THE SOLUTION FOR EARLY NUMERACY

PROFESSIONAL LEARNING
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ORIGO EDUCATION

Fostering Conceptual Understanding with Young Mathematicians

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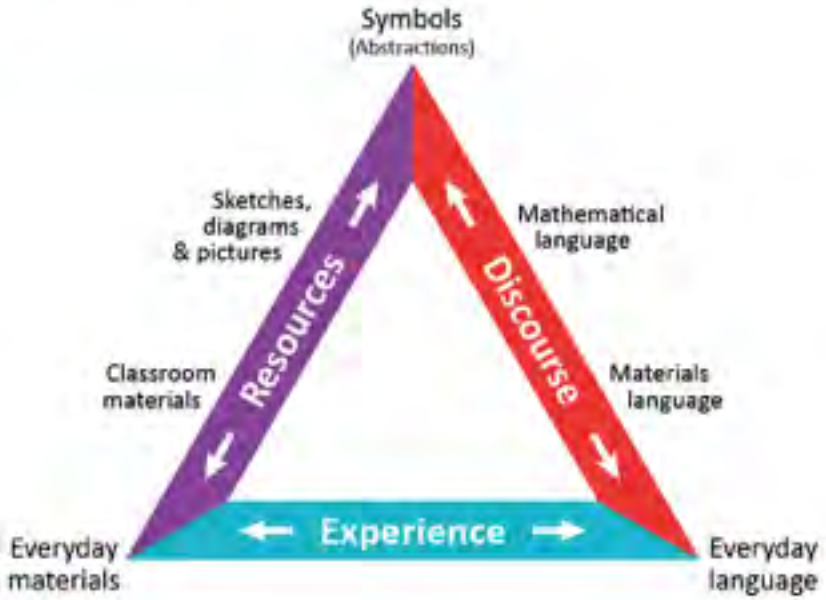
ORIGO TEACHING MODEL



More or Less

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

More or Less

Focus

Developing the comparative language of more than and less than

Materials

Each pair of players will need

- "More or Less" game board
- two (2) number cubes with the following arrangements

Each player will need

- ten (10) counters (a different color for each player)

How to Play

The aim is for each player to fill up their number track.

- Player 1 rolls the cubes.
- Player 1 says the phrase that is rolled on the first cube and the number that is on the second cube.
- Player 1 places a counter onto one answer on the game board to claim that spot.
- If the answer is unavailable, the player misses a turn.
- Play continues in turns until a player has filled their number track

Example

Nadia rolls "more than" and "8". She then places a counter on 10, a number that is more than 8. Had Nadia previously placed a counter on the numbers 9 and 10 she would have missed a turn.

PREREQUISITES FOR ADDITION/SUBTRACTION PROFICIENCY

- Proficiency with counting principles (Includes conceptual understanding of quantity with beginning numbers)
- Subitizing to five
- Understanding of relative position
- Understanding the concept of the operation

COUNTING PRINCIPLES

- Proficiency with counting principles (Includes conceptual understanding of quantity with beginning numbers)
  - One-to-one principle
  - Stable-order principle
  - Cardinality principle
  - Abstraction principle
  - Order irrelevance principle

RELATIVE POSITION: NUMBER TRACKS

- Put a finger on 5; put another finger on 7. What number comes between 5 and 7?
- Break apart all the cubes and put the numbers in order. Tell us about the order.
- What number comes just after five?

RELATIVE POSITION: NUMBER TRACKS

- Take a cube away and ask a friend to name the missing number.
- What number do you land on if you start at 5 and jump on 2 more?
- Turn over every second cube. Read the numbers you see.

ORIGO STEPPING STONES PRE-K

RELATIVE POSITION: ICE CREAM ACTIVITY

- Each pair or small group will need 10 ice cream cone shapes, a bowl of pom-poms, and cards with dots or numerals from 1-10
- Children draw the numerals and put that number of pom-poms on the ice cream cone that corresponds to that numeral
- Example: Child draws 3 dots or the numeral 3, locates the 3rd ice cream cone in line, and puts 3 pom-poms on top

- Play continues until all cards are drawn and all ice cream cones are constructed. Children explain how they knew where to build each cone.

RELATIVE POSITION: JUST AFTER

- Each small group will need 2 big cubes with numerals 1-10 or numeral cards to turn over and a number track
- Say: "Today we are going to find the number that comes just after the number on the cube." Students take turns rolling and explaining what number is just after that number, using their number track.
- To make the activity more like a game, students could cover the numbers with translucent counters as they play.
- Game could also be played finding the number just before.

RELATIVE POSITION: ORDERING WITH BIG CUBES

- Before play, arrange sticky dots on the table in groups from 1-9.
- Each small group needs a set of numeral cards from 1-10, and 2 sets of animal pictures (animals in groups from 10-10)
- Say: "Today we will roll these cubes (or turn over pictures) to help us order numbers."

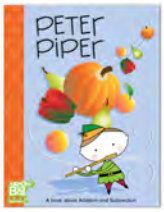
- Roll a cube or turn over a card. Say, "I rolled 9 lady bugs." I choose the number nine and place it on the table where I see nine dots.
- Play continues until all the numerals are used. If a child rolls a number that is already complete, they may roll again.
- Encourage students to discuss their thinking as they place the numerals on the dots.

RELATIVE POSITION: GUESS MY NUMBER

- Pairs of students need clothespins and number tracks.
- Say, "Today we are going to play Guess My Number. I am going to sit back to back with my partner so that we cannot see each other. I am going to place a clothespin on a number on my number track and give my partner clues to guess."
- "If I place my clothespin on 5 I might say, 'What is the number just before 6 or what is the number just after 4?'"
- "My partner places their clothespin and then we look. If our clothespins are on the same number, we both get a point."

