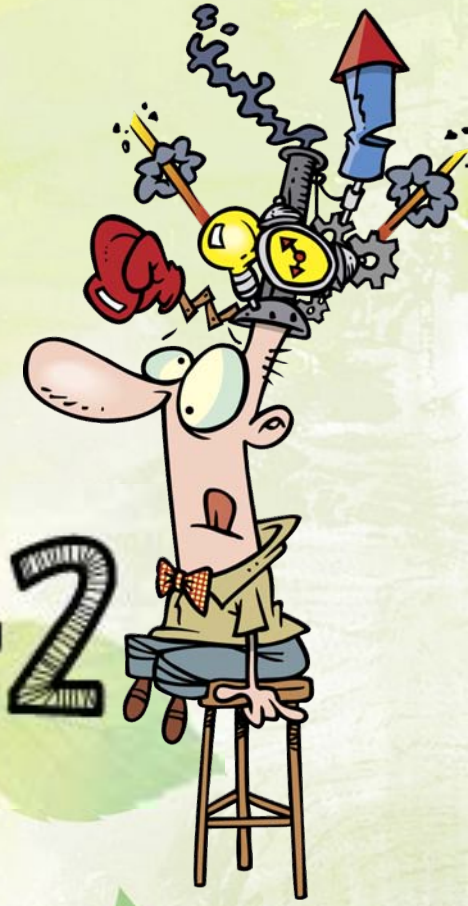
number sense prep-2



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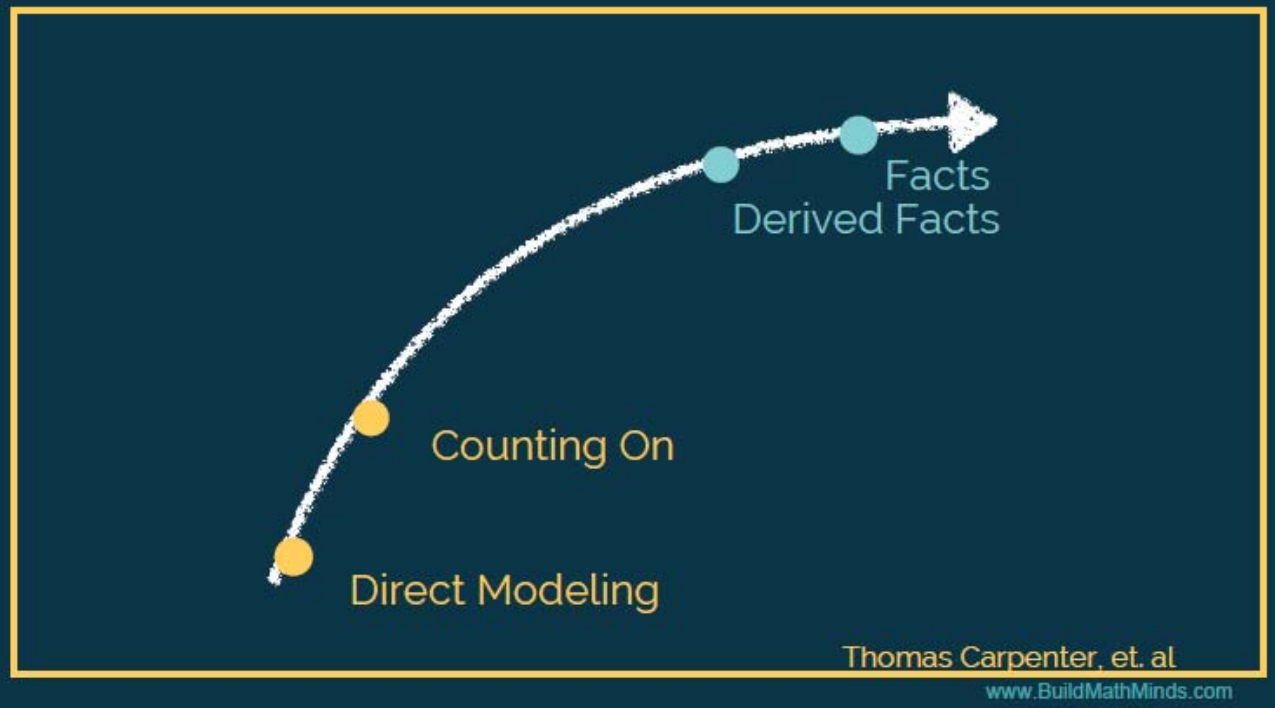
MAV Conference 2019

What is number sense?

