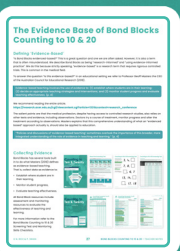
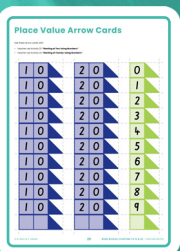
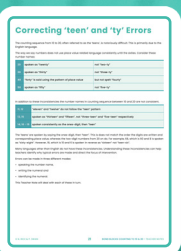
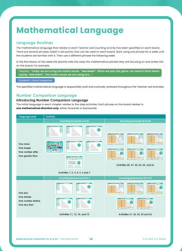
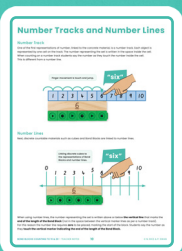
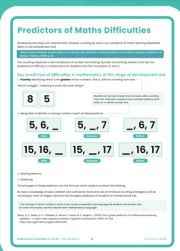


Counting to Ten & Twenty

Bond Blocks Teacher Notes

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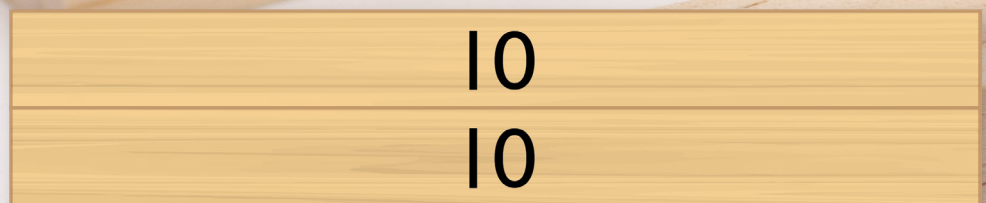
About the Blocks

A Set of Bond Blocks

A set of Bond Blocks contains:



Linear Bond Blocks



Linear Ten Blocks

(Join to make twenty)

More Linear Blocks

An extra 1, 2, 3, 4 and two 5 Blocks. Used for more complex three-part bonds when bridging ten.



Bond Block Features

Bond Blocks are a **representational manipulative** that have been designed to help students move **from counting to calculating** with numbers.

They are a representational manipulative because the quantity of the number is represented by:

1. The length of the block and
2. The written numeral on the block.

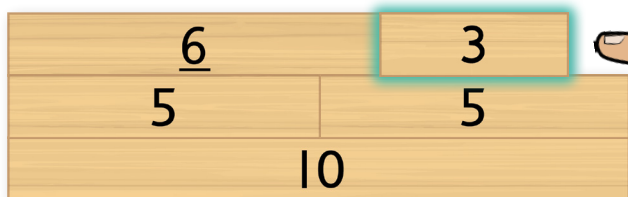
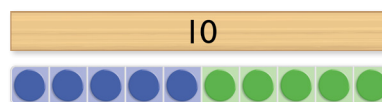
Other unique features:

- They are **not scored** with individual unit lines.
- The **length** of the block helps to develop the concept of a mental number line.
- The **natural wood** (sustainably sourced pine) reduces the distraction of coloured plastic and focuses attention on the **written numeral**.
- They can be used with other common manipulatives, such as 2 cm cubes because they match in size. They are a **ratio of one unit to 2 cm** making them easy to manipulate.
- **Self-checking.** Develop number sense and estimation using them.



Linear Ten Block

Similar to ten strip.



"I thought 3 would fit but it is one too short. I'll get the 4 block and check."

Predictors of Maths Difficulties

Developing counting is an essential skill. However, counting by rote is not a predictor of maths learning disabilities (MLD) or low achievement (LA).

“Most school children quickly learn to count by rote, and this in and of itself is not a useful indicator of MLD or LA status.” (Geary, 2009, p. 3)

The counting sequence is one component of number line thinking. Number line thinking relates to the top two predictors of difficulty in mathematics for students from Pre-Foundations to Year 2.

Key predictors of difficulties in mathematics at this stage of development are:

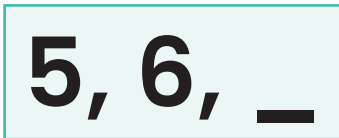
1. **Fluently** identifying which is the **greater** of two numbers. That is, without counting from one.

“Which is bigger*, meaning is worth the most things?”



Students at risk take a long time to answer, often counting from one. They lack a sense of how numbers relate to each other on a mental number line.

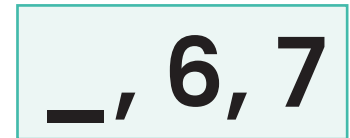
2. Being able to identify a missing number in each of these positions:



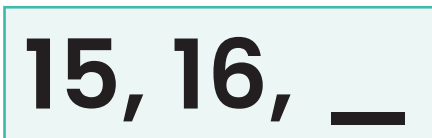
After



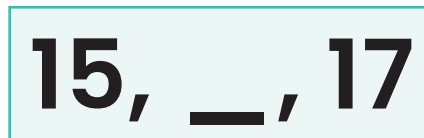
Between



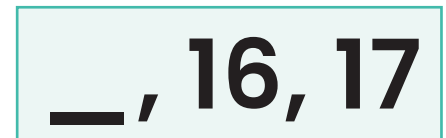
Before



After



Between



Before

3. Working Memory

4. Subitising

The strongest of these predictors are the first two, which relate to number line thinking.

By Year 2, knowledge of basic addition and subtraction facts and use of immature counting strategies such as counting by ones on fingers, become the strongest predictors of students at mathematical risk.

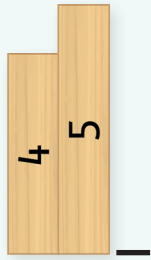
*The concept of which number is worth more or less is essential. Use language the students are familiar with. For more information, see the Teacher Note “Mathematical Language”.

Geary, D. C., Bailey, D. H., Littlefield, A., Wood, P., Hoard, M. K., Nugent, L. (2009). *First-grade predictors of mathematical learning disability – a latent class trajectory analysis. Cognitive Development, 24(4)*, 411-429. <https://doi.org/10.1016/j.cogdev.2009.10.001>

Number Line Thinking

Bond Blocks are linear to help develop number line thinking and increase their understanding of the relationships between numbers. Bond Block counting activities require students to:

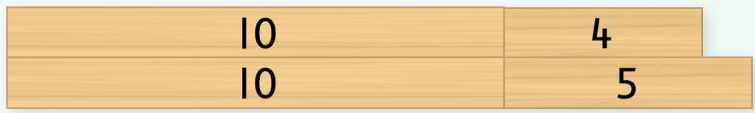
- Count forwards and backwards in sequence starting at one, ten or twenty.
- Count forwards and backwards in sequence starting at one, ten or twenty with missing numbers.
- Count forwards and backwards to twenty from any number. This is extended to identifying number before and after.



Two vertical wooden blocks are shown. The left block is labeled '4' and the right block is labeled '5'. A small vertical tick mark is positioned to the right of the '5' block.

4, 5, _

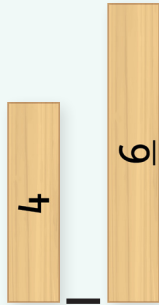
Number After



Two horizontal wooden blocks are shown. The top block is labeled '10' and the bottom block is labeled '4'. A small vertical tick mark is positioned to the left of the '4' block.

14, 15, _

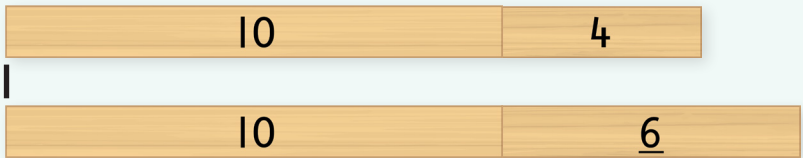
Number After



Two vertical wooden blocks are shown. The left block is labeled '4' and the right block is labeled '6'. A small vertical tick mark is positioned to the right of the '6' block.

4, _, 6

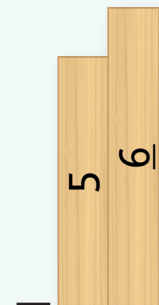
Number Between



Two horizontal wooden blocks are shown. The top block is labeled '10' and the bottom block is labeled '6'. A small vertical tick mark is positioned to the left of the '6' block.

14, _, 16

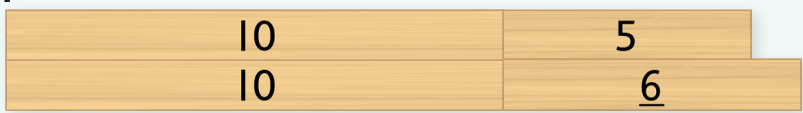
Number Between



Two vertical wooden blocks are shown. The left block is labeled '5' and the right block is labeled '6'. A small vertical tick mark is positioned to the left of the '5' block.

_, 5, 6

Number Before



Two horizontal wooden blocks are shown. The top block is labeled '10' and the bottom block is labeled '5'. A small vertical tick mark is positioned to the left of the '5' block.

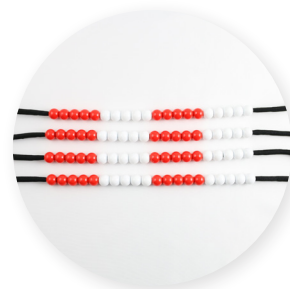
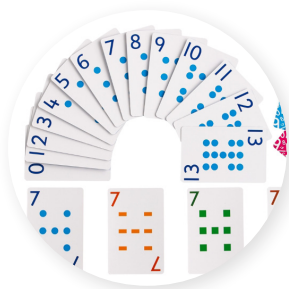
_, 15, 16

Number Before

Concrete Representational Abstract

Mathematical Manipulatives

A Mathematical Manipulative is something that can be picked up and moved (manipulated) to help teach.



While manipulatives may come in virtual as well as physical form, the authors believe young children need to physically handle manipulatives prior to having a virtual experience. This is even more the case when working with young children, which is one of the reasons why Bond Blocks are made of wood.

Manipulating the blocks helps students to develop concepts about number, length and shape.




Where Bond Blocks Fit


Bond Blocks are used within a Concrete-Representational-Abstract approach to teaching.

Bond Blocks are a **representational manipulative** designed to help students move from the concrete stage to the abstract. The goal is for students to stop using the blocks.

Concrete

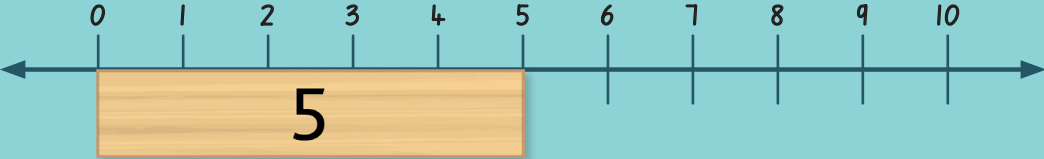


"I need to count this."



"I can see five without counting."

