NCCA

Promoting Maths Talk to support children's learning of Place Value in Stages 1 & 2

Learning Outcomes

Stage 1: Through appropriately playful learning experiences children should be able to…

Stage 2: Through appropriately engaging learning experiences children should be able to…

- understand that digits have different values depending on their place or position in a number.
- use estimation to quickly determine the value and calculation of numbers.

Planning for Maths Talk

Select a worthwhile task goal or challenge with an appropriate learning outcome over the course of a lesson/series of lessons. In line with *Universal Design for Learning* principles, children can use multiple means of representation, action and expressions, and engagement as appropriate.

Introduction:

Children are reminded of the 'Four Freedoms' and of the classroom norms around working independently, then in pairs and finally returning to the whole class group. They are introduced to the task collectively.

Introduce task to the whole class e.g., what are the numbers hidden?

Initial Phase:

If the task selected is linked to a recent learning event, children may be prompted to bring prior learning and/or misconceptions to mind.

Talk Move: Say More/Clarifying

Talk Move: Repeating

Independent Phase:

Children undertake the task independently and are given ample time to think for themselves about the task.

Sharing Phase:

The intention is to help children clarify and share their own thoughts; orient to the thinking of others; deepen their own reasoning; and to engage with the reasoning of others.

- *Small group sharing* (children work in pairs, trios or groups)

Having had adequate time to think and engage with the tasks independently, children are given an opportunity to share their ideas, thinking or strategies and to collaborate to further develop or refine their response to the task.

Talk Move: Wait Time

Talk Move: Turn and Talk

- *Whole class sharing*

This open sharing phase is teacher-led classroom discussion. Teachers may select from a range of Talk Moves to facilitate children in sharing strategies, concepts, procedures, representations, and/or explanations they have used to tackle the task. The teacher's role is to help the children compare and connect their approaches to tackling the task using one of more of these possibilities:

Talk Move: Revoicing

Talk Move: Say More/Clarifying

Talk Move: Repeating

Talk Move: Reasoning/Elaborating

Talk Move: Agree/Disagree

Talk Move: Adding on

Focusing Phase:

At this point, the teacher orients the children towards a viable and efficient strategy, procedure, representation, and/or explanation. Helping the children to use it correctly is vital.

Place Value and Maths Talk:

Our decimal system is based on ten digits (0, 1, 2, 3, 4, 5, 6, 7, 8, 9). The value of each digit in a number is determined by its position in the number. Once children move beyond working with numbers to 9, place value comes into play. Moving from counting in ones to counting in iterable units of tens introduces a significant level of abstraction to young children. Zero also takes on a new role – acting as placeholder where necessary. So, the number 234 is constituted as follows:

2		**3**		**4**
= (2 x 100)		**(3 x 10)**		**(4 x 1)**
= 200	**+**	**30**	**+**	**4**
= 234				

Children need ample time to construct place value concepts using appropriate concrete and representational materials and Maths Talk to help mediate a complex, abstract system which is fundamental to success in many areas e.g., computation, measures, money. Discourse plays a key role in helping young children develop a deep sense of place value concepts (Disney and Eisenreich 2018). Imm (2012) underlines the importance of the relationship between cognitively demanding tasks and mathematical talk, and 'the power of discourse as a "thinking device" as opposed to mere conduit of knowledge'.

Some useful Place Value Teaching Resources:

- Finger patterns
- Domino cards
- Dice cards
- Numeral tracks
- Numeral cards
- Numeral roll
- Arrow cards
- Bead strings
- 5, 10, 20 frames
- Arithmetic rack
- 10 and 20 bus
- Bundling sticks
- Base ten blocks
- Ten strips
- Pocket charts

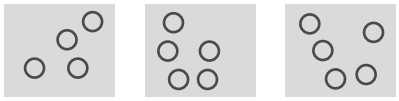
Place Value Resources and Talk Possibilities (Not in any particular order!)

Finger patterns build competence with finger patterns to 5 initially, and then to 10, to support *children's* move from counting in ones to seeing ten as a base for calculations.