THE CONCEPTS OF ADDITION AND SUBTRACTION

1. Put Together/Take Apart or Part/Part/Whole (*Static Situation*)
2. Add to and Take From (*Active Situations*)
3. Additive Comparison (*Static Situation*)



ORIGO STEPPING STONES PRE-K

PUT TOGETHER ADDITION: ROLL ON

- Each pair of students needs some concrete manipulative (counters, small toys, or pom-poms for example), a cube with the numerals 1, 1, 1, 2, 2, 2
- Each student needs a number track
- Students take turns rolling, placing that number of counters on their number track, and rolling a second time and adding that number to get the total
- Encourage talk: “I rolled a 2, I will place 2 counters on my number track. I rolled a 1. I place one more counter. 2 add 1 makes 3 counters on my track.

ORIGO STEPPING STONES PRE-K

TAKE FROM: PUPPET STORIES

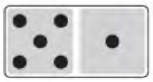
- Each pair of students needs 5 counters
- Each student needs a puppet; students can make their own before the activity or use a sock puppet
- Today we will listen to take away stories and tell take away stories
- Teacher acts out take away story with a puppet and has a child act out the story using counters. You have 3 bananas and your puppet eats 2 of them. How many bananas do you have left. Child acts out story with counters and puppets.
- Encourage student to make up a story for the teacher to act out.
- The rest of the class divides into pairs and takes turns making up and acting out puppet take-away stories.

Counting-On

Reinforcing the count-on-0, -1, -2, or -3 addition strategies

Activity

- Select the six dominoes with one dot on one end and a total of more than four dots.
- Invite individuals to take turns to describe how they can figure out the total number of dots on each of the dominoes. Encourage them to say, without counting, the greater of the two numbers they see, and then count on 1 to give the total.



"Start with 5. One more is 6."

- Continue the discussion, varying the position of the greater number. For students that need assistance, cover the single dot to reinforce beginning with the greater number. Then uncover the single dot and encourage the student to count on to give the total.
- Have students work in pairs or small groups to write the related addition facts (5 + 1 = 6 and 1 + 5 = 6) for all six tiles.
- As the students become confident, repeat the steps above for dominoes from the 2-suit (use the count-on-2 strategy) and the 3-suit (the count-on-3 strategy). Discuss the zero-suit (count-on-0) in the same way to reinforce starting with greater number, and that no counting is necessary to figure out the total.

Make a Ten

Finding combinations of numbers that total ten

Activity

- Share tiles from a set of double-six dominoes among a group of students.
- The aim is to make a total of ten with one or two dominoes. Have the students each play a tile in turn. If a total of ten is made, the player scores a point, as shown in the examples below.

Player 1 scores a point
4 + 6 = 10

Player 2 (left) does not score
Player 3 (right) uses that tile and scores a point
5 + 0 + 4 + 1 = 10

- The winner is the player with the most points after all dominoes are played.
- Students can play this game several times to find the many combinations that total ten.

Extension

Play the game using a set of double-nine dominoes. For this version, students play two dominoes at a time, combine up to 4 tiles in total, and score a point whenever a total of 20 is made.

Same Sum Sort

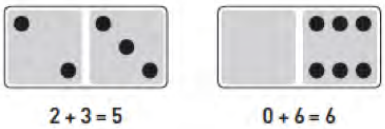
Investigating addition with two addends

Note

Dominoes provide a natural context for number sentences that use zero.

Activity

- Have students work in groups to find all the dominoes that have the same sum, for example, all those with a total of 5 to 8 dots.
- Encourage the students to draw their dominoes and write the matching number sentences as shown below.



2 + 3 = 5 **0 + 6 = 6**

6 + 1 = 7 **4 + 4 = 8**

- Repeat the activity above with greater totals and a restricted range. This will prepare the students for playing "Snap" on page 26.

Building Bridges

Reinforcing the use of the bridge-to-10 addition strategy

Activity

- Select one domino from the 9-suit and ask individuals to describe how they can figure out the total number of dots. Encourage them to describe the bridge-to-10 strategy as shown below.

"Put 1 from the 6 with the 9 to make 10. That makes 10 and 5 which is 15."

- Repeat the discussion with other dominoes from the 9-suit, varying the position of the 9. For students who need assistance, cover all but one dot of the smaller number to show that 9 add 1 is 10, then uncover the remaining dots and ask for the total.
- Have students work in pairs or small groups to discuss the strategy and write the related addition facts (e.g. 9 + 6 = 15 and 6 + 9 = 15) for each domino.
- Repeat the activity for dominoes from the 8-suit.

Double-Double

Reinforcing the double, double-plus-1, and double-plus-2 addition strategies

Activity

- Select all of the double, double-plus-1, and double-plus-2 dominoes for 0 to 9. For "6", for example, select the following:

double 6 double 6 plus 1 double 6 plus 2

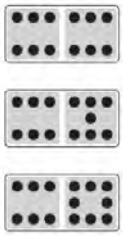
- Invite individuals to describe how they can figure out the total number of dots on each of the double dominoes.
- Show the students a double and the related double-plus-1 domino. Ask, *What double do you see on both of these dominoes? How can you use the double to figure out the total on the other?* Encourage students to explain how they could add one to the double they see on the double-plus-1 domino. Repeat the discussion for other double-plus-1 dominoes.
- Guide the students to work in pairs or small groups to verbalize the strategy and write the two related addition facts (6 + 7 = 13 and 7 + 6 = 13) for each double-plus-1 domino.
- Repeat the activity using double-plus-2 dominoes.

Match My Double

Matching near-double addition facts to related doubles facts

Activity

- Provide a group of students with the complete set of double-nine dominoes. Ask them to find all of the doubles and arrange them face up in a row.
- Have the students place all of the double-plus-1 and double-plus-2 tiles under the double they would use to figure out the answer. The arrangement for "6" is shown below.



- Encourage the students to write the related number fact (including the turnaround where possible) for each domino.

Extension

As the students develop confidence, have them write the related facts without viewing the dominoes.

