No More Math Blues

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You want me to teach what?

Numerical Fluency

- Ability to easily and accurately manipulate numbers with understanding
- Allows solving problems in different ways
- Includes metacognition and justifying why your answer is correct

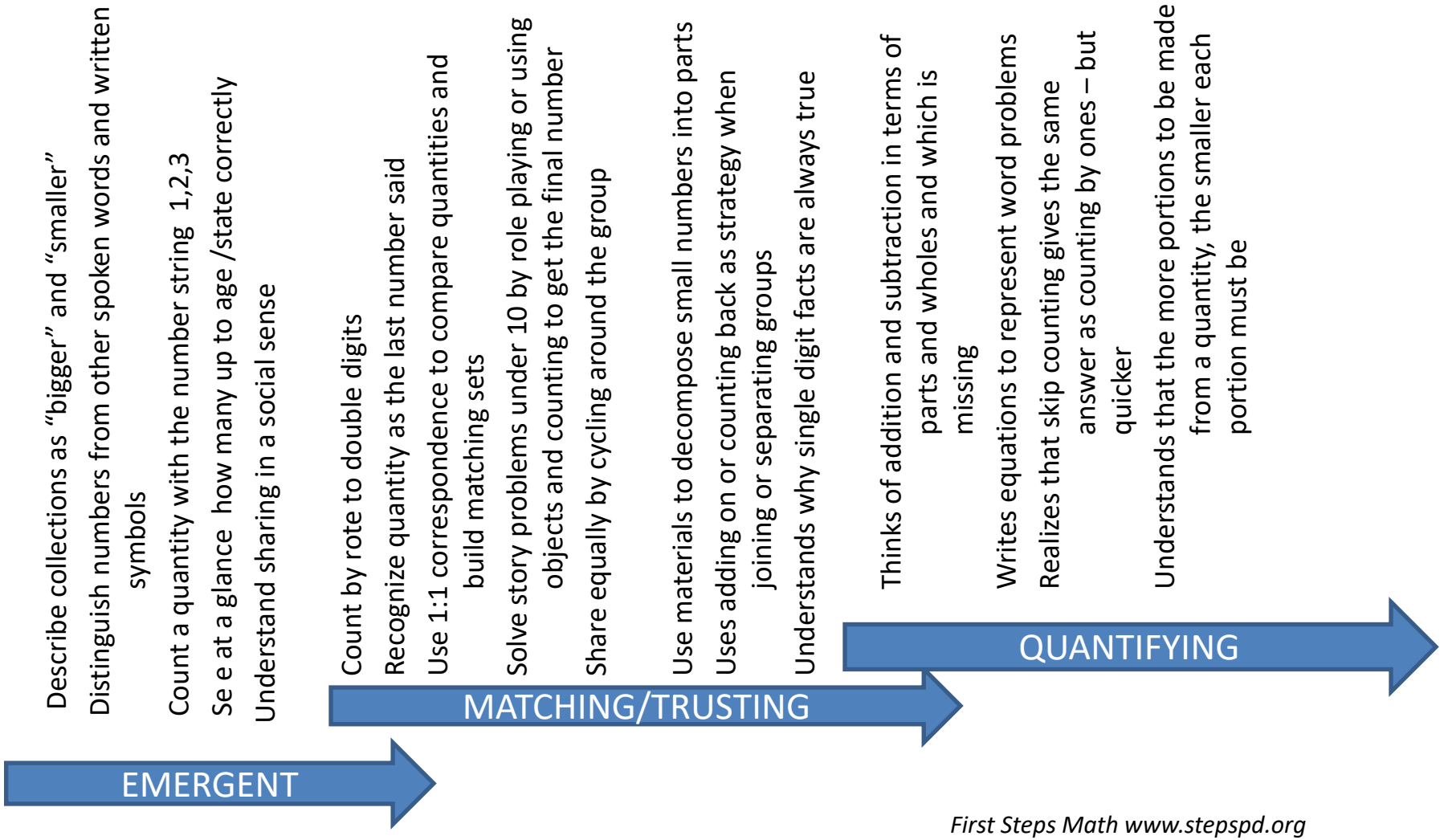
Ways to Promote Numerical Fluency:

- Storytelling
- Building
- Drawing/visualizing
- Verbalizing both what and why

(Kanter & Leinwand, 2018)

NOTES:

Continuum of Numerical Understanding



First Steps Math www.stepspd.org

Alaska State Standards

https://education.alaska.gov/standards

K.CC.1 Count to 100 by ones and tens

K.CC.2 Count forward beginning from a given number within the known sequence

K.CC.3 Write numbers from 0-20. Represent a number of objects with a written numeral 0-20 (0=count of no objects)

K.CC.4a When counting objects, say the number names in standard order, pairing each object with one and only one number name and each number name with one and only one object

K.CC.4b Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted.

K.CC.4c Understand that each successive number name refers to a quantity that is one larger

K.CC.5 Count to answer “how many?” questions about as many as 20 things arranged in a line, a rectangular array or a circle, or as man as 10 things in a scattered configuration; given a number from 1-20, count out that many objects.

1.CC.1 Skip count by 2s and 5s

1.CC.3 Order numbers from 1-100. Demonstrate ability in counting forward and backward

Teaching Emergent Learners

- BLOCKS – Build and count how many (compare based on size)
- Matching numerals and dots centers and puzzles
- “Put the animals in the pen” type centers
- Make bundles of straws or pipe cleaners – up to 10
- Collect a given quantity of objects (find 5 rocks that fit in your hand)
- Select the missing number in a written 3-number sequence
- Play “What Comes Next?” or “What comes before?”
- Story books and songs that utilize counting and repetition (10 monkeys, etc.)
- Put the short date digits in order during calendar – fill in the missing digits to make a counting sequence
- Subitizing games – number cubes, domino match, flash cards

NOTES:

Assessing Emergent Learners

- Use weekly record to monitor counting aloud, flashcard recognition, writing numbers, subitizing, and “get me” tasks (K.CC.1,2,3,5)

- To assess understanding of counting principles, (K.CC.4a,b,c) show a collection of 8-9 items. “how many?” Mix them up and repeat the question. (recounts = still emergent) Show a new collection of 7-10 items in a row. Point to one in the middle and say, “start here and count how many.” Repeat with the items in a random group. (notice how child keeps track of what they have counted – look for 1:1 association

NOTES:

Alaska State Standards

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K.CC.6 Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group (e.g., by using matching, counting, or estimating strategies.

K.CC.7 Compare and order two numbers between 1 and 10 presented as written numerals

K.OA.1 Represent addition and subtraction with objects, fingers, mental images, drawings, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations

K.OA.2 Add or subtract whole numbers to 10 (e.g., by using objects or drawings to solve word problems)

K.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way (e.g., by using objects or drawings, and record each decomposition by a drawing or equation)

K.OA.4 For any number from 1-4, find the number that makes 5 when added to the given number and, for any number from 1-9, find the number that makes 10 when added to the given number (e.g., by using objects, drawings or 10 frames) and record the answer with a drawing or equation

K.OA.5 Fluently add and subtract numbers up to 5

1.CC.5 Use the symbols for greater than, less than or equal to when comparing two numbers or groups of objects

Teaching the Matching/Trusting Learner

- Most important learning is strategy of 1:1 comparison of quantity and developing confidence that numerical quantities do not change unless something is added or taken away. Use objects first, then pictures, numerals last. Encourage them to draw it out – quick symbols prevent artistic frustration

- Storybooks that can be transitioned to partitioning mats
- Bead bracelets/hoola hoops
- Collection/group map work
- Snack quantities – how many more do you need to make xx?
- Use short date numbers for comparison questions during calendar
- Greater than/Less than card war
- Domino sums
- The Sum Is…

NOTES:

Assessing the Matching/Trusting Learner

To assess how well students understand partitioning, (K.OA.3) show a collection of 5-10 same-color unifix cubes, or counters. Get the child's agreement as to the number of cubes on the table. Have the child close his/her eyes while you hide some of the cubes. Ask them to open their eyes and tell you how many cubes are missing. Record the strategy used by the child to find the answer. (counting on, mental math, using fingers, etc.) Ask, "how did your brain know that?" Restate their verbalization for confirmation. Ask them to generate an equation telling what their brain did (ex 8-3=5 or 5+3=8)

To assess ability to create a mental image and solve simple addition or subtraction problems, (K.OA.2, 4, 5) use a collection of up to 10 blocks. Put 1 block in an opaque container and show the child. Ask, how many blocks in this container? Cover the container and ask again. Add 1 block. Say, "I added 1 block. How many blocks in the container now?" Continue in this manner, adding or subtracting up to 3 blocks each time.