"…good intuition about numbers and their relationships. It develops gradually as a result of exploring numbers, visualising them in a variety of contexts, and relating them in ways that are not limited by traditional algorithms."

Hilde Howden

Cognitively Guided Instruction



Traditionally, we jump from the counting-on phase into memorisation of facts, but this does not work for a lot of students! If they don't know a fact, they resort back to counting on their fingers. We have to teach the derived facts: how to get to facts when they don't automatically know them. The only way we can tell where kids' understanding is at is by giving them problems that bring out their thinking. Once we can see how they are thinking, we can then determine where to go next.

THE ESSENTIAL COMPONENTS OF NUMBER SENSE

1. Spatial Relationships

2. One and Two More, One and Two Less

3. Benchmarks of 5 and 10

4. Part-Part-Whole

The goal of building number sense is to promote deeper thinking (understanding, reasoning, problem-solving, fluency) instead of just the ability to compute.

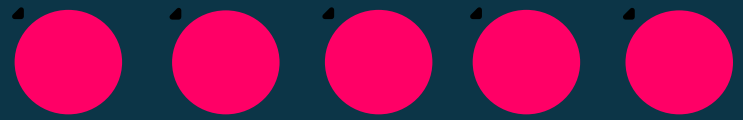
01 Spatial Relationships

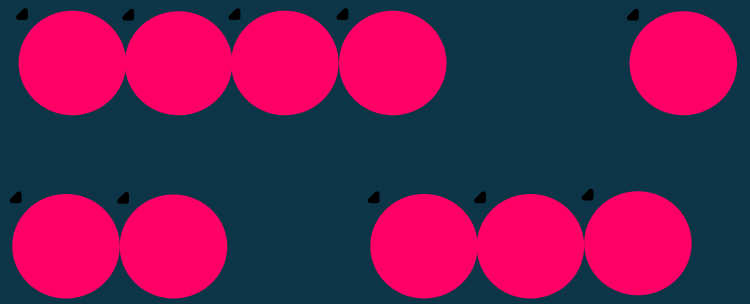
What is it?

- the ability to recognise how many without counting
- knowing how one number relates to another

Why do kids need it?

- when kids have a mental image of the quantity of a number, they can more easily recognise part/part/whole relationships.





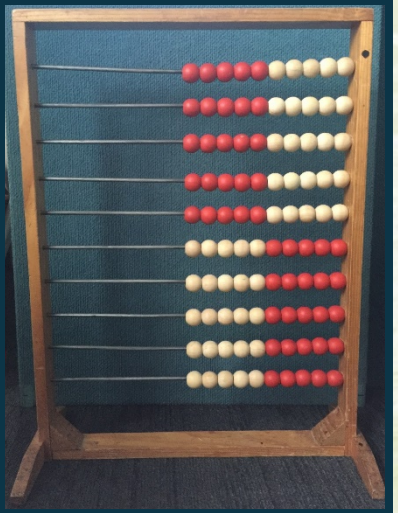
01 Spatial Relationships

How can we help them develop SR?

SUBITISING

- helps kids to visualise quantities when they see numerals
- enables kids to use counting on and counting back to add and subtract.
- the ultimate goal is to get kids working on facts and derived facts.

click image to view



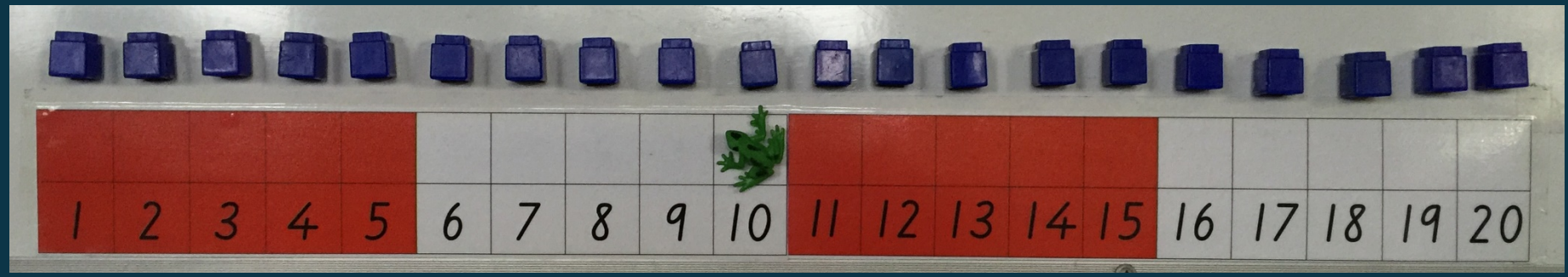
REKENREK

- helps kids to mentally see quantities.
- gives structured to support for recognition of 5, 10 AND 50 benchmarks.
- kids can see the magnitude of a number and compare it to other numbers.
- helps them to understand place value.

