Let's Develop Number Sense by Using Games in Grades K-2

Presented by

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Advantages of Using Games

For students, games:

1. provide hands-on activities, require active participation,
2. are very motivational,
3. can provide individual reinforcement or enrichment,
4. can help develop positive self-concepts,
5. and can lead them to use new problem-solving strategies.

For teachers, games:

1. can be made inexpensively, used and reused,
2. allow time for observation and assessment,
3. make math easier to teach as motivation increases,
4. provide another way to develop concepts, and encourage practice.

Adapted from:

<u>Arithmetic Teacher</u>
Krulik & Rudnik, December 1983
Jones, December 1982

NUMBER SENSE

Well developed knowledge of

- Meanings for numbers.
- Relationships among numbers.
- Relative magnitude.
- Relative effects of operating on numbers.
- Referents for measures of common objects or situations.

OPERATION SENSE

Knowledge of

- Mathematical operations that model operations in real-world problems.
- Fundamental properties.
- Relationships among operations.
- The effects of each operation on a pair of numbers.

(From NCTM's *Curriculum and Evaluation Standards,* pp. 39-41)

Counting/Number Recognition

Turn Overs

Math Skills: Recognize numerals, group recognition, match numerals with concrete representations
Materials: 2 sets of 0-9 dot cards, 1 10 sided die
Directions: Place the cards in a pile, face down. Each player turns over one card from the pile. Players alternate rolling the die. If the dots on any players' card matches the roll of the die, that player keeps the card. If there is a tie, the cards are returned to the bottom of the pile. If there is no match, the player may roll the die two more times. If still no match, cards are returned to the bottom of the pile, new cards are turned over and a new player rolls the die. When all cards from the deck have been used, players count their cards. The player with the most cards is the winner. Variations: The range of numbers represented may be larger or smaller, depending of the abilities of the children. The game may also be played with a six sided dot die and numeral cards.
Source: Adapted from Currah et al. Volume I

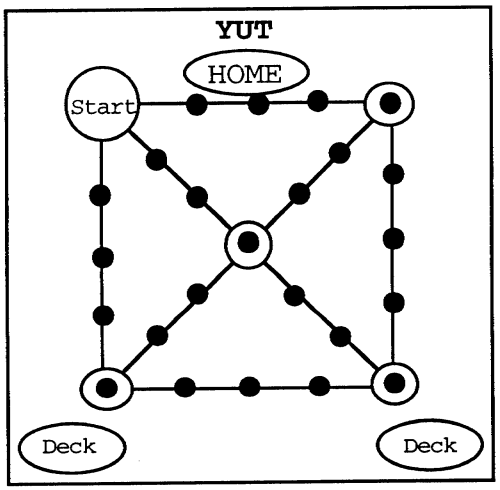
Ten In a Circle

Math Skills: Counting 1-10 objects, One to one correspondence
Materials: A small number of counters (15-20) such as beans or pennies, one counter different from the others
Directions: Place the counters in a circle. One counter should be different from the others (ex. one white bean in a group of red beans). Starting from any counter in the circle, each player takes a turn counting and touching each object as it is counted. If the counter touched at the count of ten is an ordinary one (red bean), it is removed from the circle. If it is the different counter (white bean), that player is out. The different counter (white bean) is not removed from the circle. The last player left is the winner. If all the counters are gone and only the different counter remains, then all the players left are winners. Variation: Rather than eliminate players, they keep the bean they land on. If they land on the different counter, they must give away a counter. At the end of the game, the child with the most beans is the winner.
Source: Adapted from Polonsky et al.

Count Up

Math Skills: counting, writing and reading numbers, problem solving
Materials: paper and pencil, counters or base-10 blocks are optional
Directions: Choose a range of 20 counting numbers. For example, 1-20 or 195-215 or 985-1005 etc. On a single sheet of paper, players take turns writing and reading the numbers in sequential order. On each turn, the player may choose to write and read one or two numbers, always starting from where the other player left off. The player who writes and reads the final number in the range is the winner. This is a strategy game. Encourage students to figure out how they can win every time. Variations: Have the students write the word names rather than the numbers. Allow students to write and read from 1 to 10 numbers on a turn. The player who writes and reads the last number can lose rather than win.
Source: Adapted from Schiro