Alaska State Standards

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- K.NBT.1 Compose and decompose numbers from 11-19 into 10 ones and some further ones (e.g., by using objects or drawings) and record each composition or decomposition by a drawing or equation (e.g., 18=10+8); understand that these numbers are composed of 10 ones and 1,2,3,4,5,6,7,8, or 9 ones.

- 1.OA.1 Use addition and subtraction strategies to solve word problems (using numbers up to 20), involving situation of adding to, taking from, putting together, taking apart and comparing, with unknown in all positions, using a number line (e.g., by using objects, drawings and equations). Record and explain using equation symbols and a symbol for the unknown number to represent the problem.

- 1.OA.3 Apply properties of operations [commutative, associative, zero] as strategies to add and subtract (Students need not know the name of the property). 1.OA.8 Determine the unknown whole number in an addition or subtraction equation . [refers to any position, includes equality statements)

- 1.OA.4 Understand subtraction as an unknown-addend problem. For example, subtract 10-8 by finding the number that makes 10 when added to 8.

- 1.OA.5 Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).

- 1.NBT.2 Model and identify place value positions of two digit numbers. 1.NBT.3 Compare two digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols <,>,=

Teaching the Quantifying Learner

- Composing/decomposing *One is a Snail*
- Missing addends practice *Honeycomb Flowers* and *The Sum Is…*
- Use partitioning mats and ten frames for word problems (mark with counters or quick drawing)
- Build and count with base ten blocks
- Make the greatest possible and least possible number with short date digits during calendar
- Extend filling in missing number sequences to 120
- Make bundles of straws or pipe cleaners

NOTES:

Assessing the Quantifying Learner

FORMAL ASSESSMENT

- Most first grade texts contain assessment materials that will provide adequate measures of whether students can obtain the correct answer.
- It is recommended that you observe HOW they are getting their answer for clues to whether they have actually mastered the processes.

TEACHER OBSERVATION

- Can they use each of the required strategies?
- Can they explain what their brain did to solve a problem?
- Have they acquired automaticity with single digit addition and subtraction facts?

Honeycombs and Flowers: Original Game Boards and Questions

Dinah Chancellor, 2012

Objective: Students will play a game in which they identify expressions/solutions that match a story problem. As an extension, students will develop a new game by generating expressions/solutions and creating story problems to match them in which the unknown is in a variety of positions.

Materials: individual chalkboards/chalk/erasers or paper/pencil, game boards 1 - 4, counters, story problem cards, hexagons from pattern blocks (or paper versions from die cuts), *Extension:* blank story problem cards, blank game board

Instructions:

1. Each player takes a different game board and a pile of hexagons.
2. Story problem cards are shuffled and placed face down.
3. Each player in turn draws a card and reads it to the group. The group members listen to the story problem and record a number sentence that matches the story. They help each other find the sum or difference and record it.
4. Players then examine their game boards. If they have a space that matches the sum or difference, they may cover it with a yellow hexagon. If they have a space that matches the number combination in the story, they may cover it. *If they have both, they must choose one to cover.* NOTE: **The number combination must match the story problem.** Example: Suppose the story is, "Nine candles were lit on the birthday cake. Felipe blew out three candles. How many candles were still lit?" 9 – 3 ***or*** 6 are OK to cover on the game board. BUT—although 3 + 3 also results in an answer of 6, it is NOT OK because it does not match the story problem.
5. Play continues until one player covers a flower on his/her game board.