Representational



Abstract

"five"

5

Concrete Prerequisite

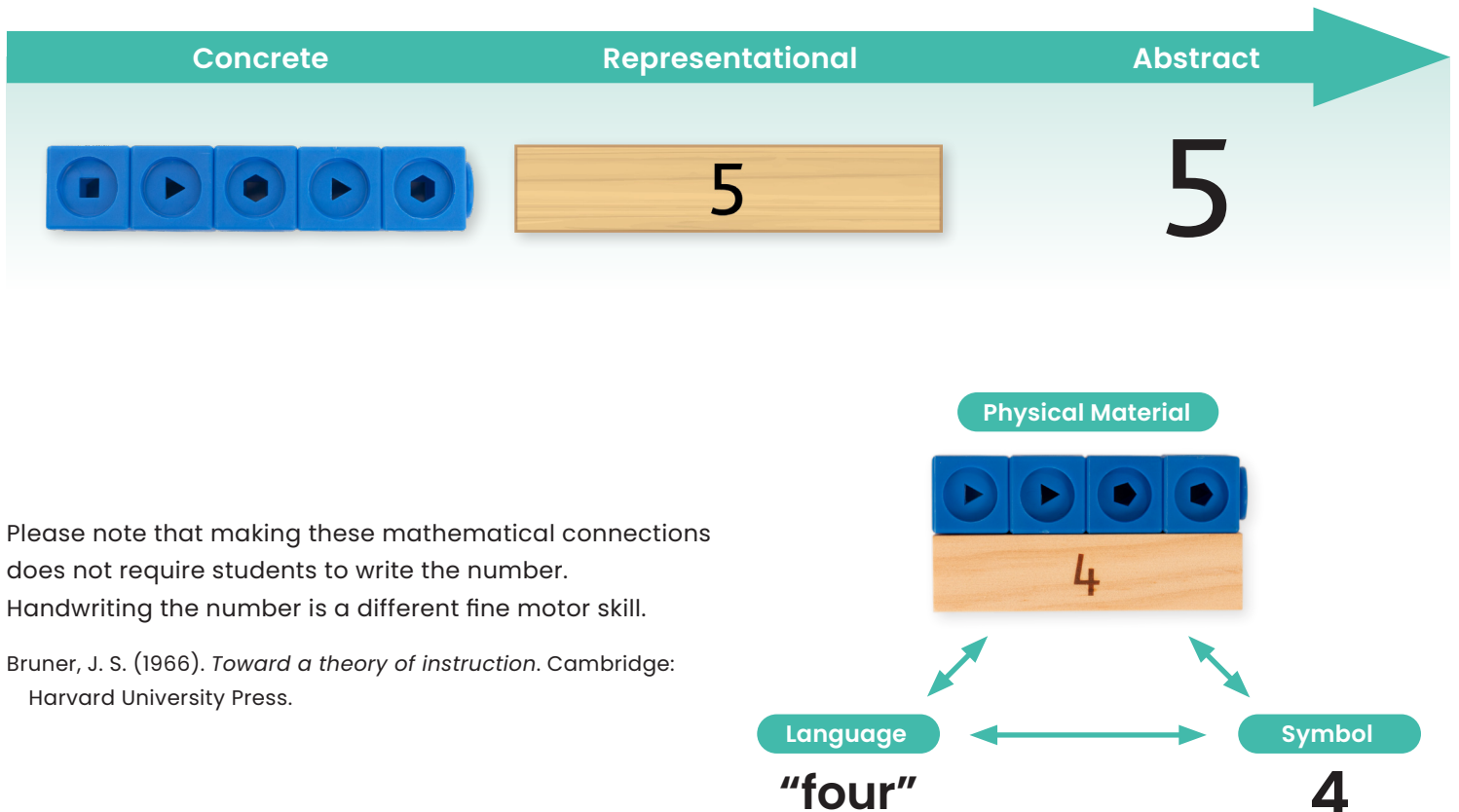
Before using **Bond Blocks** students need to be confident counting up to 10 single objects using the **first three counting principles**.

- 1 Stable Order**
 Number names are said in the conventional order.
- 2 One-to-One Correspondence**
 Each item is counted once, as the corresponding word is said.
- 3 Cardinal Value**
 The last number said indicates the total for the group.

Gelman, R. & Gallistel, C. (1978) *The Child's Understanding of Number*.
 Cambridge, MA. Harvard University Press.

Begin using Bond Blocks in conjunction with discrete objects that can be counted with one-to-one correspondence. Bond Blocks were designed to be the same size as standard 2 cm cubes for this reason. Using discrete materials such as 2 cm cubes in conjunction with Bond Blocks helps students move towards a length based concept of number.

This follows Bruner's (1966) pedagogical principle of moving from Concrete to Representational to Abstract.



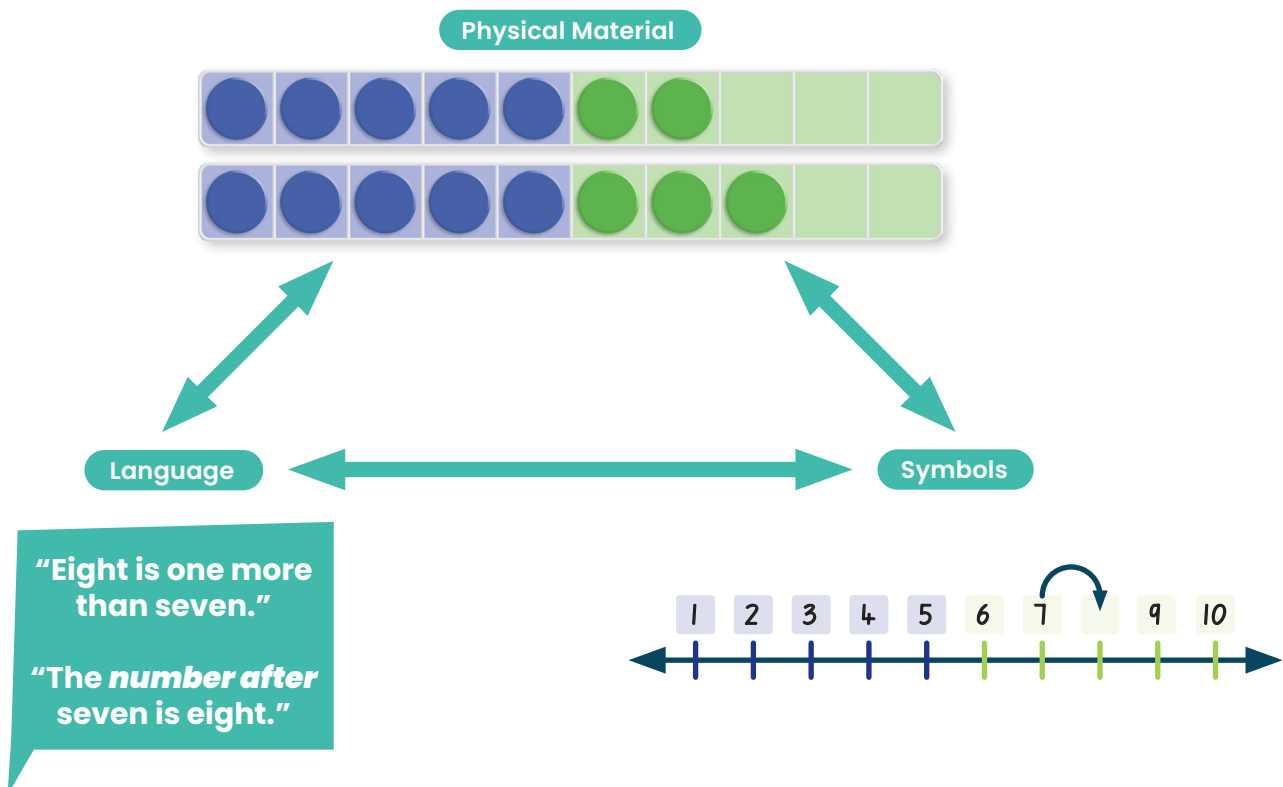
Please note that making these mathematical connections does not require students to write the number. Handwriting the number is a different fine motor skill.

Bruner, J. S. (1966). *Toward a theory of instruction*. Cambridge: Harvard University Press.

Structuring Concrete Materials

Using length based representations such as Bond Blocks, Ten Strips, Number Tracks and Number Lines helps students increase their understanding of the relationships between numbers. Once students can count from one to ten using the first three counting principles, organise countable manipulatives to develop number line thinking. To do this the manipulative should be organised so that students can identify how many **without having to count the collection from one**, but can instead look for relationships between quantities. For example, this ten strip is coloured in two fives so as quantities to ten can learn to be identified without counting from one.

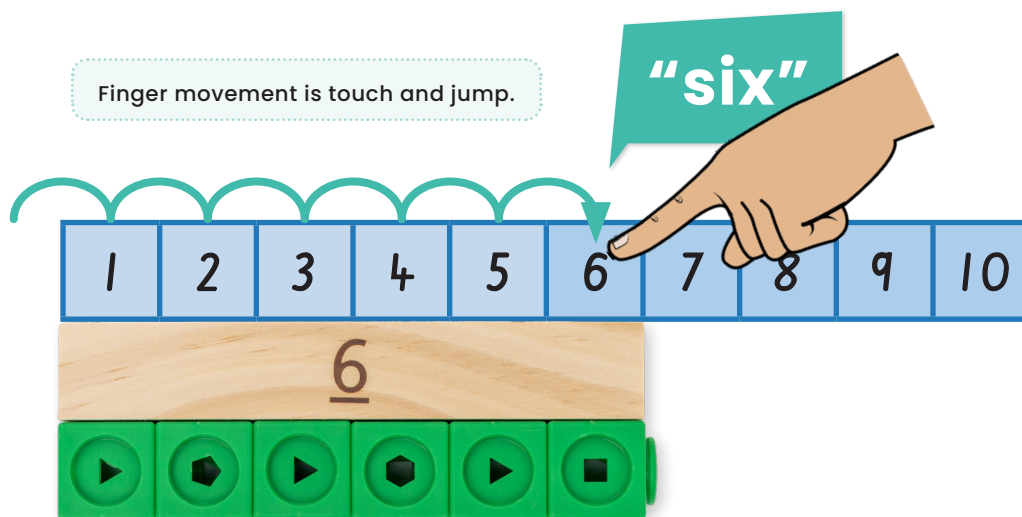
- 1, 2, and 3 **can be seen without counting** (perceptual subitising)
- 4 is **one fewer/less** than 5
- 5 is one colour filled. It looks like half.
- 6 is **one more** than 5
- 7 and 8 can be found by **counting on from 5**.
- 9 is **one fewer/less** than 10
- 10 is the frame filled.



Number Tracks and Number Lines

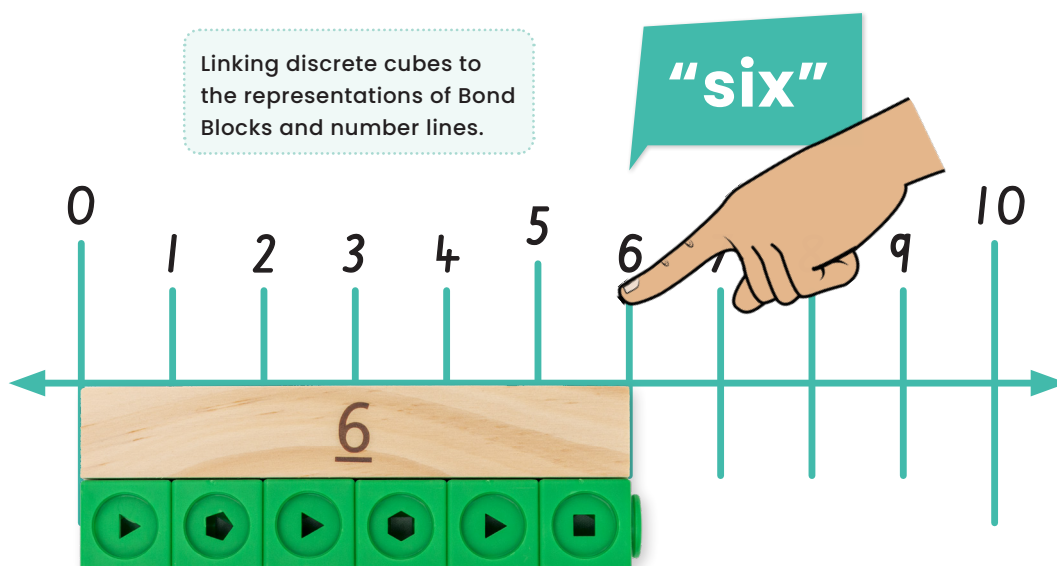
Number Track

One of the first representations of number, linked to the concrete material, is a number track. Each object is represented by one cell on the track. The number representing the set is written in the space inside the cell. When counting on a number track students say the number as they touch the number inside the cell. This is different from a number line.



