Using Games in Your Math Teaching

by Marilyn Burns

Over the forty years that I've been teaching mathematics to children in classrooms and to teachers in workshops, games have played an important role. I've found that both children and teachers are always delighted to learn a new game. But while children seldom question the value of games, teachers have often expressed to me that they don't feel entirely comfortable incorporating games in their math instruction. They're not sure that games are a good use of math time, and they worry that the parents of their students will raise concerns about games detracting from their children learning "real" math.

I have three goals for this article. One is to provide you with a sound rationale for how and why games enhance math learning. My second goal is to introduce some examples of games and describe how I've structured their use in the classroom. Finally, I'll provide suggestions for additional games along with resources for additional ideas.

Supporting math learning

It's important as teachers that we justify the instructional choices that we make in the classroom. To that end, I offer you my rational for using games to help teach math, not only to convince you of the worth of games but also to help you communicate with your students and their families about how games support math learning.

I think that incorporating games into math teaching is beneficial for:

- providing students practice with skills;
- giving students ways to apply mathematical ideas to problem-solving situations and develop strategic thinking, important aspects of mathematical thinking;
- building students' interest in and appreciation for mathematics by engaging them in enjoyable activities and challenges;
- supporting the idea that learning can (and should) be as fun as possible;
- creating a class menu of choice activities that are educationally valuable and provide options for those students who complete assignments more quickly than others.

One of the best ways I know to help parents understand the benefits of games is to introduce them through homework assignments. I often ask students to teach someone at home how to play a game they've learned in math class. This both gives students the opportunity to show others at home what they've learned and gives parents way to learn, firsthand, what their child is experiencing in math class.

Games we play can be categorized into games of chance, games of strategy, and games that rely on both chance and strategy. While I have used games in all three categories, I have had most success with games that both involve elements of luck and also call for strategic thinking. That's because the element of luck adds excitement to games and also gives students who don't think as quickly or strategically as others the chance to win.

A note about competition in the classroom: while I work hard to make cooperation and collaboration part of the culture of the classroom, I think that there's a place for games in which one player or team will

If you choose to assign a game for homework, I have two suggestions. One is to send a note home the first time you make such an assignment explaining to the parents that this game is an example of the kind of games the children will be playing throughout the year to support their mathematics learning. Secondly, the day after you've given the assignment, lead a class discussion for students to report about their experience teaching and playing the game. The students' feedback will help you evaluate the usefulness of the assignment.—MB

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be a winner. I think that it's important for children to learn to win and lose gracefully. However, I also try to avoid games that divide students into haves and have-nots. Games should promote good will as well as competition, and offer support and fun to all. To that end, I often have pairs of students play games as opponents so that the responsibility for decisions doesn't fall on one student. And, of course, I remind students regularly that the reason I'm having them play a particular game is for the learning that I'm promoting, and I'm explicit about what the learning is.

Examples from the classroom

This section presents excerpts from two books in the *Teaching Arithmetic* series. (There are currently eleven books in this Math Solutions Publications series.) Each excerpt presents a lesson that is built on using a game to support students' basic number understanding. Along with describing the rules for the games, the excerpts provide detailed information about how the games were introduced in the classroom and how students responded. I hope that these lessons provide models that will be helpful to you as you consider other games to try with your students.

THE GAME OF TARGET 300

This game appears in *Lessons for Extending Multiplication, Grades 4–5* (Math Solutions Publications) by Maryann Wickett and me. I like this game because it engages students not only with multiplying by 10s and multiples of 10, important skills for students in these grades, but it also helps develop students' number sense and strategic thinking. The object is to be the player whose total is closest to 300 after each player has rolled a 1–6 die six times. It's okay for the total to be greater than 300 or less than 300, but each player must use all six turns. Each time a player rolls the die, he or she must decide whether to multiply the number rolled by 10, 20, 30, 40, or 50. At the end of six rolls, the players total their six products. I've taught this game many times with great success.

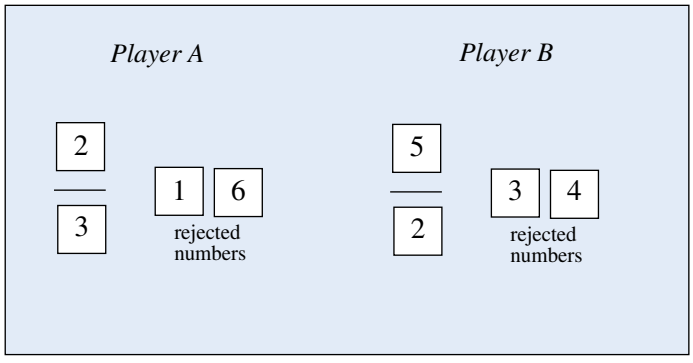
Maryann Wickett introduced the game to her class by playing with one of her students, Ben. After Maryann's fourth turn, her score was 240. Ben was now ready for his fourth turn; after three rolls he had a score of 100. Ben rolled the die.

