A teacher's manual of manipulatives for the fourth grade

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A TEACHER'S MANUAL OF MANIPULATIVES
FOR THE FOURTH GRADE

A Project Submitted to
The Faculty of the School of Education
In Partial Fulfillment of the Requirements of the
Degree of
Master of Arts
in
Education: Elementary Option

By
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Statement of the Problem

The purpose of this project is to provide a manual of games and activities for use with the adopted fourth grade mathematics textbook.

Although most mathematics instruction in the fourth grade is textbook oriented, research shows us that the use of games and activities promotes thorough understanding of mathematical concepts and provides important motivation for students.

Procedure

The mathematics framework developed by the Moreno Valley Unified School District was examined to determine the skills which are to be taught in the fourth grade. Games and activities were then compiled from various sources which seek to teach, remediate, and enrich those skills. Each game or activity includes a topic, an objective, the suggested number of players when appropriate, the materials needed, and directions for play or completion. A sample of any necessary gameboards was
then completed by the author. Games and activities were then assembled in order, according to the Moreno Valley Unified School District's mathematics framework. From this the author produced a mathematics game handbook which was made available to other fourth grade teachers on staff.

Results

It has been this writer's experience that the games and activities assembled for this handbook have proven motivating and educational. Students look forward to participating in math lessons and are involved in cooperative learning groups. Other fourth grade teachers at my school site are using these games and activities as a teaching alternative.

Conclusions and Implications

I have found that the use of games and activities in the classroom has increased the enthusiasm and interest level of the student. Other fourth grade teachers at my school have found the use of games and activities as an alternative approach to teaching mathematics. With an increased understanding of the concepts used in mathematics, students should find greater success in math with fewer misunderstandings.
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This project is dedicated to my wife, Ginger, whose help made it all possible.

Richard J. Martin
INTRODUCTION

The mathematics program in most schools is, all too often, removed from the real world of the child. It is a program dominated by the district adopted textbook, which concerns itself primarily with the manipulation of symbols rather than concrete objects. (Post, 1974) Although the adopted text has its place in the classroom, it should be supplemented with games and activities which serve not only to motivate the learner, but offer choice and variety to accommodate differences in ability, learning style, and the interest of each student. When properly chosen, manipulative materials promote the understanding of mathematical concepts and, at the same time, provide motivation for the learner.

The solution to this problem is not, however, to eliminate the text in favor of a curriculum composed solely of games and activities. This approach would place a heavy burden on the child who transfers from one school to another, or even one grade to the next, as there would be little consistency in the mathematics program offered by each teacher. It is, however, possible to develop a program of games and activities which will complement the district mathematics framework along with the adopted textbook without causing the learner any problems.
This project centers around the use of games and activities which assist the fourth grade teacher in providing motivating and concept-developing lessons for the learner.
REVIEW OF THE LITERATURE

The mathematics curriculum adopted by most teachers is that which has been provided by the textbook. This means that the student is required to manipulate symbols rather than concrete objects. This situation exists in spite of research which has been done over many years indicating that the use of manipulatives promotes a better understanding of mathematical concepts and provides a great motivational force for the student. The following is a review of literature which supports the use of manipulatives, games, and activities in the classroom.

Piaget (1973) was concerned with the development of the normal child, stating that each is capable of good mathematical reasoning when activities are directed to his interests. He further stated that the use of concrete activities must be developed and used throughout the learner's elementary education. This concept was based upon his theory that children pass through a variety of thinking processes as they develop, including the stage of concrete operations. During this stage (age 7-11) a child attains, for the first time, the use of fully logical operations. "Thought is no longer dominated by perceptions, and the child is able to solve problems that exist or have existed (are concrete) in his or her
experience." (Wadsworth, 1984, p. 132) This writer feels that young children must rely upon experiences with concrete objects if they are to comprehend the reasons behind mathematical concepts. When children have had the opportunity to manipulate concrete objects, they will be able to internalize those manipulations and, later, transfer this visual manipulation to actual mathematical computations.

Beatrice Ward (1970) supports Piaget by reporting that manipulatives are particularly important because many of the major concrete operations theorized by Piaget are mathematically oriented. This means, she tells us, that children must be actively involved in the use of manipulatives while learning mathematical concepts.

An early innovator in education, Montessori (1975) recognized the need to provide students with meaningful materials in order to promote the grasp of abstract concepts. Students were encouraged to experiment with objects designed to allow independent discovery and understanding. Her use of manipulatives remains the heart of the Montessori approach to learning.

Fennema (1973) says that the most important reason behind the use of manipulatives is to make the abstract world of mathematics more meaningful for the student. Williams (1986) agrees with this idea, pointing out that
children often see no connection between writing numbers in a book and mathematics. She suggests the use of games to help children develop logical thinking skills. This writer believes that the use of games in the classroom can bring the child in contact with some of the outside world by providing activities similar to those we all experience daily.

It is pointed out by Kennedy (1986) that children whose mathematical learning is based in manipulatives will be more likely to succeed in the abstract world of mathematics. He believes that manipulatives will help students to understand both the meanings of mathematical ideas and the application of those ideas to the real world.