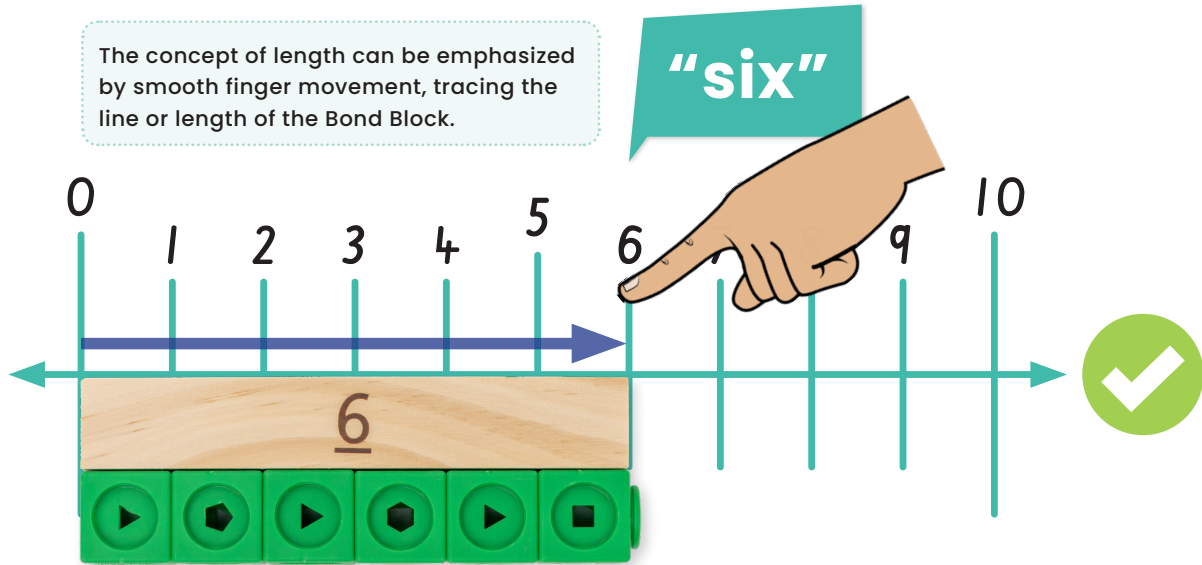
Number Lines

Next, discrete countable materials such as cubes and Bond Blocks are linked to number lines.

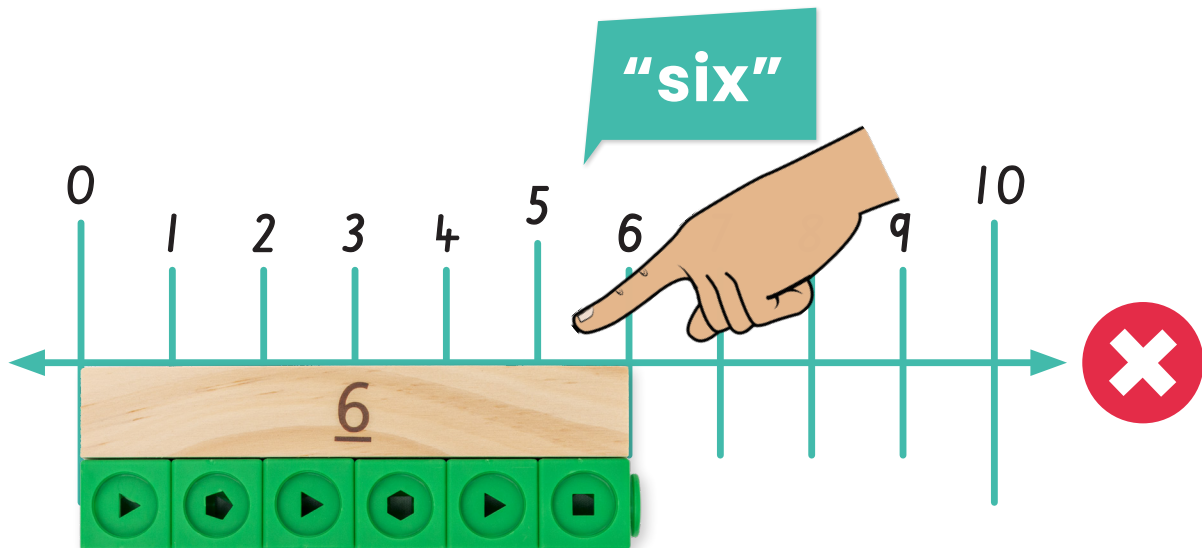


When using number lines, the number representing the set is written above or below **the vertical line** that marks the **end of the length of the Bond Block** (not in the space between the vertical marker lines as per a number track). For this reason the number line requires **zero** to be placed, marking the start of the block. Students say the number as they **touch the vertical marker indicating the end of the length of the Bond Block**.

The concept of length can be emphasized by smooth finger movement, tracing the line or length of the Bond Block.



When locating whole numbers on a number line it is **incorrect** to point to the space between the whole numbers and say the whole number (as per a number track). For example, in this diagram the finger is pointing to a number between five and six, approximately five and one half.



Five Frames

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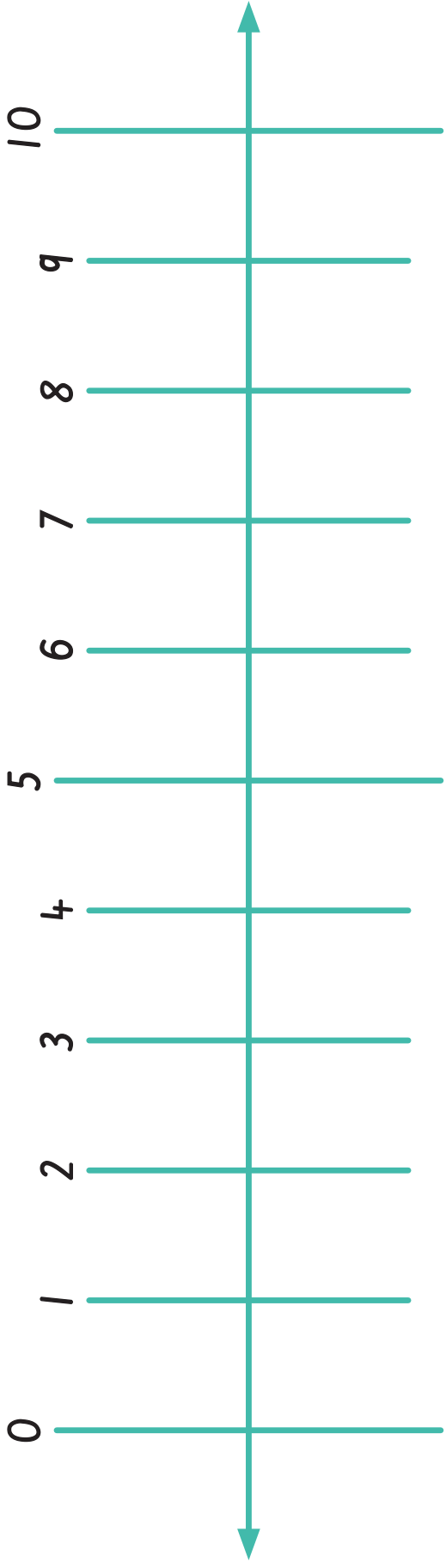
1	2	3	4	5
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Ten Strips

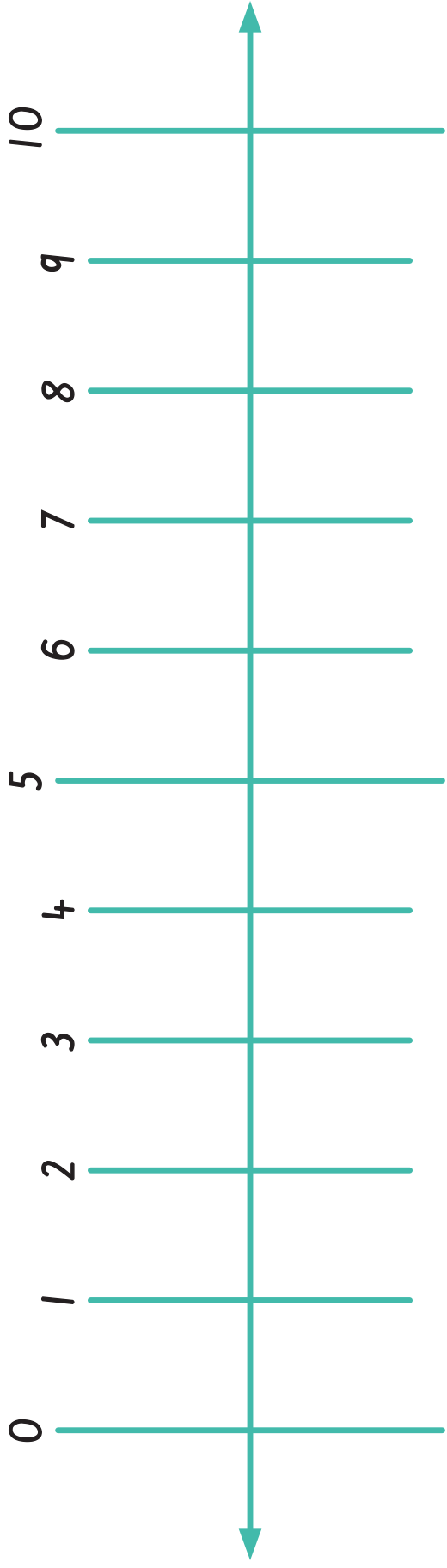
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1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

Number Line



Number Line



Mathematical Language

Language Routines

The mathematical language that relates to each Teacher Led Counting Activity has been specified on each board. There are several phrases, listed in dot points, that can be used on each board. Start using one phrase for a week until the students are familiar with it. Then use a different phrase the following week.

In the first lesson of the week the teacher tells the class the mathematical phrase they are focusing on and writes this on the board. For example,

Teacher: "Today we are using the maths words, "one more". When we play the game, we need to think about saying "one more". The maths words we are using are..."

