

Accelerating Learning in Mathematics

DRAFT

Learning to: use advanced counting to solve problems

Target group:
students in years 1–3

Focusing on:

- applying advanced counting strategies to addition and subtraction problems
- counting on and back in ones from any number between 1 and 100.



Beliefs underpinning effective teaching of mathematics:

- Every student’s identity, language, and culture is respected and valued.
- Every student has the right to access effective mathematics education.
- Every student can become a successful learner of mathematics.

Ten principles of effective teaching of mathematics:

1. An ethic of care
2. Arranging for learning
3. Building on students’ thinking
4. Worthwhile mathematical tasks
5. Making connections
6. Assessment for learning
7. Mathematical communication
8. Mathematical language
9. Tools and representations
10. Teacher knowledge

TEACHER OBSERVATION OVER A RANGE OF ACTIVITIES

The student may be able to solve addition and subtraction problems by counting on from one using materials or imaging. The student may have difficulty trusting the count, reverting to counting from one when solving a problem. For example, when solving $8 + 3$, the student may hold up eight fingers but still count from one when joining the two sets.

When counting over the decades, the student often uses the wrong decade, for example, “38, 39, um, um, 60, 61”.

POSSIBLE BARRIERS TO THE STUDENT’S PROGRESS

- | | |
|---|--|
| 1 | Inability to count on or back to solve problems |
| 2 | Confusion about teen numbers |
| 3 | Limited understanding of tens and ones in numbers to 100 |

See *Effective Pedagogy in Mathematics* by G. Anthony and M. Walshaw, Educational Practices Series 19, International Bureau of Education, available at: www.ibe.unesco.org

EXPECTATIONS FOR NUMBER

| AFTER 1 YEAR AT SCHOOL | | AFTER 2 YEARS AT SCHOOL | | AFTER 3 YEARS AT SCHOOL | | BY THE END OF YEAR 4 | | BY THE END OF YEAR 5 | | BY THE END OF YEAR 6 | | BY THE END OF YEAR 7 | | BY THE END OF YEAR 8 | |
|------------------------|-----------------------|-------------------------|------------------|---------------------------|------------------------|----------------------|------------------|-------------------------|------------------------|--|------------------|-------------------------------|------------------------|--|------------------|
| COUNTING FROM ONE | | ADVANCED COUNTING | | EARLY PART-WHOLE THINKING | | EARLY ADDITIVE | | EARLY ADVANCED ADDITIVE | | ADVANCED ADDITIVE – EARLY MULTIPLICATIVE | | EARLY ADVANCED MULTIPLICATIVE | | ADVANCED MULTIPLICATIVE – EARLY PROPORTIONAL | |
| NZC EARLY LEVEL 1 | NUMERACY STAGE 2 OR 3 | NZC LEVEL 1 | NUMERACY STAGE 4 | NZC EARLY LEVEL 2 | NUMERACY EARLY STAGE 5 | NZC LEVEL 2 | NUMERACY STAGE 5 | NZC EARLY LEVEL 3 | NUMERACY EARLY STAGE 6 | NZC LEVEL 3 | NUMERACY STAGE 6 | NZC EARLY LEVEL 4 | NUMERACY EARLY STAGE 7 | NZC LEVEL 4 | NUMERACY STAGE 7 |

BARRIER BEING ADDRESSED

1

INABILITY TO COUNT ON OR BACK TO SOLVE PROBLEMS

DIAGNOSTIC QUESTIONS

There are eight beans under this card and five beans under this card. How many beans are there altogether?

WHAT TO NOTICE IN THE STUDENT'S RESPONSE

Does the student use their fingers to count on the next five, starting with 8 as the first number in the count, for example, "8, 9, 10, 11, 12"?

DELIBERATE ACTS OF TEACHING

Students who have learned to trust the count but are unable to keep the first set separate in their heads when counting on the second set, need to develop an efficient system for keeping track of the second number. The following activities will assist the student to count on from a number. Use plenty of examples to build confidence.

Drop count: Ask the student to close their eyes. Tell them a number and ask them to hold it in their head and to listen as a number of counters/magnets are dropped into a container. For example, "Hold the number 7 in your head. I am going to drop five more into the container. How many do we have in the container right now?" (7). "We have 7, now count on as I drop the counters/magnets in." The student should hold the 7 and begin counting from 8 (7 ... 8, 9, 10, 11, 12).

Listening tin: Place 7 magnets on the tens frame on the back of the tin. Show the pattern to the student and ask them how they know that it is 7. Turn the tin around. Tell the student to hold the 7 in their head and to count on four more. Have magnets ready to fill the tens frame as the student counts on.