Dienes (1960), too, advocates the use of manipulative materials by children. His use of multibase blocks and other materials is described as helping to build the child's understanding of numbers. This view is shared by Englehardt, Ashlock, and Wiebe (1984) who state that manipulative aids help children to understand what numerals mean so that they can use them more effectively when estimating or solving problems. They go on to support the work of Piaget by pointing out that a child who has inadequate experiences may "learn an erroneous concept or process." (p. 184) They maintain that the cure
for this lack of experience is to provide children with a variety of materials in an effort to guide them towards accurate concept development.

In the book *Helping Children Learn Mathematics*, Reys, Suydam, and Lindquist (1984) discuss the need for children to have experiences with physical objects in order to develop understandings about mathematical operations. They point out the fact that "research has indicated that work with actual physical objects promotes achievement for most children." (p. 91) The concern expressed by these authors is their fear that the move from concrete materials to the abstract takes place too early in the learning process. They recommend the use of materials prior to and parallel with the use of symbols. Reys (1971) further points out that we must primarily concern ourselves "with concept formation as opposed to the memorization of facts." (p. 551) This, he feels, is an important function of classroom manipulatives.

Copeland (1979) points out that the firsthand use of objects is necessary for learning and that children should be encouraged to compare objects in order to determine possible relationships that exist between their characteristics and properties. Mathematics, he points out, is a comparison of relationships. One compares weight, size, and shape for example. It is best to allow
the child the opportunity to make these comparisons for himself in order for "a real idea of number and geometry to develop." (p. 371) This opportunity for comparison is a necessary part of a quality mathematics curriculum. Although it is often considered appropriate only in a mathematics laboratory, it is both possible and desirable to provide activities in the regular classroom which allow a child the chance to compare objects while learning new concepts.

In his article "The Teacher's Role in Increasing Student Understanding of Mathematics", Simon (1986) indicates that teachers are increasingly using an exploration and discovery approach to the teaching of mathematics, providing students with the opportunity to do mathematics as opposed to learning about it. This approach, he theorizes, challenges students to think more deeply about the concepts they are learning. As a result, he claims, retention is higher than with those students who have had to rely upon teacher or textbook explanations. He comments that students must have the opportunity to learn actively in order to use mathematics with confidence.

In their research, Suydam and Higgins (1977) found that the use of manipulatives had a higher probability of producing greater mathematics achievement than those
lessons that do not employ such materials. They went on to report that children should be involved in the use of manipulative materials as this allows them to be involved in the process of doing mathematics. Why, they wondered, have so few teachers employed the use of manipulatives when, according to their research, it is believed by most that their use is important to the understanding of math concepts? As a classroom teacher, this writer believes that many teachers are reluctant to try anything that is unfamiliar. The playing of games as a part of the mathematics curriculum is not a familiar activity for most teachers.

Schminke (1985) expresses the view that children can understand the concepts and principles appropriate to their development through the use of games and activities rather than through "long, repetitive, and laborious assignments." (p. 46) He feels that the use of games can help children by providing them with opportunities for inquiry, exploration, pleasure, and interest rather than endless problems to be solved. This writer believes that it is important to recognize the role interest plays in learning. When a child enjoys his work he will learn a great deal and, perhaps, develop an intrinsic interest in his course of study.

The use of games plays an important role in
motivating students in the classroom according to Ernest (1986), as they "generate enthusiasm, excitement, involvement, and enjoyment." (p. 2) He further maintains that the playing of games helps to take the drudgery out of the practice of skills, making the practice more effective than paper and pencil drills. This general enthusiasm should enhance the student's attitude towards mathematics over a period of time, which may result in greater success. The importance of motivation is also discussed by Doris R. Ensminger (1980) in her article "Games--More Than Just Fun!". She states that classroom games can motivate, teach, and reinforce. The use of games, she reports, provides children with a change of pace which allows for differing abilities and interests. She suggests that game selection, then, is an important part of the teacher's responsibilities. She warns that games should not be overwhelming for the players, that topics should not quickly become obsolete, and that rules governing game playing should be easily mastered. If a child is to see the game as fun, she states, it should offer some level of physical involvement. While these are fairly simple rules to follow, this writer feels that they are important to remember when selecting games to purchase or make.

Crescimbeni (1969) agrees with the importance of
motivation. He tells us that mathematical games and activities play a definite role in the process of learning and points to the motivational forces that learning aids provide. They not only improve understanding, he reports, but also allow children to satisfy their curiosity about mathematics.

Further agreement on the subject of motivation comes from the work of Werner Liedtke (1980) who says that there is "something intrinsically motivating about a game" (p. 30) which allows us to use them to review and reinforce math skills. Not only that, but games also allow the teacher to vary his teaching methods in order to provide the student with a purpose for having learned a concept, skill, or idea. In a game setting, he reports, children have the opportunity to collaborate and interact socially with other children which is an experience that is "valuable in terms of their intellectual development." (p. 30) To promote the motivational factor a game can provide in the classroom, Liedtke warns us that games should be quickly understood by potential players, that lengthy games are often frustrating, and that rules are made to be broken. He points out that the formation of new rules by the players can lead to greater interaction, cooperation, and success. It is this writer's opinion that teachers should encourage students to create new rules for games.
available in the classroom as it requires concept development and application. The student who develops new rules of play must also be able to explain these rules to his peers, demonstrating further understanding of the concept being learned.