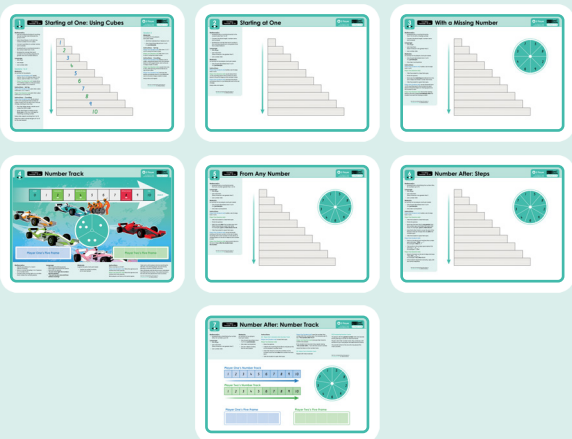


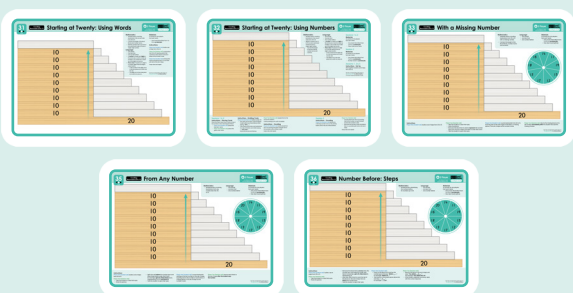
Students' choral response.

The specified mathematical language is sequentially built and cyclically reviewed throughout the Teacher Led Activities.

Number Comparison Language

Introducing Number Comparison Language

The initial language in each chapter relates to the step activities. Each phrase on the board relates to **one mathematical direction only**, either forwards or backwards.

Language Used	Activity
	<div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <h4 style="text-align: center;">Counting Forwards 1 to 10</h4>  <p style="text-align: center;">Activities 1, 2, 3, 4, 5, 6 and 7</p> </div> <div style="width: 48%;"> <h4 style="text-align: center;">Counting Forwards 10 to 20</h4>  <p style="text-align: center;">Activities 20, 21, 22, 23, 25, and 26</p> </div> </div>
<ul style="list-style-type: none"> One more One longer One number after One greater than 	
	<div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <h4 style="text-align: center;">Counting Backwards 10 to 1</h4>  <p style="text-align: center;">Activities 11, 12, 14, and 15</p> </div> <div style="width: 48%;"> <h4 style="text-align: center;">Counting Backwards 20 to 10</h4>  <p style="text-align: center;">Activities 31, 32, 33, 35 and 36</p> </div> </div>
<ul style="list-style-type: none"> One less One shorter One number before One less than 	

Applying Number Comparison Language

The language after these boards, towards the end of the chapter, lists terms related to one direction as the lesson focus. However, during these activities students have the opportunity to start to use language related to both directions, forwards and backwards. This helps students apply the initial language in the correct context.


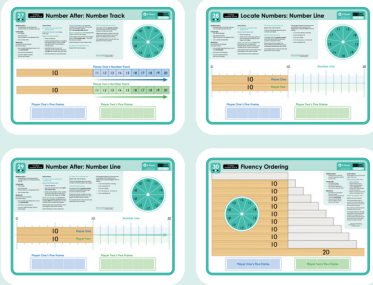

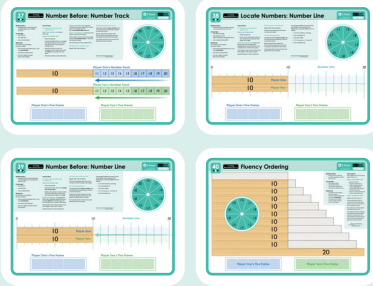
During these activities students are competing against each other to make the greatest/least number. Using these terms in context, from their own point of view, helps them make sense of the size of their number in comparison to another number and the related comparative maths language.

Teachers can build on the language students use. For example,

Student: "I won because my number is bigger."

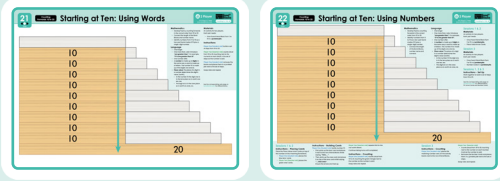

Teacher: "Yes, your number is greater. Today we are focusing on using the maths word 'greater'".

The final activity in each chapter is "Fluency Ordering". This activity specifies that students use language related to **both directions, forwards and backwards**.

Language Used	Activity	
One more/less One longer/shorter One number after/before One greater than/less than	<p style="text-align: center;">Counting Forwards 1 to 10</p>  <p style="text-align: center;">Activities 7, 8, 9, 10</p>	<p style="text-align: center;">Counting Forwards 10 to 20</p>  <p style="text-align: center;">Activities 27, 28, 29, 30</p>
	<p style="text-align: center;">Counting Backwards 10 to 1</p>  <p style="text-align: center;">Activities 16, 17, 18, 19</p>	<p style="text-align: center;">Counting Backwards 20 to 10</p>  <p style="text-align: center;">Activities 37, 38, 39, 40</p>


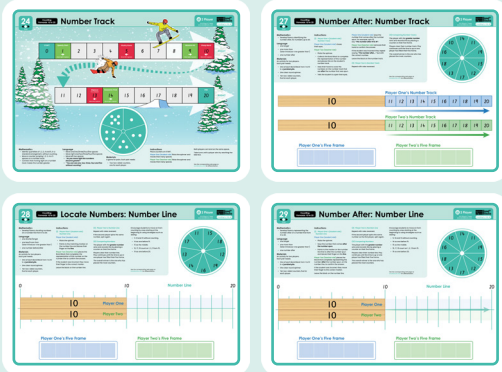

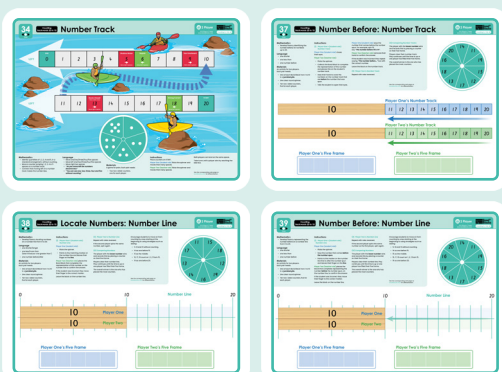
Place Value Language

As soon as numbers go to two-digits place value language is needed.

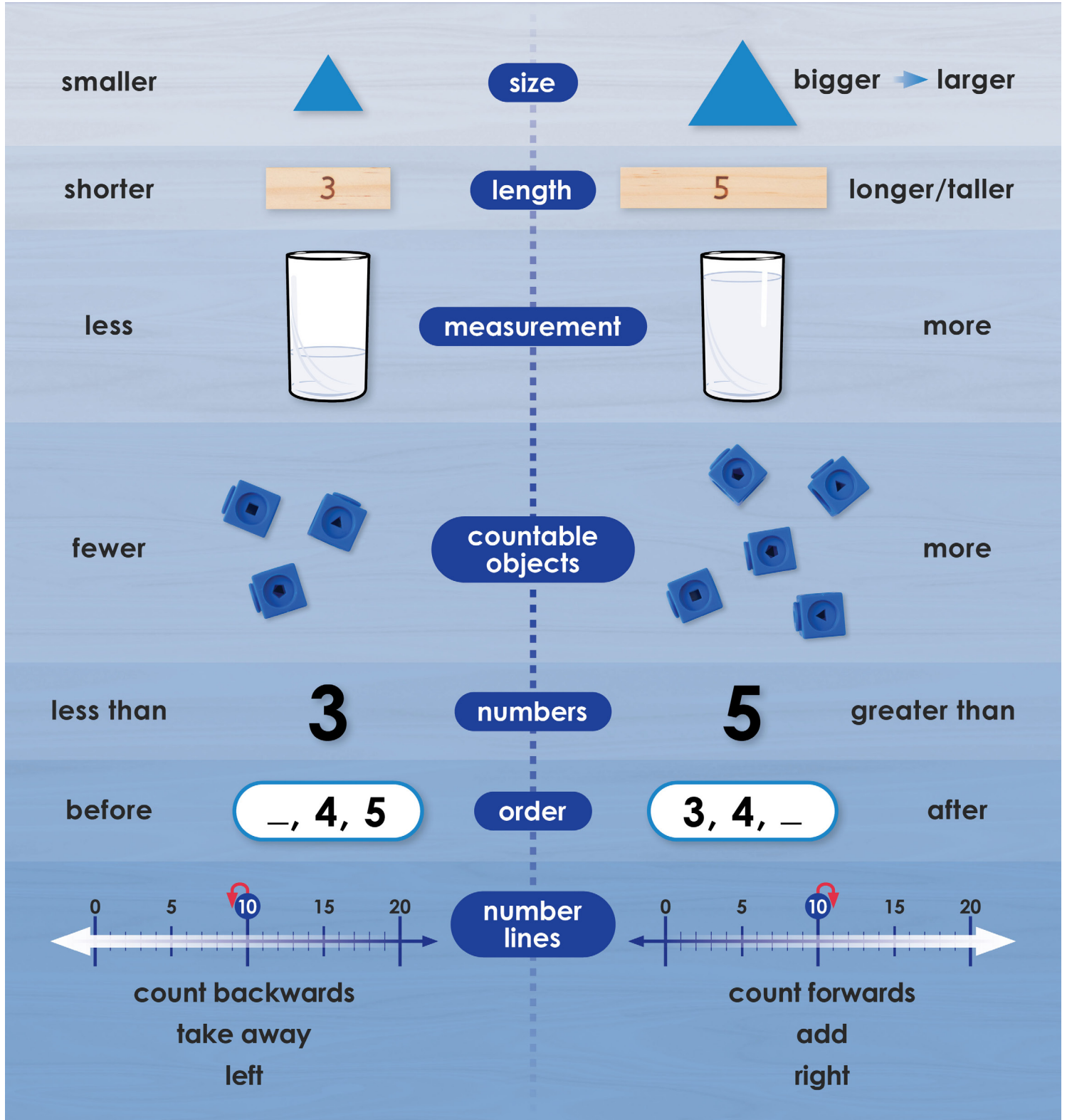
Language Used	Activity	
	Counting Forwards 10 to 20	Counting Backwards 20 to 10
Number Digits Place value Tens place Ones place Worth Teen	 <p>Activities 21 and 22</p>	 <p>Activities 31 and 32</p>

Number Track and Number Line Language

These boards also introduce language related to number tracks and number lines.

Language Used	Activity	
	Counting Forwards 1 to 10	Counting Forwards 10 to 20
Countable Items more Directional right Position first/last start/middle/end between Ordinal first, second, third, fourth, fifth	 <p>Activities 4, 7, 8 and 9</p>	 <p>Activities 24, 27, 28 and 29</p>
	Counting Backwards 10 to 1	Counting Backwards 20 to 10
Countable Items fewer Directional left Position first/last start/middle/end between Ordinal first, second, third, fourth, fifth	 <p>Activities 13, 16, 17 and 18</p>	 <p>Activities 34, 37, 38 and 39</p>

Developing the concept of which number is **worth more or less** is an essential component of number sense. For this reason, when comparing numbers, start with words the students understand such as 'bigger/smaller'. However, mathematically these words describe size. When appropriate, introduce the mathematically correct words of "less than" and "greater than".



Download this and more A3 posters from bondblocks.com

Poster

Fewer vs Less

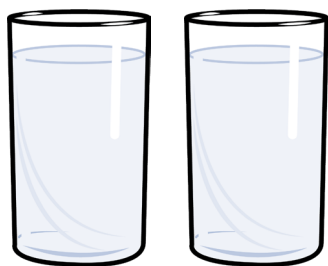
Definitions

“Fewer” is the correct term for discrete measure, that is items that can be counted with one-to-one correspondence. Use this term when referring to collections of cubes and counters.