Number Fact Strategies

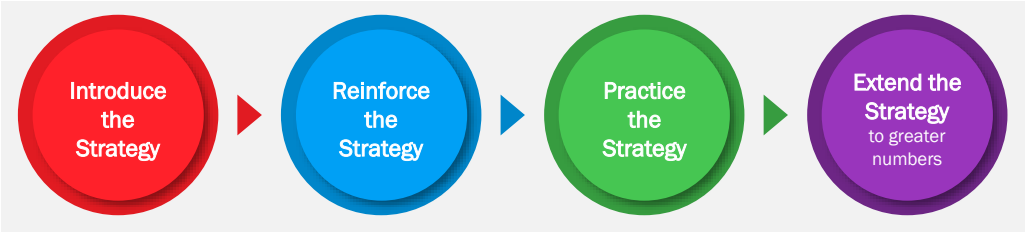
ADDITION

- Count on 1, 2 and 0
- Doubles and Near Doubles
- Bridge to Ten

SUBTRACTION

- Think Addition

The Teaching Sequence



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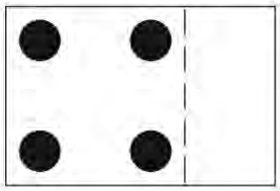
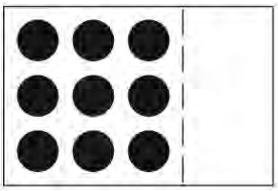
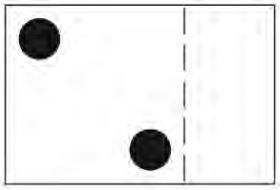
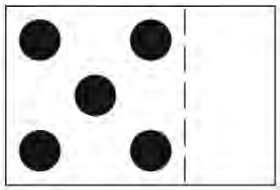
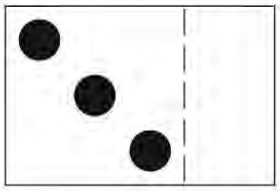
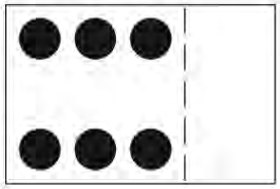
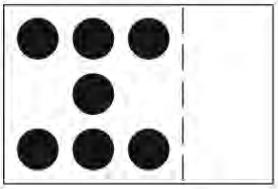
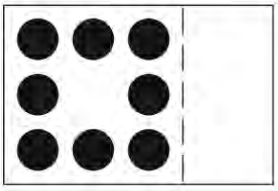
Count-on Challenge

Name: _____

Draw the dots. Count on. Write the new numbers.

a.  _____	b.  _____	c. 6 _____
d. 2 _____	e. 5 _____	f.  _____
g.  _____	h. 8 _____	i.  _____
j.  _____	k.  _____	l. 3 _____
m. 9 _____	n.  _____	o. 7 _____

Burnett, J. Irons, C. & Turton, A (2012). The Book of Facts: Addition, Blackline Master 6.

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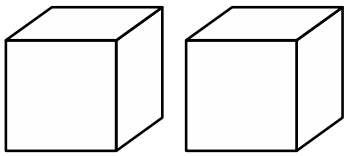
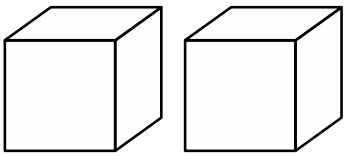
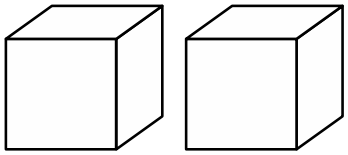
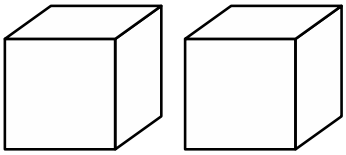
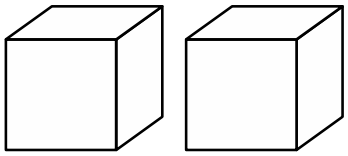
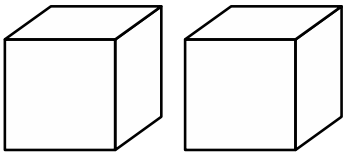
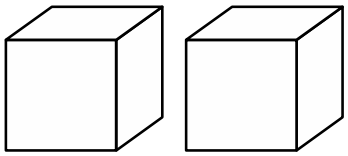
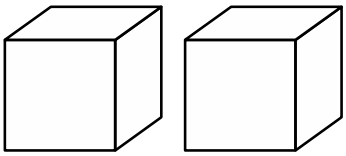
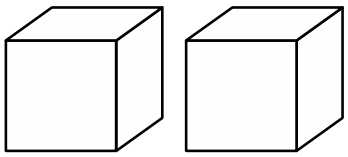
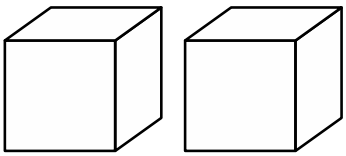
REINFORCE: Count on 1 and 2

- Roll your number cubes and count on 1 or 2.
- Find your answer below.
- Write your numbers on the number cubes. Write the number fact.

 ____ + ____ = 11	 ____ + ____ = 6
 ____ + ____ = 5	 ____ + ____ = 8
 ____ + ____ = 9	 ____ + ____ = 7
 ____ + ____ = 8	 ____ + ____ = 6
 ____ + ____ = 7	 ____ + ____ = 10

Cube A: 4, 5, 6, 7, 8, 9

Cube B:

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Total Bingo

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

Burnett, J. Irons, C. & Turton, A (2012). The Book of Facts: Addition, Blackline Master 9.

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Count-on Bingo

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

Burnett, J. Irons, C. & Turton, A (2012). The Book of Facts: Addition, Blackline Master 10.

