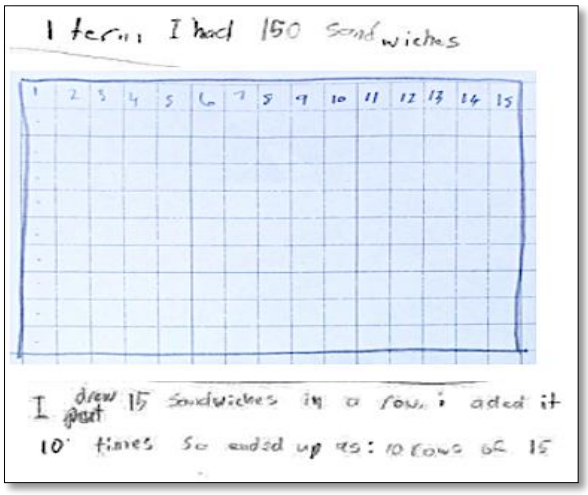
This work sample shows how the group created a yearly total by creating a term and then repeating it to create the year. They did not explain the mathematics used in writing but could do so when prompted, referring to their calculations in the Devise and Develop phases.

One day

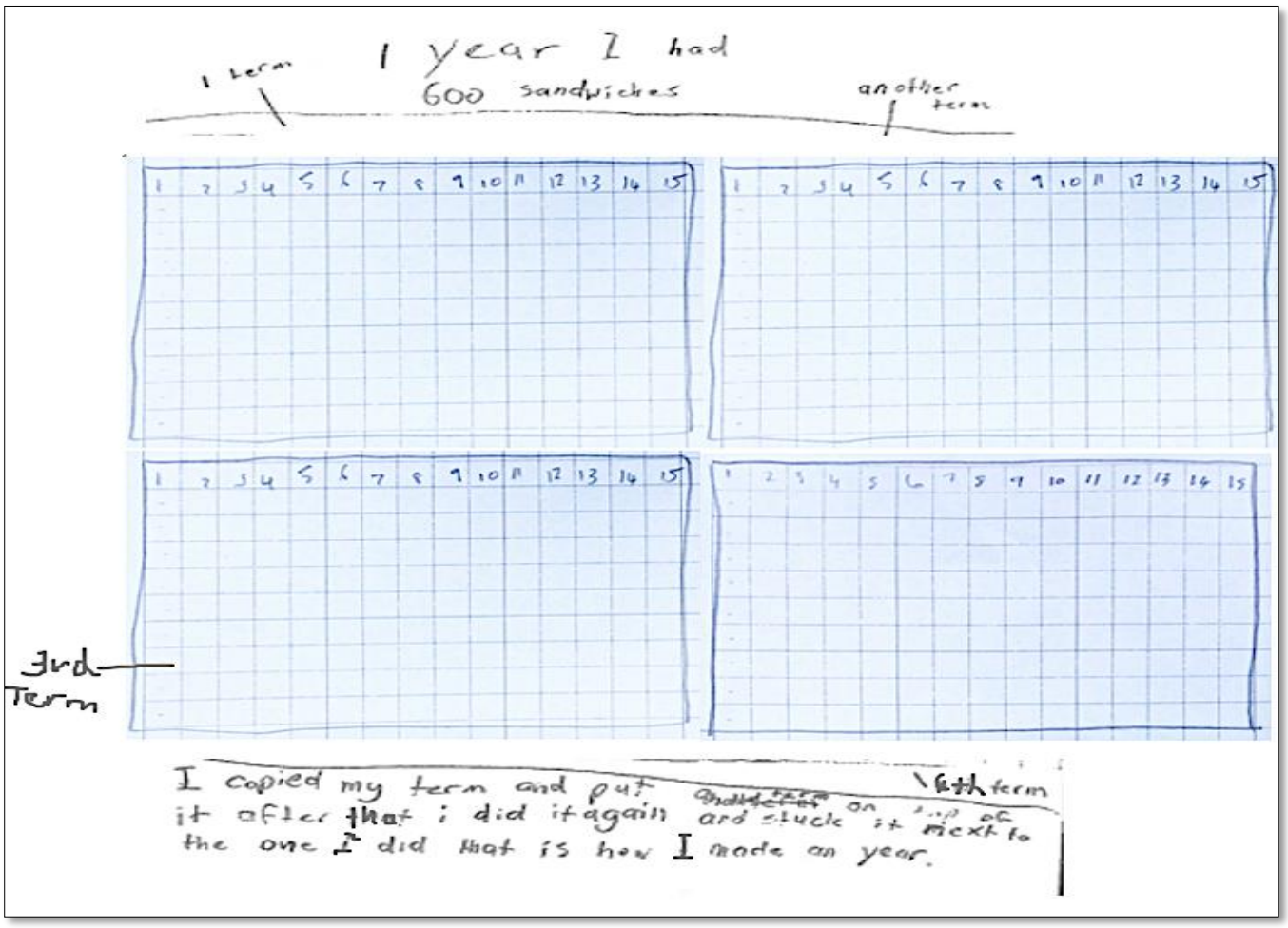
One week



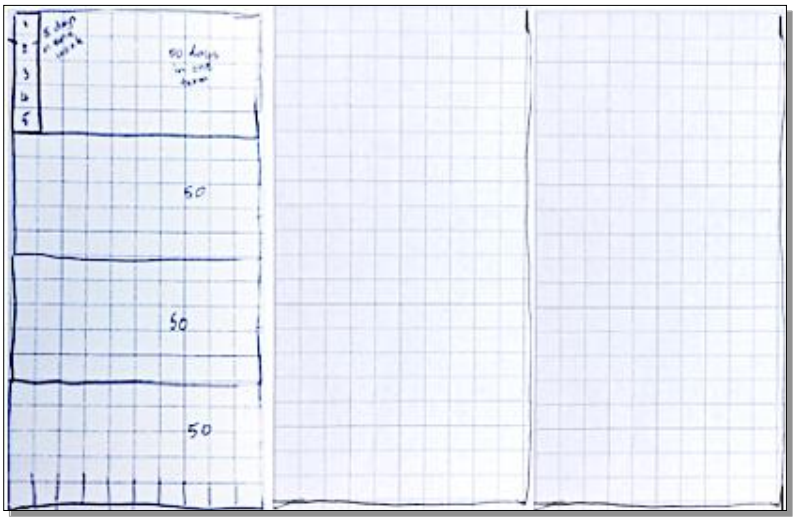
One term



One year



Alternative strategy by same group:
Total number of days and multiplied by number of items



Students' explanation

There are 5 days in one week.
Ten weeks in one term.
So, 50 days in one term.

We counted in tens.
Four terms in one year so 50+50+50+50=200. That's the first box.

We ate 3 pieces of fruit on the first day, so we did 3 boxes which is 3 groups of 200.
We have a grid of 200 for each piece of fruit.

We just copied the first grid.
That's 600 pieces of fruit for the whole year.

If it was 4 pieces, we could just add on an extra box of 200.