“Less” is the correct term for continuous measure, that is things that are not counted with one-to-one correspondence but can be infinitely broken down into decimal units.

For example,

“I had fewer glasses of water, so drank less water”.



Fewer glasses. Less water.



More glasses. More water.

The glasses are discrete countable items whereas the liquid is a continuous type of measure.

Teaching Specific Vocabulary

In society the word **‘fewer’** is rarely used. The word **‘less’** is often used, albeit incorrect mathematically. For example, shopping centre express aisles are labelled “10 Items Or Less”. Mathematically this would be written “10 Items OR Fewer”. It is common for mathematical language to be used **colloquially**, and often incorrect mathematically, in society. For example, when two people are sharing food it is common to hear, “Can I have the big half?”. Mathematically if there is a ‘big half’ and a ‘small half’ then the pieces are not halves! Students need to be taught how language changes depending on context.

When teaching it is important not to get so worried about using the wrong term that you become hesitant to use mathematical language. The **concept of ‘more’ and ‘less’ is essential**, especially in the years around Year One considering the predictors of difficulty in mathematics.

Word Problem Language

However, it is important that teachers focus on using the word ‘fewer’, at specific times, so that students learn this term. Not only is ‘fewer’ used in standardised assessments it is essential to certain mathematics such as word problems.

From Year One on students solve addition and subtraction word problems. There are two types (structures) of addition and subtraction word problems (i) part-part-whole and (ii) comparison. Comparison word questions use the term **“fewer”**. For example,

“Jax scored 3 points. This was two fewer than his friend Chen. How many points did Chen score?”

Using the word ‘fewer’ in the context of counting collections builds a solid foundation for solving these types of problems. The Bond Blocks Addition and Subtraction Program, which follows Counting to 10 and 20, systematically covers addition and subtraction in Years 1 to 3, including word problems and the associated language.

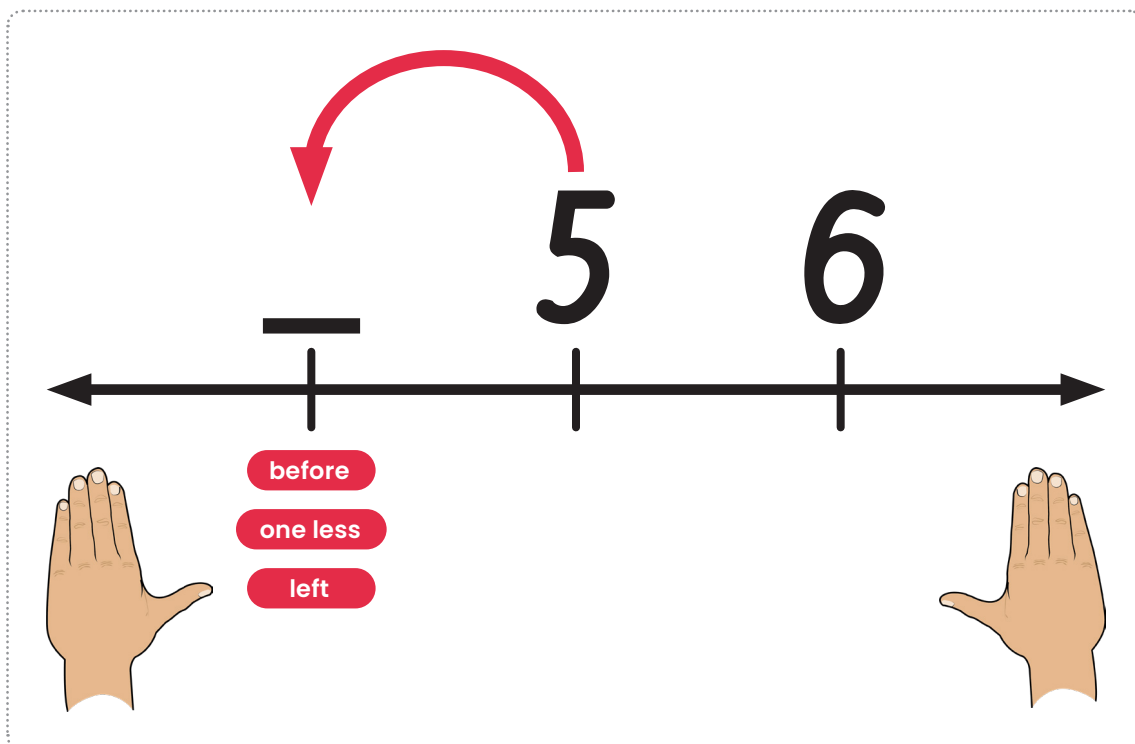
Before/After

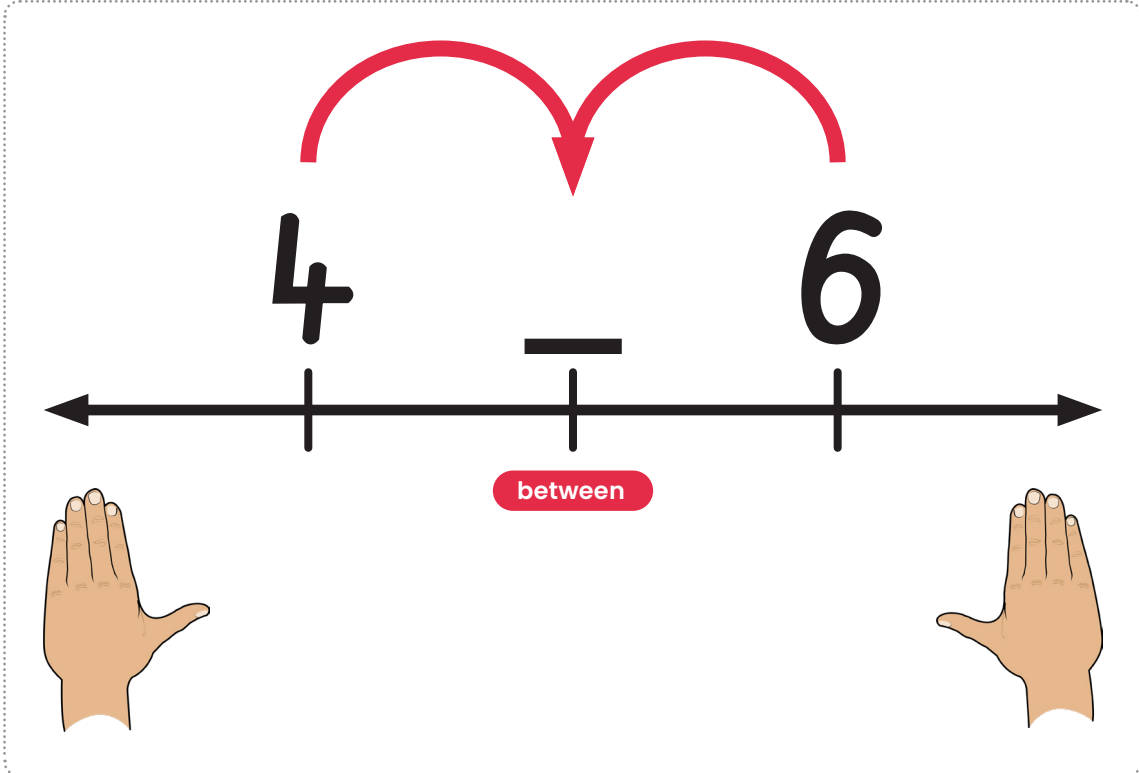
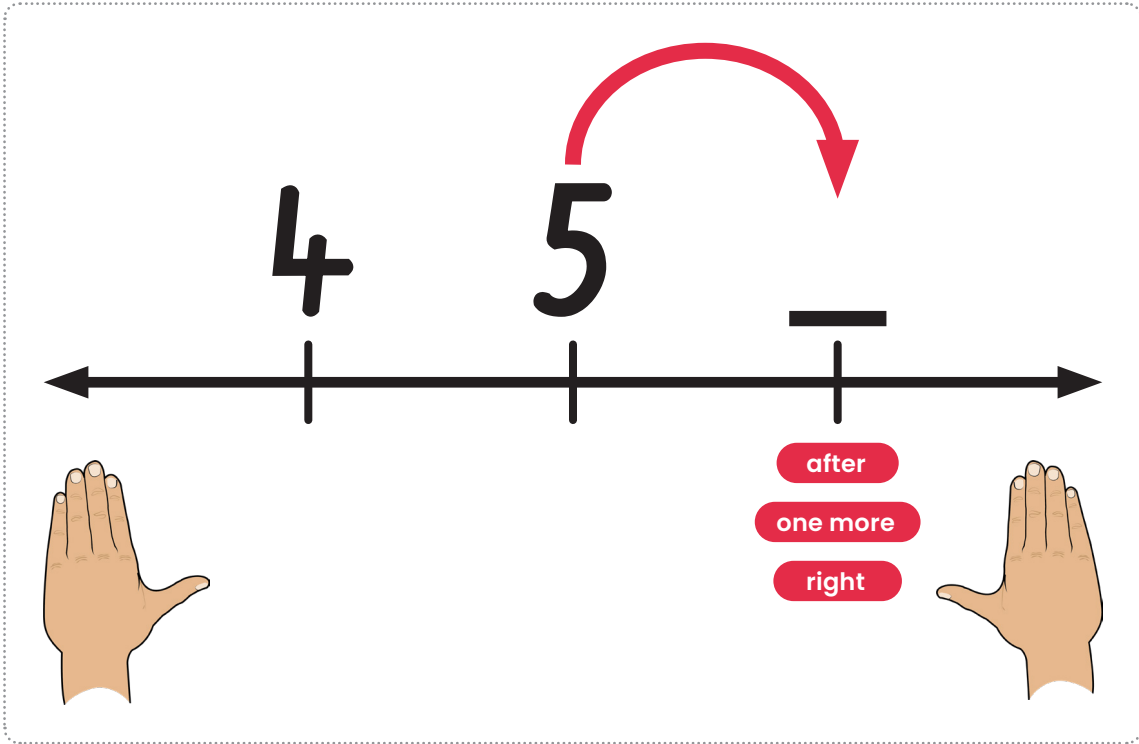
It is common for students in Foundation to confuse **'before'** and **'after'**.

- At the end of a counting forwards term check these students can identify **'one more'**, without counting starting at one/ten.
- At the end of a counting backwards term check these students can identify **'one less'**, without counting back from ten/twenty.

Being able to identify one more/less without saying the whole counting sequence is important because it relates to the top two predictors of difficulty.

There can be a range of different reasons for students confusing the terms 'before' and 'after'. Some reasons include language, directional and executive functioning difficulties. Use desk visuals, pointing prompts and pre-loading to support these students to develop fluency with these terms.





Correcting 'teen' and 'ty' Errors

The counting sequence from 10 to 20, often referred to as the 'teens', is notoriously difficult. This is primarily due to the English language.

The way we say numbers does not use place value related language consistently until the sixties. Consider these number names:

20	spoken as "twenty"	not "two-ty"
30	spoken as "thirty"	not "three-ty"
40	"forty" is said using the pattern of place value	but not spelt "fourty"
50	spoken as "fifty"	not "five-ty"

In addition to these inconsistencies the number names in counting sequence between 10 and 20 are not consistent.