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REINFORCE: Double plus 1

11	19	13	15
13	9	17	19
17	11	15	9

Cube: 4, 5, 6, 7, 8, 9 *(Same as previous game)*

Adapted from: Burnett, J. & Tickle, B. (2007). Fundamentals: Orange Level, page 20.

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REINFORCE: Bridge to Ten

- Roll your number cubes and write the fact below the example in the grid that will help you figure out the answer.
- Write the answer to both facts.

10 + 6 = ____ ____ + ____ = ____	10 + 6 = ____ ____ + ____ = ____
10 + 5 = ____ ____ + ____ = ____	10 + 5 = ____ ____ + ____ = ____
10 + 5 = ____ ____ + ____ = ____	10 + 5 = ____ ____ + ____ = ____
10 + 4 = ____ ____ + ____ = ____	10 + 4 = ____ ____ + ____ = ____
10 + 4 = ____ ____ + ____ = ____	10 + 4 = ____ ____ + ____ = ____
10 + 3 = ____ ____ + ____ = ____	10 + 3 = ____ ____ + ____ = ____
10 + 3 = ____ ____ + ____ = ____	10 + 3 = ____ ____ + ____ = ____
10 + 2 = ____ ____ + ____ = ____	10 + 2 = ____ ____ + ____ = ____
10 + 1 = ____ ____ + ____ = ____	10 + 1 = ____ ____ + ____ = ____

Cube A: 8, 8, 8, 9, 9, 9

Cube B: 3, 4, 5, 5, 6, 7

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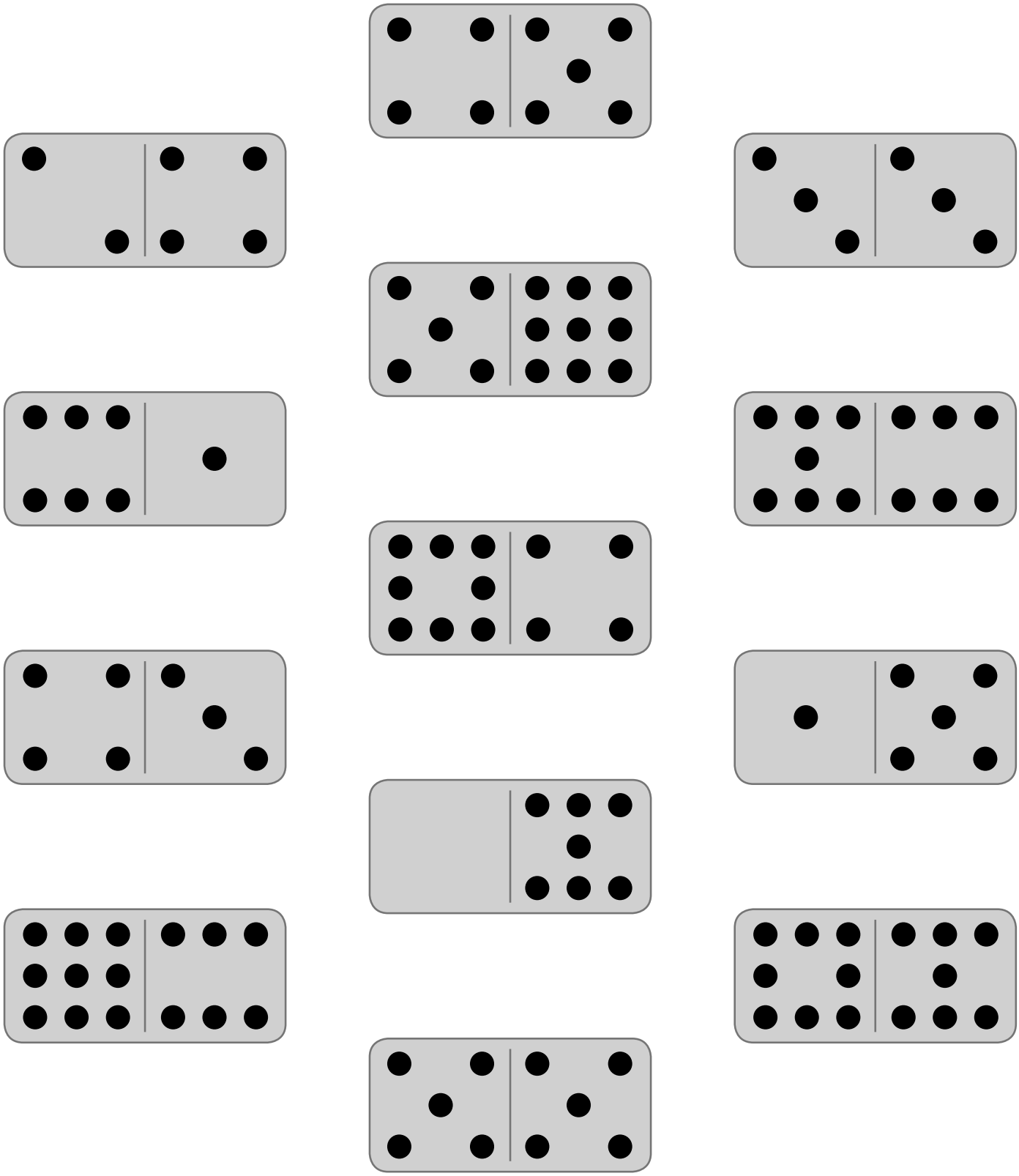
DOMINO SORT

Sort these dominos according to the addition strategy you would use to calculate the total number of dots.



☐ Count On ☐ Use Doubles ☐ Make Ten

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CONNECT ADDITION AND SUBTRACTION

Take or Tally

Player 1	Player 2
13 – _____ = _____	13 – _____ = _____
12 – _____ = _____	12 – _____ = _____
11 – _____ = _____	11 – _____ = _____
10 – _____ = _____	10 – _____ = _____
9 – _____ = _____	9 – _____ = _____
8 – _____ = _____	8 – _____ = _____
Tally	Tally

Cube A: 1, 2, 3, 1, 2, 3

Cube B: 7, 8, 9, 10, 11, 12

Adapted from: Burnett, J. & Tickle, B. (2007). Fundamentals: Orange Level, page 28.