Kerr (1974) tells us that "games are fun, and it is important to have fun." (p. 172) This is good, he maintains, because fun is not generally associated with mathematics. He warns, however, that the games chosen must complement the regular lesson to justify the time spent on them. Bright, Harvey, and Wheeler (1983) agree with Kerr, stating that games must be chosen carefully and that "teachers need to have realistic expectations of the effectiveness of games." (p. 404) It is up to the teacher, this writer believes, to choose games that will enhance the curriculum. Furthermore, careful monitoring of activities is important in order to prevent the practicing of incorrect concepts and to call to an end the playing of games when it becomes obvious that further play will not produce positive results.

Manipulatives are also important when working with students who have special needs. Herald (1974) declares that it is essential for children who are having difficulty with math to have the opportunity to work with concrete aids. Suydam and Higgins (1977) also tell us
that manipulatives can be used to provide remedial help for students having difficulty learning math concepts. In his article "Curricular Issues", Moser (1986) encourages the use of manipulatives for students in need of remediation. He goes on to theorize that the proper use of manipulatives in the early stages of learning could eventually eliminate the need for remediation.

Thornton and Wilmot (1986) direct particular attention to the needs of the special learner. They differentiate between the handicapped learner and the gifted learner, but indicate the need for manipulatives is important for both. They report that manipulatives help the handicapped learner see relationships that enable them to follow the flow of computational procedures, while the gifted learner may use manipulatives to extend thinking to higher levels. Additionally, this writer has found in the classroom that games allow these two special learners the opportunity to interact on a common, equal ground which other learning techniques do not provide.

It is apparent that researchers, studies, and educational philosophers agree on the use of manipulatives in the classroom. Reasons range from the understanding of abstract concepts through concrete objects to the motivation provided by manipulatives. It is also important to note that the use of manipulatives allows the
learner the opportunity to participate in mathematics. As Post (1974) notes, "mathematics learning is not a spectator sport and, as such, requires a very active type of physical and mental involvement on the part of the learner." (p. 619)
STATEMENT OF OBJECTIVES

Research shows us that the use of manipulatives in the teaching of mathematical concepts is important. It is believed that, when children have had the opportunity to manipulate concrete objects, they will be able to internalize those manipulations, bringing about a greater understanding behind actual mathematical computations. With this in mind, it is my objective to supplement the fourth grade mathematics program with games and activities which will reinforce, remediate, and enrich the teaching of math in the classroom. It is further hoped that this work will encourage other teachers to adopt the use of games and activities as a part of their teaching strategies.
STATEMENT OF DESIGN

In order to attain the objective stated, I plan to provide games and activities which will correspond with many of the skills recommended by the Moreno Valley Unified School District's Mathematics Framework. This framework was developed by the teachers of the Moreno Valley Unified School District for use with the adopted mathematics textbook.

The following are the areas for which games or activities will be provided:

1. Counting
2. Order
3. Place value
4. Expanded notation
5. Addition facts
6. Subtraction facts
7. Multiplication facts
8. Division facts
9. Identification of fractions
10. Identification of geometric figures
11. Graphing ordered pairs on a coordinate plane
12. Estimation
13. Using money
14. Linear measurement

It is hoped that the games included for the above skills will provide alternative learning approaches which will encourage student mastery. It is intended that they supplement rather than supplant the existing textbook.
LIMITATIONS

Because this project is primarily designed to meet the needs of one school district, its usefulness will be limited to fourth grade teachers with similar goals in mathematics.

This project is designed for use in the Moreno Valley Unified School District, considered to be the fastest growing school district in the state. With a large influx of new students from various school districts, it is important to provide a common ground from which to begin instruction.
ODD AND EVEN

Topic: Counting
Objective: To reinforce and enrich
Number of Players: Two to four
Materials: Gameboard
Two dice
Game piece for each player

Directions:
1. Player rolls two dice. If 2 even numbers show, move forward 1 space. If 2 odd numbers show, move forward 2 spaces. If 1 even and 1 odd number show, move 3 spaces forward.
2. If players land on a space with writing, they follow the directions given.
3. Player throwing doubles goes forward 2 for even numbers and 4 for odd numbers.
4. First player to reach the end wins.

Odd and Even

[Diagram of a game board with various spaces labeled as 'Free turn', 'Ahead spaces', 'Back spaces', 'Lose turn', 'Winner', '2', '3', '5']
EVEN-ODD GAME

Topic: Counting
Objective: To reinforce and remediate
Number of Players: Two
Materials: Gameboard
Two counting cubes, numbered 1,3,5,7,9,11 and 2,4,5,7,8,9.
Two markers for each player
Directions: 1. All counters are placed on START.
2. Players take turns rolling the counting cubes.
3. Multiply the two numbers.
4. If the product is an even number, move either marker forward one circle to the left.
5. If the product is an odd number, move either marker forward one circle to the right.
6. Take turns doing the same at each new circle.
7. More than one counter can be on a circle.
8. Your score is either the sum of the last two circles each marker lands on or the sums of the last two products for each marker.
9. Winner is the player with the highest score after five games.