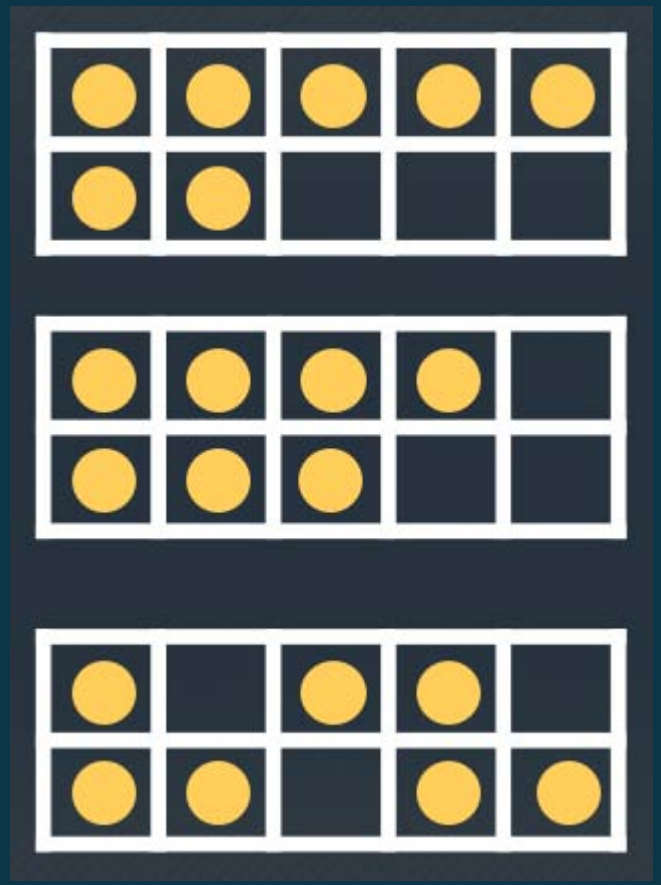
01 Spatial Relationships

NUMBER PATH

- kids can see how numbers relate to each other; 9 is much more than 2, but 5 and 6 are nearly the same because they are close to each other.
- kids see numbers as quantities, not digits.
- preferred over number lines for prep/1s - kids can't see quantities on a number line, the numbers are represented by the space between two markers



01 Spatial Relationships

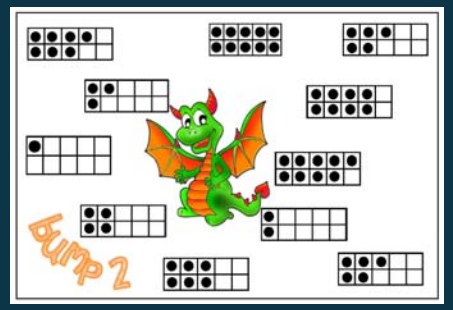


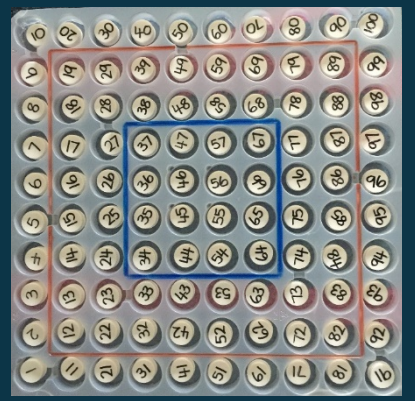
TEN FRAMES

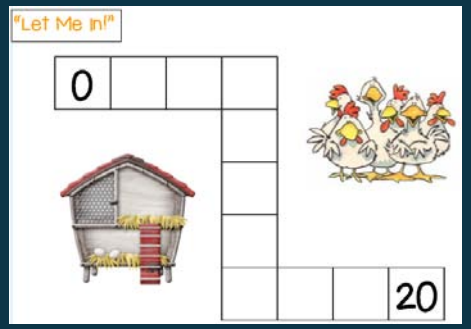
- We don't want kids to only see quantities in one way. Use top row filling, vertical pairs and random arrangements to help them see the connections.
- They may see this as 7, but we want them to also see that it is 5 and 2, 6 and 1, 3 and 4.

