

Accelerating Learning in Mathematics

DRAFT

Learning to: understand and use place value to solve problems

Target group: students in years 3–6

Focusing on:

- creating models of whole numbers using place value materials
- ordering three-digit numbers
- using place value partitioning as a strategy to solve addition and subtraction problems.



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 have rote-learned place value names and may be able to identify the digit in the tens or hundreds place but cannot create a model of whole numbers. The student may not understand 10 as the basis of our number system and may see 1 purely as a counting unit.

POSSIBLE BARRIERS TO THE STUDENT'S PROGRESS

1	Limited understanding of place value notation
2	Difficulty visualising place value groupings
3	Limited understanding of groupings of ten

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****LIMITED UNDERSTANDING OF PLACE VALUE NOTATION****DIAGNOSTIC QUESTIONS**

1. Show the student a three-digit number and ask them which digit is in the tens place.
2. a. Ask the student to write down three hundred and seven.
 - b. If the student writes 307, ask them why they used a zero.

If the student cannot write 307, flip the paper, write 307, and read out the number.
 - c. Ask the student to model 307 using place value equipment.
3. Ask the student what place value means.

WHAT TO NOTICE IN THE STUDENT'S RESPONSE

- Can the student correctly identify which digit is in the tens place?
- Can the student record a number that includes a 0?
- Can the student identify the role of a place holder?
- Can the student model a number using place value equipment?
- Does the student understand the meaning of place value?

DELIBERATE ACTS OF TEACHING

Concrete materials are useful for representing mathematical ideas. However, their effectiveness relies on the student making a connection between the materials and their own mathematical ideas about number.

Using place value equipment, model one, ten, and one hundred. Discuss the relative value of each piece of equipment.

Ask the student to use place value equipment to show you:

- 2 hundreds, 3 tens, and 4 ones
- 1 hundred and 5 ones
- 1 ten and 7 ones.

Ask the student to write the numbers down.

Explain the connection between place and value, that is, the place that a digit is in tells us how many hundreds, tens, or ones there are. Talk about the role of zero as a place holder.

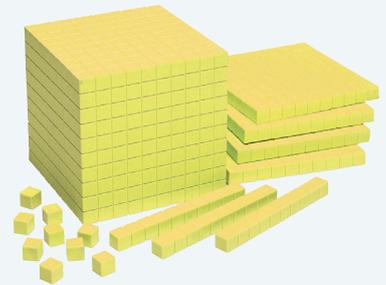
Write out a range of numbers and ask the student to model them using place value equipment.

Discuss how, in English, we say twenty rather than 2 tens, and fourteen rather than 1 ten and 1 four, but that this is not the same in all languages, for example, in te reo Māori, 25 is rua tekau mā rima (two tens and five).

1. Dictate a list of numbers to the student and ask them to write them down. Use models to make any numbers that the student can't write down.
2. Dictate five numbers. Ask the student to record each number on memo paper and then to place the numbers in order of size, making a model of each number if necessary.

MATERIALS/LINKS

Make a 1000
(Number and Algebra, level 2,
www.nzmaths.co.nz)

**WHAT TO DO NEXT IF THE STUDENT IS STUCK**

Give the student place value equipment and read out several numbers in terms of their value. For example, for 208, ask the student to select 2 hundreds and then 8 ones. Emphasise the link between the way the number is written and the way it can be modelled. Encourage the student to read out numbers in terms of their value, for example, 315 can be read as 3 hundreds, 1 ten, and 5 ones.

INITIATING HOME-BASED ACTIVITIES

Ask parents to help the student to identify numbers in their environment (spoken or written). Parents can ask the student how many hundreds, tens, or ones there are in each number.

NEXT TEACHING STEPS BACK IN THE CLASSROOM

Provide the student with access to place value equipment to use when working on problems involving addition and subtraction. Digital Learning Objects can be used in class for independent practice.

**BARRIER BEING
ADDRESSED****2****DIFFICULTY VISUALISING PLACE VALUE GROUPINGS****DIAGNOSTIC QUESTIONS**

1. Provide the student with 30 single iceblock sticks and 20 bundles of 10 sticks. Place a two-digit number in front of the student, for example, 32, and ask the student to model it with the sticks.
2. Provide the student with place value blocks (ones, tens, and hundreds) and ask them to model the two-digit number used in 1.
3. Give the student a three-digit number and ask them to model the number using equipment of their choice.

WHAT TO NOTICE IN THE STUDENT'S RESPONSE

- Does the student try to count out the number using single sticks?
- When using place value equipment, can the student correctly differentiate between tens and hundreds?
- Does the student choose to use place value blocks to model the three-digit number?