Yut
Math Skills: Counting, One to one correspondence, problem solving
Materials: Yut Gameboard, 1 die, 1-4 counters for each player
Directions: This is adapted from a Korean game similar to Parcheesi. Each player starts with his/her counters in one of the deck ovals. The object of the game is to be the first player to move all four of one's counters around the board and back to the start position. On a player's turn, he/she rolls the die. The number rolled is the number of spaces a counter may be moved on the board. The moving is always counterclockwise around the outside lines of the board unless a player lands on one of the bottom corner points. These corner points allow a diagonal shortcut. If one lands on the center dot while using a diagonal shortcut, the counter may go directly back to start. Each time one rolls the die, he/she can choose which counter to move, or take a new counter from the deck, move it to start, and start it's move around the board. If one lands on an opponent's counter, the opponent's counter is sent back to the deck. If one lands on his/her own counter or counters, the counters may be piggybacked and moved as if a single counter. Variations: When children are first learning the game, they may only have 1 or 2 counters. Additional counters may be added as children gain more experience.
Source: Adapted from Kaye



Number Relationships

Find the Prize
Math Skills: Ordinal numbers, spatial visualization, problem solving
Materials: 10 cards or paper cups, numbered 1-10, 1 prize to be hidden under one of the cards or cups
Directions: The object of the game is to guess the location of the hidden prize in 4 guesses or less. The person guessing must use an ordinal number in their guess. For example: Is it under the 3rd cup? The person who hid the prize responds by telling if the prize is closer or further than the guess. Variation: The cups or cards which are eliminated by a guess may be turned over to help the child narrow his/her guess. Children with advanced skills may play the game mentally without concrete manipulatives.
Source: Adapted from Kaye

More or Less
Math Skills: Comparison, problem solving
Materials: More or Less Gameboard, Spinner labeled with: less than <, greater than >, equals =, does not equal, 1 less than, 1 more than, 1 die, colored counters for each player
Directions: Players take turns spinning the symbol spinner and rolling the die to make a math statement such as < 5. The player covers one open number on the board that fits the statement created. Once placed, the counter may not be moved. If no open number fits the statement, the player loses that turn. The first player with three counters in a row horizontally, vertically, or diagonally, wins the game. Variations: Instead of trying to get 3 in a row, players may keep track of points covered on the board with the player with the most points winning. The size of the numbers used on the board and die may be adjusted to change the difficulty of the game. Players may roll more than one die to form multidigit numbers. Four in a row can be the object rather than three in a row.
Source: Adapted from Miller

4	9	3	5
10	2	1	8
0	5	7	2
3	11	6	4

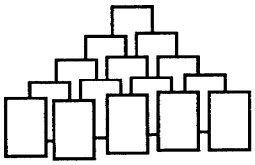
More or Less

Guess My Number
Math Skills: Classifying, comparing and ordering whole numbers, problem solving
Materials: A 100's board and counters for each player.
Directions: The leader secretly chooses a number of the 100's board. The other players try to guess the secret number. Players take turns asking the leader questions which may be answered with yes or no. For example: Is the number even? Is the number greater than 50? Does the number have a 5 in the ones place? After a question is answered, all players can cover numbers on their board which can be eliminated as the secret number. The first player who guesses the secret number on his/her turn, earns a point for that round. Variations: For younger children, have them use fewer rows on the hundreds chart. For example, row 1 only or rows 4 and 5 only. Instead of yes/no questions, players could ask a question which could be answered less than, greater than, or equal to. For example: Is it 25? It's greater than 25. The leader could respond with symbol cards labeled <, >, =. It is also possible to earn points for the number of guesses used before the number is revealed. The person with the least number of points wins. Children can also play this game without concrete manipulatives and could expand the secret number to 3-4 digits.
Source: Adapted from Schiro

Sandwiches
Math Skills: Comparison, ordering
Materials: Two sets of 0-9 cards
Directions: Each player draws two cards from a pile and arranges them on the table smallest to largest. A third card is drawn. The player scores one point if the third number is sandwiched between the two already arranged on the table. Play continues to a set number of points. Variations: For children who are having difficulty ordering their cards, provide a number line. The child can place counters on the line to represent the cards drawn. The game may also be played with 2- and 3-digit numbers. The children should be encouraged to arrange their cards to form the largest range between the first two numbers.
Source: Adapted from Currah et al. Volume II