Cube count: Place five numeracy cubes on the tips of your fingers and show the student a container. Say "There are eight cubes in the container, and we are going to count on five. How many are in the container right now?" (8). "Eight is the starting number. Count on as I drop the five cubes in the container." The student should respond, "... 8 ... 9, 10, 11, 12, 13."

MATERIALS/LINKS

Equipment animations:

- Counters in Container
- Number Strip 3
- Number Strip 4

(www.nzmaths.co.nz)

Counters, blocks, interlocking cubes

Listening tin with one tens frame on the back and one on the front

Magnets



WHAT TO DO NEXT IF THE STUDENT IS STUCK

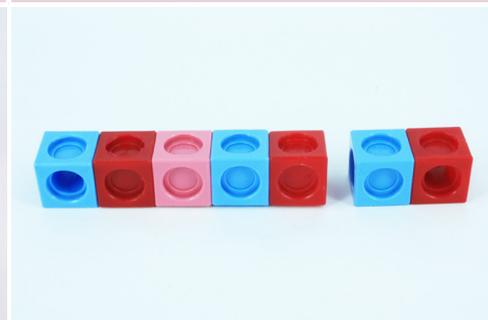
Check whether the student can tell you what is one more or one less, what is two more or two less, for numbers up to 20. If the student struggles with the concept of one more or one less, use a number strip and transparent counters to solve problems. Refer to equipment animations and The Number Strip in *Book 5: Teaching Addition, Subtraction, and Place Value*.

INITIATING HOME-BASED ACTIVITIES

Encourage parents to ask the student to count up to five more numbers, forwards and backwards, for numbers from 6 to 19.

NEXT TEACHING STEPS BACK IN THE CLASSROOM

Continue to reinforce starting points for counting, increasing the size of the numbers by using teen numbers.



BARRIER BEING
ADDRESSED

2 CONFUSION ABOUT TEEN NUMBERS

DIAGNOSTIC QUESTIONS

- Ask the student to count from 7, stopping them when they reach 20.
- Ask the student to count backwards from 23, stopping them when they reach 10.
- Show the student the following teen numbers on a card and ask them what they are: 14, 12, 15, 17, 11.

WHAT TO NOTICE IN THE STUDENT'S RESPONSE

- Can the student only count forwards to 12?
- Does the student have difficulty distinguishing between “-ty” and “-teen” numbers, saying thirty instead of thirteen?
- Does the student count out of sequence when counting forwards or backwards?
- Is the student able to identify all the teen numbers?
- Does the student mix up numbers such as 12 and 21?
- Does the student count up from 1 to identify a number?

DELIBERATE ACTS OF TEACHING

Many students are unaware that “x-teen” in English means “x” ones and one ten.

Focus on the language patterns of teen numbers.

1–20 number card sets

Ask the students to place the cards in order from 1–20, using a number strip as support if necessary. Move the numbers 11–20 beneath the row of numbers from 1–10, pointing out the number pattern. With the student, count forwards and backwards from different points through teen numbers, asking the student to identify each teen number and the numbers that come before and after it.

Number flip strip to 20

Show the students the numbers 11–20, then cover all but one number. Point to any hidden number and ask the student what number it is. Ask the student how they worked it out, encouraging them to count aloud.

Playground teen numbers

Use a painted number strip or hoops and laminated A4-sized teen numbers. Ask the student to physically count forwards and backwards along the number strip. Use different starting numbers to count on and back from. Ask the student to jump on the number before or after a specific teen number. Throw a bean bag onto a number and ask the student to say which number it has landed on. A similar activity can be completed inside, using a set of 1–20 cards and a number mat with teen numbers.

MATERIALS/LINKS

1–20 number cards

Playground markings:
1–20 number strip painted in the playground

Hoops and laminated A4-sized teen numbers

Bean bags

Flip Strip
(Material master 4-2)

Number Strip
(Material master 5-1)

Number Mat
(Material master 4-13),
adapted to include teen numbers

WHAT TO DO NEXT IF THE STUDENT IS STUCK

Use a large calendar with numbers 1 to 31. Place an iceblock stick in each square. As each number is counted, move the iceblock stick(s) from the preceding square into the next square. When 10 is reached, bundle the ten sticks together and move them as a bundle. When the sticks are moved to 11 the student will see 1 ten and 1 one. By the time the sticks reach 23, there will be 2 bundles of ten and 3 single sticks. Continue up to 31.

INITIATING HOME-BASED ACTIVITIES

Send home a set of 1–20 number cards and a 1–20 number strip.