Extension:

1. Play the game several times, trading game boards each time.
2. ***Create an original game board and story problem cards.*** Fill the hexagons on the blank game board by asking students to brainstorm 21 different sums, differences or number combinations. Try for a variety. Record number combinations in both vertical and horizontal formats.
3. Assign different hexagons on the new game board to pairs of students. They will create story problems to match the sum, difference or number combination on their hexagons. Example: For a number combination "12 – ☐ = 5", the story problem could be, "Sam had twelve gumdrops. He ate some. Now he has five. How many gumdrops did he eat?"
4. Record the story problems on blank cards. Play the new game to try it out. Ask students to polish the story problems to make them even better.

Honeycombs and Flowers Story Problem Cards

It is Juan's birthday. His mother puts three red candles and three blue candles on his cake. How old is Juan?

Ten leaves flutter on a tree branch. A squirrel pulls four leaves off to use in her nest for winter. How many leaves remain on the branch?

There are ten leaves left on the tree in the fall. Some are red and some are orange. A gust of wind blows two away. How many leaves are still on the tree?

The camera store is very busy. There are five men and two women waiting to have their picture taken. How many people are at the camera store?

There are four boys and two girls at the photo shop. How many children are waiting to have their picture taken?

Two cows see seven horses running around the pasture. How many cows and horses are in the pasture?

Nine candles are lit on the birthday cake. Felipe blows out three candles. How many are still lit?

Nine rocks are in the river. Amy tries to pull one rock out of the river. The river is so cold Amy drops the rock. How many rocks are still in the river?

Honeycombs and Flowers Story Problem Cards

Eight fish swim in the lake. Jason puts his hook into the water. Good luck! Jason catches one fish. How many fish are in the lake now?

Five chipmunks are running in the forest. Five squirrels join them. How many chipmunks and squirrels are running in the forest?

Ten horses are in the field. Three horses jump over the fence and run away. How many horses are still in the field?

Ten pins are in the pincushion. John starts to use some for his bulletin board but decides instead to use tacks. How many pins are left in the pincushion?

Ten stockings hang by the fireplace. Mother takes one away to mend. How many are still hanging by the fireplace?

Seven bluebirds sit in a tree. Three robins fly to the tree. How many birds are now in the tree?

Charlie builds six snowmen. Danny builds four snowmen. How many snowmen do the boys build?

Four Girl Scouts are selling cookies. Three Girl Scouts run out of cookies and go home. How many Girl Scouts are still selling cookies?

Honeycombs and Flowers Story Problem Cards

Six jack-o'-lanterns are sitting on the porch. The wind blows four jack-o-lanterns off the porch. How many jack-o'-lanterns are left on the porch?

Robby puts four goldfish in his aquarium. Robbie feeds the fish five pinches of food. Robby's grandma gives him three more fish. How many fish does Robby have now?

Seven ghosts are in the haunted house. Five ghosts leave to scare some trick-or-treaters. How many ghosts stay at the haunted house?

One tiny mouse with pink ears sits on the mouse trap. Three mice with black ears come to the trap and sit down also. How many mice are sitting on the trap?

Two ghosts and two spiders are in the haunted house. How many scary things are in the house?

Three shells wash up on the beach. Jason finds the shells and puts them in his bucket with the other two shells. How many shells does Jason have in his bucket now?

Two airplanes are on the runway. Another airplane lands. How many airplanes are on the runway now?

Four strawberries are growing red, ripe, and juicy on the plant. A robin comes along and eats one strawberry. How many strawberries are left on the plant?

Honeycombs and Flowers Story Problem Cards

Nine children are playing soccer. Four children are wearing hats. Three children have to go home for dinner. How many children are still playing soccer?

Five chicks are eating corn. They eat and eat. Three chicks are so full they go for a walk. How many chicks are still eating corn?

There are four red glass balls on the tree. A kitten pulls two red glass balls off the tree. How many red glass balls are still on the tree?

Susan puts six pins in the pincushion. Laura needs one pin and takes it out. How many pins remain in the pincushion?

Seven chocolate cookies are on the plate. The cookie monster eats two cookies. How many cookies are still on the plate?

Eight fish swim in the fish tank. The cat tries to catch one but he misses. How many fish are still in the fish tank?

Jack makes four vanilla cookies and four chocolate cookies. He pours himself two glasses of milk. How many cookies does Jack make?