Start

Even-odd game
COUNT UP

Topic: Counting
Objective: To reinforce and remediate
Number of Players: Two to four
Materials: Cards with one, two, five, and ten on them. Die Gameboard Game marker for each player
Directions: 1. Players throw the die. The one with the highest number draws a one, two, five, or ten card. This determines what the players will count by.
2. The first player throws the die and moves ahead the number of ones, twos, fives, or tens indicated by the card. (for example: If a five card is drawn, the first player would throw the die. If it landed on three, the player would move ahead three fives. If a two card is drawn and a three is thrown, the player would move ahead three twos.)
3. Take turns. The first to reach 100 wins.

ORDER UP

Objective: To reinforce and remediate

Number of Players: Two to four

Materials: Gameboard
Two sets of cards numbered 1 to 100
A marker for each player

Directions:
1. Each player draws a card. The player with the highest number goes first.
2. The first player draws two cards, compares them, and moves his marker to the correct sign.
3. If a player misses a correct answer, he loses a turn.
4. Take turns. The first to reach the finish is the winner.

ORDER IT

Topic: Order

Objective: To remediate and reinforce

Number of Players: One to a whole class

Materials: Student activity sheet and a pencil for each player

Directions: 1. Remove and reproduce a student activity sheet for each player.
2. Students are to put the letters in the right box.
3. Observe the players to be certain directions are being followed.

ORDER IT

R 9 x 7
L 6 x 3
E 9 x 9
O 6 x 9
A 4 x 2
T 21 x 5
R 25 x 3
C 7 x 7
L 12 x 2
C 27 x 3

N 37 x 21
O 37 x 17
L 26 x 9
E 13 x 13
D 29 x 18

R 29 x 29
I 16 x 16
N 19 x 19
O 27 x 27
W 25 x 25
E 21 x 21
F 12 x 12
K 21 x 31
DIGIT HUNT

Topic: Place value
Objective: To reinforce and remediate
Number of Players: Two to four
Materials: Gameboard with spinner
40 cards, 4 each numbered 0-9
Markers
Directions:
1. Each player places a marker at the start. The player draws a card, then spins the spinner. The player then moves to the space on the board that has that number in the place given by the arrow on the spinner.
2. If two players land on the same number, the second one has to go back to the start. Players have to go to the nearest space for which they are looking, even if it means going backward.
3. The first player to reach the last space is the winner.

Source:
Unpublished.
DIGIT DELIGHT

Topic: Place value
Objective: To reinforce and remediate
Number of Players: Two
Materials: Gameboard
          Cards (two sets numbered 0-9 and two wild).
          Markers of different colors
Directions: 1. The players place their markers anywhere on the board to start.
2. The first player takes a card.
3. The player may move one space in any direction, but must move to a number that has his digit.
4. The player receives as many points as the value of the digit in the number. (For example: The player would receive 70 points for the '7' in 476, or 700 points for the '7' in 713.)
5. Take turns. Use all the cards. The highest score wins.

# Digit Delight

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EXPANDO RELAY

Topic: Expanded notation

Objective: To reinforce, remediate, and enrich

Number of Players: Two or more

Materials:
- Chalk and chalkboard
- Two paper bags
- Cards numbered with those numerals on which expanded notation is needed.

Directions:
1. Place an equal number of cards in each paper bag.
2. Select two teams from the players.
3. Designate space on the chalkboard for each team and place a bag of cards nearby.
4. At a given signal the first player on each team pulls a card from the bag and writes that number on the board in expanded notation. Example: $64=6\times10 + 4(10$
5. When finished, the player touches the hand of the next player on that team, who then proceeds as did the first. Play continues until all players have had a turn. Incorrect responses must be corrected by the player before the next player may pull a new number card.
6. The winning team is the team which completes the relay first.

Source:
DISC SLIDE

**Topic:** Addition facts

**Objective:** To remediate and enrich

**Number of Players:** Two

**Materials:** One disc for each player

**Gameboard**

**Directions:**

1. Player takes a disc, puts it on the start box, and gives it a push onto the gameboard.
2. Player adds the numbers of all squares touched by disc.
3. If the disc lands on any of the four border areas, the player follows the instruction written there.
4. If the disc lands where two lines cross space, four numbers can be added to the score.
5. The winner is the player who accumulates 50 points.

**Source:**

## Disc Slide

### Rules:
- **Start Here**: Begin at the bottom left corner.
- **Lose Your Turn**: If you land on any cell with a '0', you lose your turn.
- **Subtract 5 Points**: If you land on any cell with a '5', subtract 5 points from your score.
- **Subtract 10 Points**: If you land on any cell with a '10', subtract 10 points from your score.

### Grid:

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</table>

*Start by subtracting 10 points from your score.*
PENTA-GONE

Topic: Addition facts

Objective: To remediate, reinforce, and enrich

Number of Players: Two

Materials: Gameboard covered with clear Contact Paper Crayons

Directions:
1. Two players share the same gameboard. One player uses a red crayon, the other a blue one.
2. Each player, taking a turn, colors over one straight line on shape 'A'. A player may trace a line that is inside or around shape 'A', as long as it has not been colored already.
3. Whenever a player covers three lines of any box, the number inside that box belongs to him and he circles that number with his crayon.
4. Play continues until each number is circled in shape 'A'. The players then total their circled numbers. The player with the highest total wins shape 'A'.
5. Players alternate starting each shape.
6. The winner is the player who wins three shapes.

