Bond® Blocks

BUILDING STRONG MATHEMATICAL FOUNDATIONS

Using Blocks 1 to 5

This sample booklet shows just some of the things that can be taught using Bond Blocks. Use the sample pack of Bond Blocks 1 to 5 to try the five activities in this booklet.

From Counting to Addition and Subtraction.

Concrete

Most manipulatives can be counted by ones.

Many students struggle to move from counting to add and subtract at a concrete level, to fluently adding and subtracting at an abstract level.

Bridging the Gap

Representational

Bond Blocks bridge the gap from concrete to abstract because they do not have individually scored lines. Bond Blocks are a representational manipulative because:

- The length and written numeral represent the number of cubes.
- How they are arranged (using part-part-whole) and moved represents the operations of addition and subtraction.

The length base of Bond Blocks makes them self-checking.

Students say the number sentence as they manipulate the physical blocks. Connecting verbal and visual information helps students build connected schemas and effectively store information in their long-term memory.

Abstract

Adding and subtracting using numbers and symbols.

Part + Part = Whole

3 + 2 = 5

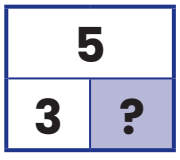
2 + 3 = 5

Whole - Part = Part

5 - 3 = 2

5 - 2 = 3

Extend with algebraic thinking.



5 - ? = 3

3 + ? = 5

Using your sample of blocks 1 to 5, try the following activities.

Bond® Blocks
Narelle Rice
www.bondblocks.com
Dr Paul Swan
www.drpaulswan.com

Developed by Narelle Rice with the support of Dr Paul Swan

1 Counting Forwards

When students start building with the shortest block, to the longest, they create a counting forwards sequence. Encourage students to use their steps to **count aloud**.

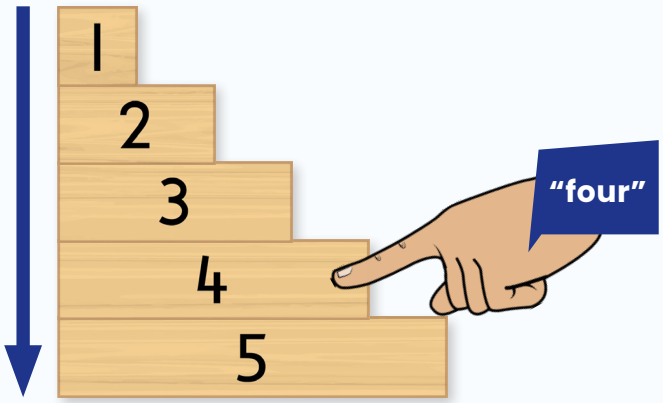
"One, two, three, four, five."

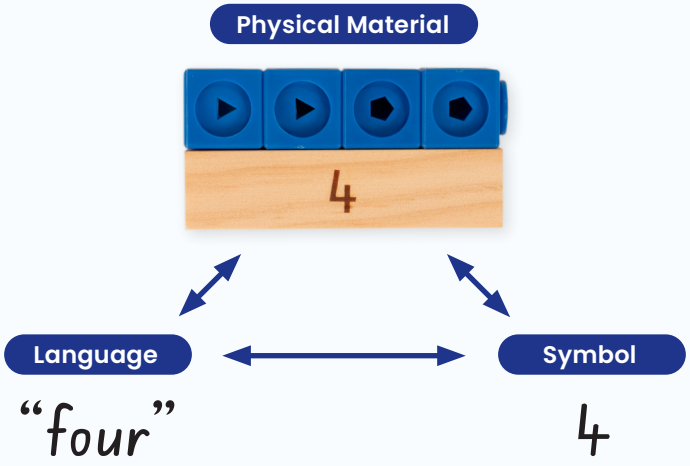
1. Build a set of steps from 1 to 5.
2. Count forwards.

Make sure students **touch the block**, next to the number, **as they count**.

From 1 to 5

Count forwards **starting at one**. Make sure the students **touch the block**, next to the number, **as they count**.



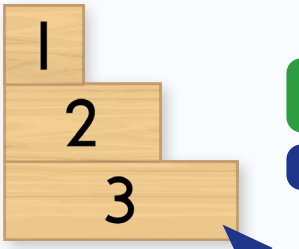


Doing this helps students connect the physical material with the language and symbols.