Nine shells are on the beach. Waves wash four shells out to sea. How many shells are left on the beach?

Honeycombs and Flowers Story Problem Cards

Three frogs sit on lily pads in the pond. Two frogs jump into the pond for a swim. How many frogs are still on the lily pads in the pond?

Five girls wear their Brownie uniforms to school. When they get to school, one girl falls in a mud puddle. She has to change clothes. How many girls are still in Brownie uniforms?

Four grasshoppers jump in the wheat field. Three more grasshoppers come to join them. How many grasshoppers are jumping in the wheat field now?

Teddy takes five pennies to the candy store. Teddy spends one penny for bubble gum. How many pennies does Teddy have left?

Three children go out to play baseball. Two children leave when the ice cream truck drives by. How many children are still playing baseball?

Felipe, Marc, Wayne, and George are playing soccer. Katie, Julie, and Nicole come along and join the soccer game. How many children are playing soccer?

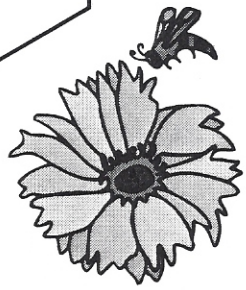
Four puppies chase each other in the yard. Three more puppies sneak under the fence and join the chase. How many puppies are in the yard now?

There are ten jack-o'-lanterns at the Halloween party. Someone takes two jack-o-lanterns away. How many jack-o'-lanterns are still at the party?

Honeycombs and Flowers Game Board: 1

shared by Dinah Chancellor, 2012

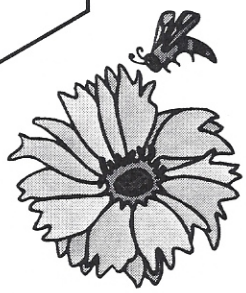
9	7 − 5	6
8 − 1 =	4	4 + 4 =	1
10	9 − 4	9 − 6
4 − 3 =	10 − 4	7	2
6 + 4	3	1 + 3 =
10 − 4 =	8	5



Honeycombs and Flowers Game Board: 2

shared by Dinah Chancellor, 2012

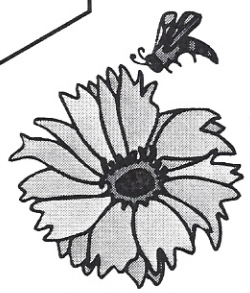
3	3 + 3	1
2 + 7 =	5	7 + 3
		4 – 2 =
10 – 3	5 – 1 =	8
3 – 2 =	6	3 + 2
		2
10 – 2 =	4	9
10	5 - 2	7



Honeycombs and Flowers Game Board: 3

shared by Dinah Chancellor, 2012

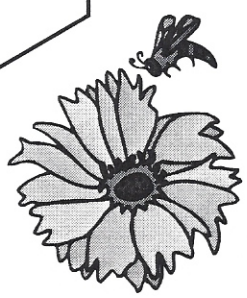
$3 - 2$	$8 - 0 =$	1
3	6	7
$7 - 2$		
9	$5 - 3 =$	4
$7 - 3$	$10 - 0$	5
$2 + 1 =$		
$4 + 3 =$	2	$5 + 4$
8	10	$4 + 2 =$



Honeycombs and Flowers Game Board: 4

shared by Dinah Chancellor, 2012

6 - 4 =	10	5 + 2	
2 + 2 =	8	6	3
9	4 – 3	4	
2	5 + 3 =	5	7
6 - 1	5 + 5 =	4 - 1 =	
9 - 0 =	1	9 - 3	



GAME: One Is a Snail

by Dinah Chancellor, 2010

Rationale/Objective: Changing the way a number is represented may cause a model of the number to *look* different, but it does not change the *value* of the number. Or put a different way, just changing the visual representation of a number does not change its *meaning*.

Description of Activity: Students will work in pairs to play a game in which they represent whole numbers in terms of the number of feet in the story, *One Is a Snail, Ten Is a Crab*.