Penta-gone

A

B

C

D
DOUBLE CASINO

Topic: Addition facts

Objective: To remediate and reinforce

Number of Players: Two

Materials: Gameboard with two number strips numbered 1-12
Two dice
24 markers

Directions: 1. Player rolls the pair of dice, and covers the sum of the numbers rolled on the board.
2. If the number is already covered the player loses the turn.
3. The player who covers all the numbers first is the winner.

Double Casino
DOUBLE CROSS

Topic: Subtraction facts
Objective: To remediate, reinforce, and enrich
Number of Players: Two to six
Materials: Game sheet

Directions:
1. Each player receives a game sheet and randomly writes the numbers 6 through 30 in the 25 circles, with each circle having a different number. Once a number has been placed in a circle, it is crossed out on the gamesheet. The players must not see each other's gamesheet.
2. Each player takes a turn choosing a coordinate by calling the letter-number combination. He calls the letter first and the number second.
3. Following this procedure, the players locate the number circle for the called coordinates. If player 'A' calls the coordinate B-4, both players locate B-4 on their gamesheets. On player 'A's' gamesheet B-4 may be 15, while on player 'B's' gamesheet B-4 may be 9.
4. The players then subtract the smaller number from the larger as in the above example, 15-9=6. Since player 'A's' number was larger, six points are scored.
5. Each player crosses out the number circle once it is used. These circles cannot be chosen again.
6. The game continues until all
circles have been used. The player with the highest score wins.

Double Cross

Numbers to be put in circles
COOL OFF

**Topic:** Subtraction facts

**Objective:** To remediate, reinforce, and enrich

**Number of Players:** One to four

**Materials:**
- Gameboard
- Dice
- Four pairs of markers

**Directions:**
1. **Start with markers on 100.**
2. **Roll the dice.** Add the two numbers together and then subtract that total from 100. Place markers on that number.
3. **Each player takes a turn throwing the dice.**
4. **On succeeding turns the player subtracts the value of the two dice from the previous answer.**
5. **The first player to reach 0 (zero) is the winner.**

<table>
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<td>5</td>
</tr>
<tr>
<td>40</td>
<td>4</td>
</tr>
<tr>
<td>30</td>
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<tr>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>
KANGAROO

Topic: Multiplication facts

Objective: To reinforce, remediate, and enrich

Number of Players: Two

Materials: Gameboard
Scissors

Directions:

1. One player cuts out all numbered squares while the other player cuts out all numbered circles.

2. Each player arranges either the circles or the squares in the first three rows of the gameboard, as in checkers.

3. Players follow the same rules as for checkers. When a player is about to jump the opponent, that player's number must be multiplied by the opponent's number before moving. For example, if a player is about to jump a square 8 with a circle 6, the answer, 48, must be called out prior to moving. If more than one jump is to be made, the equation must be called out prior to each move. If the equation is solved incorrectly, the move does not take place and the turn is lost.

4. The player wins who captures all of his opponents men. If neither player can capture all of his opponent's men, the game is a draw.

Englewood Cliffs: Prentice-Hall.
Square cut-outs

Circle cut-outs

KANGAROO
Match the number tags to the spaces. Use each tag only once.

A  
B  
C  
X  
X  
X  

18  24  40  

D  
E  

×  = 0  
×  = 21  

<table>
<thead>
<tr>
<th>9</th>
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<th>1</th>
<th>2</th>
<th>3</th>
</tr>
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<tbody>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>
LEFTOVERS

Topic: Division facts
Objective: To reinforce, remediate, and enrich
Number of Players: Two
Materials: Gameboard with spinner Markers
Directions:
1. Each player spins to see who starts. High number wins.
2. The first player places the marker on GO, then spins a number. The number is then taken and divided into 10, the first number after GO. The remainder in the answer determines the number of spaces the player may move forward with the marker. It is now the second player's turn.
3. For each successive spin the players divide the number they spin into the number where their markers previously landed.
4. If the remainder is zero, the player stays in the same space.
5. If an incorrect answer is given, the turn is lost.
6. The player who reaches the CHEESE first is the winner.

MATCHMAKER

Topic: Division facts
Objective: To reinforce and enrich
Number of Players: Two
Materials: Gameboard Cards

Directions:
1. Each player cuts out the thirty cards on his gamesheet.
2. All 60 cards are shuffled together. Each player takes five cards. The remaining cards are placed face down in a pile. The top card is turned over. Neither player sees the other's cards.
3. Player 'A' goes first, either taking the card in the central pile or taking the card turned over. If he matches the drawn card, he places the pair aside (out of play). He is attempting to match a problem with an answer. Player 'A' then discards a card and puts it face up near the central pile. In order to make a match, player 'B' takes a card from the discard pile or the central pile.
4. A player can take any card in the discard pile, providing all of the cards above it are taken as well.
5. Play continues until one player has no cards left in his hand or until there are no cards left in the central pile.
6. The winner is the one with the most matched pairs.