Multiple Representations

Pyramid
Math Skills: Identify combinations of numbers which sum to 10, problem solving
Materials: 3 sets of 0-9 cards or 1-10 cards
Directions: Place 15 cards face up in 5 rows in a pyramid formation with 1 card in the first row, covered by 2 cards in the second row, etc. with the 5 cards in the 5th row on top The remaining cards are placed face down in an undealt pile to be drawn later. The object of the game is to remove as many cards as possible from the pyramid. You can only remove cards that are not covered by any other card in the pyramid. You can only remove a pair of cards that add to ten or one card with a value of ten. Begin by moving, to a tens pile, any tens or sums of ten that are uncovered. Next turn over the top card from the extra pile. If it is a ten or if it can be matched with any uncovered card to form a ten, move them to the tens pile. If you cannot use the top card, place it face up in a discard pile. Keep turning over the top card from the undealt pile, moving tens or sums of ten to the tens pile. You may match cards from the pyramid, from the undealt pile, and from the discard pile. When you have gone through all of the cards from the undealt pile, go through those in the discard pile again. The game is over when you have used up all of the extra cards or removed all cards from the pyramid. Variations: A list of numbers that sum to 10 may be provided for children who need them. The game may be made more difficult by including face cards. You would deal 28 cards into 7 rows and would look for sums of 13.
Source: Adapted from Polonsky et al.



Five Cards Make Ten
Math Skills: Identify equations which can be used to make ten, problem solving
Materials: 3 or 4 sets of 0-9 or 1-10 cards
Directions: Deal 5 cards to each player. Using the numbers in their hand, players try make equations which equal ten. To make an equation, you can add or subtract any of the 5 cards but can't use a number more than once in a single equation. You may only use a combination of numbers one time. For example if you have used 1 + 2 + 7, you cannot use 7 + 2 + 1. Players record each equation as it is identified and score 1 point for each equation identified. Variations: You can limit the operation to only addition or allow all four operations. You can allow the use of fact families so that 2 + 8 and 8 + 2 would each earn a point. You can deal 6 cards instead of 5 to allow for more combinations.
Source: Adapted from Kaye

From 1-12
Math Skills: Represent the numbers 1-12 in a variety of ways
Materials: Two dice
Directions: The object of the game is to be the first person to throw the dice in order from 1 to 12. The first person rolls both dice and tries to get a 1 on either die. If a 1 is rolled, a 2 is needed on the next round. Each player only gets one roll per round. To get a 2,3,4,5, or 6 you can use either the number on only one of the dice or the total of the numbers on both dice. For the remaining numbers, 7 through 12, you will need to use the total of the numbers on both dice. Variations: To simplify the game, the winner can be the first person to get to 6 or any agreed-upon number. The game can be expanded to include all four operations.
Source: Adapted from Polonsky et al.

Running Sum
Math Skills: Represent a predetermined sum in a variety of ways.
Materials: Seven sets of 0-9 cards.
Directions: Select a target number between 10 and 20. Deal each player 15 number cards. Each player places two or more cards face up in a line on the table. The numbers in the run must add up to the target number. The next player adds more cards to the table in a manner similar to Scrabble. Each new run must be connected to a card in the previous run. Also the sum of the new cards plus the interconnecting card must equal the target number. If a player cannot play, he/she must pass. Extra cards may be drawn to replace those played. The game ends when one player has no more cards or when all players have passed and none can play any of their remaining cards.
Source: Adapted from Schiro

Place Value

Trading Game
Math Skills: Counting, addition, regrouping
Materials: A place value mat for each player, two dice, base-ten blocks or pennies, dimes, and dollars
Directions: Each player takes a turn rolling the dice, adding the numbers, and taking that number of pennies or unit blocks. They are placed in the penny or ones column. As soon as 10 of them are collected, the player trades for a dime or long block. On each turn the player should say the number represented on the mat. If the player does not trade when able to do so and another player notices, the other player receives a penny or unit block from the first player. The first player to reach a dollar or a flat wins the game. Variation: Start with a dollar or a flat and have students subtract the amount rolled on the dice. The first to reach zero wins. Players can be asked to record their progress.
Source: Adapted from Schiro

Hundreds	Tens	Ones

OR

Dollar	Dimes	Pennies

Double Digit
Math Skills: Place value, addition, subtraction, estimation and mental computation
Materials: Place value mat for each player, one die
Directions: Each person takes a turn rolling the die. The number may be written in the tens column or the ones column of the place value mat. When a number is entered in the tens column, zero is written next to it in the ones column. After each player has rolled the die seven times, the players add their numbers. The player who is closest to 100 without going over is the winner. Variations: Students could also model the numbers with base-ten blocks. Dimes and pennies may be substituted for base-ten blocks. Have students start with 100 or one dollar. They subtract tens or ones with the goal being closest to zero after seven rolls.
Source: Adapted from Stenmark et al.