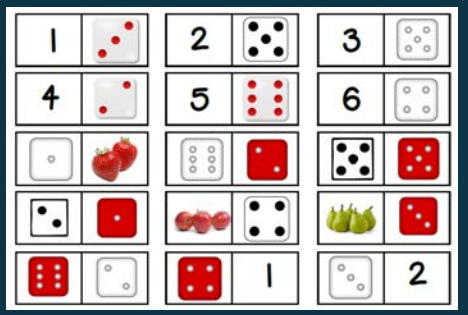
01 Spatial Relationships

Let the games begin!









02 One/Two More & Less

What is it?

- knowing which numbers are one and two less or more than any given number without having to count

Why do kids need it?

- It allows them to be flexible thinkers and aids in mental computation. We want kids to use the concept of 9 being 1 less than 10 to solve 9 + 5 by thinking it is just like 10 + 5, but one less. If they know what 9 + 5 is, they can use it to work out what 49 + 5 is.
- When kids don't remember number facts and don't have the concept of 1 and 2 more and less, they will revert back to counting on their fingers.
- When kids understand the concept of 1 and 2 more/less, it is faster, (and easier) to solve problems such as 59 + 25 by seeing it as 60 + 25, less one.

02 One/Two More & Less

How do we develop it?

Try to remember this number...

25811141720

Will you be able to remember it in three days or two months?

Look for a relationship within the numbers, can you remember them now?

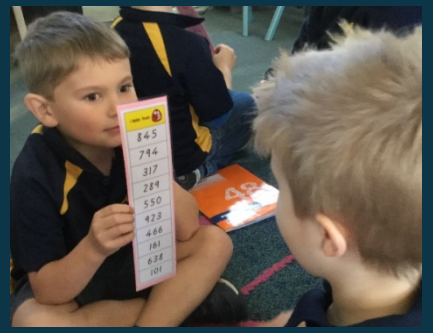
Start with the first digit and keep adding 3; now the number is easier to remember.

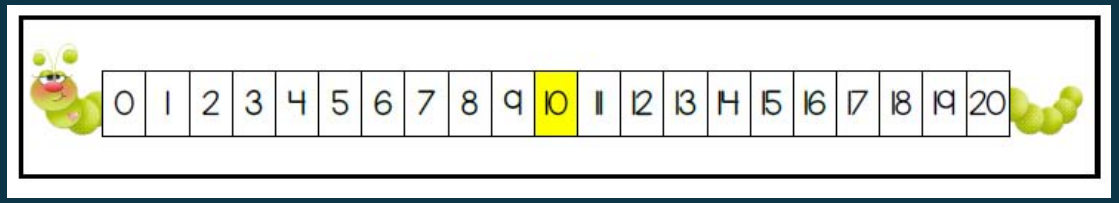
This is the flexibility we want our kids to develop in working with derived facts... it is all about strategies, not memorisation!

02 One/Two More & Less

Let the games begin!

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





WHO HAS THE MOST COUNTERS?

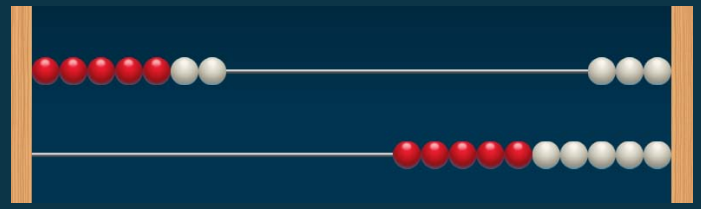
NAME	CLUES	NUMBER	SHOW IT
Willow		7	
Laynie	2 more than Willow		
Aiya	2 less than Willow		
Bodhi	2 less than Aiya		
Darcy	2 more than Laynie		
Marlow	1 more than Darcy		
Hudson	2 less than Bodhi		
Daisy	2 more than Marlow		
Luca	1 less than Laynie		
Albert	2 less than Luca		
Charlotte	2 more than Daisy		
Djaran	1 more than Bodhi		
Petra	2 more than Charlotte		
Blue	2 more than Darcy		
Xavier	2 less than Blue		
Brylie	2 more than Xavier		
Sunny	2 more than Brylie		
Margot	2 less than Djaran		
Lucas	2 more than Luca		
Noah	1 less than Brylie		

03 Benchmarks of 5 & 10

What is it?

- knowing how numbers relate to 5 and 10 (and then to 50 and 100)

Why do kids need it?