Materials: *One Is a Snail, Ten Is a Crab* by April and Jeff Sayre (ISBN# 978-0-7636-2631-0) spinner: 1 – 10 (Two-digit numbers may be generated with two spinners: 1 – 9 and 10 – 90.), pictures of characters from the story (copied on cardstock and cut apart), paper, pencils, crayons (optional—for recording different ways to show the target number)

Procedure:

Introduction *A description of how this lesson might be introduced to students—accessing prior learning, creating a meaningful context for new math concepts*

Read the book, *One Is a Snail, Ten Is a Crab*. As you read the book, stop periodically to ask children how they think a number in the story will be represented. Then show students the illustrations so they can check their predictions.

Exploration *A description of the task within the lesson and how it will engage students in learning the mathematics*

In a large group, introduce the game.

1. Use the 1 – 10 spinner to randomly generate a target number. (Example: 7)
2. Use the characters' feet from the story to show that number in a variety of ways. (Example: one insect and one snail; seven snails; one dog, one snail, and one boy; three boys and one snail)
3. Organize the ways and look for patterns. Ask children how the different ways could be arranged.

Example:	7 snails	7 is 1 and 1 and 1 and 1 and 1 and 1 and 1
	1 snail, 3 boys	7 is 1 and 2 and 2 and 2
	1 snail, 1 boy, 1 dog	7 is 1 and 2 and 4
	1 snail, 1 insect	7 is 1 and 6

   To make this recording system less cumbersome, mathematicians use symbols: $7 = 1 + 6$
4. Discuss whether 1 dog, 1 snail, 1 boy is the same or different from 1 snail, 1 boy, 1 dog. *(If the characters & their number of feet are the same, it doesn't matter the order in which they are arranged. This is the Commutative Property of Addition.)*
5. Use the patterns to answer the question, "Have we found all the ways to make our target number using feet from our story?"

Playing the Game:

1. The student with the greatest number of letters in his/her name is Player 1.
2. Spin the 1 – 10 spinner and report the number it lands on. (Example: 8)
3. Player 1 will use characters' feet from the story to represent the target number. (Example: 1 spider OR 1 insect + 1 boy)
4. Player 2 will try to represent the target number in a new way. (Examples: 4 boys or 2 dogs)

5. Players will continue to take turns trying to find NEW ways to represent the target number.
6. Players will decide when the round is over—when they have found all the ways to show the target number.
7. Players will earn points by counting the number of ways each found to show the target number.
8. Players will play additional rounds as time permits. Final scores will determine a Winner.

Modification: When students are just learning the game, they will play "cooperatively" instead of "competitively". Scores will not be kept and everyone WINS. The question players must be able to answer is "How do you know when the round is over—that you have found all the ways to represent your target number?"

Extension 1: Players will record the different ways they found to show their target number during each round. They will then organize their ways and look for patterns. They will use the patterns to determine if they have found all of the ways to show their number.

Extension 2: Use different spinners: 1 – 9 and 10 – 90. Take out all story characters except snails and crabs to show numbers in terms of tens and ones. For each round, students will spin one double-digit spinner and one single-digit spinner to generate a double-digit target number.