Place My Digits
Math Skills: Place value, problem solving
Materials: Paper and pencil
Directions: The goal is to guess the leader's secret three-digit number. The digits in the secret number must be all different. The leader gives clues after each written guess. For example

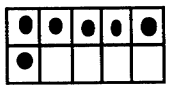
None of the digits are correct.
A __ number of the digits are correct, but are in the wrong place.
A __ number of the digits are correct and in the correct place.

Variations: Play with 2 digits or more than 3 digits.
Source: Adapted from Stenmark et al.

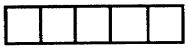
Computation

Make Ten
Math Skills: Addition with concrete objects
Materials: A Ten frame for each player, 10 counters for each player, one die
Directions: The players take turns rolling the die and placing that number of counters on the first column of the ten frame. The winner is the first to completely fill their ten frame. Players may be encouraged to verbalize how many spaces are filled and how many more are needed. Variation: Start with all of the spaces filled and play Take Ten (subtract the number rolled). The first to clear the board is the winner. For younger children use a five frame. For older students fill in several ten frames.
Source: Adapted from Kaye

Ten Frame



Five Frame



Target Addition
Math Skills: Mental addition, problem solving
Materials: Target Addition gameboard, colored counters
Directions: Choose a target number between 25 and 55. Players take turns placing a marker on the board each time announcing the total of the covered numbers. The first player to reach the target number EXACTLY wins. If a player goes over the target number he or she is out of the game. Variations: Change the size of the target number. Use counters to help with the addition if needed.
Source: Adapted from Stenmark et al.

Target Addition

5	5	5	5	5
4	4	4	4	4
3	3	3	3	3
2	2	2	2	2
1	1	1	1	1

Race to the Nineties
Math Skills: mental computation
Materials: 100 board, a counter for each player, four each of arrow cards (up, down, left, right, diagonal left down, diagonal right down, diagonal left up, diagonal left down, double down, 1 right, 1 down, 1 left, one down)
Directions: Each player starts on the first square of the 100 board. Players take turns drawing a card and following the arrow on the board. If a playing piece is moved onto a space already taken by another piece, the piece that was on the space first is bumped back to the first square on the board. If a card's move would make the player go off the board, another card is selected. During the turn players must state and/or write the equation the corresponds to their move. For example if the player is on 25 and draws an up arrow, the equation is 25-10=15. The winner is the first player to reach the bottom row of the game board. Variation: Use a smaller game board. for example, 1-50.
Source: Adapted from Schiro

Circles and Stars
Math Skills: Create a repeated addition model for multiplication facts
Materials: paper and pencil, two dice
Directions: Each player rolls the dice. The first die tells the player how many circles to draw. The second tells how many stars go in each circle. The player counts the total number of stars and records the number on the paper. The player with the most stars wins one point for the round. Play continues for a designated number of rounds. Variation: Players can record the multiplication equation. Players can keep track of the total number of stars drawn. The player with the most stars wins.
Source: Adapted from Kaye

Build a Rectangle
Math Skills: Create an array model for multiplication facts
Materials: Grid paper, crayons, two dice
Directions: Each player rolls the dice. The first die tells the player how wide to draw the rectangle. The second die tells how tall to draw the rectangle. The player counts the total number of squares in the rectangle and records the number inside. He/she records 1 point per square. The player with the most points after a designated number of turns is the winner. Variation: Players can record the multiplication equation.
Source: Adapted from Kaye

Bibliography

Currah, J., Felling, J., & MacDonald, C. (1994). Math Games for Kids using Cards and Dice: Box Cars and One-Eyed Jacks Volume I Box Cars & One-Eyed Jacks, Canada.

Currah, J., Felling, J., & MacDonald, C. (1994). Math Games for Kids using Cards and Dice: Box Cars and One-Eyed Jacks Volume II Box Cars & One-Eyed Jacks, Canada.

Kaye, P. (1987). Games for Math. Pantheon Books, New York.

