SA NUMERACY CHAIR PROJECT

eNICLE
Grade 1 & 2 Teacher Development Programme

Session Six
Teacher Handbook

Name

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School

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www.ru.ac.za/sanc
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Table of contents

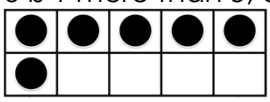
5 and 10-frames for developing a sense of numbers between 1 and 20

Our number system and understanding of place value depend on groupings of 10. Ten-frames provide a reference for the numbers of 5 and 10. A 10-frame is a simple tool that allows learners to "see" numbers and to develop number sense of ten and beyond.

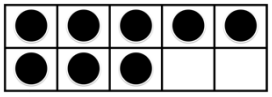
- Arranging counters in different ways on the ten-frame helps learners to form mental images of the numbers.
- Understanding that two-digit numbers are made of tens and ones is an important concept that prepares learners for work with larger numbers.
- A strong sense of "ten" is needed for understanding place value and doing mental calculations.

Look at these 10 frames. Can you '**see**' these number facts?

- 6 is 1 more than 5, or 4 less than 10.



- 8 can be seen as "5 and 3 more" or as "2 less than 10."



Once learners can visualise the numbers 1 through 10, they begin to develop mental strategies for manipulating those numbers.

Children in Grades R and 1 can start to explore numbers with a five-frame and then move on to a ten-frame. Once children are comfortable using the 5-frame, introduce the 10-frame.

The following **rule** is a good way to encourage a "standard way" to show numbers on the ten-frame.

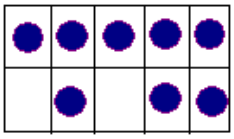
10-frame RULE

Always fill the top row first, starting on the left, the same way you read.
When the top row is full, place counters on the bottom row, also from the left.

Plenty of practice

The NRICH[1] website says that if we give learners plenty of activities with 10-frames, they will begin to think of numbers less than ten in terms of their relationship to ten. This also helps them to build a solid knowledge of the basic addition/subtraction facts for ten. These are important for mental calculations.

For example, a six-year-old child, when shown this ten-frame, immediately said, "*There's eight because two are missing*."



This child had a strong sense of ten and was assisted by the structure of the 10-frame. Once this type of thinking is there, the 10-frame is no longer needed.

[1] https://nrich.maths.org/2479

Number talks: Talking about the patterns in the 10-frames

It is important for learners to talk about the way that they see the arrangement of items. The same is true of 10-frames.

Number talks using 10-frames can be very helpful to build number sense, mathematical vocabulary and a strong understanding of 10. Here are some examples.

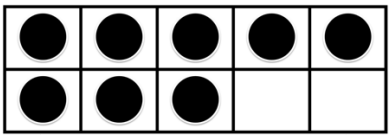
To build number sense ask and discuss:

- What numbers do not fill one row? (Those less than 5)
- What numbers fill more than the first row? (Numbers larger than 5)
- How many spaces are left in the frame? (i.e. building numbers less than 10)

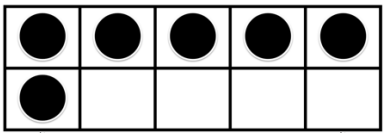
Look at numbers as sums including five:

Have learners make the numbers to 10 and write them as sums of 5 and another number.

For example:



8 = 5 + 3 or 5 + 3 = 8;



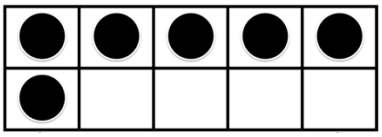
6 = 5 + 1 or 5 + 1 = 6 and so on

Look at numbers in the context of ten:

Make learners aware of the **spaces** in the frame as this can be used to answer the question *how many more to make ten?*

This will later help learners decompose addition greater than ten: i.e. 8 + 8 is 8 + 2 + 6, or 16. This can be extended to explore subtraction too.