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Headache

Connecting addition and subtraction

3 players

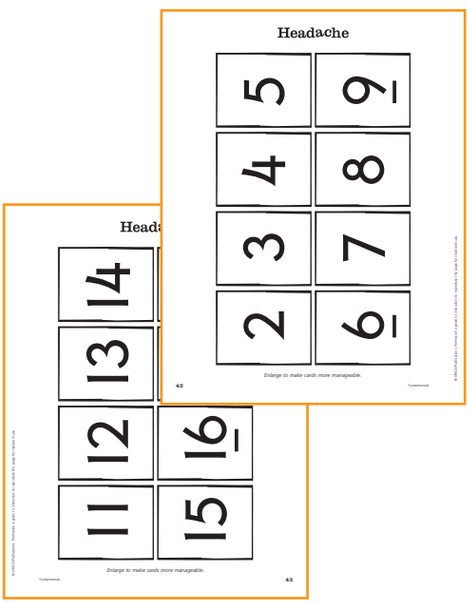
Purpose

In this game, students are given a total and a part and are required to figure out the part that is missing. Activities such as this help reinforce the connection between addition and subtraction.

Materials

Each group of players will need

- One (1) set of numeral cards for 2-9. Copy page 42 as shown below onto red paper (or another available color). Cut out and laminate the cards to make one set.
- One (1) set of numeral cards for 11-18. Copy page 43 as shown below onto yellow paper (or another available color). Cut out and laminate the cards to make one set.



How to Play

The aim is to figure out the part that is missing.

- The two sets of cards are shuffled and placed in separate stacks between the players.
- Simultaneously, one player draws a red card and another player draws a yellow card. Without looking, the players place their card face outwards on their forehead.
- The third player adds the two numerals and says the total aloud.
- The first two players each use this total and the part they can see to figure out the numeral on their own card.

  Example: Elisha shows 15 on her forehead and Kerri shows 9. Marissa tells them the total is 24. Elisha says her card is 5 because 9 + 15 = 24. Kerri calculates 24 – 15 and says her card is 9.

- When all the cards have been used, they are reshuffled, and replaced in separate stacks.
- The players switch roles.
- There is no competition and no winner in this game.

Reading the Research

If students understand the relationship between addition and subtraction, perhaps by thinking of the problem in terms of part-part-whole, then they recognize that counting up can be used to solve subtraction problems (National Research Council, 2001b).

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Before the Game

Give the students practice figuring out the part that is unknown. Hold the set of numeral cards in your hand. Invite a student to draw a card and show it to the class. Draw a card, and keeping it hidden from view, add the two numbers, and say the total aloud. Challenge the students to figure out the numeral that is on your card. Elicit a correct response, then encourage the students to share the strategies they used. Repeat the activity three or four times.

During the Game

After a round is completed, ask the players to share how they figured out the missing part. The strategies used could vary greatly depending on the numbers. They will also vary between players. For example, the following responses could be given when one card is 8 and the total is 14 (14 – 8).

Brent: *I started with 8 and counted on 2 to get to 10, then another 4 to 14.*

Bianca: *I knew that 8 plus 6 is 14, so my card was 6.*

Bailey: *Double 7 is 14, so I thought 14 take away 8 must be 6.*

Brook: *I counted back 6 to get to 8, so I knew my card was 6.*

After the Game

Lead a discussion about the different strategies used by the students. Talk about the range of strategies that could be used. Did any students use the same strategy for all the number combinations they encountered? Did the students have a favorite strategy? Were there any examples that the students could not solve?

Beyond the Game

- Combine the two sets of cards and play the same game again.
- Change the rules to identify a winner between two players. At the end of each round, the player who had the smaller (or greater) number can keep the cards. The player who has the greater number of cards at the end of the game wins.
- Extend the game by making cards for numbers beyond twenty.