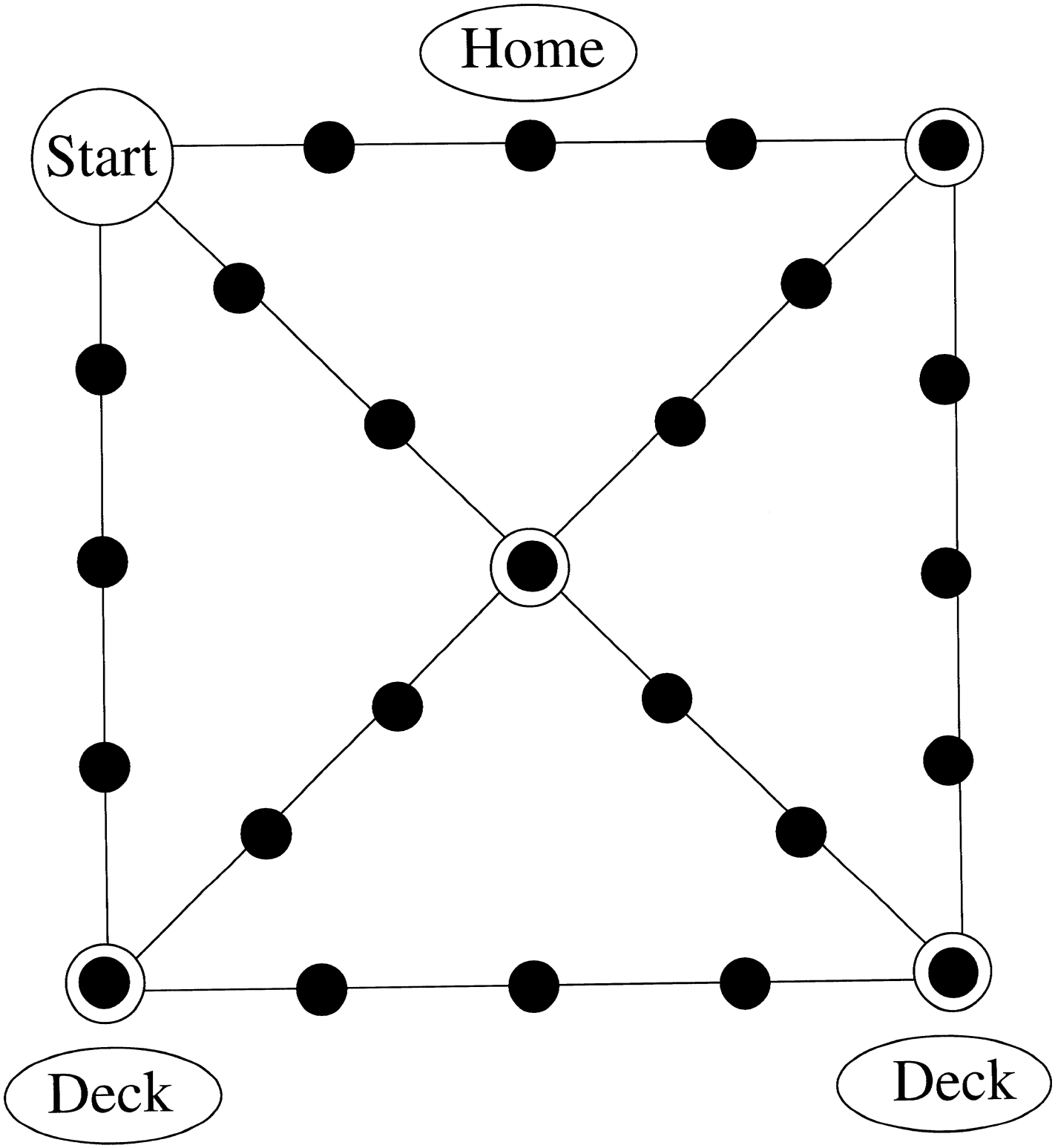
Miller, M. (1996). Quick and Easy Learning Games: Math. Scholastic Professional Books, New York.

Polonsky, L., Freedman, D., Lesher, S., & Morrison, K. (1995). Math for the Very Young. John Wiley & Sons, Inc. New York.

Schiro, M. (1995). Mega-Fun Math Games. Scholastic Professional Books, New York.

Stenmark, J., Thompson, V., & Cossey, R. (1986). Family Math. Lawrence Hall of Science, Berkeley, CA.