Summary *Specific questions important to include in a summary discussion*

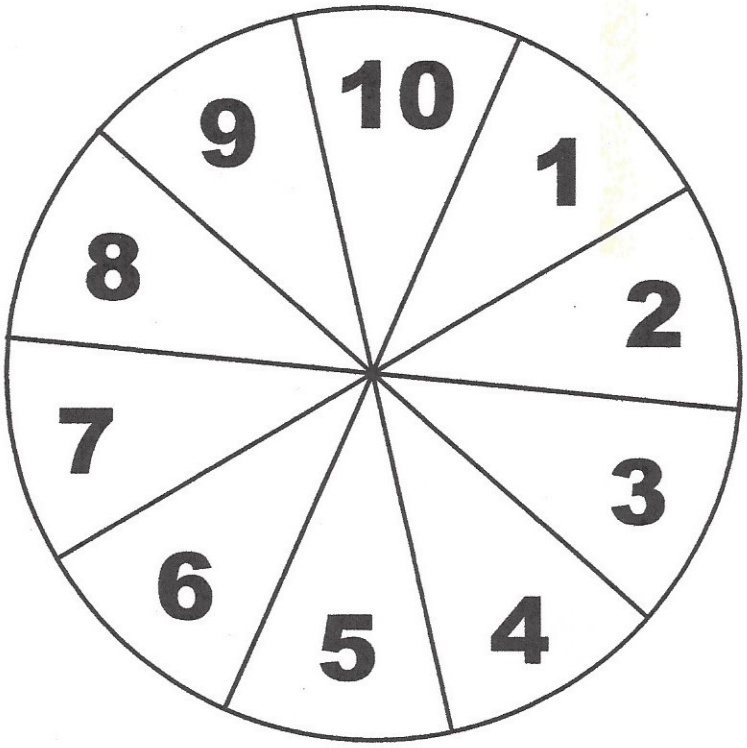
- How many rounds did you have time to play?
- Which target numbers did you show with numbers of feet from our story?
- Could you make your target number with just the boy's feet? In other words, if you count by twos, do you land on your target number? How many of our possible target numbers can be represented with just boy's feet? What do we call these numbers? *(even numbers)* What do we call the numbers we CANNOT land on when we count by twos? *(odd numbers)* Did you notice anything when you represented the odd target numbers with characters' feet from the story? Tell us about it. *(Students may notice that odd numbers must include at least one snail's foot.)*
- How many different ways did you find to represent your target number in terms of the characters' feet from the story?
- When you built your number using different combinations of feet, did the NUMBER change? Why? What did change? How can you explain this?
- Were you able to predict how many different ways there would be? Explain.
- How did changing your target number affect the number of ways you found to show the number? Which target numbers seemed to have the greatest number of ways to represent them?
- How did you organize your work? Did you see any patterns? Describe them. Did anyone use a different way of organizing their work? Were the patterns you noticed *also* different? Explain.
- How did you use the patterns to tell if you had found *all* the ways to represent your target number?

One Is a Snail...

Dinah Chancellor, 2010

You need: spinner (1 - 10) pictures of characters from One Is a Snail, Ten Is a Crab

- Spin the spinner to find a target number. *(Example: 7)*
- Player 1 shows the target number using characters' feet from the story. *(Example: one insect and one snail)*
- Player 2 shows the target number in a NEW way. *(Example: one dog, one person, and one snail)*
- Continue to take turns finding new ways to show the target number.
- When no new ways can be found, the round is over.
- Count up your score: one point for each new way to show the target number.
- Spin to find a different target number and play the game again.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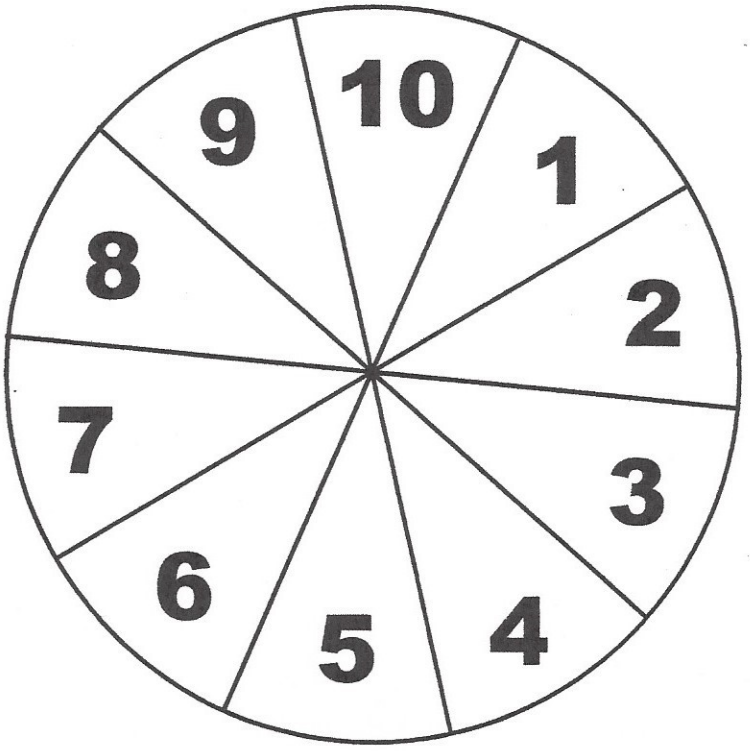
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