Talk Possibilities:

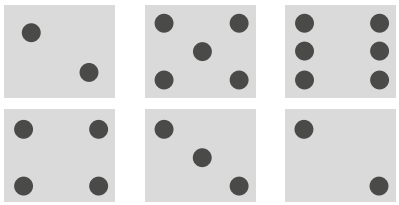
- Can you show me 2 fingers? Now, can you show me a different way?
- Can you show me how to make 5? Now, can you show me using both hands?

Irregular dot patterns help children to move from subitising or visualising composite units by describing the arrangement of the dots, particularly for larger numbers.



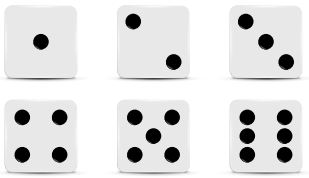
Talk Possibilities:
I'm going to show you these dots for just a second. Flash card. Can you tell me what you saw? How do you know? Did you notice a pattern? Can you draw in the air what the pattern was? Did anyone else see it in a different way?

Domino Cards build children's ability to ascribe number to regular spatial patterns using dominoes. They support children to subitise and later visualise patterns in the calculation of single digit numbers and are an important basis of calculation involving strategies not involving counting by ones.



Talk Possibilities: I'm going to show you a domino pattern. Can you tell me how may dots you see? Can you make the pattern in the air? Can you describe what you saw? How many dots on one side? On the other side? Altogether?

Dice Patterns build children's ability to ascribe number to regular spatial patterns using dice patterns. Dice patterns support subitising and the visualisation of patterns. Using two dice supports the calculation of single digit numbers and is an important basis of calculation strategies not involving counting by ones.



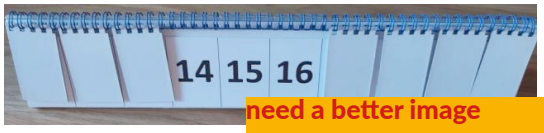
Talk Possibilities:

- Let's look at some patterns on our dice. Tell me about this one... can you describe it? How are 2 and 3 alike? What's different? How are 4 and 5 alike? What's different? What about 6? Is it like any of the others? Can you make them using counters? In the air?
- Let's throw two dice. What two numbers have been thrown? Can you add those numbers together?
- If I say a number, which two numbers on the dice could you throw to make that total?
- Which is more/less? 4 or 5?

Numeral Roll: Supports children to master the sequencing of numbers initially from 1-20, and then to 100 or beyond. It can be particularly helpful in helping pupils cross decuples e.g., 19, 20, 21. Using a window card/lid can help the learner focus on one number at a time. The structure of the rolls makes it easier for the learner to see the extended range of numbers. It allows children to see patterns emerging in numbers beyond 10 and to see the position of any number in relation to the decuple. Children can also cut it up to make a 100 square.

Talk Possibilities: I'm going to show you just one number on this roll? I'm hiding some using this cover. What is the number you can see? What do you think is next? Why do you think that? What was the number before it? Why do you think that?

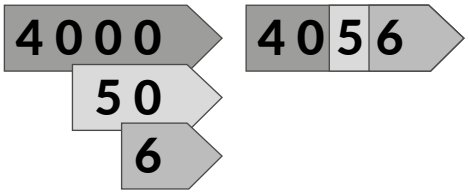
Numeral Tracks can be used initially from 1-10 and then extended based on suitable ranges e.g., 11-15, 16-20 and 11-20 and so on. They support counting in sequence forwards and backwards. As children advance number ranges can be selected to highlight the bridging of decades and to reinforce the decuples e.g., 36-45.



need a better image

Talk Possibilities:
Can you read these numbers? What number comes after 16? Would you like to lift the lid and check? Were you correct? And after that? What number do you think is next? Why do you think that? Would you like to check? Were you correct? What number came before 14? Would you like to check? And before that? Would you like to check? Could you tell me what this number is (pointing to a hidden 19)?

Arrow cards support children in extending their knowledge and conceptual understanding of the place value system involving two digits. They can help build a sense of the structure of multi-digit numbers which supports incrementing/decrementing by tens and ones in mental calculations. They support expressing numbers in their expanded form.