To see this done with numbers 1 to 10, see Counting Kit Activity 2, *"Counting Forwards to 10 - Starting at One"*.

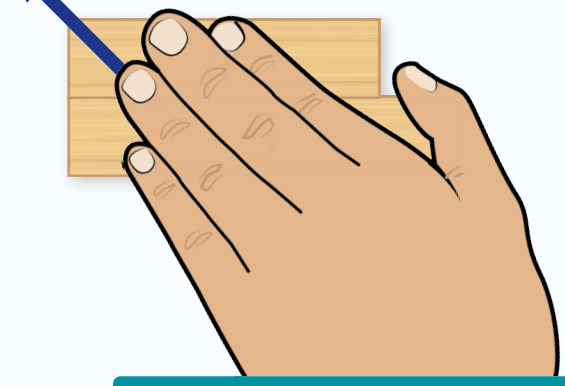
From numbers other than 1

It is important to start counting at numbers other than 1. Split the steps and count forwards starting at different numbers. For example, instruct the student to **"start at three"** and **"count frowards"**.



Teacher *"Start at three. Count forwards."*

Student *"Three, four, five ..."*



!

Counting, without seeing the number on the block, like this is different to counting from one **and harder**.

Cover the blocks to be counted.

Return each block to the steps, **immediately AFTER** the student has said the missing number.

To see this done with numbers 1 to 10, see Counting Kit Activity 5, *"Counting Forwards to 10 - From Any Number"*.

2 Counting Backwards

When students start building with the longest block, to the shortest, they create a counting backwards sequence. Encourage students to use their steps to **count aloud**.

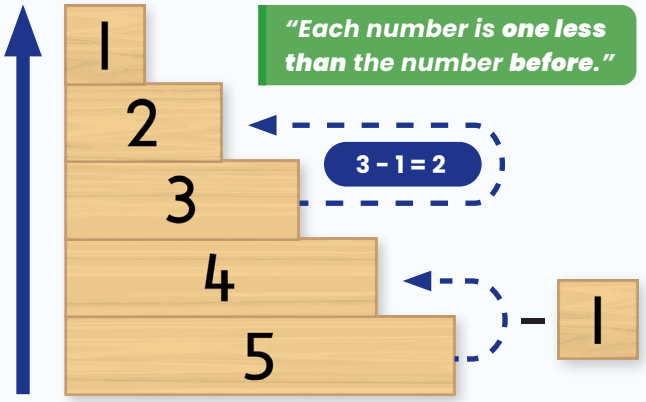
"Five, four, three, two, one."

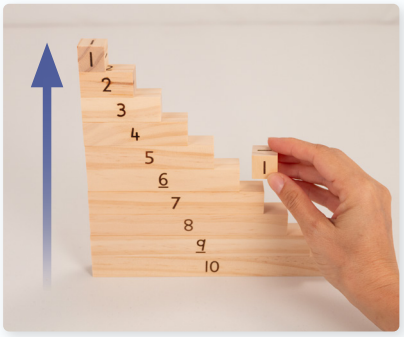
1. Build a set of steps from 5 to 1.
2. Count backwards.

Make sure students **touch the block**, next to the number, **as they count**.

From 5 to 1

Count forwards **starting at one**. Make sure the students **touch the block**, next to the number, **as they count**.





