Accelerating Learning in Mathematics

DRAFT

Learning to: use counting from one to solve problems

Target group: students in years 1–3

Focusing on:
- applying counting-from-one strategies to addition and subtraction problems
- recognising patterns to 10
- saying forward and backward number sequences.

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

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

TEACHER OBSERVATION OVER A RANGE OF ACTIVITIES

The student may be able to count a set of objects to 10 by one-to-one matching but may not join or separate sets. They can rote-count forwards and backwards to 10 but may have difficulty saying the sequence of the teen numbers when counting forwards and backwards to 20. The student may recognise some patterns to 5 (finger patterns and dice patterns) but not patterns greater than 5 (finger patterns, tens frame patterns, groupings of "five and" patterns).

POSSIBLE BARRIERS TO THE STUDENT'S PROGRESS

1	Limited understanding that the last number counted is "how many"
2	Difficulty joining sets
3	Difficulty recognising patterns to 10

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

Aligned to *The New Zealand Curriculum* and *Mathematics Standards for years 1–8*

BARRIER BEING ADDRESSED	1	LIMITED UNDERSTANDING THAT THE LAST NUMBER COUNTED IS "HOW MANY"

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 hold up eight fingers and proceed to count them all, "1, 2, 3, 4, 5, 6, 7, 8", then continue adding using their fingers, "9, 10, 11, 12, 13"?

DELIBERATE ACTS OF TEACHING

Work on helping the student to understand that a number such as 5 can be viewed as a set, a line of objects, a finger pattern, a number on an abacus, and a number on a tens frame and that when they count out the number, the last number both quantifies and names the set.

Start with a number greater than 5 and add on a set less than 6. Repeat the first number several times before adding the next set. Use several examples to help build the student's confidence. As the student gains confidence, increase the numbers into the teens.

THE FOLLOWING ACTIVITIES WILL HELP THE STUDENT TO TRUST THE COUNT

Hidden objects: For a problem such as 8 + 3, ask the student to count out eight bears. Hide the bears under a container. Shake the container, asking "How many bears are in here?" Place three bears alongside the container and say "Three more bears come along, so how many are there altogether?" Encourage the student to hold the 8 in their head and to count the 3 on.

Playing cards: Show the student a card, for example, a 7, and then put the card face down on the table. Turn over another playing card and ask the student to work out how many there are now.

Abacus: Cover half of an abacus lengthways. Move nine beads behind the cover. Ask the student how many beads were moved. Repeat the number and count on four more, moving one bead at a time. Ask the student how many beads are behind the cover now. Remove the cover to show 13 beads.

MATERIALS/LINKS

Bears

Plastic container

Playing cards

Abacus

WHAT TO DO NEXT IF THE STUDENT IS STUCK

Give the student practice quantifying numbers by, for example, exploring the "threeness" of 3 or the "fiveness" of 5.

Useful resources include:
Exploring 1–5 by Bev Dunbar
BSM, Studies of 5–10:
5-3-8, 6-1-7, 7-1-8, 6-3-5, 7-3-4, 9-1-3

INITIATING HOME-BASED ACTIVITIES

Encourage parents to find problems for the students to solve within the home. For example, "We have eight plants in the garden, and we are going to plant four more. How many plants will we have altogether?" or "You have 13 marbles, and you give five to your brother. How many marbles do you have left?"

Advise parents to get the student to count from the biggest number.

NEXT TEACHING STEPS BACK IN THE CLASSROOM

Reinforce the development of advanced counting strategies by providing story problems involving a teen number.

Increase the number range as the student's confidence increases by moving across the decades: 37 + 5, 32 − 4, 18 + □ = 23
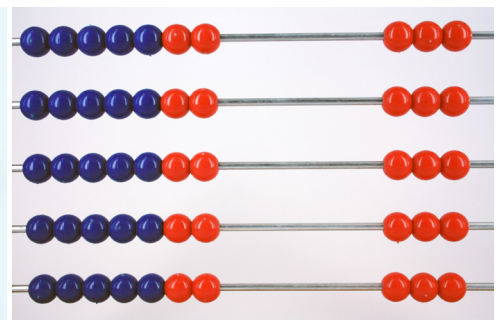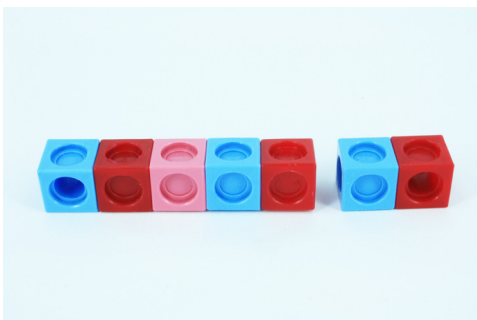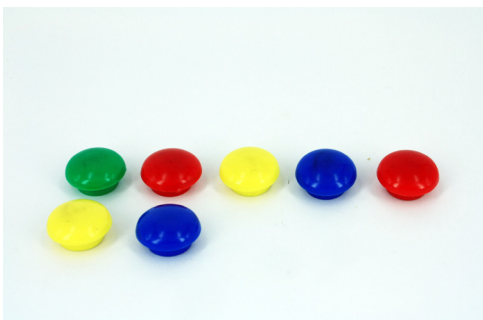
BARRIER BEING ADDRESSED	2	DIFFICULTY JOINING SETS

DIAGNOSTIC QUESTIONS

Place six beans in one of the student's hands and three beans in the other. Say to the student, "You have six beans in this hand and three beans in this hand. How many beans do you have altogether?"

WHAT TO NOTICE IN THE STUDENT'S RESPONSE

Does the student open their hands and count six beans in one hand and three beans in other and say "6 and 3" without joining the two sets?

Does the student keep their hands closed and say "6 and 3"?