For example



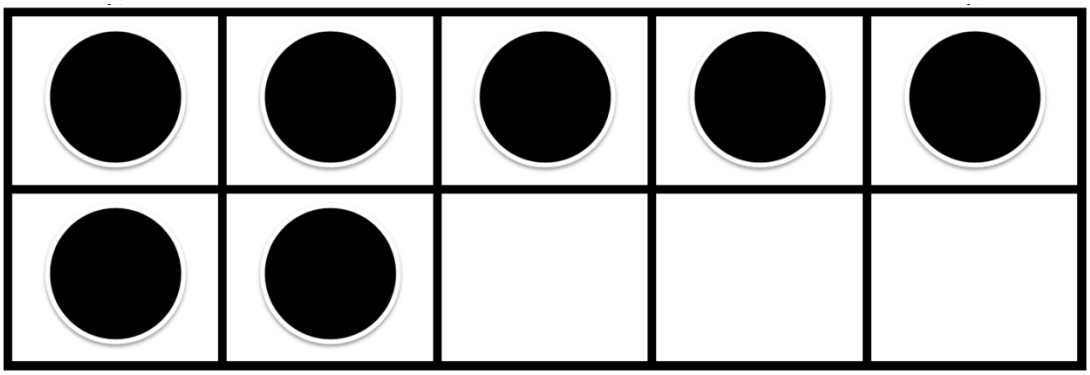
"How many do you need to add to 6 to make ten?"

There are four spaces in the frame. These could be filled with 4 more counters to make up the 10.

"There are six dots in the frame. There are four spaces in the frame. Six plus four more makes 10."

Today's number talk

Today, we will look at this 10-frame layout and talk about the different ways we see the dots in the frame.



Questions as learners

- How many do you see?
- How do you see it?
- Can you convince me?
- Can you give at least 2 different ways of checking how many there are?

Questions as teachers

- How many different ways can you see these dots?
- Can you think of some ways that might involve subtraction?
- What words could be added to the word bank from this talk?

See page 19 for discussion of this pattern.

"Trusting the Count"

The activities that we present in this session help learners to "trust the count". Trusting the count is knowing that:

- when you count a set of objects, the last number you say represents the total number in the set – the "how many" or quantity.
- if you count a set of objects and then count it again, you'll get the same answer ... every time.
- if you move the objects around, but nothing is added to, or removed from the set, you'll get the same answer ... every time.

Why is it important for children to trust the count?

It helps children to:

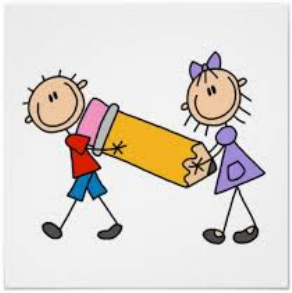
- Read, write or hear a number and imagine what it looks like as a collection / set.
- Instantly recognise a set without counting, no matter how it is arranged (subitise).

Common misconceptions about trusting the count

There are a number of misconceptions about whether children have this ability. These can affect their learning in mathematics.

- Misconception: If a learner can count verbally to 100, they "trust the count"
  Fact: Learners who can count may not know what those numbers mean.
- Misconception: If a learner can add small numbers, they "trust the count".
  Fact: If a learner adds 5 + 8 but counts out 1-2-3-4-5-6-7-8-9-10-11-12-13, they do not trust the count. They are recounting both numbers, using the 'counting all' strategy.

Reflection Activity



Discuss the following with the teachers in your group:

Reflect on your use of the following resources from the last session.

- **Number talks**
- Various **dot pattern** activities

1. Reflect on your experiences using **these resources in class.**
2. Did you try a Number Talk with your class?
3. Discuss how it worked and if you had any problems.
4. Did you make any adaptations to the resources? If so, explain to the members of your group.
5. What were the learner experiences of the resources?

NOTES:

This section provides details of the activities that are be presented in this workshop.

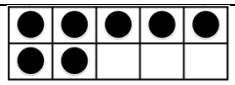
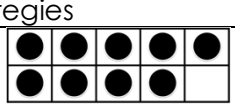
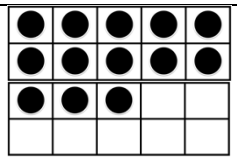
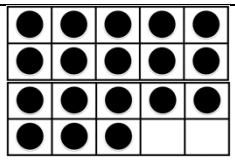
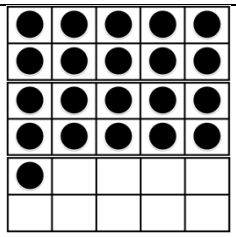
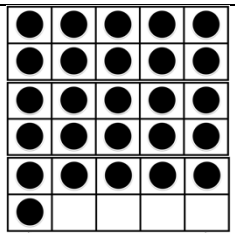
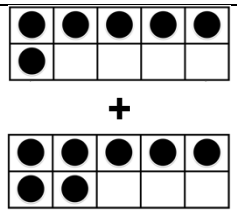
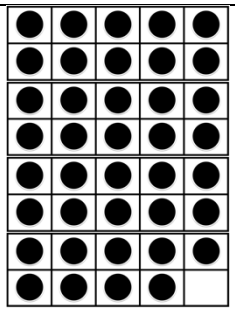
Every workshop will have a similar section so you know where to look in the handbook.