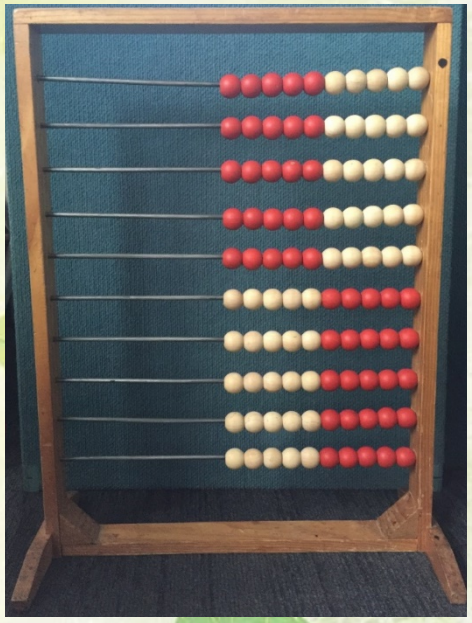


- it makes computation easier
- it aids more efficient problem solving (Albert)
- It helps kids to work out problems in their heads without having to always write or draw something.
- We want kids using the ‘make a ten’ strategy, but if they don’t know a number’s relationship to 10, this won’t work for them.

03 Benchmarks of 5 & 10

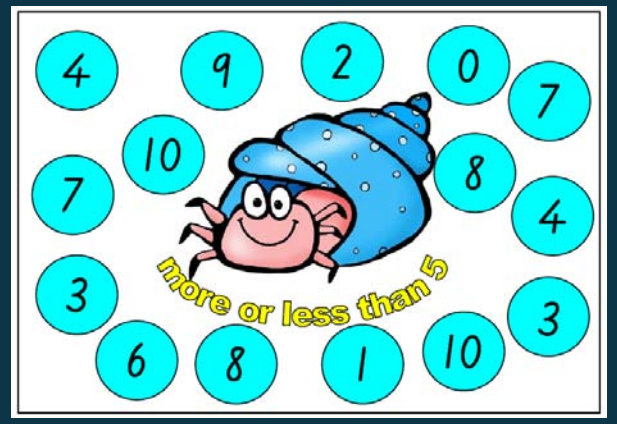
How do we develop it?

- Any activity that involves ten frames or rekenreks is an opportunity to use benchmarking knowledge.
- When showing 8 on a rekenrek, we want them to slide 5 and then 3 more. When showing 78, we want them to slide 50, then 20, then 8.
- Spend time developing their understanding of the teen numbers as '10 and some more'.
- Any work with Ten Frames: note that kids need to develop 'five-ness' before they can work on 'ten-ness'.

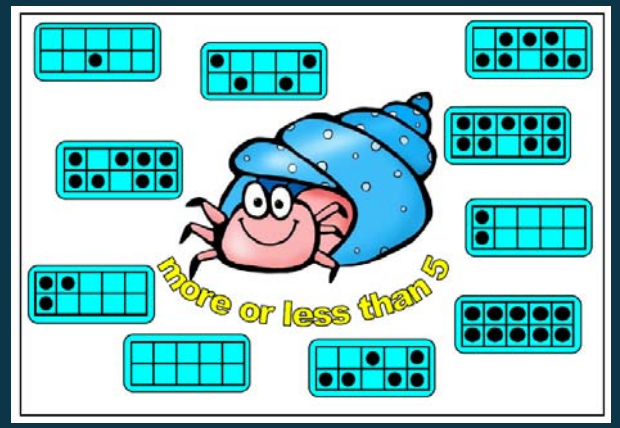


03 Benchmarks of 5 & 10

Let the games begin!



BUMP!



clothes line

number sounds

04 Part-Part-Whole

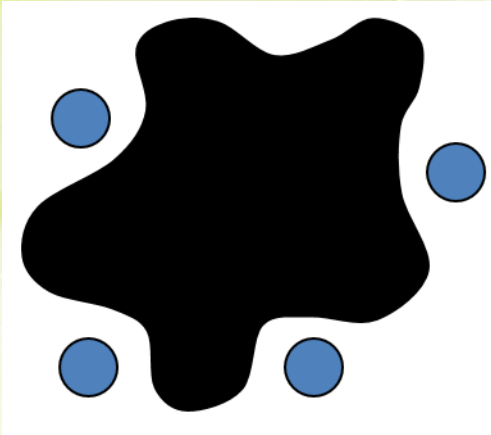
What is it?

- **s**eeing a number as being made up of two or more parts and understanding that numbers can be combined to make a bigger ‘whole’

Why do kids need it?

- The three other Number Sense concepts help build the idea that a number (7) is not just seven items; it is also 4 and 3, it is 1 less than 8, 3 less than 10, half of 14, etc.

- As their number sense grows, kids will see the usefulness of P/P/W as they work with multi-digit numbers. (37 can be 30 + 7, 32 + 5, 20 + 17, etc.