DELIBERATE ACTS OF TEACHING

Materials can help provide a structure for students to organise their thinking.

Read it–Write it–Make it–Change it

Choose a sentence from the newspaper that contains a two- or three-digit number. For example, "The Black Caps won by 63 runs."

Ask the student to read the number in context and to write it on a laminated place value house, starting from right to left, using one digit per room.

Ask the student to make a model of the number using place value blocks.

Ask the student what would change in the model and in the written number if the Black Caps had got 10 more runs or 100 more runs.

Ask the student what would change if the Black Caps had got 32 more runs.

MATERIALS/LINKS

Place Value Houses
(Material master 4-11)

Place value blocks

Digital Learning Object: Modelling Numbers
(three-digit numbers)

Place Value Blocks
(Number and Algebra, level 2,
www.nzmaths.co.nz)

WHAT TO DO NEXT IF THE STUDENT IS STUCK

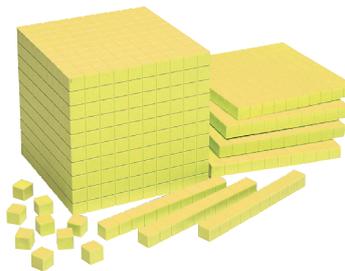
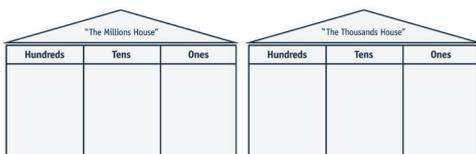
Work with the student to collect groups of ten, one hundred, and one thousand. Use play money to familiarise the student with ones, tens, and hundreds.

INITIATING HOME-BASED ACTIVITIES

Parents can challenge the student to increase or decrease numbers by 10 or 100.

NEXT TEACHING STEPS BACK IN THE CLASSROOM

Provide the student with access to place value equipment to use when working on problems involving addition and subtraction. Digital Learning Objects can be used in class for independent practice.



**BARRIER BEING
ADDRESSED****3****LIMITED UNDERSTANDING OF GROUPINGS OF TEN****DIAGNOSTIC QUESTIONS**

Write the number 145 on a piece of paper. Ask the student to answer the following questions verbally:

- 1.a. Tane has \$145 in his savings account. His nana gives him \$10 for his birthday.
 - b. How much money does Tane have now?
 - c. Which digits will change in the written number?
If the student answers correctly, flip the paper and write 155.
- 2.a. If Tane has \$155 and his aunty gives him another \$13, how much does he have now?
 - b. Which digits will change in the written number?
If the student answers correctly, flip the paper and write 168.
- 3.a. If Tane has \$168 and he finds another \$2 on the footpath, how much money does he have now?
 - b. Which digits will change in the written number?

WHAT TO NOTICE IN THE STUDENT'S RESPONSE

Does the student solve by counting on?

Does the student identify the impact that addition has on digits within a number?

Can the student make changes within a group of ten?

Can the student answer questions that involve creating a new group of ten?

DELIBERATE ACTS OF TEACHING

The place value system we use is based on groups of 10. In this game, students use a place value flip chart to add or subtract powers of 10 (1, 10, 100, 1000).

Win, Lose, Draw

This is a game that can be played several ways. If necessary, begin by using place value blocks to model each number.

Write \$100 at the top of the page.

Ask the student to roll the number dice.

Ask the student to roll the operation dice to find out whether the result of the first throw will be added to or subtracted from \$100.

Ask the student to change the model as required and to record the new amount. If the amount subtracted is greater than the existing total, they can record the result as 0, not as a negative number. Continue for five or ten rolls and determine whether the game was a win, lose, or draw by comparing the end result to 100.

Introduce a game element, with pairs trying to score the biggest or smallest number, or have a target number and see whether the students can reach it within a certain number of dice throws.

MATERIALS/LINKS

2 dice labelled differently:

- +, +, +, -, -, -
- 1, 10, 10, 100, 100, 1000

Place value blocks

Place value flip chart or place value houses

WHAT TO DO NEXT IF THE STUDENT IS STUCK

Use a dice labelled with only ones and tens. Build up to a dice labelled with ones, tens, and hundreds. Omit the operation dice and add each new amount to the total.

INITIATING HOME-BASED ACTIVITIES

Send home a set of place value dice, along with instructions on how to play the game. Explain to the student how to record the results of the game in their homework book.

NEXT TEACHING STEPS BACK IN THE CLASSROOM

Work on using place value to solve problems involving addition and subtraction. If the student reverts to counting on, ask them whether they can identify how many tens and ones a number has and discuss how these can be used to solve addition and subtraction problems.