DELIBERATE ACTS OF TEACHING

When supporting a student to grasp the concepts of joining and separating sets, it is important to focus on the action and language of the process. Begin with sets of five, then increase to sets of ten. Emphasise the language of "How many are there altogether?" and "How many are there left?"

Set circles for joining sets
Place two set circles on the floor/table beside each other and use a larger set circle to enclose both sets. Create stories involving discrete objects, for example, "Farmer John has two paddocks of cows. One paddock has four cows, and the other has five cows. How many cows does Farmer John have altogether?" Place one set in one circle and a second set in the other. Remove the two inner set circles to show objects as one large set. Encourage the student to physically push the two sets together and to count all the objects.

Feed the Elephant (adapted from *Book 5: Teaching Addition, Subtraction, and Place Value*)
Create stories in which an elephant eats specific foods. Ask the student to use coloured blocks to represent items of food and to place them in, or remove them from, a plastic cup. Tip out the contents of the cup and ask the student to count the blocks to see how much the elephant has eaten altogether or how much food the elephant has left.

For example, "Elephant ate three bananas and two apples. How many fruits did he eat altogether?" or "Elephant got six oranges from the shop and ate two on the way home. How many oranges does he have left?"

Teddy Bears' Picnic can also be used – see the Mathematics Standards illustration on www.nzmaths.co.nz

MATERIALS/LINKS

Paper or plastic cups with elephants on the outside

Set circles made from container lids or sorting circles

Cubes and counters

Plastic animals, such as bears or cows; toy transport vehicles

Feed the Elephant (Material master 5-7)

Teddy Bears' Picnic (Mathematics Standards illustration, on www.nzmaths.co.nz)

WHAT TO DO NEXT IF THE STUDENT IS STUCK
Check that the student has a stable order count. Ask the student to count objects from a box, for example, six teddy bears, eight beans and four pegs. After each count, ask the student "How many?" Repeat using different numbers. Ensure that the student identifies the number they have counted as "how many" objects there are.

INITIATING HOME-BASED ACTIVITIES
Encourage parents to help the student use the counting-all strategy to solve word problems within everyday contexts. For example, "How many red marbles do you have? How many green marbles do you have? So how many marbles do you have altogether?" Parents could cut up a piece of fruit to create problems such as "Here are eight pieces of apple. If you eat three pieces, how many pieces will you have left?"

NEXT TEACHING STEPS BACK IN THE CLASSROOM
Introduce "change unknown" number sentences/problems, for example, $4 + \square = 7$, $5 - \square = 3$

Increase the size of the number involved in story problems, encouraging the student to work with numbers greater than 10.
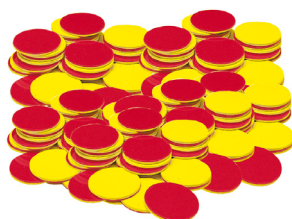
BARRIER BEING ADDRESSED	3	DIFFICULTY RECOGNISING PATTERNS TO 10

DIAGNOSTIC QUESTIONS

Show the student the finger patterns for 4, 9, and 6 and ask the student what numbers they show.

Show the student the numbers 2, 8, and 5 on tens frames and ask the student what numbers they show.

Ask the student to make finger patterns for 3, 7, and 10.

WHAT TO NOTICE IN THE STUDENT'S RESPONSE

- Can the student recognise patterns to 5?
- Does the student use one-to-one counting for patterns greater than 5?
- Can the student recognise and make finger patterns without counting but count the dots when working with a tens frame?

DELIBERATE ACTS OF TEACHING

Recognising and creating patterns is essential for the development of number concepts and relationships.

Familiarise the student with patterns and structures so that the student instantly recognises patterns to 10 when using fingers, tens frames, dice, dominoes, or an abacus. Make connections between pattern representations and work on "five and" grouping patterns.

Listening tin
Ask the student to place their hands behind their back and to close their eyes. Drop magnets into the listening tin and ask the student to use their fingers to make a matching pattern. Ask them to describe their finger pattern and to tell you "how many fingers". Place the magnets on the tens frame on the front of the tin and compare it to the student's fingers and to their description.

Connect patterns on tens frame with patterns on other materials
Ask the student to create their own set of numbers on tens frames by drawing pictures or shapes onto blank tens frames. Use the frames to play snap by matching representations of each number with digit cards or with another student's set of numbers made on tens frames.

Use matching cards (tens frames, finger patterns, dominoes, dice patterns, and digits to 10) to play a matching game or a game of memory.

MATERIALS/LINKS

Listening tin

Magnets

Dominoes and dice

Abacus

Tens frames
(Material master 4-6)

Finger pattern 1–10 cards

1–10 digit cards
(Material master 4-1)

Digital Learning Object: Number Trains
(Number, level 1)

WHAT TO DO NEXT IF THE STUDENT IS STUCK
Give the student opportunities to practise subitising (instantly recognising the number in a small group without counting) by getting them to draw and work with tens frames.

Use an abacus half-covered by card. Move beads out from underneath the card so the student can see them and then move them back again. Point out the change of bead colour when moving from 5 to one more than 5.

INITIATING HOME-BASED ACTIVITIES
Send home a maths kit that has two sets of tens frames, including blank frames, ten counters, 1–10 dice, a finger pattern set, and cards with numbers 1–10.

The student can:
- play memory and snap using tens frames or using a combination of tens frames and finger pattern cards
- roll the dice and, on a blank tens frame, create the number shown on the dice
- match cards showing tens frames, finger patterns, and digits
- use the Digital Learning Object: Number Trains task.

NEXT TEACHING STEPS BACK IN THE CLASSROOM
Develop the student's conceptual understanding of teen numbers by practising "ten and" problems.

Introduce addition and subtraction problems that involve making patterns to 10.