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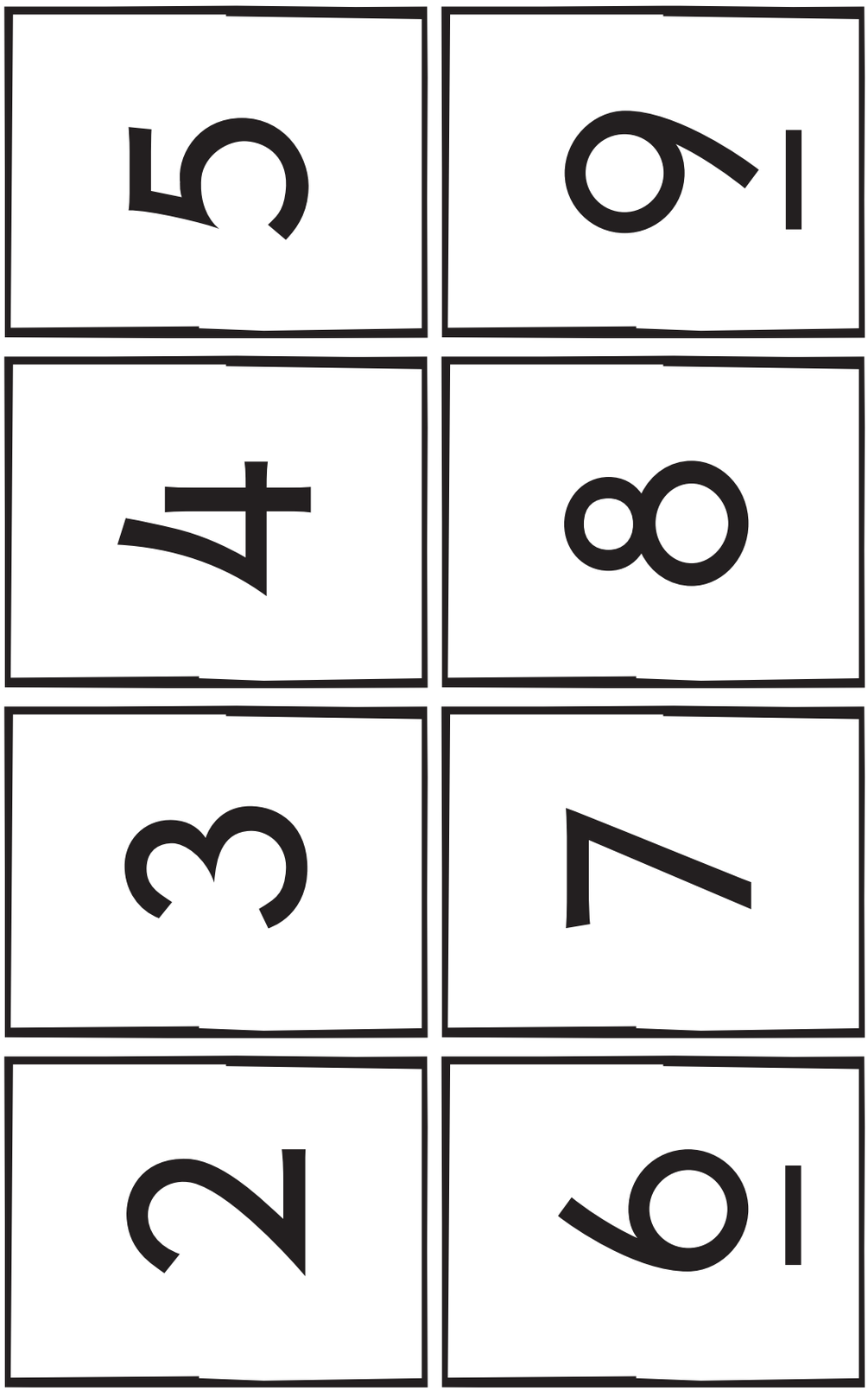
Headache



Enlarge to make cards more manageable.

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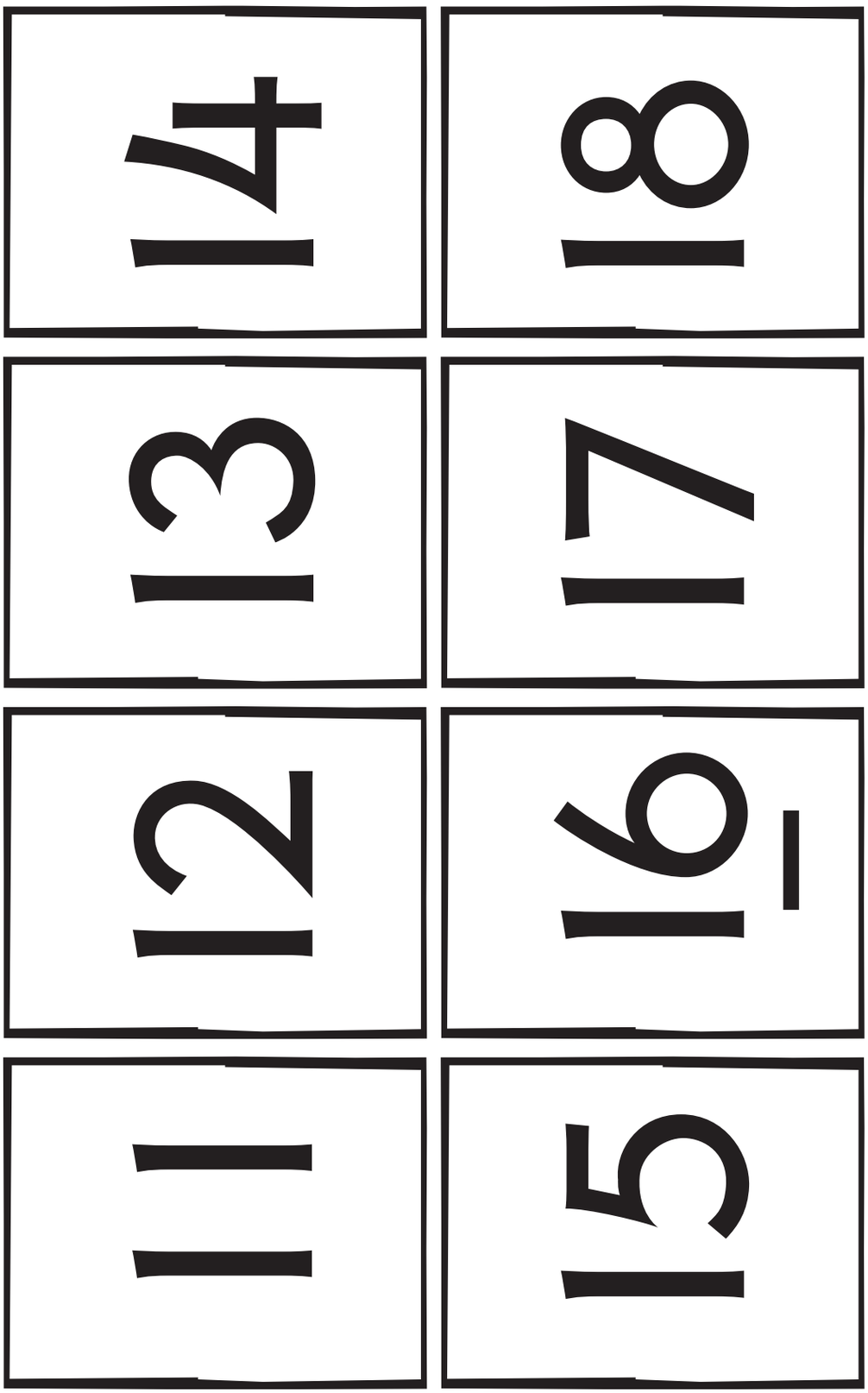
Headache



Enlarge to make cards more manageable.