Resources

Number talk activities

Why use 10-frames for this number talk?

Visual representations such as a 10-frame can help learners to build new understandings of how numbers are structured. This number talk also values the many ways that students see and experience mathematics.

<table>
<tr><td>TYPE OF TALK</td><td colspan="2">10-frames
• Do not suggest methods
• All learners should participate</td><td colspan="2">• Increase confidence in talking about maths
• Develop maths vocabulary & build a word bank
• Allow many solution strategies</td></tr>
<tr><td>OBJECT OF LEARNING</td><td colspan="2">• Learners explain their thinking: HOW they SEE it and WHY it makes SENSE
• Learners develop more flexible and efficient strategies</td><td colspan="2">Learners begin to:
• See and use numbers flexibly
• Reason abstractly
• Speak mathematically</td></tr>
<tr><td>PROMPTS</td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td>MORE PROMPTS</td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td>ANTICIPATED LEARNER RESPONSES</td><td colspan="4">Before a number talk, think about how your learners might respond to each dot pattern.
o How do you think they will see the arrangements of dots in the frame?
o How do you see the dots in the frame?</td></tr>
<tr><td rowspan="3">QUESTIONS FOR LEARNERS</td><td colspan="4">o How many? How do you see it?
o Can you convince me?
o Can you give at least 2 different ways of checking how many there are?</td></tr>
<tr><td colspan="4">The next questions must ask learners to explain what they see, not how they should see it:
o Does that make sense?
o Do you see a pattern? Can you explain the pattern?</td></tr>
<tr><td colspan="4">Which is the quickest for you? Why?
Which allows you to be more accurate? Why?</td></tr>
</table>

Quick "trust the count" activities

Building "Trust the Count"

- Place a number of objects such as counters, beans in front of the learner, close together but not too close.
- Ask:
  "How many are there?"
- Wait for a response.
- Ask:
  "How did you know?"
- Learners may count each individual object, or they may subitise

- Move the items around
- Make sure it's obvious that you have not added any or removed any objects.
  - You can layout the items in different ways:
    - Close together;
    - far apart;
    - in a line;
    - in two lines;
    - like a dice;
    - like a ten frame;
    - in a V shape, etc.
- Ask:
  "Did I add anything?"
  "Did I take anything away?"
- Ask:
  "How many are there now?"
- Wait for a response.

NOTE: If a learner starts to guess an answer before counting, regardless of whether it's correct or incorrect, say "Let's check!" and have them count it out.

- If this happens, repeat the counting 2 or 3 times.
- Say:
  "I'm going to move the objects again. This time, I want you to give me your best guess BEFORE counting."

5-frame activities

These are the introductory activities for working with a 5-frame. If your learners have no experience of working with a 5 or 10-frame, start with these activities before moving on to using a 10-frame.

For all of these activities, we suggest working with smaller groups on the mat, if possible.

Remember the 10-frame rule:
Always fill the top row first, starting on the left, the same way you read.
When the top row is full, place counters on the bottom row, also from the left.

Five Frame Tell About

Mathematical object of learning:	***For each learner, you need:***
• developing number sense within the context of 5 • help learners to form mental images of the numbers represented	• Blank 5-frame  • Set of counters or beans

- Ask children to show 3 on their five-frame.
- After hearing from several children, try other numbers from 0 to 5.
- Children may place their counters on the five-frame in any manner.
- Ask learners what they see. What they observe will be different from child to child.
- For example, with four counters, a child with two on each end may say, "It has a space in the middle," or "It's two and two."
- There are no wrong answers. Focus attention on how many more are needed to make 5 or how far away from 5 a number is.