11, 12	"eleven" and "twelve" do not follow the "teen" pattern
13, 15	spoken as "thirteen" and "fifteen", not "three-teen" and "five-teen" respectively
14, 16 - 19	spoken consistently as the ones-digit, then "teen"

The 'teens' are spoken by saying the ones-digit, then "teen". This does not match the order the digits are written and corresponding place value, whereas the two-digit numbers from 20 on do. For example, 68, which is 60 and 8 is spoken as "sixty-eight". However, 16, which is 10 and 6 is spoken in reverse as "sixteen" not "teen-six".

Many languages other than English do not have these inconsistencies. Understanding these inconsistencies can help teachers identify why typical errors are made and direct the focus of intervention.

Errors can be made in three different modes:

- speaking the number name,
- writing the numeral and
- identifying the numeral.

This Teacher Note will deal with each of these in turn.

Errors speaking the number name: "ty" not "teen"

Sometime students say "ty", instead of "teen". For example, saying 13 as "thirty", 14 as "forty". This often happens when students are learning to count forwards. After this is corrected, the error often reappears when students count backwards from 20 because of the increased intrinsic cognitive load of the task.

Some students have difficulty hearing the differences in these sounds and saying the different sounds. To increase their awareness of this draw attention to:

- the written spelling of 'ty' and 'teen' and
- the correct placement of the tongue when making the 'n' sound, which is against the roof of the mouth, behind the teeth.

How to correct students saying 'ty' instead of 'teen' using Bond Blocks is modelled in video on the website under Counting to 10 and 20, Teacher Notes, Correcting "teen" and "ty" Errors.

Errors writing the numeral

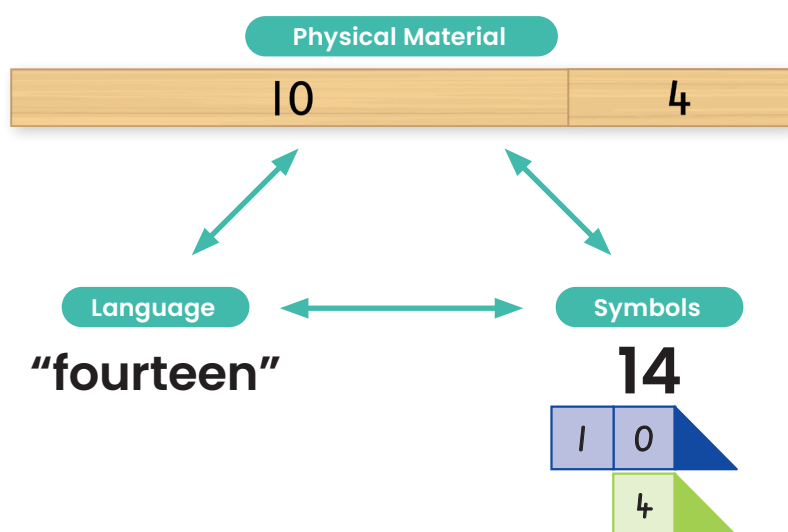
The order we say the parts of the teen number names, does not match the order the digits are written and corresponding place value. This causes errors when writing 'teen numbers'. For example, writing "fourteen" as "41". Students write the digits in the order they hear them. They are applying the same strategy of 'sounding out' they have been hard at work learning when reading and writing English. It is a very understandable error.

Connecting the Blocks and Words

For this reason Bond Blocks activities **first link** the **blocks with the spoken word**. Students need to be fluent with Teacher Led Activity "21 Starting at Ten: Using Words" before starting the Teacher Led Activity "22 Starting at Ten: Using Numbers".

Connecting the Blocks, Words and Numerals

Once students are fluent connecting the block and spoken word, the written numerals are introduced using **place value arrow cards**.



Place Value Arrow Cards

Use these arrow cards with:

- Teacher Led Activity 21 "Starting at Ten: Using Numbers"
- Teacher Led Activity 22 "Starting at Twenty: Using Numbers"

1	0	2	0	0
1	0	2	0	1
1	0	2	0	2
1	0	2	0	3
1	0	2	0	4
1	0	2	0	5
1	0	2	0	6
1	0	2	0	7
1	0	2	0	8
1	0	2	0	9

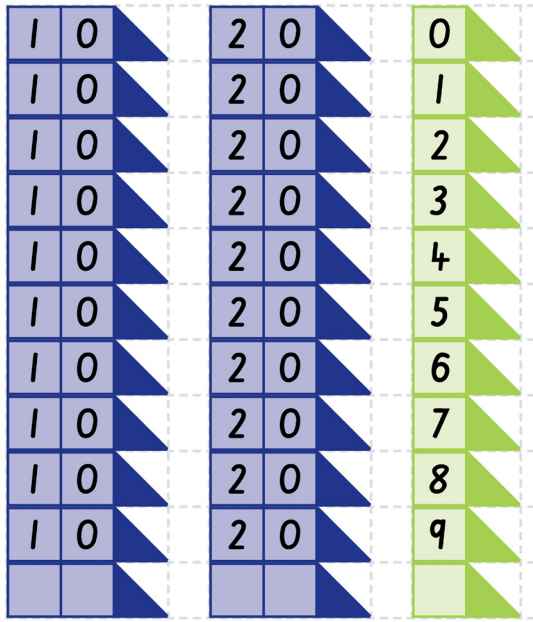
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It is important that students make the written numeral first using the place value arrow cards, before using the number cards.

Place Value Arrow Cards

Use these arrow cards with:

- Teacher Led Activity 22 "Starting at Ten: Using Numbers"
- Teacher Led Activity 32 "Starting at Twenty: Using Numbers"



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Place Value Arrow Cards

Number Cards

10	20
11	21
12	22
13	23
14	24
15	25
16	26
17	27
18	28
19	29
20	30

BOND BLOCKS COUNTING TO 10 & 20 - TEACHER NOTES 26

Number Cards

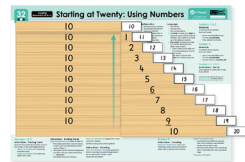
- Cut these number cards out and place them next to the matching Bond Blocks.
- Arrange Bond Blocks with the 10 blocks on the left according to place value.

Use these number cards with:

- Teacher Led Activity 22 "Starting at Ten: Using Numbers"



- Teacher Led Activity 32 "Starting at Twenty: Using Numbers"



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Use "Place Value Arrow Cards" and "Number Cards" with each of these activity boards.

This activity board is titled 'Starting at Ten: Using Numbers' and is for a 2-player activity. It features a staircase of ten blocks, each labeled with a number from 10 to 20. A vertical arrow points downwards from the top block (10) to the bottom block (20). The board includes instructions and materials for a two-player activity.

Counting forwards 10 to 20.

This activity board is titled 'Starting at Twenty: Using Numbers' and is for a 2-player activity. It features a staircase of ten blocks, each labeled with a number from 20 to 30. A vertical arrow points upwards from the bottom block (20) to the top block (30). The board includes instructions and materials for a two-player activity.

Counting backwards 20 to 10.

Using the place value arrow cards helps students connect the physical blocks of 10 and one other block, with the value of each written digit. This is especially important in the teens where the spoken word contradicts the written order.

Handwriting the numbers is a different skill that can be focused on in a separate activity. The emphasis of this activity is to connect the physical material, spoken word and written numeral. Students with learning difficulties often have difficulties focusing on the **mathematics and fine motor skill at the same time**.

If difficulties persist writing the teen numerals after tier one teaching there is more information about how to correct this error using Bond Blocks on the website under Counting to 10 and 20, Teacher Notes, Correcting "teen" and "ty" Errors.

Please note that once students have engaged with two-digit numbers up to 100, they will often self-correct writing errors in the teens saying things like,

"Oops, I wrote 41, I meant 14".

Errors identifying the numeral

Finally, students who make these errors need to be assessed to check whether they can correctly identify two-digit numbers that are written using the same digits, but in a different order.

First, assess identifying "teen" numbers. Write two numbers such as 41 and 14. Say to the student

"Point to fourteen".

Second, assess identifying "ty" numbers. Write two different numbers such as 61 and 16. Say to the student

"Point to sixty one".

To correct this:

- Write these numerals on separate post-it notes and place them in random order.

13, 14, 15, 16, 17, 18, 19

31, 41, 51, 61, 71, 81, 91

- Instruct the student to:

Sort them into two groups. Label one group "teen" and one group "ty".

Order each group from smallest to largest (least to greatest).

Circle these numbers on a 1 to 100 Number Board.

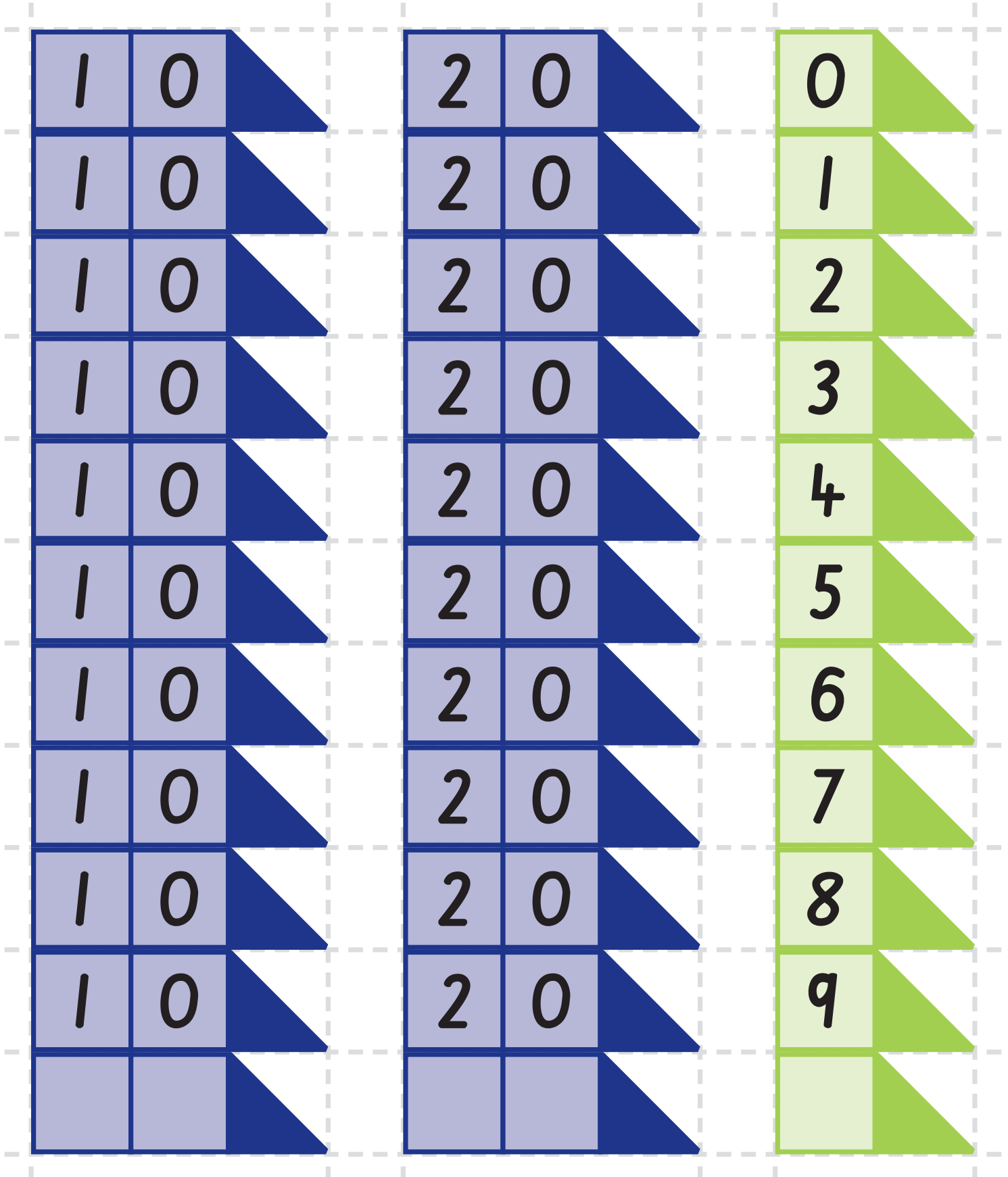
Say each "teen" number in order from least to greatest, pointing to them on the Number Board as they say the number name.