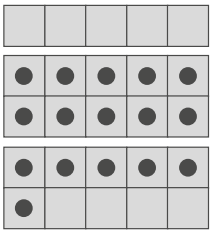


Talk Possibilities:
Show the children a tens arrow card (20). What number is this? Now, I'm going to show you another arrow card (5). Can you make a number using both? What number is it? Can you explain why? How could I make another number using one of these cards?

Bead Strings use alternate colours for each set of five or ten. They can support building to and from 5 initially and then 10. A ten-catcher with the bead string to build a sense of ten as an iterable unit, preparing for adding and subtracting 10s.

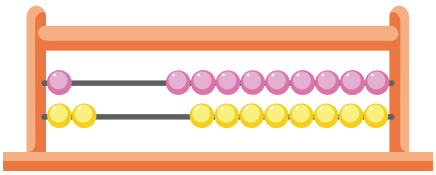
Talk Possibilities:
Let's count the white beads. How many did you find? Now, the red? How many? Can you predict how many whites are next? Want to check? And the red? Do you need to check? Do we need to keep counting each set of beads? Do you see a pattern? Want to check. Let's count them all from the start.

5, 10 and 20 frames Frames can help children build understanding of the structure of number to and through 5, using it as a bridge. This forms a basis for developing a sense of the structure of numbers to 10 and seeing 10 as a composite iterable unit i.e., 10 ones can be seen as a single unit of ten. The structure of the teen numbers and the further development of a conceptual understanding of place value is built on 10-plus using the 2 ten frames.



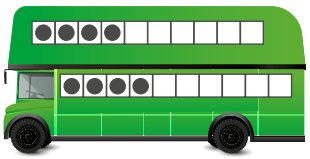
Talk Possibilities:
- I'm going to quickly show you some dots on this frame. Tell me how many you saw. How many empty squares? Did you see a pattern? Can you show me in the air? Would you like to check?
- I'm going to quickly show you this frame. Tell me how many red dots you saw. How many blue dots? How many altogether? Would you like to check?
- In this one, how many red dots? How many more would you need to make 10? Would you like to check?

Arithmetic Rack supports conceptual development of the structure of number up to 20 which is critical for calculations in the 1-20 range. It builds on the work done with bead strings, 5 and 10 frames and establishes five-wise, pair-wise and ten-wise combinations. Making a number e.g., 14, in one or two moves is what is desired.



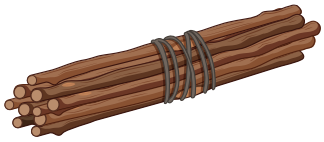
Talk Possibilities:
- I'm going to show you a number on the rack... what is it (14)? How do you know? Can you check another way? Can you make 14 a different way?
- Can you make 14 on the rack using a full ten on the top row? 10 and ...?
- Can you make 14 using doubles? What do you notice?
- How many more would you need to make 20? Would you like to check?

10 and 20 buses provide a story context for developing addition and subtraction to 10 and 20 respectively. The 10 bus is an extension of the work on double five frames and on 10 frames work. It supports the vital development of 5-plus combinations to 10. The 20 bus builds on the use of double ten frames and supports the essential development of addition and subtraction to 20.



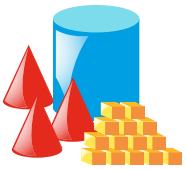
Talk Possibilities:
If 14 people get on the bus how many seats will be left? Remember we must fill the 10 seats on the top deck first! How many seats downstairs will be filled? How do you know? How many will be free? If 2 more get on, how many will be on the bus now? Then 3 get off... how many now? How many more would you need to fill the bus? Would you like to check?

Bundling sticks or straws are an accessible proportional and groupable resource ideal for demonstrating tens as an iterable unit built from ten ones. They provide an ideal basis for addition and subtraction of two-digit numbers incrementing and decrementing by tens and ones.



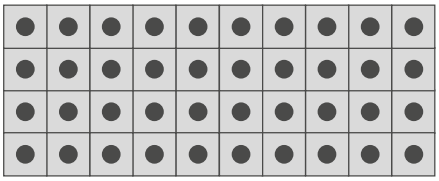
Talk Possibilities:
There's a lot of straws in this box. I need help to organise them. Can you help me? How will we go about counting them? 1, 2, 3, ... is there a better way to do this? How about in bundles of ten? 1, 2, ... 10 so that's on bundle of 10! Let's do more. Another 10! Great to have so many bundles but how can we check how many we have without opening them again... any ideas?

