

Manipulating Math With Games
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Overview: This unit was developed to give classroom teachers a quick look at some of the games from the Everyday Math Curriculum. It is a small sample of the games that were most effective in my classroom of third grade learning support students. The purpose of this unit is to demonstrate the importance of the use of games as a curriculum supplement. Through games, the students practice not only their math skills, but their social skills as well. Games provide reinforcement and additional practice of a skill without the tedium of worksheets. Games also increase speed and accuracy of basic addition and subtraction skills. The mastery of these skills enable the student to build upon the foundation of all basic math concepts. Through game playing, the students increase speed and accuracy, in turn increasing their confidence and motivation level. This unit will provide directions and master sheets needed for some of the games that were used by my students. It will show how playing games as part of the Every day Math Curriculum helped the students to increase their speed and accuracy when working on timed math tests provided in the curriculum.

Objective: To demonstrate the importance of the games provided by the Every Day Math Curriculum and to illustrate the impact that these games have for a learning support classroom at an elementary level by investigating the correlation between practice and repetition that these games provide with a measured increase of speed and accuracy on basic math facts by a group of third grade L.S. students. Also to provide the classroom teacher with an easy to use and quick resource highlighting a few of the addition and subtraction games from the Every Day Math Curriculum.

The Rationale: All students, especially learning support students, learn through a variety of methods. Students learn visually, orally, auditorally, and tactilely. The Learning Support student must be provided with all learning styles. These children need an increase of practice and repetition to ensure mastery of a new skill. The games, provided by the Every Day Math Curriculum, provides the opportunity that the students need to practice basic mathematical skills that are the foundation of all

future math concepts. Their implementation into the everyday curriculum are crucial to provide the repetition and practice that a child needs to increase speed and accuracy and thus confidence.

In my opinion, children need more repetition of a skill before moving on to another skill. In the Everyday Math Curriculum, the spiraling theory provides students with a range of knowledge and experiences that are revisited throughout the students' years of instruction. I understand the philosophy that strives to enrich the student's knowledge and introduce them to various techniques. I realize that this curriculum has high expectations for the students and works to achieve these expectations. I would like however for the students to have more time and practice of a particular skill before moving on to the next skill. I like the spiral philosophy, but I would like to see it spiral at a slower rate. This would give the students a better opportunity to gain mastery of a skill before moving on to the next. Many students, especially the learning support student, need time to digest and process new information. They need time to practice a skill and become comfortable with it. In my experiences with the learning support student, I have found that the students often confuse methods from concept to concept when it is introduced at a rapid pace. Playing the games with the students give them the opportunity to practice basic skills that are the foundation of all math concepts. Games enable them to increase their confidence, speed, and accuracy in a way that they do not realize that they are learning. Games however are time consuming and finding time while trying to stick to the pace of the curriculum is often difficult. As a learning support teacher, I have a bit more flexibility with my students than a regular education teacher might have with her curriculum pacing. In the beginning of the school year I did not make as much time for games as I could have. However, taking this course and doing this experiment forced me to incorporate games on a regular basis. My findings were that games do indeed increase speed and accuracy on basic addition and subtraction facts. Games enabled my students to perform at a higher rate when tested and charted over a 2-month period.

Strategies: As part of my study I set up an experiment with my third grade learning support students. These students are working on an ending 2nd grade level in the EDM curriculum. They are secure in writing 2 and 3 digit numbers, writing addition turn arounds, constructing fact families, understanding "What's my Rule?", and extending addition facts to tens and hundreds. These are some of the skills that the students show a secure understanding of, however they lack speed, accuracy and confidence in themselves. These students are also developing math skill in areas such as understanding doubles, triples, quadruples, 5 times, 10 times for 1 digit numbers. They are developing such skills as devising solution strategies for finding sums and differences, adding 2-digit numbers mentally, solving money problems dealing with change, understanding multiplication arrays, and equal sharing division. In order for a

child to have success with these concepts, he/she must have a strong foundation of basic addition and subtraction facts.

I looked at how the games from the Every Day Math Curriculum increased speed and accuracy with basic addition and subtraction facts. I will provide you with directions for a few of the games that my kids seemed to do well with. All of these games can be provided for you through your PRIME Coach, or in the Game section of your teacher's manual.