04 Part-Part-Whole

- If they can decompose numbers, understand their relationship to 5 and 10 and they know 1/2 more and less, they will naturally see the connection between 8 + 7 and 38 + 7.
- Too many kids compute without thinking and so they don't understand when their answers are unreasonable.
- Once kids are taught the standard algorithm, they tend to stop using mental strategies, even though they are often far more efficient.
- The more practice kids have with decomposing numbers into smaller parts in meaningful and fun ways, the more automatic it becomes.

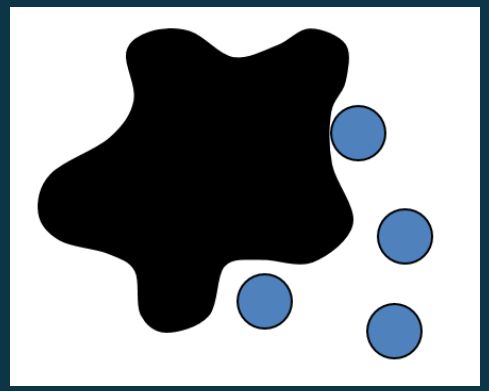
Types of problems we should be giving kids

	Result Unknown	Change Unknown	Start Unknown
change	John had 4 balloons blown up. His brother blew up 8 more for him. How many balloons does he have blown up now?	John had 4 balloons blown up. His brother blew up some more. Now he has 12 balloons blown up. How many balloons did his brother blow up?	John had some balloons blown up. His brother blew up 8 more. Now he has 12 balloons blown up. How many balloons did he have blown up to start?
	John had 12 balloons blown up. His brother popped 8 of them. How many balloons does he have blown up now?	John had 12 balloons blown up. His brother popped some of them. Now he has 4 balloons blown up. How many balloons did his brother pop?	John had some balloons blown up. His brother popped 8 of them. Now he has 4 balloons blown up. How many balloons did he have before his brother popped some?
	Total Unknown	**Addend Unknown**	**Both Addends Unknown**
collect	John had 8 red balloons and 4 blue balloons. How many balloons does he have?	John had 8 red balloons and the rest are blue. If he has 12 total balloons, how many blue balloons does he have?	John has 12 balloons some are red and some are blue. How many of each color could he have?
	Difference Unknown	**Bigger Unknown**	**Smaller Unknown**
compare	(more version) John has 12 balloons. His brother has 8. How many more balloons does John have than his brother? (fewer version) John has 12 balloons. His brother has 8. How many fewer balloons does his brother have than John?	(more version) John has 4 more balloons than his brother. His brother has 8 balloons. How many balloons does John have? (fewer version) John's brother has 4 fewer balloons than John His brother has 8 balloons. How many balloons does John have?	(more version) John has 4 more balloons than his brother. John has 12 balloons. How many balloons does his brother have? (fewer version) John's brother has 4 fewer balloons than John John has 12 balloons. How many balloons does his brother have?

7 x 15.00 in

Let the games begin!

SPLAT



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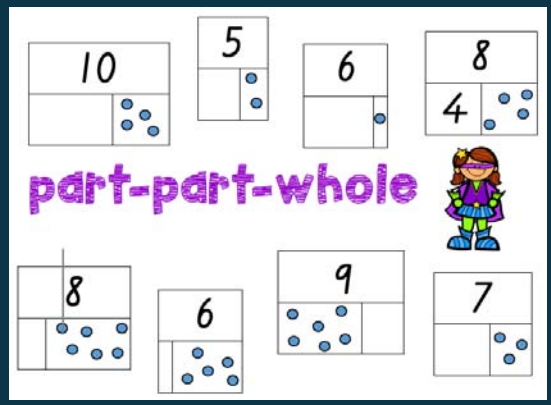
Bears in the Cave

What's Missing?



Measuring number sense growth through the proficiencies

Understanding

Children demonstrate this when they make connections between numbers, when they represent numbers in many different ways, when they interpret problems and situations.

Fluency

Children develop fluency when they choose strategies, when they manipulate materials and numbers, when they perform calculations in a manner that makes sense to them and produces accuracy.

Problem solving

Children are problem solvers when they design and plan a solution to a problem where the solution is not immediately evident or where multiple solutions may work.

Reasoning

Children demonstrate reasoning when they are asked to explain or justify their thinking.