Base Ten Blocks are pre-grouped, proportional materials which make concrete the relationship between ones, tens and later hundreds. They contribute significantly to understanding the composition and decomposition of multi-digit numbers.



Talk Possibilities:
- Using the yellows, can you show me 9? How about 13 using just yellows? Do you think there might be another way of making 13? Want to compare them?
- How many yellows are the same length as one one green? How many do you think for two greens? Want to check? 3 greens?
- Can you make 26 using as few as possible? Is there another way to make 26?

Ten-dot strips are a proportional, pre-grouped and inexpensive resource used to develop addition and subtraction of tens and ones through incrementing and decrementing by tens and ones.



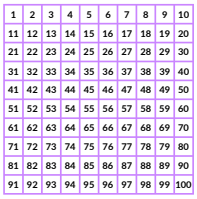
Talk Possibilities:
How many dots on this strip? Let's count. Here's another strip. How many now? How many do you think there are in the next strip? How many dots altogether? How many strips? Want to check?

Place Value Pocket Charts on a classroom wall allow for the visible and cumulative building of ones into tens and tens into hundreds e.g., a straw per day at school over the course of the school year.

need a better image

Talk Possibilities:
Ok, let's add a straw for today? How many in the ones now? How many more ones do we need before we get to 10? What will we do then? How many in the tens? Hundreds?

The 100 Square builds on the numeral roll, numeral track and number line. The inherent structure offers a means of extending children's knowledge of tens and ones by emphasising vertical and horizontal relationships. It supports addition and subtraction of tens and ones to 100.



1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Talk Possibilities:

- How could we make our own 100 square? What about our numeral roll? Could we use it? How would we arrange the tens? Do you see a pattern? What is it? What will the next strip have in the tens place?
- Now that the 100 sqaure is complete, I'm going to cover a number (27)... can you tell what it is? How do you know? Do you have another way of figuring it out? Another way? I'll cover these 4 numbers now... what are they? How do you know?
- Can tell me how much 24 + 10 makes? How do you know? Is there another way? 43 + 20?
- What is 38 – 20? How do you know?

Digit Cards help children to recognise, identify, sequence, order, and compare two-digit numbers. They also help children to build, read and write multi-digit numbers. They offer a flexibility to children to make, compare and explore relationships between numbers.

Talk Possibilities:

- Can you pick out the number 4?
- Can you name this card?
- If I took two cards, 2 and 3, can you use them to make a number? What did you make? What is the value of the 2? The 3?
- Can you use them to make a different number? What is the value of the 2 now? The 3?

Numeral Cards supports the recognition, identification, sequencing, ordering, and comparison of single- and multi-digit numbers.

Talk Possibilities:

- Can you pick out the number 44?
- What is this number (36)? What is the value of the 3? The 6?
- Can you put these numbers in the correct sequence (36, 37, 38, 39)?
- Can you order these numbers? (3, 39, 46, 37)
- Which is bigger? Smaller? How do you know?

References:

Disney, A. and Eisenreich, H. (2018). *'Deepening Place Value Understanding in K-2 Through Explanation and Justification,'* Proceedings of the Interdisciplinary STEM Teaching and Learning Conference: Vol. 2, Article 9.

Imm, K. (2012). *'Talking Mathematically: An Analysis of Discourse Communities'*. The Journal of Mathematical Behavior, 31 (1).

Wright, R.J., Ellemor-Collins, D. and Tabor, P. (2012). *Developing Number Knowledge: Assessment, Teaching and Intervention with 7– 11 year olds*, London: Sage.

Wright, R.J., Martland, J., Stafford, A.K. and Stanger, G. (2006b). *Teaching Number: Advancing Children's Skills and Strategies*, 2nd ed. London: Paul Chapman.

Wright, R.J., Stanger, G., Stafford, A. and Martland, J. (2015). *Teaching Number in the Classroom with 4– 8 year olds*, 2nd ed. London: Sage.