I began by giving a basic addition fact timed test to my whole group. I explained to the group that we were going to be part of an experiment. We discussed what that meant and built motivation for the project. They were excited that they were going to be part of my paper. They were excited that I had to do homework also and that I needed them. I picked 4 names randomly from a hat to be my first group. I made sure that everyone knew that they would all have a chance to participate. I taught the daily EDM curriculum for the first half of the class with both groups for the initial instruction. For the second half of the class my test group "A" was provided with an opportunity to play a math game. The students played the games provided by the EDM curriculum such as Addition Top-It, addition shuffleboard and addition bingo each day for 15 minutes while the "B" group continued to work in their journal on the concept studied that day. At the end of week both groups were given a similar 5 minute timed test consisting of 25 problems, the same amount of time, and number of problems, given on the initial test. I wanted to see if I could show an increase of problems completed correctly by the group "A", who had additional practice through games. I then had group "B" join in the games the second week. They had an opportunity as well as group "A" to participate in a variety of EDM game activities. They also had 15 minutes daily for 1 week to practice their mental math skills. Both groups were once again given a 5-minute basic addition test consisting of 25 problems. I used this data as a baseline for my study. I have continued to provide time for games the second half of each math session. I continued to give a test similar in skill each week and chart the number of correct answers. I hoped to show an increase in speed and accuracy in basic mathematical addition and subtraction facts. The appendix at the end of this paper will indeed show how playing these games increased, over time, the number of correct answers achieved by my initial test group.

The Games:

The Every Day Math Curriculum recognizes that frequent practice is necessary for a child to attain mastery of a skill. They believe however, that drill tends to be tedious and gradually loses its effectiveness. Children enjoy games and learn more readily when given more opportunities to play them. Games reduce tedium that may cause behavior problems. Games also cut down on work sheets and offer an almost

unlimited source of problem material, because in most cases, numbers are generated randomly. Games also provide cooperative learning environments in which children discover that working together is much more fun than being alone. They learn to work as a team with cooperation, and they are peer tutors for each other.

As stated earlier, games involve generating numbers randomly. The following methods are suggested for generating random numbers when playing the games included in the EDM curriculum.

The Everything Math Deck:

This deck consists of four sets of number cards 0-10 and one set 11-20. By removing some of the cards, you can reduce the range of numbers generated according to the need of the group. Numbers can be added as skills increase or to add variation.

Dice:

Regular dice may be used to generate numbers up to 6. A polyhedral die should be used if you want to extend the range of generated numbers.

Egg Cartons:

Label each cup of the carton with a number. For example, you may label the cups 0-11. Place one or more pennies or cm cubes inside the carton, close the lid, shake, and open the carton to see where the objects have landed.

Game 1: Addition Draw card

Materials: Game Master 1, addition draw card record, for each player, Everything Math card deck, one of each 0-20, a slate for each player, a calculator

Number of players: 2-4

Directions: Players shuffle the cards and place the deck number side down on the playing surface.

Players take turns drawing the top three cards to generate a 3-addend addition problem. The player whose turn it is records the three addends on the master, and then discards the three cards. After three turns, players check each other's work using the calculator.

After all six answers have been checked, each player finds the total sum of his or her three correct answers using a slate to do the computation. The player with the higher total wins the game.

Game 2: Shaker Addition Top-It

Materials: 2 dice (standard dice provide review and practice with numbers through 6, polyhedral dice [marked 0-9] provide review and practice for all basic fact combinations), 20 pennies or counters.

Number of Players: 2 to 5

Directions: For each round, each player shakes and rolls the dice, adds the dots (using any method except the calculator), and states the sum. Saying the wrong sum disqualifies a player for that round, so children check every sum, not just their own.

The player with the highest sum of each round takes a penny or counter from the pile. Begin the game with 20 pennies for each partnership or small group. If there are ties, each winning player takes a counter or penny. The player with the most counters at the end is the winner.

Game 3: Addition Shuffleboard

Materials: 1 shuffleboard mat, game master # 2, a penny, a slate, quarter sheets, and a calculator for each player.

Number of players: 2

Directions: In each round, players take turns being the “calculator” and the “checker”.

The calculator:

First, the calculator places the penny in the starting square and pushes it with a flick of the finger in the direction of one of the numbered squares.

Next, on the slate the calculator records the number on which the penny lands. If the penny touches more than one square, the smaller number is recorded.

Third, the calculator gives the penny another push from where it landed and records the number on which the penny lands.