"I rolled a three," he said. "That's good for me. Let's see, if I multiply three by twenty that would be sixty. I would have one hundred sixty altogether if I did that. I still have two turns." Ben paused for a moment to think this over further. "I think I'll multiply three by twenty and get sixty." Ben wrote the multiplication sentence on his chart and recorded his new total of 160. (p. 97)

To vary the difficulty of the game, change the target number. Making it 200 encourages multiplying by 10 rather than multiples of 10; raising it to 600 encourages more multiplication by multiples of 10. Changing the target to 2,000, 3,000, or 6,000, and asking students to multiply by 100 or a multiple of 100, gives students practice with larger numbers.

THE COMPARING GAME

The Comparing Game appears in my *Teaching Arithmetic* book, *Lessons for Extending Fractions, Grade 5* (Math Solutions Publications). It's a two-person game that provides students practice with representing and comparing fractions. Players draw the following game board for each round; one player uses the left side and the other uses the right side.



Players take turns rolling a die, each time writing the number that comes up on the die in one of the boxes. Once a player has written a number, he or she cannot change it. The boxes to the side are reject boxes for numbers players don't want to use. After both players have recorded a fraction, they compare to see whose fraction is larger. Each makes a drawing to show his or her fraction, first agreeing on the shape they'll both use for the whole. Then they write a math sentence, for example, 3/4 > 2/3. They play at least three rounds.

After students have played this game, I introduce three more versions of it. I've found that it's helpful to write all four versions on the board for their reference:

Version 1: The larger fraction wins
Version 2: The smaller fraction wins
Version 3: The fraction closer to ½ wins
Version 4: The fraction closer to 1 wins

When I taught the game to fifth graders, they used a 1–6 die, but it's also possible to use a 1–10 die or spinner. After introducing the game to the students, I asked them to play it with someone at home that evening. The next day, I asked what they had learned from playing the game at home. Several students were eager to report.

"I have a strategy for winning," Elliot said. "Put big numbers on top and little numbers on the bottom."

"It didn't always work," his partner, Booth, said, "but it did most of the time."

"I beat my mom every time," Emma said.

"Not me," Kalila said. "She won every game but one."

Score the Difference, which appears in Chapter 13 of the same book, is similar to The Comparing Game but also gives students practice with adding and subtracting fractions.

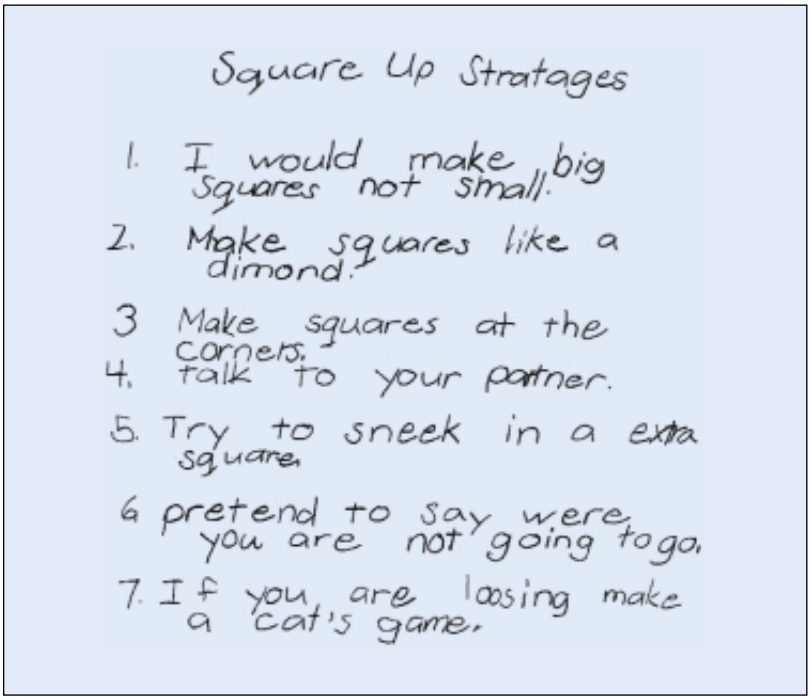
Additional games

While the area of number and operations category receives the major attention in the elementary grades, not all games should address this strand of the curriculum. Rather, they should draw from a variety of strands to support students' learning.