Discussion Ideas/Possible Questions to Ask:

- Observe how learners group their counters.
- "What can you tell me about 3 by looking at your mat?" A child might answer: "It is 2 and 1".

Extension

Do the same activity with a 10-frame.

5-frame activities continued

Building Sets

Mathematical object of learning:	*For each learner, you need:*
• developing number sense within the context of 5 • help learners to form mental images of the numbers represented	• Blank 5-frame  • Set of counters or beans

- Call out a number to the students, such as 4, and ask learners to make that amount on their frame.
- Allow them to arrange the counters in any way.
- Ask if they can place the 4 counters down in a different way.
- Try other numbers from 0 to 5.
- Ask your learners to talk about how they see the placement of counters.

For example:

  - It has a space in the middle.
  - It's two and two.

Extension

Do the same activity with a 10-frame or see the ideas in Crazy Mixed Up Numbers below.

Roll and Build

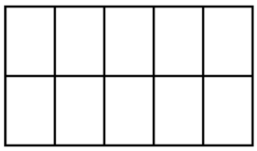
Mathematical object of learning:	*For each learner, you need:*
• developing number sense within the context of 5 • help learners to form mental images of the numbers represented	• Blank 5-frame  • 1 dice • Set of counters or beans

- Learners roll one dice and build that amount on their five frame with counters or beans.

Extension

Do the same activity with a 10-frame, using two dice. If the learner rolls an 11 or twelve, roll again.

10-frame activities



Once learners are comfortable with how to use a 5-frame, you can start using the 10-frame to structure numbers up to 10.

Crazy Mixed Up Numbers

The aim of the basic activity is for all children make their 10-frame show the same number.

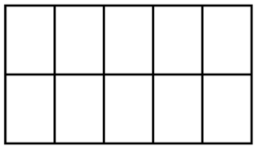
There is a certain amount of thought that children need to put into this activity each time they change their 10-frame to match the number.

How do they decide to change the frame?

- Some children will take off all the counters and start again, building always from one.
- Others will know what each number "looks like" and will add or subtract counters to make the pattern.

Observe the learners to see how they do it. This will help you to assess their level of understanding of the numbers.

If they are building from one every time, you can encourage them to start thinking about how many more or less they need for the next number (see activity 4 below).

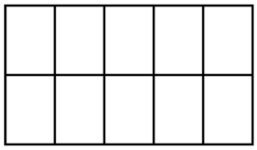
Mathematical object of learning:	***For each learner, you need:***
• developing number sense within the context of 10 • help learners to form mental images of the numbers represented **Extension activities** • Developing more and less with the 10-frame • Building numbers to 10 • Learning maths facts to 10 with the frame • Introducing addition and subtraction with the frame	• Blank 10-frame  • Set of counters or beans

Basic activity

- Call out random numbers between 0 and 10.
- After each number is called (or shown), the children change their 10-frames to show the new number.

NOTES

10-frame activities continued



VARIATIONS AND EXTENSIONS

There are many ways to vary this activity to extend the learning from structuring the numbers, to thinking about the number bonds to 10, as well as addition and subtraction. Eight variations are shown below.

1. Show a number card

- Instead of verbally saying a number, you can show a number symbol card.
- The learners build that number on their frame.

2. Show fingers

- Instead of verbally saying a number, you can show a number of fingers.
- The learners build that number on their frame.

3. Match 10-frames and fingers

Once they have built the called-out number, ask them to show you the same number of fingers.

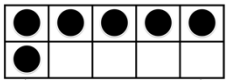
4. One more, two more / one less, two less

Once they have built the number called out, ask:

- *What will be one more? Two more?*
- *What will be one less? Two less?*

For example:

If the frame currently shows 6



- *What will be one more? Two more?*
- The children will respond "One more is 7" or "Two more is 8".
- *What will be one less? Two less?*
- The children will respond "One less is 5" or "Two less is 4".

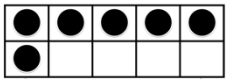
5. Making 10: How many spaces?

An important variation is to make learners aware of the **spaces** in the frame. Once they have built the number called out, ask:

- *How many <u>more</u> will we need to make 10?*

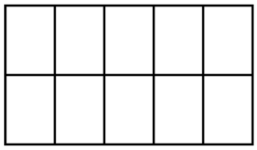
For example:

If the frame currently shows 6



- Ask: *How many <u>more</u> will we need to make 10?*
- The children will respond "We will need four".
- "*How do you know that?*"
- Discuss their ideas and methods.

