



naturally
mathematical

Early Subtraction

**A Collaborative Guided Inquiry
with Ann Baker**

**Series
Introduction**





Overview

Subtraction has many facets which include strategies, representations and contexts. This series covers this topic comprehensively, even though many of the components can be used separately when the teacher sees a need for a particular aspect that needs attention. The series consists of:

1. Strategy lessons:
 - Strategy 1 – Finger Gnosis
 - Strategy 2 – Conceptual Subitizing
 - Strategy 3 – Count Back
 - Strategy 4 – Count On or Count Back?
 - Strategy 5 – Working with Unknowns
2. Mental routines
3. Problematized situations
4. Word problems
5. Number talk
6. Games

The material is also set within the context of an inquiry that will enable the teacher to show where the students started from and where they have reached in their exploration of subtraction.



Having an Impact?

John Hattie has coined the term 'know thy impact'. Teachers are more and more being expected to know if they are having sufficient impact on their students' learning. Teachers are also expected to involve students in knowing the learning intentions and to be involved in knowing how well they are meeting the success criteria. With this in mind, we have planned this mini-classroom based inquiry such that we can begin to collect data about our impact: what's working, what we can achieve and how we can share the learning journey with our students.

The Collaborative Guided Inquiry

An inquiry begins with important guiding questions. Two questions are outlined below but as you work with peers you may want to rewrite them to suit your own needs or interests. At least they will start the process.

Acknowledgement

Johnny and I would like to express our very sincere thanks to Caroline Swinburne for her support in the preparation of this series. “Caroline, thanks to your insights and comments; parts of the series that might have been incomprehensible are now accessible to all!”



ACARA: Numeracy Learning Progressions

The content of this series has been guided by the Australian Mathematics Curriculum, which sets broad goals for Early Subtraction:

Year 1: They carry out simple additions and subtractions using counting strategies

Year 2: They perform simple addition and subtraction calculations using a range of strategies

These goals are made more explicit in the Numeracy Learning Progressions (NLPs).

AdS2 Perceptual strategies

- builds and subtracts numbers by using objects or fingers

AdS5 Counting back (by ones)

- uses count-down-from for subtraction tasks ($9 - 3 = ?$, $9 \dots 8, 7, 6$. It equals 6)
- uses count-down-to to calculate (9 take away something equals 6, responds $9 \dots 8, 7, 6 \dots$ It's 3)
- finds the difference between two numbers less than 20
- counts back to find the difference between two quantities where the difference is no greater than 4

AdS6 Flexible strategies with combinations to 10

- applies inverse relationship of addition and subtraction

Where does this material fit with the NLPs?





Building on the Numeracy Learning Progression, here are 11 items that list the key indicators for Early Subtraction. The modules of this series will help you know where your students are in terms of achievement and this information will form the basis of the formative assessment that will show the impact you are having on your students' learning.

Key Indicators

1. I can show how to take away from a collection using materials (counters).
2. I can show how to take away using my fingers (finger gnosis).
3. I can show how to subtract by using subitizable groups.
4. I can count back 1, 2, 3 from numbers up to 10 to subtract (count-down-from).
5. I can count on 1, 2, 3 from numbers up to 7 to subtract.
6. I can choose the count-back or count-on strategy that is the most efficient.
7. I can model a count-back or a count-on on a number strip.
8. I can record subtraction using mini-chunking for problems with
 - result unknown,
 - start unknown,
 - change unknown.
9. I can show subtraction on an empty number line for a
 - count-back strategy,
 - count-on strategy.
10. I can compare 2 groups to find the difference (how many more than or less than).
11. I can solve everyday problems involving subtraction.

Questions to ask yourself

Question 1

To what extent do visual strategies such as finger gnosis and seeing subitizable groups help develop fluency and flexibility with subtraction?

Question 2

Are students able to make connections between the action of subtraction and recording subtraction with mini-chunking?

What do we know about students and early subtraction?

We know that some of our students:

- have limited conceptual understanding of the process of taking away/removing objects from a collection,
- fall back on count-all strategies rather than count-back and count-on because they have had limited exposure to visual strategies such as subitizing and finger gnosis, where counting is not actually needed,
- do not connect their hands-on and visual experiences with more abstract representations.



The Learning Intentions

Intention 1

To use dialogue and visual connections to encourage students to develop a deep understanding of the strategies that can be used in subtraction calculations.

Intention 2

To develop pedagogy that promotes engagement with, and disposition toward, fluency and flexibility as outlined in the ACARA: National Numeracy Learning Progressions.

Activities for the Inquiry

Observations, work samples and anecdotes will be collected lesson by lesson so that we can examine our impact through ongoing formative assessment.