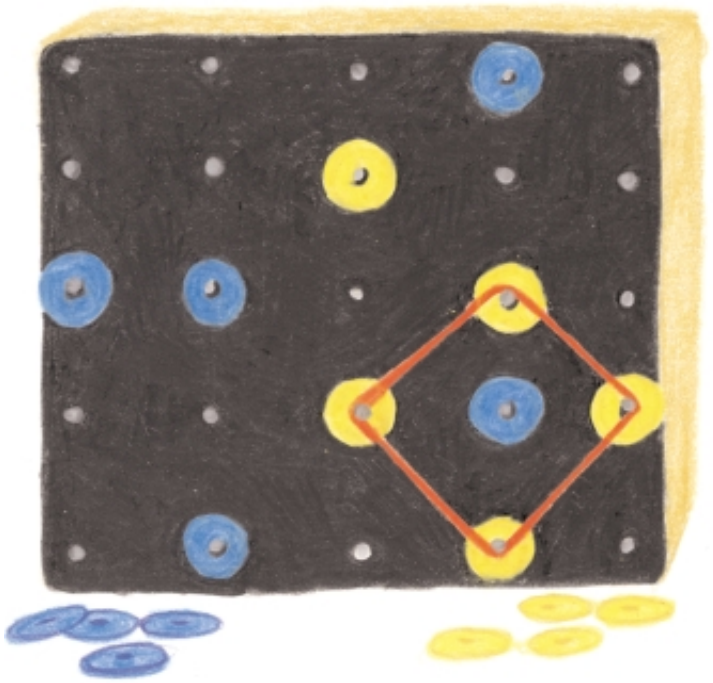
SQUARE UP

Square Up is another of my favorite games. This game supports students' spatial skills while also providing them experience with strategic thinking. I first included it in *The I Hate Mathematics! Book*, (Little, Brown & Co.), calling it "Square Wins," and a classroom version appears in Cheryl Rectanus's book, *Math By All Means: Geometry, Grades 3–4* (Math Solutions Publications). While Cheryl's book was geared for third and fourth grade instruction, I've used the game with fifth graders with similar success.

To play, students need a geoboard and 12 each of two different colored markers with holes in them (so that they will fit over pegs) or dot paper with a 5-by-5 array of dots and two different colored marking pens or crayons. Students take


Square Up Stratages

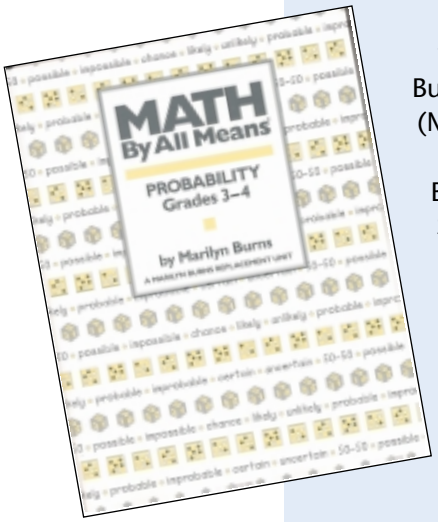
1. I would make big squares not small.
2. Make squares like a dimond.
3. Make squares at the corners.
4. talk to your partner.
5. Try to sneek in a extra square.
6. pretend to say were you are not going to go.
7. If you are loosing make a cat's game.



turns marking any unmarked peg. When a player thinks that he or she has marked mark four pegs or dots with his or her color that are the corners of a square, he or she says, "Square Up." The other player says, "Prove it." If the first player convinces the second that he or she has made a square, the game is over. If not, they keep playing. (With the geoboard, stretching a rubber band around the four marked pegs helps determine if it indeed is a square.)

While this game is easy for children to learn (even second and third graders can enjoy it), it's interesting and challenging to older and more capable students (and even adults). At first, students typically don't see the potential for marking corners of squares with sides that are not parallel to the sides of the geoboard or edges of the paper. Once they see the possibility of squares on the diagonal, the game becomes more complex and exciting. After children have had the chance to play, they write about the strategies they use.

Marilyn Burns is a nationally known mathematics educator. She is the founder of Math Solutions Professional Development, which supports teachers through books, videotapes, audiotapes, and extensive inservice programs that have been attended by more than 100,000 teachers.



"The Game of Target 300" appears in Maryann Wickett and Marilyn Burns's *Teaching Arithmetic: Lessons for Extending Multiplication, Grades 4–5* (Math Solutions Publications, 2001), pp. 92–102.

"The Comparing Game" and "Score the Difference" appear in Marilyn Burns's *Teaching Arithmetic: Lessons for Extending Fractions, Grade 5* (Math Solutions Publications, 2003), pp. 56–63, 145–52.

"Square Up" appears in Cheryl Rectanus's *Math By All Means: Geometry, Grades 3–4* (Math Solutions Publications, 1994), pp.96–103.

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