NOTES:



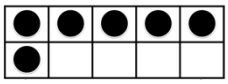
MORE CRAZY MIXED UP NUMBERS – VARIATIONS CONTINUED

6. Making 10: Saying the facts

Once children have experience with working with both the dots and the spaces in the frame, you can then ask them to build the two into a number fact.

For example:

If the frame currently shows 6



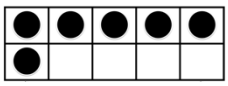
- Ask: *How many <u>more</u> will we need to make 10?*
- The children will respond "We will need four".
- Ask: "*<u>What number fact</u> could this be?"*
- The children will respond with "6 and 4 make 10".

7. What will I change?

Before making the change for the new number called or shown, learners must say how many counters they will add or remove from their frame to make the new number.

For example:

If the frame currently shows 6

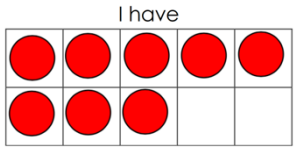


- You call out 4.
- The children will respond "Take away two counters".
- Allow them to change their frames and discuss how they knew to do it this way.

8. Children play in groups

- Children can play this game on their own, in pairs, or in groups of up to 4.
- Children like to make up their own lists of 15 "crazy mixed up numbers".
- One child plays "teacher" and the rest use the ten-frames.
- Roles can be reversed.

NOTES

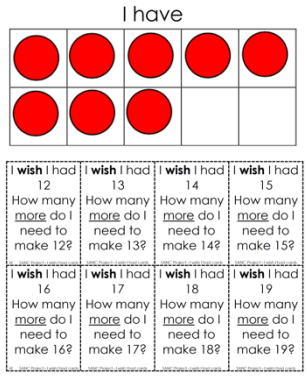


I Wish I Had…

The purpose of these activities is to get learners to think about the concepts of more and less and how many more or less they need to make a number.

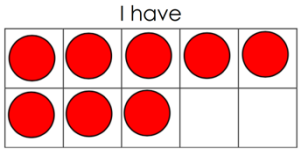
They can be used as an early introduction to **addition** and **subtraction** using the 10-frame.

Mathematical object of learning:	***You need:***
• developing number sense up to 10 and then 20 • developing the structure of numbers between 1 and 20 • developing the concepts of more and less with the 10-frame	• Your set of I Wish I Had cards • And these cards if you wish to extend into the teen numbers



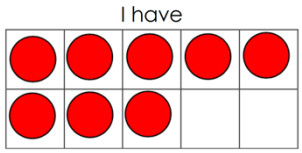
Activity One: More (Addition)

- Hold up one of the I Wish I Had cards.
- Say, "I have eight. I wish I had 9."
- The children respond with the part that is needed to make 9.
- Counting can be used to check.



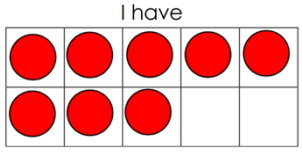
Activity Two: Less (Subtraction)

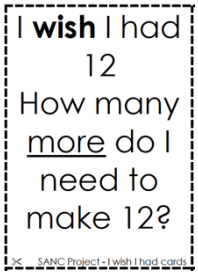
- Hold up one of the I Wish I Had cards.
- Say, "I have eight. I wish I had 5."
- The children respond with the part that is needed to take away to make 5.
- Counting can be used to check.



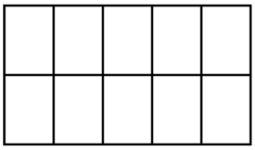
Activity Three: More and Less (Addition and Subtraction) using numbers 11 to 20

- Hold up one of the I Wish I Had cards.
- Say, "I have eight."
- Show one of the I Wish I Had cards and repeat the words
- The children respond with the part that is needed to make 12 for example.
- Counting can be used to check.





10-frame activities continued



Ten and Some More

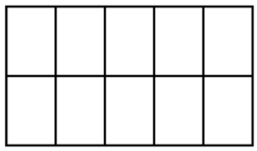
Once learners are comfortable with how to use a 10-frame and have done plenty of activities with numbers to 10, you can use the frames to progress to structuring numbers up to 20.