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Criss-Cross

Connecting addition and subtraction

2 or 3 players

Purpose

This game reinforces the connection between addition and subtraction involving two-digit numbers. It requires students to find the sum of two multiples of ten, then cross out two related subtraction number sentences.

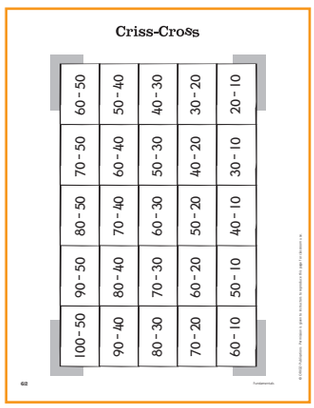
Materials

Each group of players will need

- A 'Criss-Cross' game board (page 62) as shown below.
- Two (2) number cubes showing the numerals 10, 20, 30, 30, 40, and 50. These can be made from blank wooden cubes.

Each player will need

- One (1) marker pen (a different color for each player).


Criss-Cross

60 – 50	50 – 40	40 – 30	30 – 20	20 – 10
70 – 50	60 – 40	50 – 30	40 – 20	30 – 10
80 – 50	70 – 40	60 – 30	50 – 20	40 – 10
90 – 50	80 – 40	70 – 30	60 – 20	50 – 10
100 – 50	90 – 40	80 – 30	70 – 20	60 – 10

How to Play

The aim is to cross out four subtraction sentences adjacently in a horizontal, vertical, or diagonal line.

- The first player rolls the number cubes.
- The player calculates the sum of the numbers rolled and thinks of two related subtraction sentences. Notice that there is only one option for players who roll a double.

  Example: Melanie rolls 20 and 40 and calculates the sum to be 60. She could cross out 60 – 40 or 60 – 20.

- The player then crosses out one related subtraction number sentence on the game board. Some sentences appear on the game board more than once, so players must decide which moves may be more advantageous for building winning patterns or for blocking an opponent. If both subtraction sentences are unavailable, the player misses a turn.
- The other player has a turn.
- The first player to cross out a line of four adjacent sentences is the winner.

Reading the Research

For students in grades K to 2, learning to see the part-whole relations in addition and subtraction situations is one of their most important accomplishments in arithmetic (National Research Council, 2001b).

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Before the Game

Play the game as a class. Use an overhead transparency of the game board to explain the rules then divide the class into two teams. Give different players from each team an opportunity to roll the number cubes and cross out the chosen number sentence. Call upon several of these players to share how they calculated the total mentally.

During the Game

Encourage the students to explain the strategy they use to find the sum of two numbers. The methods may vary depending on the numbers being added. Furthermore, different students will use different strategies. For example, when asked to explain their strategy for calculating the sum of 40 and 30, four students gave the following responses:

Lewis: *I started with 40 and counted on 3 tens.*

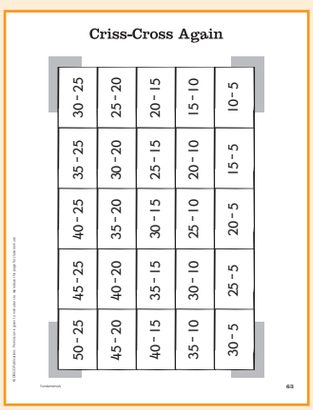
Linda: *I just doubled 30 and added another 10.*

Lee: *I just knew that 40 and 40 is 80, so 40 and 30 must be 70.*

Lara: *I knew 4 plus 3 is 7, so 40 plus 30 is 70.*

After the Game

Patterns are the hallmark of mathematics. Have the students study the game board. Ask, ***Where do you see the number sentences that show doubles?*** (In a diagonal line starting at the top left-hand corner.) ***Where do you see the number sentences that have an answer of 50 ...10 ...30?*** (In columns.) ***Where are the number sentences that start with the same total?*** (In diagonal lines from right down to left.) Say, ***Run your finger along the diagonal line that starts with 90 – 40 and finishes at 30 – 10. Describe how the answers change.*** (They start with 50 and decrease in tens.) Repeat this for other diagonal lines that move down from left to right.


Criss-Cross Again

30 - 25	25 - 20	20 - 15	15 - 10	10 - 5
35 - 25	30 - 20	25 - 15	20 - 10	15 - 5
40 - 25	35 - 20	30 - 15	25 - 10	20 - 5
45 - 25	40 - 20	35 - 15	30 - 10	25 - 5
50 - 25	45 - 20	40 - 15	35 - 10	30 - 5

Beyond the Game

- Play 'Criss-Cross Again' using the game board on page 63 (illustrated). For this game, the students will need to make two number cubes showing the numerals 5, 10, 15, 15, 20, and 25. The game rules are the same.
- Encourage students to make their own number cubes and game board to match. For example, they may want to add multiples of ten that have sums beyond one hundred.

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Fundamentals 2 Orange.indd 62

Criss-Cross

100 - 50	90 - 50	80 - 50	70 - 50	60 - 50
90 - 40	80 - 40	70 - 40	60 - 40	50 - 40
80 - 30	70 - 30	60 - 30	50 - 30	40 - 30
70 - 20	60 - 20	50 - 20	40 - 20	30 - 20
60 - 10	50 - 10	40 - 10	30 - 10	20 - 10

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Criss-Cross Again

50 – 25	45 – 25	40 – 25	35 – 25	30 – 25
45 – 20	40 – 20	35 – 20	30 – 20	25 – 20
40 – 15	35 – 15	30 – 15	25 – 15	20 – 15
35 – 10	30 – 10	25 – 10	20 – 10	15 – 10
30 – 5	25 – 5	20 – 5	15 – 5	10 – 5

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Directions for the Games

Count on 1 or 2

Focus:
Adding 1 or 2 using the count on strategy

Materials:
Two number cubes configured as follows:
Cube A: 4, 5, 6, 7, 8, 9
Cube B: 1, 1, 1. 2. 2. 2
Colored pencil or marker for each student in different colors
Game board

Directions:
The player who completes the most equations is the winner.