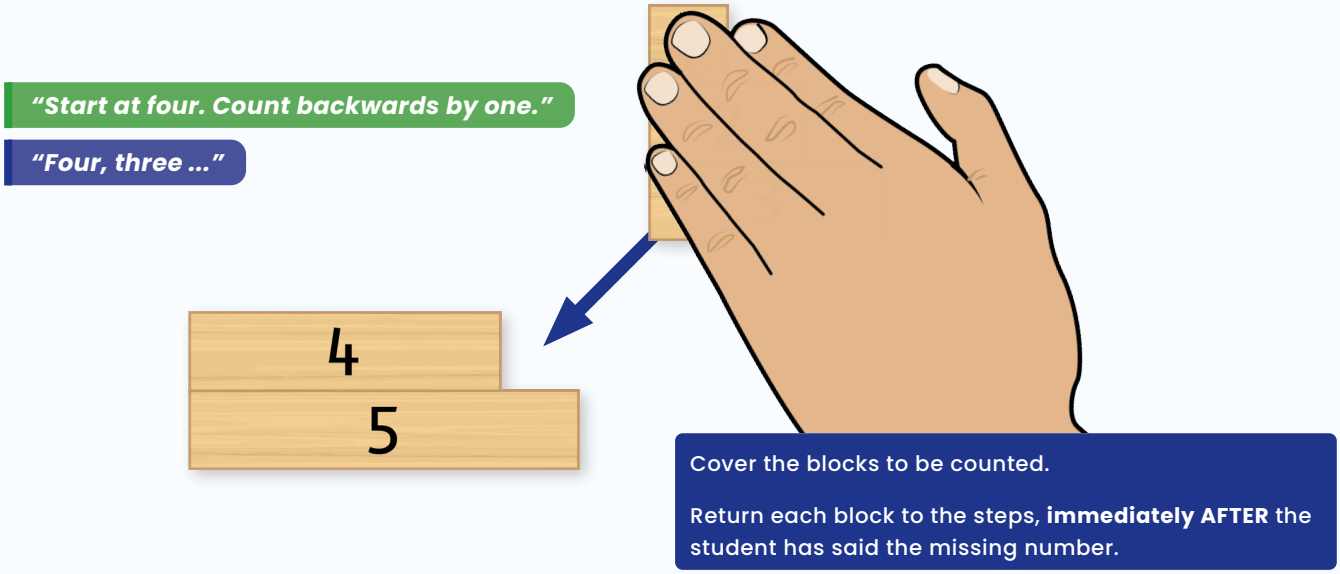
Use the steps (by building vertically) to show that each number in this sequence is **one less than** the number **before**.

Instruct students to act this out using a small figurine to jump up or down the set of steps, depending on the orientation of the blocks. Students count aloud as they move the figurine.

To see this done with numbers 10 to 1, see Counting Kit Activity 11, *"Counting Backwards from 10 - Starting at Ten"*.

From numbers other than 5

It is important to start counting backwards from numbers other than 5. Split the steps and count backwards starting at different numbers. For example, instruct the student to **"start at three"** and **"count backwards"**.



To see this done with numbers 10 to 1, see Counting Kit Activity 14, *"Counting Backwards from 10 - From Any Number"*.

3 Estimation and Testing

Show students a quantity of cubes joined together. Ask them to guess how many, without counting. Students then confirm and refine their answer using Bond Blocks.

Doing this helps students learn about the size of numbers in relation to each other.

Repeat this when the blocks are positioned vertically and horizontally.

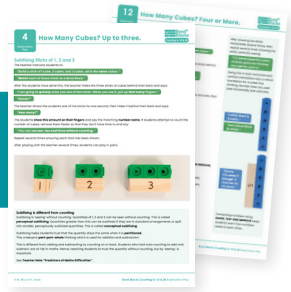
Doing this in both orientations lays a robust foundation for number line thinking.

"I think there is 5 cubes."

"Use a Bond Block to check."

"Nearly. Five wasn't enough. It must be six. I'll check."

This activity features in the Counting Kit Exploratory Play Cards as *"How Many Cubes? Up to three."* and *"How Many Cubes? Four or more."*



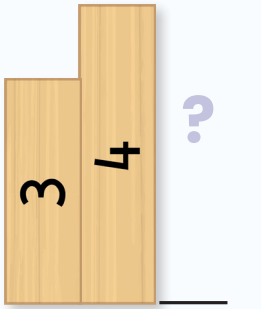
4 Number Line Thinking

Bond Blocks are linear to help develop number line thinking. Bond Block counting activities require students to:

Count On

Count **on from any number**.

This lays the foundation for identifying the **number after**.

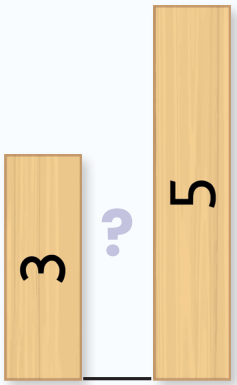


3, 4, ?