The student can:

- pick up five random numbers and place them in order of size
- pick up a number and tell their parent which numbers come before and after
- practise writing teen numbers
- place the number cards in order and then turn them over. The parent removes a number from the row and closes the gap, then asks the student to identify which number it is. The student turns over the rest of the cards to work this out.

NEXT TEACHING STEPS BACK IN THE CLASSROOM

Work on developing the student's conceptual understanding of the place value of teen numbers, for example, 17 represents 1 ten and 7 ones.

Use Peter Hughes' (Auckland University) “Read, Say, Do, Times Two” model. Students who can “read and say” the teen numbers also need to be able to “do” the teen numbers. For example, for 17, the student needs to be able to count out 17 items by counting from 1 to 17, and be able to show 17 as one bag of 10 lollies and 7 loose lollies. Other materials that can be used include bundles of sticks, tens frames, beans in canisters, an abacus, and arrow cards.

BARRIER BEING
ADDRESSED

3

LIMITED UNDERSTANDING OF TENS AND ONES IN NUMBERS TO 100

DIAGNOSTIC QUESTIONS

- Ask the student to count from:
 - 12 to 23
 - 27 to 35
 - 66 to 72
- Ask the student to count back from:
 - 9 to 2
 - 24 to 16
 - 62 to 55

WHAT TO NOTICE IN THE STUDENT'S RESPONSE

- Does the student mix up decades, for example, counting 12, ... 18, 19, 40, 41, 42 or similar?
- Does the student stop counting when they reach a new decade?
- Does the student struggle when counting back?
- Can the student only count backwards from 10?

DELIBERATE ACTS OF TEACHING

These activities help the student to increase the fluency with which they count on or back from a number.

Connecting the digits 0–9 with larger numbers: Ensure that the student is secure with counting up and back from 0–9. Write the digits 0–9 in a line or as a column. Count on from a number larger than 20, pointing to the appropriate digits in the line or column. For example, if counting on from 24, start by pointing to the 4, then for 25 point to the 5, for 29 point to the 9, for 30 point to the 0, for 31 point to the 1. Repeat the process counting back. (Refer to the Oamaru North School: ALiM report on www.nzmaths.co.nz)

Number line to hundreds board: The student may not realise that a hundreds board is simply another way of presenting a number line. Create a set of numbers in decades with magnetic strips on the back, for example, 1–10, 21–30, 51–60. Ask a group of students to stand in a line, holding the decades in the right order, to create a number line. Ask the students to put the numbers on a magnetic board, placing each decade above a smaller decade.

Counting: Relate the number counted-on to fingers, for example, if counting on five from 17, ask the student what the next counting number after 17 is. As the student says 18, they hold up one finger (keeping it up), at 19 they hold up two fingers (keeping both up), continuing until they have reached 22 and are holding up five fingers. Keep using 5 as the number to add on so that the student only needs to use one hand. Use the same approach to help the student to count backwards, ensuring that the student knows that for addition they count on from the next number, but for subtraction they have to start with the number that comes before the starting number.

Feeding the chickens: Give the student practice in subtracting numbers, for example, $9 - 4$. Place nine beans in a circle and ask the student to remove four beans, one bean at a time, counting down as they do so, for example, “9”, (remove one) “8”, (remove one) “7”, and so on. When the student has removed four beans and the count has reached “5”, they will see that there are five beans remaining. Give the children several similar problems to increase their confidence in counting back.

MATERIALS/LINKS

Paper and pen

Number line 1–100 in decades

Beans and counters

Oamaru North: ALiM report on www.nzmaths.co.nz

WHAT TO DO NEXT IF THE STUDENT IS STUCK

Return to activities involving shielding one set, for example, Fly Flips (Material master 4-5).

Use fives frames to give the student practice with language such as less, more, before, after, even, odd, and closest. For example, “4 is one less than 5, 4 comes before 5, 4 is closer to 5 than 1, 4 is two more than 2, and 4 is an even number”.

Use 5 as a benchmark to add on from, building up the structure of 5 and one more, 5 and two more.

INITIATING HOME-BASED ACTIVITIES

Ask parents to give the student daily practice counting forwards and backwards from two-digit numbers.

Give parents the “Supporting your child’s learning” booklet for year 2 students (available on www.tki.org.nz). Highlight useful activities.

NEXT TEACHING STEPS BACK IN THE CLASSROOM

Work on counting in tens, for example, moving from 4 to 14 to 24, all the way up to 104 and back down to 4.

Ensure that subtraction work is given equal time with addition work. Counting backwards and comparing the size of numbers is important for the development of number sense.

Use addition and subtraction problems in contexts relevant to the student.

Use problems where the student is encouraged to start counting on or back from the larger of two numbers.