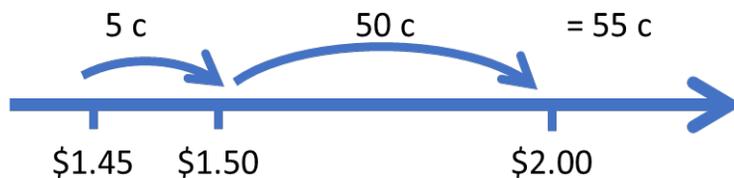
Before getting started: A quick check

Before moving on to the actual focus and pedagogical content goals of this inquiry please look at the following subtraction question and notice how you go about answering it.

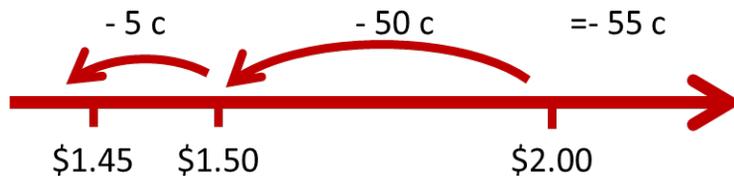
How much change will you get from \$2 if you spend \$1.45 on a snackbar?

We are going to ask you to try a simpler version of this with your class, but before that, consider what approaches and starting points you could use.

➤ **Count on**



➤ **Count back**



➤ **Just knew it.** 55 cents

Examples of strategies are shown on the next page.

A Variety of Strategies

Students may well use any of the following approaches to finding $4 - 2 = ?$

Sample 1

Count all every time.



Count out
4 fingers



Count 1, 2 as fingers
are put down



Count 1, 2 fingers
that are left

Sample 2

Uses subitizing



4 fingers put up,
with no counting



Put down 2 with
no counting



Know what's left

Sample 3

Uses count back



4, 3, 2.
I counted back 2.

Sample 4

Uses count on.



2, 3, 4.
I counted on 2.

Sample 5

Just knows it.



Too easy!
The answer is 2.



Subtraction Picture Books

Here is a list of Early Subtraction picture books that I have used with Foundation Year students. Hopefully, your library will have some of them and you'll be able to dip into them with your students.

- Allen, E, (2013) *10 Hooting Owls*, Scholastic
- Allen, E. and Binks, W. (2014) *10 Clumsy Emus*, Scholastic
- Campbell, R. A. (1997) *Lift the Flap Book Farm 123*, Puffin Books
- Carle, E. (2005) *10 Little Rubber Ducks*, Harper Collins
- Crisp, D. (2005) *Five Little Men in a Flying Saucer*, Classic
- Dean, J. (2016) *Pete the Cat and the Missing Cup Cakes*, Harper Collins
- Fox, M. (2016) *Ducks Away*, Scholastic Australia
- Gackenbach, D. (1983) *A Bagful of Pups*, Houghton
- Gerth, M. (2001) *Ten Little Ladybirds*, Gullane
- Giganti, P. (2005) *How Many Blue Birds Flew Away?*, Greenwillow
- Hauskamp, S. (2003) *Eight Silly Monkeys*, Gullane
- Jonas, A. (1997) *Splash!* Harper Collins
- Manning, J. (2001) *Who Stole the Cookies from the Cookie Jar*, Harper Collins
- Metzger, S. (2004) *Five Little Bats Flying in the Night*, Scholastic
- Murphy, S. J. (1997) *Elevator Magic*, Harper Collins
- Murphy, S. J. (2001) *Monster Musical Chairs*, Harper Collins
- Reiser, L. (2006) *Hardworking Puppies*, Harcourt
- Sharratt, N. and Heap, S. (2005) *One to Ten and Back Again*, Puffin
- Sykes, J. (2009) *Dora's Chicks*, Little Tiger
- Tarlau, A. and Mounsey-Smith, K. (2015) *Ten Tricky Dinosaurs*, Scholastic
- Wise, W. (2004) *Ten Sly Piranhas*, Puffin
- Wood, A. and Wood, B. R. (2004) *Ten Little Fish*, Blue Sky Press



Achievement Record

This chart has been made part of each module so that you can build a complete picture of how your students are progressing.

I look forward to hearing how your journey into Early Subtraction goes.

Indicator	Name						
I can show how to take away from a collection using materials (counters).							
I can show how to take away using my fingers (finger gnosis).							
I can show how to subtract by using subitizable groups.							
I can count back 1, 2, 3 from numbers up to 10 to subtract (count-down-from).							
I can count on 1, 2, 3 from numbers up to 7 to subtract.							
I can choose the count-back or count-on strategy that is the most efficient.							
I can model a count-back or a count-on on a number strip.							
I can record subtraction using mini-chunking for problems with							
- result unknown,							
- start unknown,							
- change unknown.							
I can show subtraction on an empty number line for a							
- count-back strategy,							
- count-on strategy.							
I can compare 2 groups to find the difference (more than or less than).							
I can solve everyday problems involving subtraction.							