YUT



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

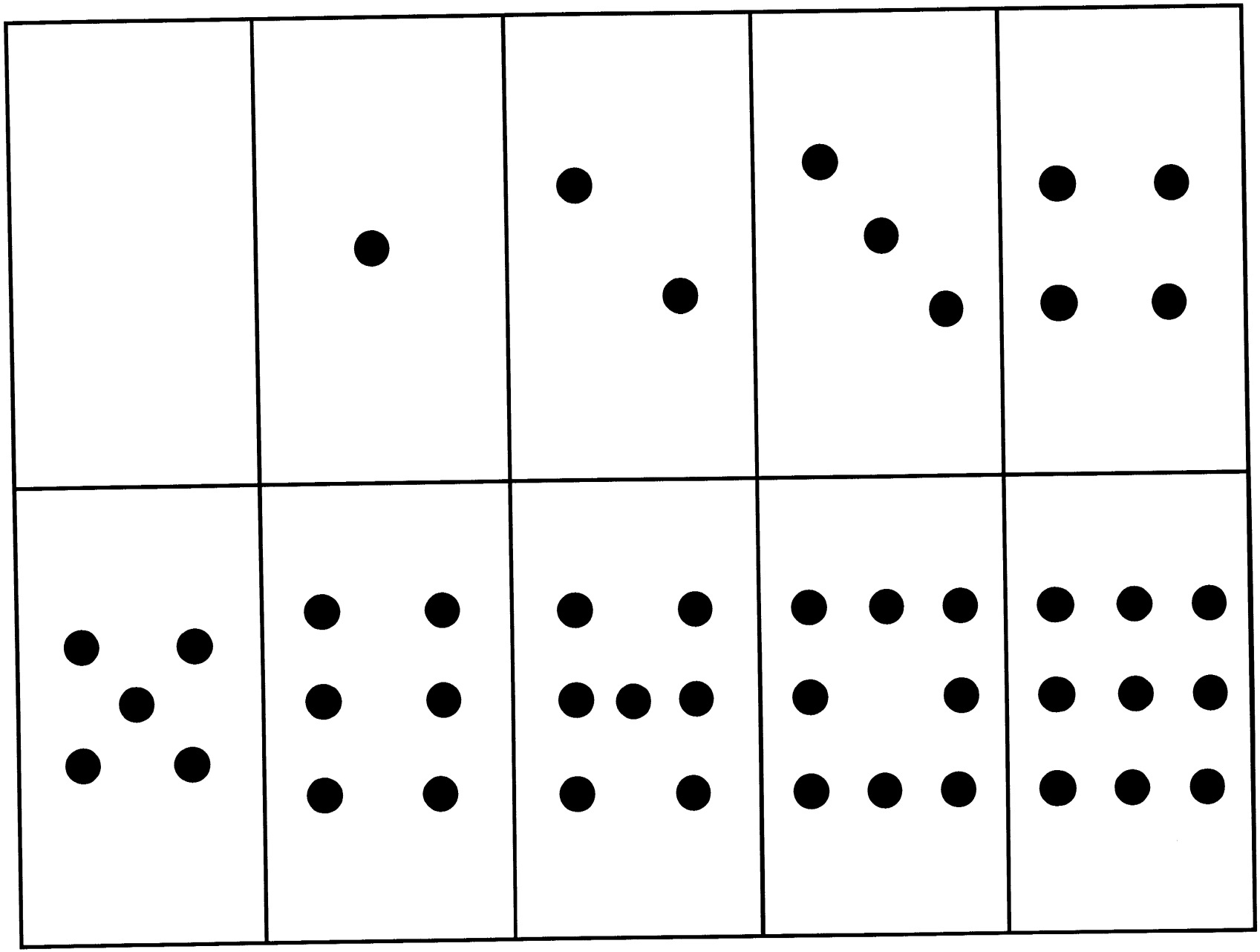
Target Addition

5	5	5	5	5
4	4	4	4	4
3	3	3	3	3
2	2	2	2	2
1	1	1	1	1

More or Less

4	9	3	5
10	2	1	8
0	5	7	2
3	11	6	4

0-9 Cards



0-9 Cards

0	1	2	3	4
5	<u>6</u>	7	8	<u>9</u>

Hundreds	Tens	Ones
Dollars	Dimes	Pennies

<	+ 1	<	+ 1	<	+ 1
=	+ 2	=	+ 2	=	+ 2
- 2	≠	- 2	≠	- 2	≠
- 1	>	- 1	>	- 1	>
<	+ 1	<	+ 1	<	+ 1
=	+ 2	=	+ 2	=	+ 2
- 2	≠	- 2	≠	- 2	≠
- 1	>	- 1	>	- 1	>

Race	Race	Race	Race	Race
Race	Race	Race	Race	Race