Say each "ty" number in order from least to greatest, pointing to them on the Number Board as they say the number name.

Place Value Arrow Cards

Use these arrow cards with:

- Teacher Led Activity 22 “Starting at Ten: Using Numbers”
- Teacher Led Activity 32 “Starting at Twenty: Using Numbers”



Number Cards

10	20
11	21
12	22
13	23
14	24
15	25
16	26
17	27
18	28
19	29
20	30

- Cut these number cards out and place them next to the matching Bond Blocks.
- Arrange Bond Blocks with the 10 blocks on the left according to place value.

Use these number cards with:

- Teacher Led Activity 22 **“Starting at Ten: Using Numbers”**

22 Starting at Ten: Using Numbers

Mathematics
Counting: counting forwards from 10 to 20.

Language
Use your Bond Blocks to represent the number 10. Use your Bond Blocks to represent the number 11. Use your Bond Blocks to represent the number 12. Use your Bond Blocks to represent the number 13. Use your Bond Blocks to represent the number 14. Use your Bond Blocks to represent the number 15. Use your Bond Blocks to represent the number 16. Use your Bond Blocks to represent the number 17. Use your Bond Blocks to represent the number 18. Use your Bond Blocks to represent the number 19. Use your Bond Blocks to represent the number 20.

Instructions - Building Cards
Place the number cards next to the corresponding Bond Blocks for the numbers 10 to 20.

Instructions - Counting
Count the number of blocks in the number line. Start at 10 and count up to 20. Record the numbers on the number line.

- Teacher Led Activity 32 **“Starting at Twenty: Using Numbers”**

32 Starting at Twenty: Using Numbers

Mathematics
Counting: counting forwards from 20 to 30.

Language
Use your Bond Blocks to represent the number 20. Use your Bond Blocks to represent the number 21. Use your Bond Blocks to represent the number 22. Use your Bond Blocks to represent the number 23. Use your Bond Blocks to represent the number 24. Use your Bond Blocks to represent the number 25. Use your Bond Blocks to represent the number 26. Use your Bond Blocks to represent the number 27. Use your Bond Blocks to represent the number 28. Use your Bond Blocks to represent the number 29. Use your Bond Blocks to represent the number 30.

Instructions - Building Cards
Place the number cards next to the corresponding Bond Blocks for the numbers 20 to 30.

Instructions - Counting
Count the number of blocks in the number line. Start at 20 and count up to 30. Record the numbers on the number line.

The Evidence Base of Bond Blocks Counting to 10 & 20

Defining 'Evidence-Based'

"Is Bond Blocks evidenced-based?" This is a great question and one we are often asked. However, it is also a term that is often misunderstood. We describe Bond Blocks as being "research-informed" and "using evidence-informed practice". We do this because strictly speaking, "evidence-based" is a research term that requires rigorous controlled trials. This is common in the medical field.

To answer the question "Is this evidence-based?" in an educational setting we refer to Professor Geoff Masters the CEO of the Australian Council for Educational Research (2018).

Evidence-based teaching involves the use of evidence to: (1) establish where students are in their learning; (2) decide on appropriate teaching strategies and interventions; and (3) monitor student progress and evaluate teaching effectiveness. (p. 4)

We recommend reading the entire article.

https://research.acer.edu.au/cgi/viewcontent.cgi?article=1335&context=research_conference

The salient points are that the medical profession, despite having access to controlled research studies, also relies on other tests and evidence, including observations. Doctors try a course of treatment, monitor progress and alter the treatment according to observations. Masters explains that this comprehensive understanding of what an "evidenced based" approach actually is, should also be applied to education.

"Policies and discussions of 'evidence-based teaching' sometimes overlook the importance of this broader, more integrated understanding of the role of evidence in teaching and learning." (p. 4)

Collecting Evidence

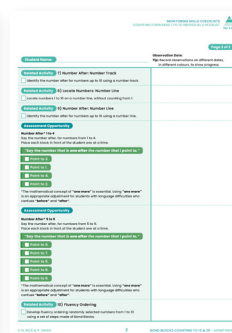
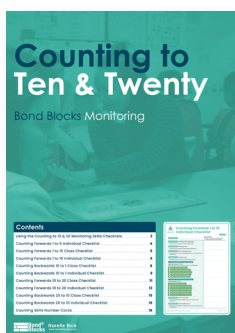
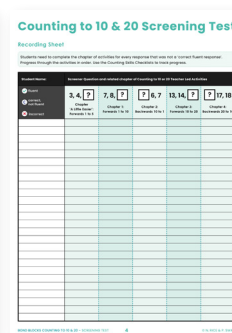
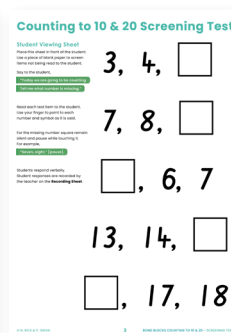
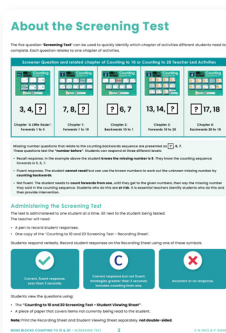
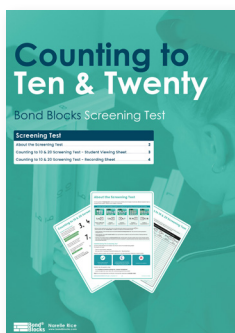
Bond Blocks has several tools built in to do what Masters (2018) defines as evidence-based teaching.

That is, collect data as evidence to:

- Establish where student are in their learning,
- Monitor student progress,
- Evaluate teaching effectiveness.

All Bond Block resources include assessment and monitoring resources to evaluate the effectiveness of teaching and learning.

For more information refer to the Bond Blocks Counting to 10 & 20 Screening Test and Monitoring Skills Checklists.



Evidence-Informed Mathematics Teaching

Masters (2018) highlights that general, non-subject specific, evidence-based strategies “must be interpreted and implemented in the contexts of the subjects teachers teach... Teachers require evidence about the best ways to implement effective teaching strategies and interventions in subject-specific contexts” (p.5).

The following section outlines evidence informed principles that are embedded in both the “Bond Blocks Counting to 10 & 20” Program and the “Bond Blocks Addition and Subtraction” Program.

Mathematics Specific Evidence-Informed Teaching Strategies

Bond Blocks incorporates the following key principles that have been identified by Sullivan (2011), and Anthony and Walshaw (2009), as effective for the teaching of **mathematics**.

Articulating Learning Goals*	The learning goals of every activity are provided.
Making Mathematical Connections	Connections are made between the concrete, representational and abstract elements of learning basic addition and subtraction facts through to pre-algebra and word questions.
Differentiated Teaching*	Activities are differentiated ‘a little harder’ and ‘a little easier’ alternatives.
Structuring Lessons*	The Bond Blocks session fits into standard lesson structures.
Promote Fluency and Transfer	The goal of the system is to do away with the Bond Blocks in favour of automatic recall. Activities are structured to move from using the blocks, to diagrams, to finally using numbers only.
Mathematical Language	Mathematical language is specified in the teacher notes for every activity and is modelled in the teaching videos.
Assessment for Learning	Tools include a placement test that is used to ascertain prior knowledge and monitor progress and a variety of recording sheets to document observational notes.
Improving Teacher Knowledge	Clear succinct teacher notes are provided for every activity and concept along with Professional Learning opportunities.








*Key principles that are also identified as general High Impact Teaching Strategies (Victoria Department of Education, 2020).

Bond Blocks incorporates these general High Impact Teaching Strategies:

Explicit Teaching	Explicit teaching is modelled in the videos that are provided for every activity.
Multiple Exposures	Bond Blocks activities are organised in cyclical chapters so that students return to the same concept, spaced over the teaching period.

Sequentially Built, Cyclically Reviewed

Bond Block activities are sequenced based on prerequisite knowledge to ensure students have the required prior knowledge to build new understandings. This reduces the risk students will rely on **counting from one to compare numbers** which is a major indicator that students will be at risk in mathematics. The activities are cyclically reviewed every chapter.

Mathematical Focus of each Counting to 10 & 20 Activity									
Activity Chapter	Counting in order using • Cubes • Words • Numbers	Counting With a Missing Number	Number Track	Counting From Any Number	Number After/Before: Number Line	Number After/Before: Number Track	Locate Numbers: Number Line	Number After/Before: Number Line	Fluency Ordering
'A little easier'  Counting Forwards 1 to 5	1  2 	3 	4 				8 		10 
1) Counting Forwards 1 to 10	1, 2	3	4	5	6	7	8	9	10
2) Counting Backwards 10 to 1	11	12	13	14	15	16	17	18	19
3) Counting Forwards 10 to 20	20, 21, 22	23	24	25	26	27	28	29	30
4) Counting Backwards 20 to 10	31, 32	33	34	35	36	37	38	39	40

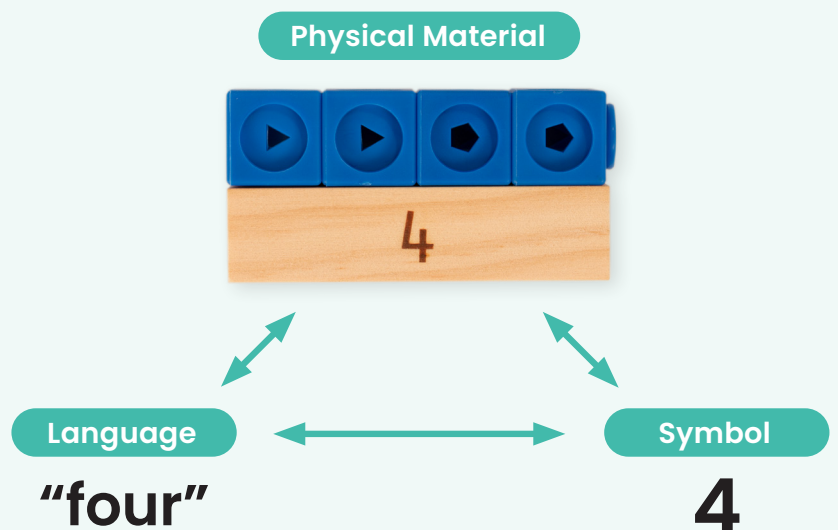
Numbers represent Teacher Led Activity boards.

Mathematical Language and Connections

Mathematical understanding is strengthened when connections are made between the physical materials, mathematical language and symbols (written numerals).

Counting to 10 & 20

For this reason students **say** the number name as they **touch** next to the written numeral on the block.