<table>
<thead>
<tr>
<th></th>
<th>63 ÷ 7</th>
<th>36 ÷ 6</th>
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<th>4</th>
<th>7</th>
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<tr>
<td>18 ÷ 9</td>
<td>81 ÷ 9</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td></td>
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<tr>
<td>12 ÷ 12</td>
<td>32 ÷ 8</td>
<td>5</td>
<td>6</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>45 ÷ 9</td>
<td>40 ÷ 8</td>
<td>35 ÷ 5</td>
<td>7</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>27 ÷ 9</td>
<td>42 ÷ 6</td>
<td>36 ÷ 9</td>
<td>8</td>
<td>6</td>
<td></td>
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<tr>
<td>54 ÷ 9</td>
<td>72 ÷ 9</td>
<td>24 ÷ 3</td>
<td>9</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>
FRACTURE

Topic: Identification of fractions

Objective: To reinforce and enrich

Number of Players: Two to four

Materials: Gameboard
Fractional pieces

Directions:
1. Fractional pieces are dealt to each player. Players then cover the shapes on the board with the pieces (one during each turn).
2. Players must estimate where their piece belongs without holding it up to the board. If a piece does not fit, it must be discarded and the player loses his turn.
3. If a player completes a whole, 5 points are scored. Play continues until all pieces have been used. The player with the most points is the winner.

FRACTIONMATCH

Topic: Identification of fractions

Objective: To enrich

Number of Players: One to a whole class

Materials: Student activity sheet, ruler, and a pair of scissors for each player

Directions:
1. Remove and reproduce the student activity sheet for each player.
2. Players are to cut out the squares on the activity sheet and match them to their equivalents.

CUT OUT THE SQUARES. FIT THEM TOGETHER SO THAT THE EDGES THAT TOUCH NAME THE SAME NUMBER.

<table>
<thead>
<tr>
<th></th>
<th>2/4</th>
<th></th>
<th>2</th>
<th>2/10</th>
<th>1/8</th>
<th>3/7</th>
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<tr>
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<td></td>
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<td>6/3</td>
<td>2/16</td>
<td>3/8</td>
<td>1/2</td>
<td>2/3</td>
<td></td>
</tr>
<tr>
<td>2/6</td>
<td>6/16</td>
<td>6/10</td>
<td>6/8</td>
<td>10/12</td>
<td>6/14</td>
<td>11/2</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>3/10</td>
<td>12/24</td>
<td>0</td>
<td>1</td>
<td>1/6</td>
<td>1/3</td>
<td>3/8</td>
<td>6/10</td>
<td></td>
</tr>
<tr>
<td>4/6</td>
<td>0/2</td>
<td>2/8</td>
<td>4/5</td>
<td>0</td>
<td>1/2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
EQUAL FRACTIONS

Topic: Identification of fractions

Objective: To remediate, reinforce, and enrich

Number of Players: One to a whole class

Materials: Student activity sheet, ruler, and a pencil for each player
Crayons for each player

Directions:

1. Remove and reproduce the student activity sheet for each player.
2. Players are to use a ruler to connect each pair of equivalent fractions with a line segment.
3. When completed, players are to color in the three squares they find.

Use a ruler to draw a line segment between each pair of equivalent fractions. Color the three squares.
FRACTIONAL TIME

Topic: Identification of fractions

Objective: To remediate and reinforce

Number of Players: One to a whole class

Materials: Student activity sheet and a pencil for each player; Crayons for each player

Directions:
1. Remove and reproduce the student activity sheet for each player.
2. Players are to draw clock hands for each time shown.
3. One section of the clock is to be shaded in and a fraction is to be written for that amount.
4. Students must be reminded that there are two possible fractions for each clock.

FRACTIONAL TIME

This clock is set at 3:00
If it's shaded this way, it shows $\frac{1}{4}$
If it's shaded this way, it shows $\frac{3}{4}$

For each clock face:
1. Draw the hands for the time shown.
2. Shade in one section.
3. Write a fraction that tells how much you shaded.

<table>
<thead>
<tr>
<th>9:00</th>
<th>2:00</th>
<th>8:00</th>
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</thead>
<tbody>
<tr>
<td><img src="image1" alt="Clock" /></td>
<td><img src="image2" alt="Clock" /></td>
<td><img src="image3" alt="Clock" /></td>
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<tr>
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<td>6:00</td>
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</tr>
<tr>
<td><img src="image4" alt="Clock" /></td>
<td><img src="image5" alt="Clock" /></td>
<td><img src="image6" alt="Clock" /></td>
</tr>
<tr>
<td>11:00</td>
<td>10:00</td>
<td>5:00</td>
</tr>
<tr>
<td><img src="image7" alt="Clock" /></td>
<td><img src="image8" alt="Clock" /></td>
<td><img src="image9" alt="Clock" /></td>
</tr>
</tbody>
</table>
GROOVE

Topic: Identification of geometric shapes

Objective: To reinforce, remediate, and enrich

Number of Players: Three teams with two or three players per team

Materials: Gameboard
Envelopes of cut-up squares

Directions:
1. Each team takes a gameboard and an envelope containing three cut-up squares.
2. The teams must assemble the three squares by fitting the pieces on the gameboard.
3. Each team member may use any of that team’s game pieces to complete the squares.
4. Team members may point, but may not talk while playing.
5. The team that wins must complete all three squares first.

SHAPE-O

Topic: Identification of geometric shapes

Objective: To remediate and reinforce

Number of Players: Two to four

Materials: Thirty-six shape cards, six each of squares, circles, rectangles, triangles, pentagons, and octagons. Markers for each player

Directions: 1. First player rolls the die and moves his marker the indicated number of spaces in either direction from the start.