Count On *or* Back

Count on or back with **a missing number**.

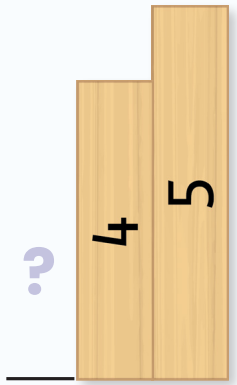
This lays the foundation for identifying the **number between**.



3, ?, 5

Count Back

Count **back from any number**. This lays the foundation for identifying the **number before**.



?, 4, 5

Many activities in the Counting Kit involve number line thinking. To see this done with numbers 1 to 10, see Counting Kit Activity 8, *"Counting Forwards to 10 - Locate Numbers: Number Line"*.

5 Addition and Subtraction

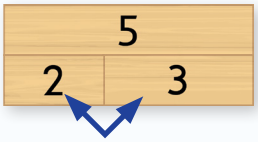
Learn number facts (bonds) and understandings about addition and subtraction.

Explicit Connections

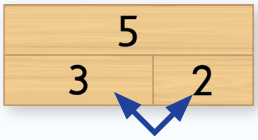
Link Bond Blocks to **Mathematical Language and Symbols** to develop robust understandings.

Concepts and relationships about addition and subtraction are taught through how Bond Blocks are placed and moved.

Blocks representing parts are rearranged to show the **Commutative Property of Addition:** swapping the order of the parts does not alter the size of the whole.

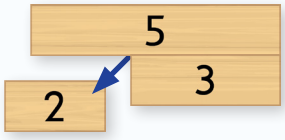


2 + 3 = 5. Swap to make 3 and 2.

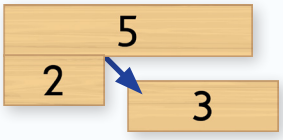


3 + 2 = 5. Swap to make 2 and 3.

Subtraction is not commutative. However, it is related to addition. Mathematicians call this inverse.



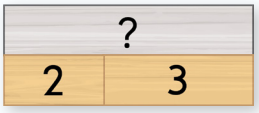
Whole - Part = Part, so **5 – 2 = 3**.



Whole - Part = Part, so **5 – 3 = 2**.

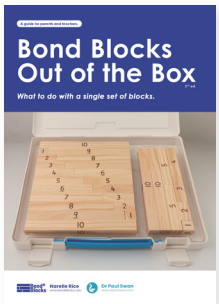
We use the relationship between addition and subtraction to find **missing numbers**.

Whole - Part = Part, so **5 – 2 = ?**.



Whole - Part = Part, so **? – 2 = 3**.

For activities involving addition and subtraction, see the Addition and Subtraction Kit at bondblocks.com