This activity uses two 10-frames to develop numbers in the range 11 to 20.

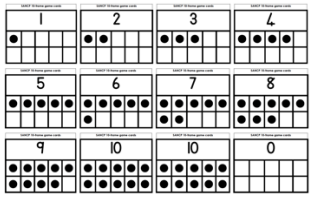
Mathematical object of learning:	***You need:***
• developing number sense up to 20 • developing the structure of numbers between 11 and 20 • help learners to form mental images of the numbers represented	• Two 10-frames for each learner • Counters or beans

- Give each child two 10-frames.
- Call out numbers up to 20 e.g. 11, 13, 15, 16 and so on.
- Do not forget to include numbers less than ten.
- Learners build the numbers on their frames using counters or beads.
- Once they have built their numbers, look at the different methods learners have used.
- Discuss how the numbers can be placed on the frame so it is easy to see how many there are.

Note:
Not every child will use a full set of ten i.e. they will not fill the first 10-frame with counters. However, with discussion and seeing other children fill one 10- frame, the idea that 10 and some more is a teen amount will soon be developed.



Ordering frames

Mathematical object of learning:	*You need:*
• developing number sense within the context of 10 • help learners to form mental images of the numbers represented • developing an understanding of the order of numbers from 1 to 10	• 1 set of 10-frame game cards per learner or pair of learners 

- Shuffle the cards and ask a learner to put them in order from smallest to biggest.
- If they are able to do that, ask them to put in order from biggest to smallest.

Other ideas for the small 10-frame cards

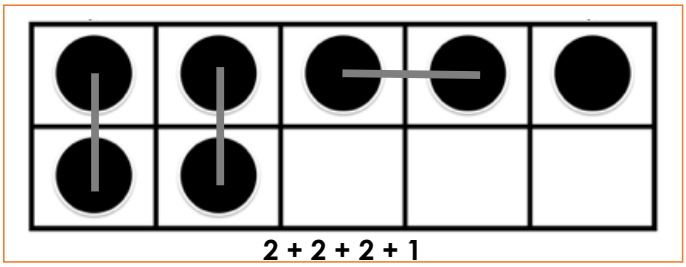
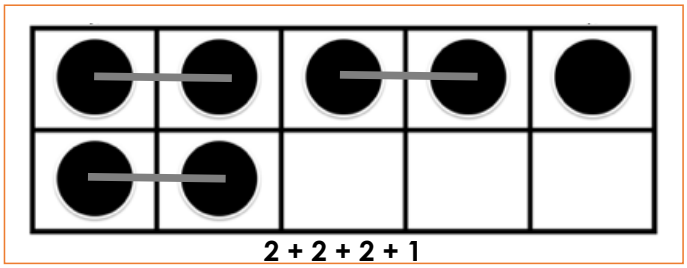
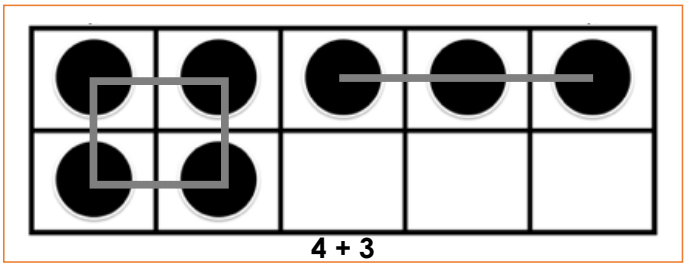
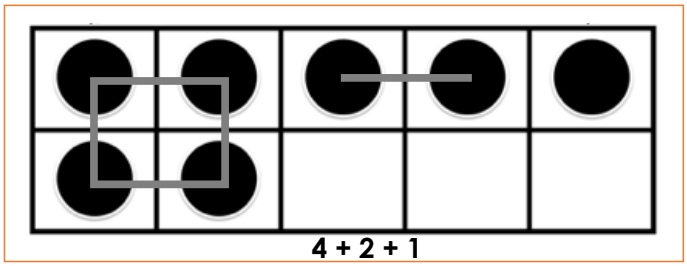
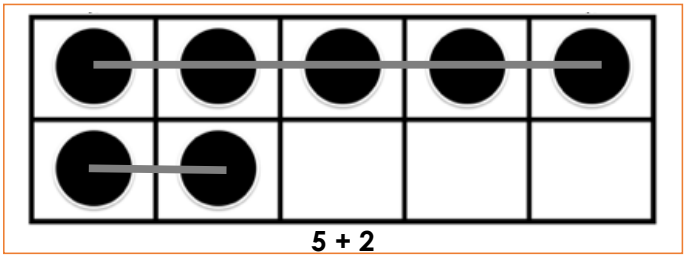
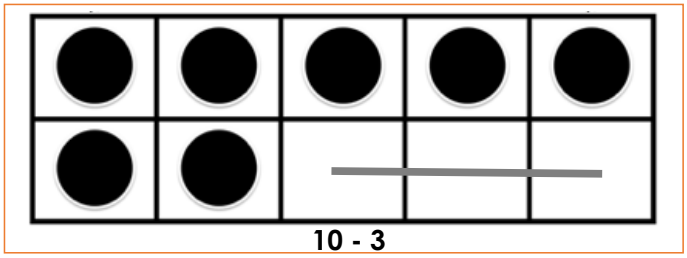
- Use the sets of small of 10-frame cards for any of the activities presented in the pages above. Once learners know how an activity works, they can use the cards to work in pairs or small groups.