2. Players may move either direction on the gameboard.

3. The first player to have two of each shape wins.

Shape-O

START -

[Diagram of various shapes arranged in a circular path]
.Graphy

Topic: Coordinate graphing

Objective: To enrich

Number of Players: Three

Materials: Two sets of 18 markers in contrasting colors

Gameboard

Directions:

1. Player ‘A’ chooses a coordinate and calls out the two numbers that describe the coordinate. Using an over and up pattern, the player calls out the light number first, and the dark number second. The player then places one of the colored discs on that circle of the gameboard.

2. If a player places his disc incorrectly, he loses his turn.

3. Player ‘B’ then takes a turn.

4. If a player chooses a coordinate that has already been covered, the turn is lost.

5. The player to place four discs in a row, either vertically, horizontally or diagonally, is the winner.

GRAPHART

Topic: Coordinate graphing

Objective: To enrich, remediate, and reinforce

Number of Players: One to whole class

Materials: One student activity sheet per player
Pencils and crayons

Directions:
1. Remove and reproduce one activity sheet per player.
2. Players are to locate ordered pairs on the graph and connect them with straight line segments.
3. When completed, the picture may be colored in.

Locate the following points on the graph below and connect them in order with straight line segments.

\[(X, Y) = (1, 14), (10, 14), (10, 23), (14, 23), (14, 14), (23, 14), (23, 10), (14, 10), (14, 1), (10, 1), (10, 10), (1, 10), (1, 14).\]
ESTIMATION

Topic: Estimation
Objective: To reinforce and enrich
Number of Players: Two
Materials: 20 colored chips per player
Gameboard
Cards with dots for estimating

Directions:
1. Dot cards are placed face down on the gameboard (one one each square).
2. The first player turns up a card anywhere on the board. He must declare an estimation of the number of spots on the card by the time his opponent counts to 15. After he declares his estimation, he must count the number out loud. If his estimation was correct, he may remove the cover and replace it with one of his chips. If he was incorrect, he turns the card back over and loses his turn.
3. The game continues in this manner until one player covers three squares in a row horizontally, diagonally, or vertically.

Estimation?

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**ESTIMATE SUMS**

<table>
<thead>
<tr>
<th>Topic:</th>
<th>Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective:</td>
<td>To remediate and reinforce</td>
</tr>
<tr>
<td>Number of Players:</td>
<td>One to a whole class</td>
</tr>
<tr>
<td>Materials:</td>
<td>Student activity sheet and a pencil for each player</td>
</tr>
</tbody>
</table>
| Directions:  | 1. Remove and reproduce a student activity sheet for each player.  
2. Players are to study each number line.  
3. Make sure that each player understands that when addition is required, the sum is not to be written but only the number line the answer is found on is to be identified. |
*Ideas from the arithmetic teacher.*  
Reston, VA: The National Council of Teachers of Mathematics. |
ESTIMATE SUMS

Name

A

0

500

B

501

1,000

C

1,001

5,000

D

5,001

10,000

Which number line has a point for these numbers?

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>247</td>
<td>965</td>
</tr>
<tr>
<td></td>
<td>4,645</td>
<td>9,999</td>
</tr>
<tr>
<td></td>
<td>8,492</td>
<td>873</td>
</tr>
<tr>
<td></td>
<td>146 + 840</td>
<td>654 + 87</td>
</tr>
<tr>
<td></td>
<td>146 + 283</td>
<td>845 + 4,525</td>
</tr>
<tr>
<td></td>
<td>999 + 3</td>
<td>2,042 + 4,650</td>
</tr>
</tbody>
</table>
ESTIMATE PRODUCTS

Topic: Estimation

Objective: To remediate and reinforce

Number of Players: One to a whole class

Materials: Student activity sheet and a pencil for each player

Directions:

1. Remove and reproduce a student activity sheet for each player.
2. Have each player study the number lines.
3. Make sure each player understands that products are not to be computed, but that the number line containing the product is to be identified.

ESTIMATE PRODUCTS

Name______________________________

A

0

500

B

501

1,000

C

1,001

1,500

D

1,501

2,000

Which number line has a point for these numbers?

___ 1. 9 X 8  ___ 2. 25 X 12  ___ 3. 51 X 12
___ 4. 21 X 40  ___ 5. 45 X 33  ___ 6. 18 X 72
___ 7. 92 X 9  ___ 8. 25 X 25  ___ 9. 323 X 5
___ 10. 35 X 16  ___ 11. 105 X 12  ___ 12. 14 X 8
___ 13. 32 X 61  ___ 14. 87 X 8  ___ 15. 54 X 23

To help you check: There are 3 points on line A, 6 points on line B, 4 points on line C, and 2 points on line D.
BUY IT

Topic: Using money
Objective: To reinforce and enrich
Number of Players: Two
Materials: Gameboard
Picture cards
18 number squares

Directions:
1. The number squares are shuffled and placed face down in one pile, while the picture cards are shuffled and placed face up in another pile.
2. The players, using their number squares as money, take turns and try to reach the price on the top picture card. The player coming closest to the items priced, using all of his numbered squares, wins the picture card. If the total of a player's number squares goes over the price, the other player wins the picture square.
3. Each player draws a card from the number pile and places it up so that both players can see it. The number becomes part of the total price they are trying to reach.
4. Play continues until both players have decided to stop taking number squares, or if one player goes over the price.
5. Once play has stopped, the player wins the picture card whose number comes closest to the price without exceeding it. In a tie, the card is returned.
to the bottom of the pile for replay.