Fourth, the calculator then adds the two numbers and records the sum on the quarter sheet.

The Checker:

The checker now checks the sums on the calculator. If the sum is correct, the calculator gets a 10- point bonus. If it is incorrect, the calculator corrects the sum on the quarter sheet.

After 5 rounds, play stops and the players use the calculator to find the sums of their five scores. The player with the higher total wins.

Game 4: Name That Number

Materials: 1 Everything Math Deck

Number of players: 3 or 4

Directions: The cards are shuffled and five cards are placed face up on the playing surface. The rest of the deck remains face down and the top card from the deck is turned over. This is the number to be named.

In turn, players try to name the number by adding or subtracting the numbers on two of the five face-up cards.

- Successful players take the two cards and number named. The three cards taken are replaced by the top three cards from the facedown deck.
- Unsuccessful players lose their turns. The top card from the facedown deck is turned over and becomes the new number to be named.
- Play continues until all facedown cards have been turned over. The player who takes the most cards wins.

Example: Beth's turn:

Beth may have the following numbers on her cards:

4 10 8 12 2 The card to be named may be 6, She may name it with the following combinations: $4+2$, $8-2$, or $10-4$. If Beth selects $8-2$, she then takes the 8, 2, and 6. She replaces the 8 and 2 with the top two cards from the face down deck and turns over the next card to replace the 6.

Ronald's turn:

Ronald may have the following numbers on his cards:

7 10 8 12 1 the card to be named may be 16. Ronald cannot find two cards with which to name 16 so he loses his turn. He turns over the next card from the facedown deck and places it on top of the 16.

Play continues as before.

Game 5: Exchange Games:

There are two kinds of exchange games, Collection games and take-apart games. Collection games give children time to practice in exchanging a number of items of lesser value for an item of greater value. For example, students can exchange 1 dime and 3 nickels for a quarter. Take-apart games allow the student opportunities to practice exchanging an item of greater value for several items of lesser value. For example, they might exchange a bundle of 10 single sticks, that is, 1 ten for 10 ones. Exchange games help students when practicing the concept of place value.

Money Exchange

Materials: twelve \$1 bills, twelve \$10 bills, and one \$100 bill for each player. 2 dice, a place value mat.

Number of players: 2 or 3.

Collection Game:

Directions: Players put all of their money in the bank. At each turn, they roll the dice, take from the bank the amount that they roll, and place the money on their game mat. Whenever possible, they trade ten \$1 bills for one \$10 bill or ten \$10 bills for a \$100 bill. The first player to trade for \$100 bill wins the game. Most games will last 12-18 rounds.

Take-Apart Games:

Directions: Each player begins with \$100 bill. At each turn, players roll the dice and put the amount they roll in to the bank. They exchange a bill of higher denomination for bills of the next lower denomination, as needed. The first player with less than \$12 wins.

Making Change Games:

Materials: 2 dice, a \$1 bill, 6 quarters, 2 dimes, and 2 nickels for each player,
Journal 1 p. 31

Number of players: 2 or 3

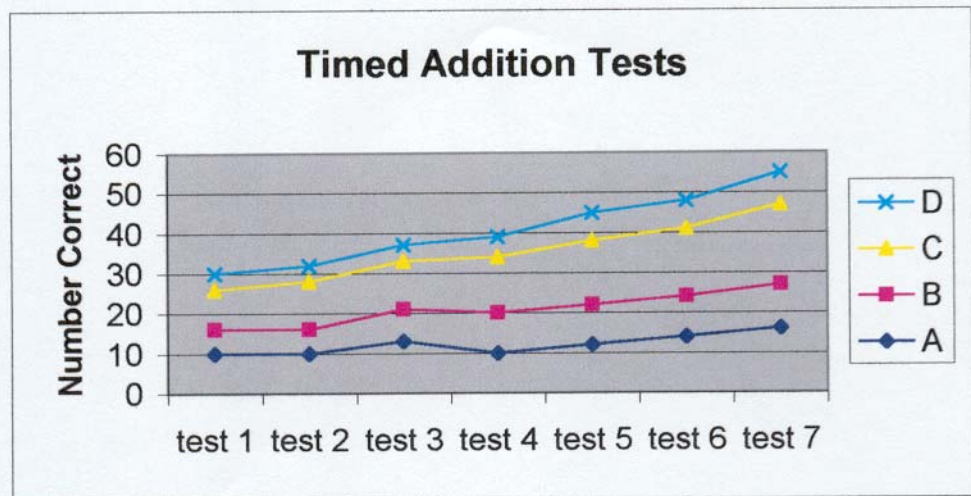
Basic Game

Directions: There is no money in the bank at the beginning of the game. Player takes turn depositing money into the bank. This is determined by rolling the dice and looking up the amount on the chart at the bottom of journal page 31.