NOTES:

Today's number talk discussion

Today, we spoke about this arrangement of dots in the 10-frame and about the different ways we see the dots.

Here are some possible ways to see the dots in the frame:

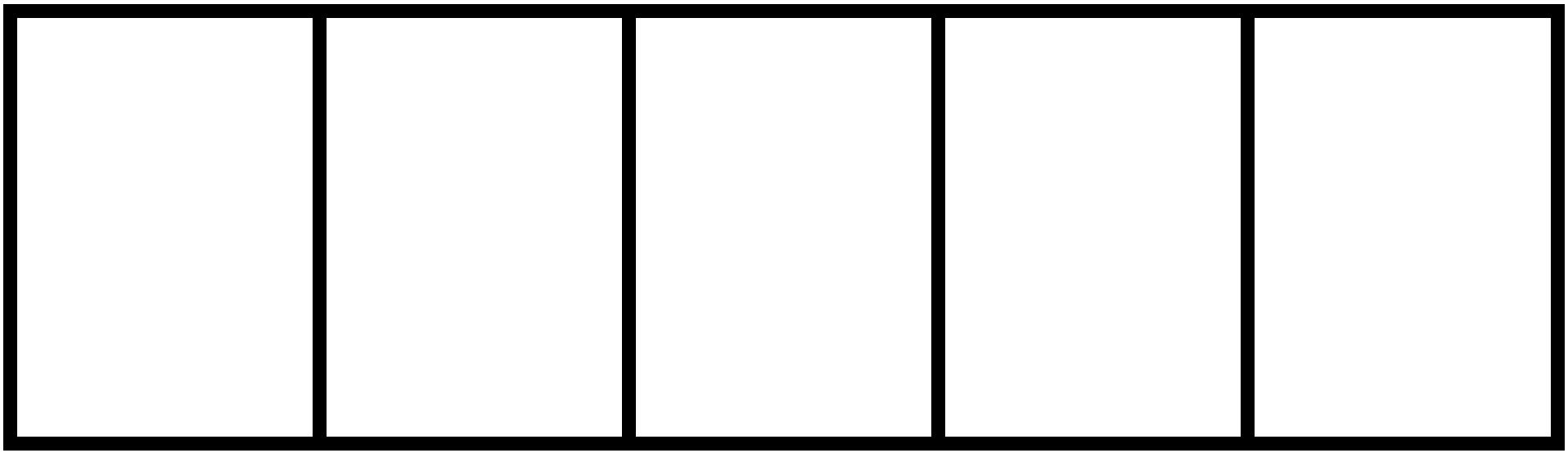
1  **2 + 2 + 2 + 1**	2  **2 + 2 + 2 + 1**
3  **4 + 3**	4  **4 + 2 + 1**
5  **5 + 2**	6  **10 - 3**

Can you think of any others?

Reflection questions:

- How are methods 1 and 2 the **same**? And different?
- How are methods 3 and 4 the **same**? And different?
- What is **different** about method 6?

5-frame board



10-frame board