How to Play:
Player 1 rolls, finds the matching equation with the matching sum and fills in the dice and equation on the game board in his/her color.
Next player rolls and fills in dice and equation in his/her color.
If a player rolls a sum that is already filled, he/she misses a turn.
Play continues until board is filled or time runs out.

Example:
Gertrude rolls a numeral six and 2 dots. She says. Six count on 2 is seven, eight. I will fill in one of the equations with the sum of 8 and fill in the dice to match my roll.

Doubles plus 1

Focus:
Using doubles facts to solve a doubles plus 1 equation

Materials:
Doubles add one game board
Once cube showing the numerals 4, 5, 6, 7, 8, 9
Four counters per player, each player has a different color counter

Directions:
The player who places all four counters on the board first, wins.

How to Play:
First player rolls the number cube and doubles the number rolled, then adds one to it.
Player claims the sum by covering it with a counter. If that sum is already covered, the player misses a turn.
Other players have a turn.

Example:
Carla rolls a 7 and says, “I know that double 7 is 14, so 7 add 8, must be one more, that’s 15.”

For ideas on how to bring out the mathematics in this game, see Fundamentals Yellow, pp 56-57.

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Bridge to Ten

Focus:
Reinforce the Bridge-to-Ten strategy for addition

Materials:
Two number cubes configured as follows:
Cube A: 8, 8, 8, 9, 9, 9
Cube B: 3, 4, 5, 5, 6, 7
Colored pencil or marker for each student in different colors
Game board

Directions:
The player who completes the most equations in their color is the winner. One player plays the left side of the board, one plays the right side. It is possible to add another player or two. In that case, each player would use the entire board and count the equations completed in his/her color at the end of the game.

How to Play:
First player rolls both cubes.
Player finds the tens fact that corresponds to the 8 or 9s fact that is rolled.
Player fills in the sum of the tens fact and the equation for the 8 or nines fact.
Next player has a turn.
Play continues until one player fills a side (in a two-player game), or the board is filled (if more than two are playing), or until time runs out.
Player with the most equations in his/her color is the winner.

Example:
Jorge rolls a 9 and a 5. He says, “I know that 9 is one away from ten. Nine add 5 has the same value as 10 add 4. That’s 14. So I will fill in the space with 10 add 4 and add the equation 9 add 5 equals 14.

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How to Play:

Take or Tally

Focus:
Using addition to subtract

Materials:
Two number cubes configured as follows:
Cube A: 1, 2, 3, 1, 2, 3
Cube B: 7, 8, 9, 10, 11, 12
Game board

Directions:
First to complete his/her side of the game board without receiving 5 tallies is the winner.

How to Play:
First player rolls both cubes.
Player writes the two numbers in one of the number sentences on his/her game board. The completed equation must be true.
If a true sentence cannot be made, the player makes a tally in the space provided at the bottom of the game board.
The first player to complete 6 equations before making 5 tallies is the winner.

For ideas on how to bring out the mathematics in this game, see Fundamentals Orange (pp28-29).

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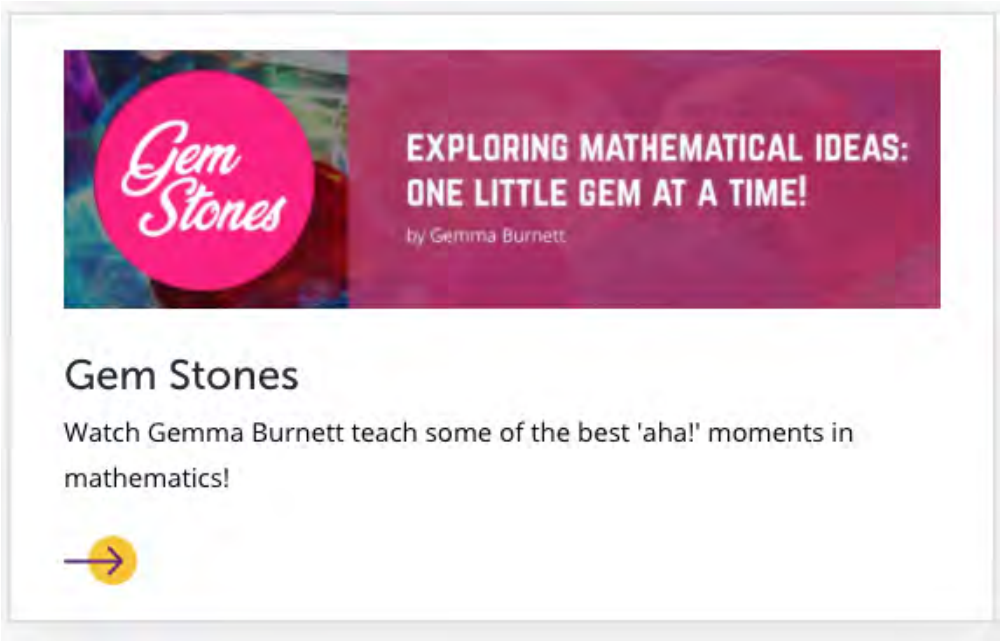
Addition and Subtraction Strategies Videos

To find the ORIGO One and Gem Stones videos you may visit www.origoeducation.com and join our community of learners.
You may also go to https://www.youtube.com/c/OrigoOneVideos/featured or go to YouTube and do a search for ORIGO One videos.
Gemma's videos can also be found on YouTube https://www.youtube.com/c/GemStonesElementaryMath/featured
Be sure and subscribe to these Channels! James and Gemma are producing new videos regularly.



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