Concrete-Representational-Abstract

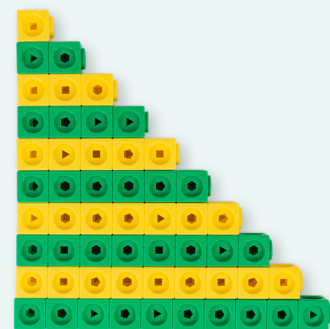
The Bond Block system is built using the **Concrete-Representational-Abstract approach**. This stems from the work of Bruner (1966). Bond Blocks are a **representational manipulative** that bridge the gap from concretely counting by ones to abstractly working with numbers and symbols.

Counting to 10 & 20

Concrete

Counting using Discrete Measure

Students begin counting discrete manipulatives with one-to-one correspondence. Many students don't progress from counting (for example, fingers or collections of objects) to compare numbers.



Representational

Developing Number Line Thinking and Magnitude Comparison using Continuous Measure

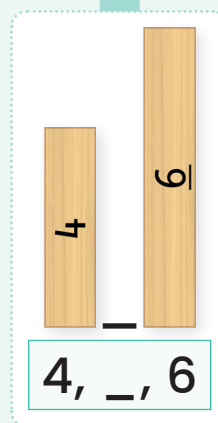
Bond Blocks Counting to 10 and 20 has been designed to help students:

- compare the **size of numbers**, relative to each other, using **number line thinking** (as opposed to counting by one from one).
- **count forwards and backwards from any number**, including identifying missing numbers.

Bond Blocks can help students develop these concepts because:

- they are **length based**, like the number line, which is continuous measure. They are not scored with discrete countable unit lines.
- they have the **numeral written** on them that the length represents. This helps students make connections between the abstract numeral, physical length and spoken number name.

"I can see 7 is greater than 4, because it is longer and closer to 10."



Abstract

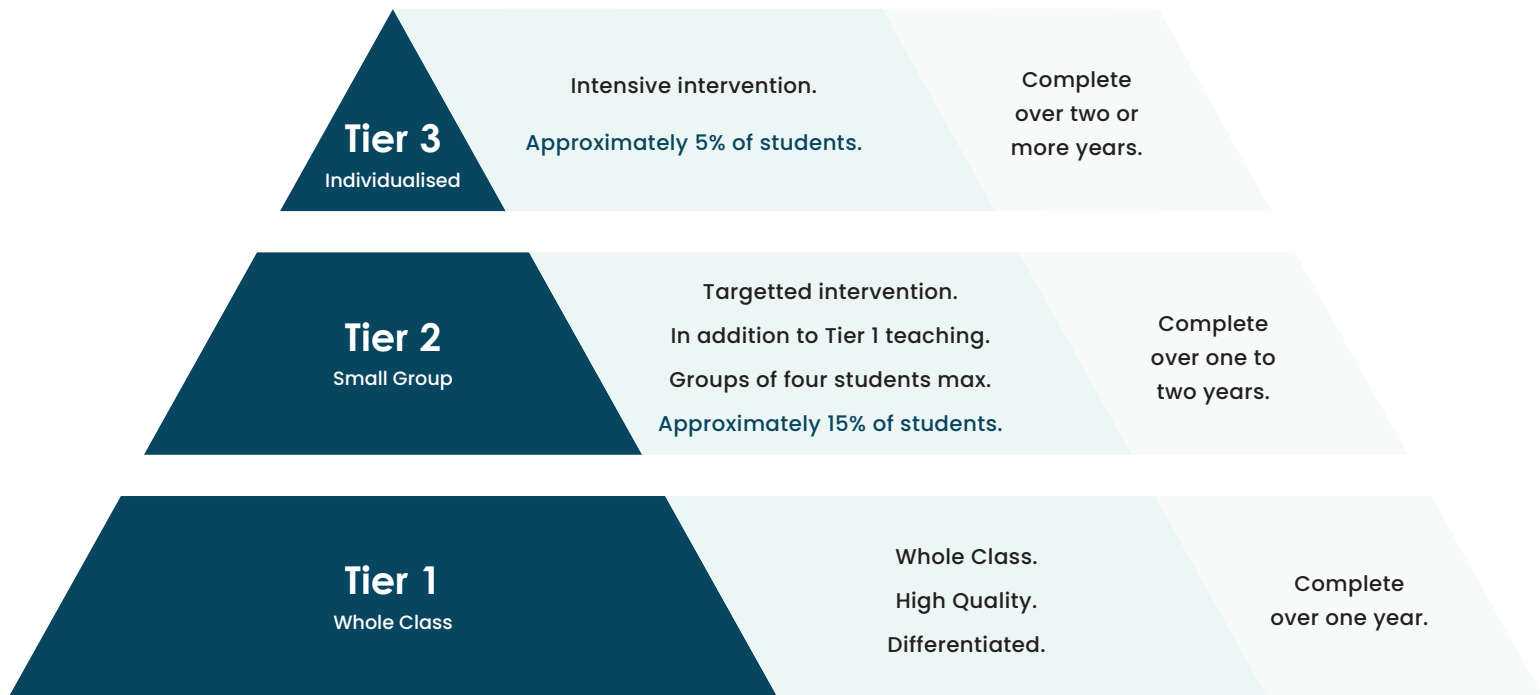
Developing Number Line Thinking and Magnitude Comparison using Numbers

Students can count on and back from any number and can abstractly compare numbers to identify which is greater or less.

Evidence-Informed Intervention

Implementing Bond Blocks using Response to Intervention

The Bond Blocks System has been designed to be implemented at a whole school level. Implementation occurs at three different levels in line with a Response To Intervention process of instruction.



Firstly, Bond Blocks Counting to 10 & 20 is implemented at a **tier one whole class** level as part of a whole school approach to teaching counting in **Pre-Foundation** and **Foundation**.

Secondly, Bond Blocks Counting to 10 & 20 is implemented at **tier two and three** as an **intervention program** for students who have specific difficulties counting.

Using Bond Blocks in these early years as a high-quality, differentiated teaching resource will reduce the numbers of students who require intervention.

The GRATTAN Institute

For more information about implementing Bond Blocks refer to the implementation guides. The GRATTAN Institute's report (2023) "**Tackling under-achievement: Why Australia should embed high-quality small-group tuition in schools**" strongly endorses using tier two intervention in **small groups of four** students, as is recommended in the Bond Blocks implementation guide, as a cost effective way to help reduce the gap between advantaged and disadvantaged students. The report also recommends intervening as early as possible, before the gap increases. Bond Blocks targets the skills that are predictors of difficulty in maths from the first years of schooling, identified by research, and provides a high-quality differentiated resource to help close the gap.

Learning Difficulties Information Guide Numeracy

Using a **Response to Intervention** approach is endorsed by the State of Victoria Department of Education and Training (2019) "Learning Difficulties Information Guide Numeracy". You can download this guide free from their site. One of our favourite quotes from this guide is, **"There is no 'one size fits all' approach to supporting students with learning difficulties in numeracy"** (p. 14). Instead Intervention needs to be differentiated based on the needs of the learner. For this reason every Bond Block activity has differentiation options. This quote is also in line with Masters (2018) definition of evidenced-based teaching. The effectiveness of the intervention needs to be constantly evaluated for every student. This is why the Bond Block recording sheets for monitoring progress at a tier two and three level have significant space for recording anecdotes.

Response to Intervention Recommendations

Implementation of Bond Blocks for tier two and three intervention enacts the top four recommendations of the Institute of Education Sciences for RTI in Maths (Gersten et. al., 2009, p. 5).

Recommendation	Level of Evidence	Bond Blocks
<p>Instruction during the intervention should be explicit and systematic.</p> <p>This includes providing models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review.</p>	<p>Strong</p>	<ul style="list-style-type: none"> • Explicit, video modelled teaching of every activity. • Systematically sequenced activities based on required prior knowledge and curriculum standards. • Verbalisation of mathematical process and content specified for every activity. • Mathematics is cyclically reviewed every chapter of activities. • Guided practice using gradual release model.
<p>Interventions should include instruction on solving word problems that is based on common underlying structures.</p>	<p>Strong</p>	<ul style="list-style-type: none"> • Word problem instruction uses underlying additive structures of part-part-whole and comparison problems, solved using Polya and the bar model. In depth teacher notes provided for professional learning.
<p>Intervention materials should include opportunities for students to work with visual representations of mathematical ideas and interventionists should be proficient in the use of visual representations of mathematical ideas</p>	<p>Moderate</p>	<ul style="list-style-type: none"> • Bond Blocks are a representational manipulative that is proportional. In each chapter students move from using the using physical Bond Blocks, to drawings of Bond Blocks, then to non-proportional part-part-whole diagrams.
<p>Interventions at all grade levels should devote about 10 minutes in each session to building fluent retrieval of basic arithmetic facts.</p>	<p>Moderate</p>	<ul style="list-style-type: none"> • Bond Blocks intervention specifies a minimum of four, ten minute sessions per week.

Research Informed

Each Bond Block resource has been designed to target the major predictors of maths difficulties, identified by research, with evidence-based teaching strategies. Therefore, Bond Blocks doesn't cover every area of the curriculum but focuses on:

- initial counting (Pre-Foundation and Foundation) using the "Bond Blocks Counting to 10 & 20" Program and
- addition and subtraction (Year 1 to 3 level) using the "Bond Blocks Addition and Subtraction" Program.

"Critical early quantitative competencies that children must possess to learn mathematics include an understanding of the relation between number words, Arabic numerals, and the underlying quantities they represent, as well as skill at fluently manipulating these representations; knowledge of the mathematical number line; and basic skills in arithmetic (i.e., skilled use of counting procedures, decomposition, and fact retrieval in problem solving). These skills are easily assessed in young children and many have been shown to be highly responsive to instructional interventions." (Geary, 2011, p. 15-16)

Counting to 10 & 20

In the early years of schooling before Year One, the **top two predictors of difficulty** in maths are (Geary et al., 2009):

1. **Fluently** identifying which is the **greater** of two numbers. That is, not counting from one.

"Which is bigger, meaning is worth the most things?"



Students at risk take a long time to answer, often counting from one. They lack a sense of how numbers relate to each other on a mental number line.

2. Being able to identify a missing number in each of these positions:

5, 6, _

After

5, _, 7

Between

_, 6, 7

Before

15, 16, _

After

15, _, 17

Between

_, 16, 17

Before

Reid's paper "Changing Minds: Discussions in neuroscience, psychology and education - Counting on it: Early numeracy development and the preschool child" (2016, p. 4) prepared for the Australian Council for Educational Research lists the following content, as cited by Griffin (2004, p. 174), as requisite for number sense for five-year-old children:

- knowing numbers indicate quantity and thus have a magnitude
- understanding and using relative terms such as more, less, bigger and smaller
- knowing numbers in the counting sequence have a fixed position
- understanding the sequence of numbers, e.g. three comes before four
- knowing higher numbers reflect greater quantities, e.g. four is greater than three
- knowing each counting term represents a unit increase

Bond Blocks: Counting to 10 & 20 systematically targets each of the skills identified by Geary and Griffin as essential for students in Foundation.

We will conclude with our favourite quote from John Hattie (2016).

"Almost everything in published research works at least some of the time with some students. Our challenge as a profession is to become more precise in what we do and when we do it. Timing is everything, and the wrong practice at the wrong time undermines efforts." (p. 103)

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