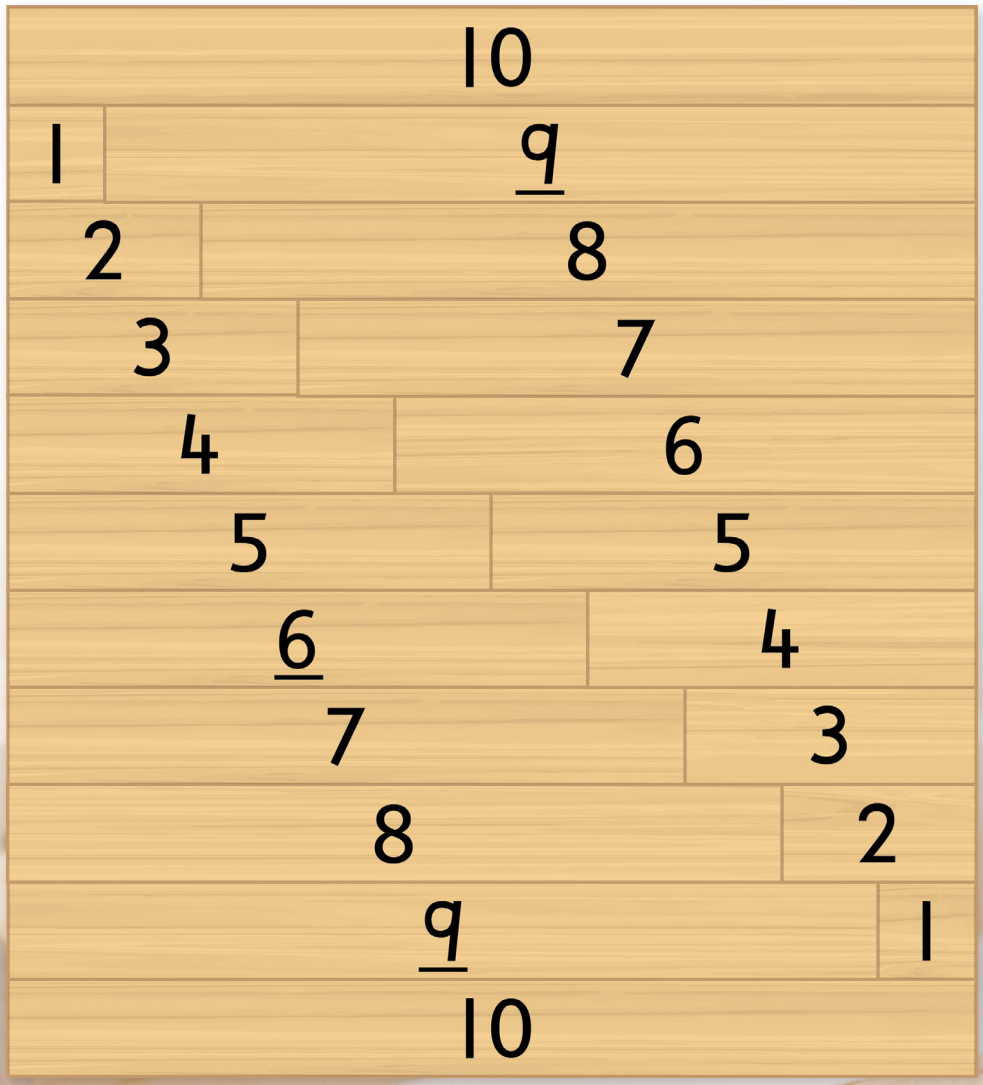
If you have a Wooden Blocks Pack, try the activities in the Out of the Box Book which use blocks 1 to 10.

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.

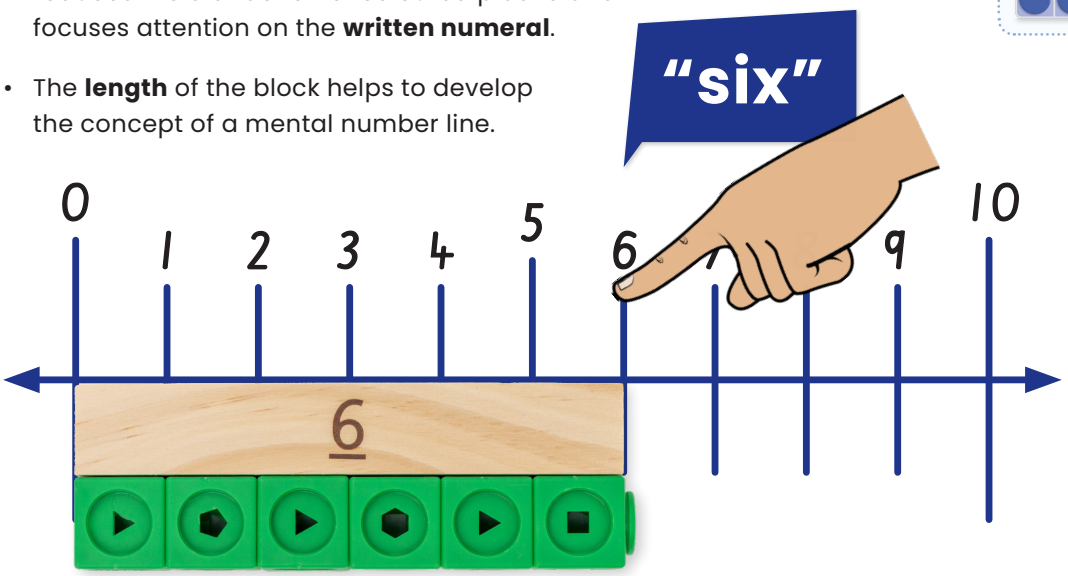
Linear Ten Block

Similar to ten strip.