Assessment of Number Sense

NUMBER SENSE ASSESSMENT	Name:	Date:
SPATIAL RELATIONSHIPS		
1. Show 4 using your fingers.	level 1: incorrect number of fingers level 2: puts one finger up at a time and counts "1-2-3-4" level 3: puts all 4 fingers up at once without having to count	
2. Flip over a dice onto each side and ask how many dots there are on each.	level 1: does not correctly identify all numbers level 2: counts dots one by one level 3: instantly recognises the amount without counting within 3 seconds	
3. Show a dot card for 6 and ask the child to show the same number of counters.	level 1: incorrect numb level 2: counts one-by- level 3: instantly produc	
4. Show 8 using your fingers. Repeat with other numbers between 6 and 10 if necessary.	level 1: incorrect numb level 2: puts up one fing 8. level 3: puts up all 5 on "6,7,8" on the other ha level 4: puts all 8 finger	
5. Show 10 subitising cards (1-5) and ask child to identify how many objects are on each.	level 1: cannot identify level 2: counts some ob level 3: instantly recogr seconds	

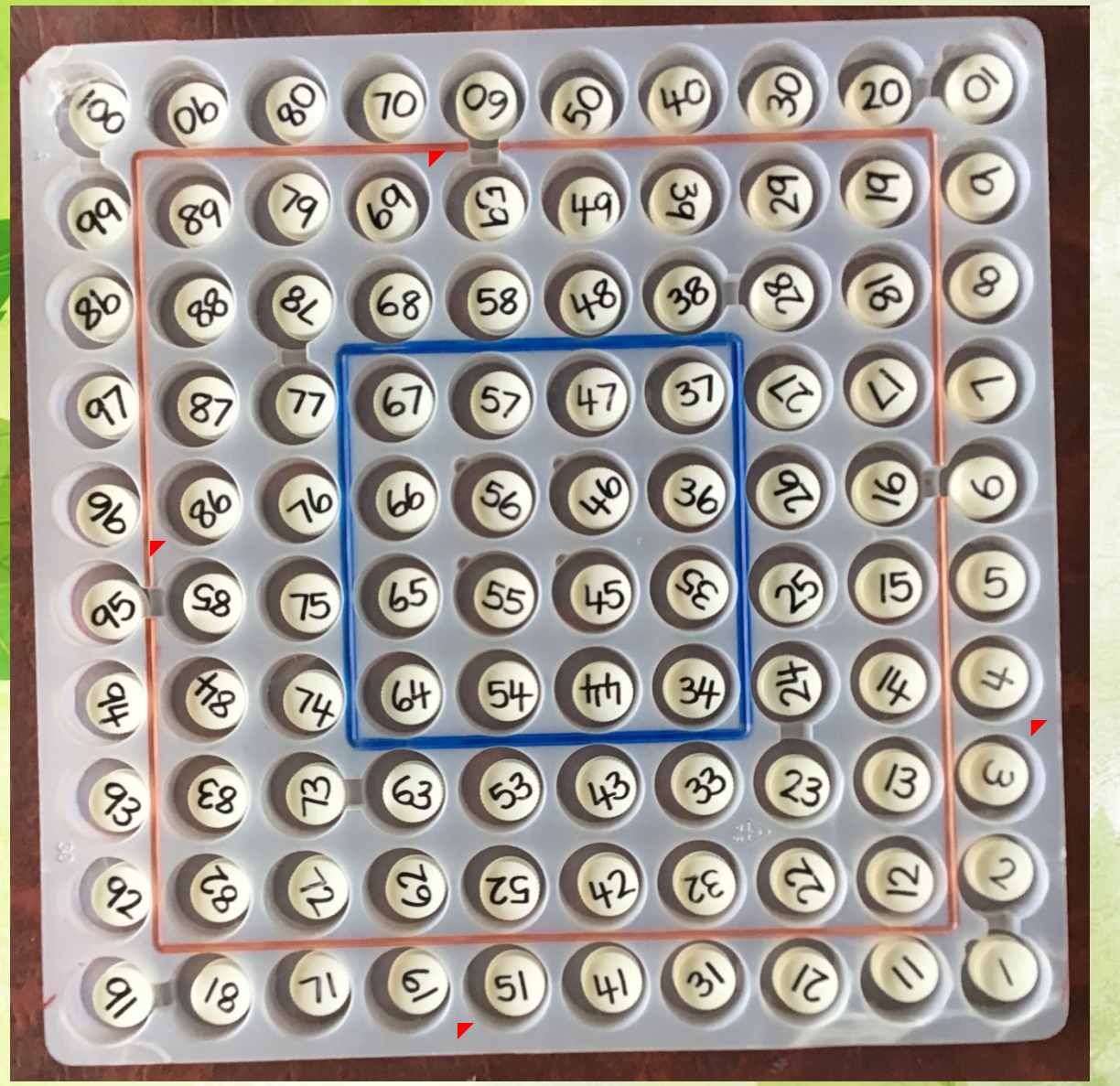
NUMBER SENSE ASSESSMENT	Name:	Date:
ONE MORE/LESS, 2MORE/LESS		
1a. Show numeral card for 7 and ask what number is one more than it. 1b. If correct, show numeral card for 9 and ask what number is 2 more than it.	level 1: incorrect answer level 2: gives correct number for +1 level 3: gives correct answer for +1 but has to count for +2 level 4: instantly knows +1 and +2	
2a. Ask child to count out 5 counters. Teacher adds one more then ask how many there are now. 2b. If child can answer 2a correctly, ask him/her to count out 8 then add 2 more.	level 1: incorrect answer level 2: counts one by one to give correct answer level 3: gives correct answer for +1 without having to re-count level 4: knows how many for +1, but has to re-count for +2 level 5: knows how many when 1 or 2 are added, without counting	
3a. Show the numeral 6 and ask what is one less than this number. 3b. If correct, show the numeral 8 and ask what is 2 less than it.	level 1: incorrect answer level 2: gives correct answer for –1 level 3: gives correct answer for –1 but has to count for –2 level 4: instantly knows –1 and –2	
4a. Ask child to count out 9 counters. Teacher takes 1 away and asks how many there are now. 4b. If child correctly answers 4a without counting, ask him/her to put out 7 and then take 2 away.	level 1: incorrect answer level 2: gives correct answer but has to count all level 3: gives correct answer for –1 without re-counting level 4: knows how many when 1 is removed, but has to count to work out –2. level 5: knows how many when 1 or 2 are removed without counting.	