At the beginning of the game, players will be able to count out the exact amount. Later, they make change from the money in the bank if they don't have the exact amount. The first player without enough money to put in the bank wins.

Summary: The games highlighted above are just a few of the many games that are provided to you in the Every Day Math Curriculum. Each Teacher's Manual has an Appendix in which the games can be easily found and incorporated into your daily routine. Games do make a difference. The students enjoy playing them and become secure in basic skills when given time to practice and engage in the games. In the upcoming school year (2003/2004) a revised Every Day Math Curriculum will be adopted for Pittsburgh Public Schools. It is my understanding that this curriculum is more "teacher friendly". It provides more time on each skill, and it allows for more supplementary practice opportunities. I am anxious to review it and incorporate it in my daily routine. I am not sure if any of the games have changed but I would highly recommend reviewing these games and making a concentrated effort to provide time for these highly motivating methods of instruction. Your students will benefit from having the opportunity to play them and you will also reap the benefits by allowing your students the opportunity to become proficient in basic math facts, which will in turn increase motivation, confidence and classroom management.

students	test 1	test 2	test 3	test 4	test 5	test 6	test 7
A	10	10	13	10	12	14	16
B	6	6	8	10	10	10	11
C	10	12	12	14	16	17	20
D	4	4	4	5	7	7	8



Name _____

Date _____

Shuffleboard Mat

Game Master

2

75	40	75	45	75	50
50	60	40	75	45	70
75	30	70	25	65	35
25	55	10	50	15	60
15	10	40	30	45	20
30	25	10	15	20	35

Date _____

Shuffleboard Mat

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Game Master

11

Place-Value Mat for \$1.00, \$10.00, \$100.00 Games

One Hundred Dollars \$100.00 10,000 pennies 1,000 dimes	Ten Dollars \$10.00 1,000 pennies 100 dimes	One Dollar \$1.00 100 pennies 10 dimes

Name _____

Date _____

Use with exchange games.

Standards:

Pittsburgh Public Schools have taken an extensive amount of time to develop standards in all academic areas that are developmentally appropriate for all students K-12. These standards have been developed to give both students and teachers guidelines to strive toward to be proficient in a particular subject area. The standards have been developed for each subject taught, and often times a project may encompass many curriculum areas. This project will do just that. It will cover the very important standards required through the math program along with meeting standards in the area of citizenship. The standards that will be met are as follows:

Math:

- Standard 1 All students use number, number systems. And equivalent forms (Including numbers, words, objects, and graphics) to represent theoretical and practical situations.
- Standard 2 All students compute, measure, and estimate to solve theoretical and practical problems, using appropriate tools, including modern technology such as calculators and computers.
- Standard 3 All students apply the concepts of patterns, functions, and relations to solve theoretical and practical problems.
- Standard 4 All students formulate and solve problems and communicate the mathematical processes used and the reason for using them.
- Standard 5 All students understand and apply basic concepts of algebra, geometry, probability and statistics to solve theoretical and practical problems.
- Standard 6 All students evaluate, infer, and draw appropriate conclusions from charts, tables, and graphs, showing the relationship between data and real-world situations.
- Standard 7 All students make decisions and predictions based upon the collection, organization, analysis and interpretation of statistical data and the application of probability.

Citizenship:

- Standard 7 All students demonstrate their skills of communicating, negotiating and cooperating with others.
- Standard 8 All students demonstrate that they can work effectively with others.
- Standard 10 All students demonstrate an understanding of the various roles they can play as citizens through participation in a community service project.

Standard 11 All students demonstrate the ability to resolve conflicts in peaceful ways, including but not limited to peer mediation, anger management, interpersonal skills, and problem solving.

Bibliography:

Jean and Max Bell UCSMP, *Everyday Mathematics second grade Teacher's Manual & Lesson Guide Volume A*, 1988 by Everyday Learning Corporation.