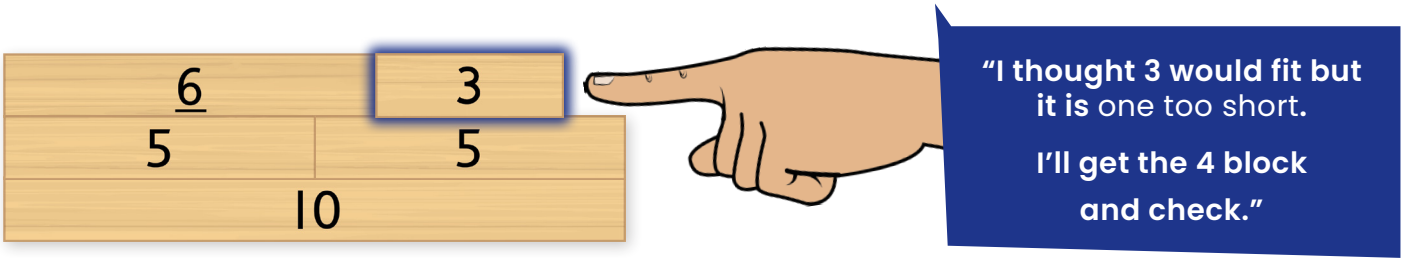
10

Other unique features:

- They are **not scored** with individual unit lines.
- The **natural wood** (sustainably sourced pine) reduces the distraction of coloured plastic and focuses attention on the **written numeral**.
- The **length** of the block helps to develop the concept of a mental number line.



- 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.

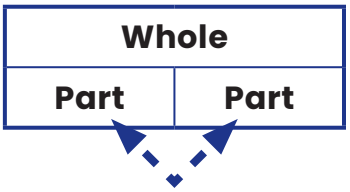


Number Bonds

The term bond refers to the parts that join to make a whole.

Number Bonds are also referred to as **Number Facts** and **Fact Families**.

This diagrammatic concept is known by a number of names including **'part-part-whole'** and **'bar model maths'**.



Parts BOND together to make a whole.

Concrete, Representational, Abstract

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

Concrete Prerequisite: Counting

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

1 Stable Order
Number names are said in the conventional order.

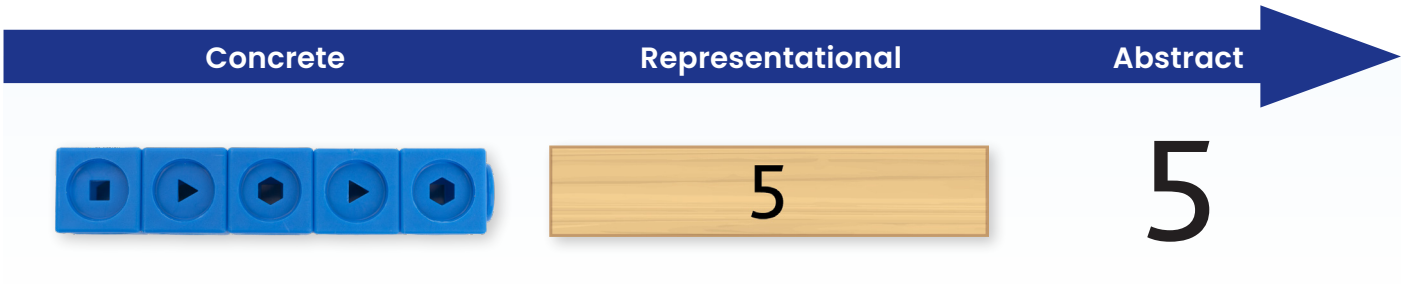
2 One-to-One Correspondence
Each item is counted once, as the corresponding word is said.