Assessment of Number Sense

NUMBER SENSE ASSESSMENT	Name:	Date:
BENCHMARKS		
1. Ask child to show you 7 beads on the rekenrek and watch how he/she does it. Check with other numbers if necessary.	level 1: incorrect answer level 2: counts the 7 beads one-by-one level 3: moves 5 red beads together and then 2 whites level 4: counts three beads to leave and slides the rest over	
2. Ask child to count out 6 counters then work out how many more would make it to 10.	level 1: inaccurate response level 2: counts one-by-one to get to ten, then counts how many they added	
3. Count out 17 blocks and ask the chil how many need to be taken away to leave 10.		
4. Ask child to count out 12 counters ar write the number down. What does the and the 2 in the written number mean?		

NUMBER SENSE ASSESSMENT	Name:	Date:
PART/PART/WHOLE		
1. Ask child to count out 7 counters. Teacher separates them into two groups (3 and 4). Ask the child how many counters there are now. Rearrange again and ask how many.	level 1: incorrect answer level 2: has to count them all to determine that there are still 7 level 3: instantly knows that there are still 7	
2. Ask child to count out 8 counters. Child closes eyes while teacher removes 3 of them. Ask child how many counters are in your hand?	level 1: incorrect answer level 2: counts each counter one by one to figure out how many are missing level 3: can say within 3 seconds how many are hidden	
3. Show dot card for the number 8. Place a card over some of the dots so that they are now hidden and ask child how many dots are hidden.	level 1: gives incorrect answer level 2: counts one by one to figure out how many are under the card. level 3: gives correct answer within 3 seconds without counting	

PUTTING IT ALL TOGETHER...



THE DISCUSSION HAPPENING...

"I need 75...Where's 83? Can you find 48? Is this 16 or 61?"

"Who put 86 there? It can't go there 'cos all the 6s are down here!"

"Oh, look, it starts at the bottom and goes up, see? Here's 1 and it goes up to 10 at the top, then it starts again down the bottom."

"And look, all the 3s go across this way!"

"How long did it take us? Did we break the world record?"

"Gees, Mrs Smith, you could've put all the lids on the table in order so we can find them easier!"

"Franklin was right...it's a lot easier when we work as a team!"

Handy Resources and Links

Christina Tondevold https://buildmathminds.com (Number Sense Research)

Steve Wyborney https://stevewyborney.com (SPLAT slideshows, interactive 100 chart)

Graeme Fletcher https://gfletchy.com/ (Number Sounds, 3-Act Maths Tasks)

Online rekenrek https://apps.mathlearningcenter.org/number-rack/ (also available to download from iTunes as an app)

Which One Doesn't Belong? https://wodb.ca/ (sets of 4, which number/shape is the odd one out and why?)