6. The first player to get five picture cards wins.

## Buy it

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<td><img src="coke.png" alt="Coke" /></td>
<td><img src="soda.png" alt="Soda" /></td>
<td><img src="muffin.png" alt="Muffin" /></td>
<td><img src="juice.png" alt="Juice" /></td>
<td><img src="milk.png" alt="Milk" /></td>
</tr>
<tr>
<td>12¢</td>
<td>15¢</td>
<td>18¢</td>
<td>21¢</td>
<td>22¢</td>
<td>25¢</td>
<td>27¢</td>
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</table>

## Change

<p>| | | | | | | |</p>
<table>
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<tbody>
<tr>
<td>1¢</td>
<td>2¢</td>
<td>3¢</td>
<td>4¢</td>
<td>5¢</td>
<td>6¢</td>
<td></td>
</tr>
<tr>
<td>7¢</td>
<td>8¢</td>
<td>9¢</td>
<td>10¢</td>
<td>11¢</td>
<td>12¢</td>
<td></td>
</tr>
<tr>
<td>4¢</td>
<td>5¢</td>
<td>6¢</td>
<td>7¢</td>
<td>8¢</td>
<td>9¢</td>
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</table>
**SPIN-A-COIN**

<table>
<thead>
<tr>
<th>Topic:</th>
<th>Objective:</th>
<th>Number of Players:</th>
<th>Materials:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Using money</td>
<td>To reinforce and enrich</td>
<td>Coin wheel</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tally sheet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Directions:</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>1. Each player takes turns spinning the spinner.</td>
</tr>
<tr>
<td></td>
<td>2. After every spin, the player spinning adds the amount of money indicated by the spin to the tally sheet and keeps a cumulative total.</td>
</tr>
<tr>
<td></td>
<td>3. The winner is the first player to reach $5.00.</td>
</tr>
</tbody>
</table>

<table>
<thead>
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</table>
Spin A coin
MEASURE IT

Topic: Linear measurement

Objective: To reinforce and remediate

Number of Players: One to a whole class

Materials: Student activity sheet
          Centimeter measuring stick
          and pencil for each player

Directions:
1. Remove and reproduce the student activity sheet for each player.
2. Players are to measure each line path from start to finish in centimeters.
3. When finished, students are to compare results and re-measure as necessary to settle disputes.

Find each line path from START to FINISH. Measure the length of each path in centimeters.

MEASURE IT

START

FINISH

FINISH

START
<table>
<thead>
<tr>
<th>Topic:</th>
<th>Linear measurement and fractions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective:</td>
<td>To reinforce, remediate, and enrich</td>
</tr>
<tr>
<td>Number of Players:</td>
<td>One to a whole class</td>
</tr>
<tr>
<td>Materials:</td>
<td>Student activity sheet and string for each player</td>
</tr>
<tr>
<td></td>
<td>Scissors</td>
</tr>
<tr>
<td></td>
<td>Pencils</td>
</tr>
<tr>
<td>Directions:</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Remove and reproduce the student activity sheet for each player.</td>
</tr>
<tr>
<td>2.</td>
<td>Players are to cut string equal to their height.</td>
</tr>
<tr>
<td>3.</td>
<td>Players are next to find body parts equal to one-half, one-third, one-fourth, and one-fifth of their height. They may also find other fractions on their own.</td>
</tr>
<tr>
<td></td>
<td>Ideas from the arithmetic teacher.</td>
</tr>
<tr>
<td></td>
<td>Reston, VA: The National Council of Teachers of Mathematics.</td>
</tr>
</tbody>
</table>
Cut a piece of string equal to your height.

Fold it in half and try it on yourself.

What can you find that is $\frac{1}{2}$ your height?

Fold it in thirds. What can you find that's $\frac{1}{3}$ your height? $\frac{1}{4}$? $\frac{1}{5}$? What else?

**RECORD HERE**

<table>
<thead>
<tr>
<th>$\frac{1}{2}$ my height</th>
<th>$\frac{1}{3}$ my height</th>
<th>$\frac{1}{4}$ my height</th>
<th>$\frac{1}{5}$ my height</th>
<th>What else?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
CENTIMETER SNAKE

Topic: Linear measurement
Objective: To remediate and enrich
Number of Players: Two to six
Materials: One 15cm ruler per player
One marker per player
1 die
1 gameboard
12 cards marked as follows:

Go back the number of cm in
line A
Go forward the number of cm in
line B
Go forward the number of cm in
line C
Go forward the number of cm in
line D
Go back the number of cm in
line E
Go forward the number of cm in
line F
Go forward the number of cm in
line G
Go back the number of cm in
line H
Go forward the number of cm in
line I
Go forward the number of cm in
line J
Go back the number of cm in
line K
Go forward the number of cm in
line L

Directions:
1. The players take turns throwing the die and moving the number of spaces shown.
2. If the player lands on a cm space, he takes a card. A player cannot go back beyond the start. If this happens, play begins again in space one.
3. The first player to reach
the finish is the winner.

Source:
Contimeter Snake
BIBLIOGRAPHY


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