3 Cardinal Value
The last number said indicated the total for the group.

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

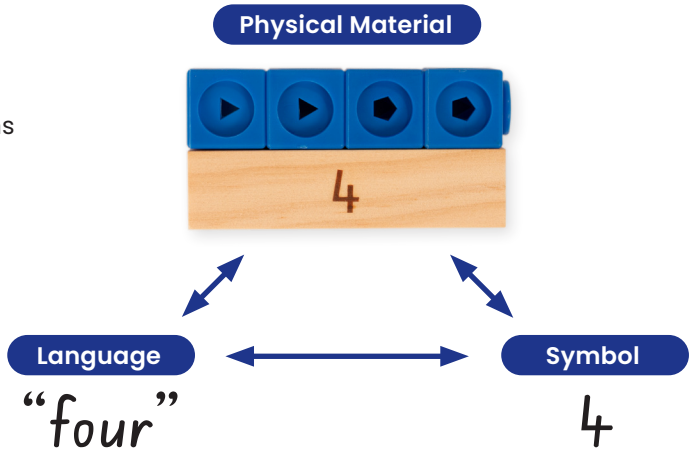
Begin using Bond Blocks in conjunction with discrete objects that can be counted with one-to-one correspondence. Bond Blocks were designed to be the same size as standard 2 cm cubes for this reason. Using discrete materials such as 2 cm cubes in conjunction with Bond Blocks helps students move towards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



Bond Blocks Kits

We have two kits.

Bond Blocks Counting to 10 & 20 Kit

Bond Blocks Addition & Subtraction Kit

PRE-FOUNDATION	FOUNDATION	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6

Bond Blocks Counting to 10 & 20 Kit

As whole class teaching (Tier 1).

As Intervention (Tier 2 and 3).

Bond Blocks Addition & Subtraction Kit

As whole class teaching (Tier 1).

As Intervention (Tier 2 and 3).

Bond Blocks Website

Evidence Base

of Bond Blocks

Curriculum Covered

Counting Kit

Curriculum Covered

Addition & Subtraction Kit

Testimonials

"Dear Narelle, I just wanted to follow up with a little testimonial for your wonderful Bond Blocks. ***My lovely little grade 1 student who was not able to successfully use counters or a number line to do a class maths assessment (one question out of 45 were correct) has now completed two thirds of it in a few sessions using the Bond Blocks with 100% accuracy.***

I have sat with him 1:1 but he is using the check strategy with the Bond Block to see if his answer is equal to what he thinks. Sometimes, he is one off and can see that quickly and adjusts his answer and re-checks with the block. He is working towards commutative thinking so if questions repeat after each other, he is doing it again. Interestingly, a few times he was wanting to use a "one block instead of a zero cause there is no zero block"... at these times I have assisted him with his thinking. The last couple of questions containing a zero, he has remembered what to do. ***Thanks so much! Nothing was working. This is wonderful! The smile on his face today was worth a million dollars!*** I am going to send home the counting on spinner games for him and his nan to try out. - Jo S, Year 1 Teacher, Victoria

"Dear Paul & Narelle; just an update on how our school has implemented the Core Kit. We have assigned a full time maths intervention teacher, who is working predominantly with the program with identified students in our year 3 to 6 cohort. Adding to this we also have several of our support staff engaging in small group work using the program. ***We have seen an absolute 100% turn around in our students' confidence, alongside their ability to respond with a deeper understanding of the concepts they have been addressing. It is so heart-warming to see.*** The program has allowed all the staff involved to see how rich and crucial the concepts are. As a school we are now converts to the value of the Bond Blocks as a mathematical tool that support building strong mathematical foundations, hence our latest purchase to support our year 1/2 students 'nail' their understanding of counting and addition and subtraction. Thank you so much for creating such a valuable resource for our students."
- Terri T, Teacher in Victoria




During my 20 years teaching I kept seeing students hit the same roadblocks when adding and subtracting. It didn't matter if they were in Year 2 or Year 9. They tended to count by ones to add and only had one concept of subtraction, that of taking away by counting backwards. This affected their ability to learn higher maths and their view of themselves. I wanted them to experience success and see the beauty and the connectedness of maths. When I looked for a ready-to-go resource to help it was slim picking. So, I created Bond Blocks, a system that could be used for intervention but also to teach well in the first place from Pre-Foundation to Year 3, reducing the number of students who need intervention.

I want to thank Dr Paul Swan for his support and guidance, and his small team for helping me build Bond Blocks to what you see today.
- Narelle (Bond Blocks Creator & Educator)