

Brick Math Series

# TEACHING ADDITION USING LEGO® BRICKS

Dr. Shirley Disseler



## *Teaching Addition Using LEGO® Bricks*

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# INTRODUCTION

Addition concepts start to form long before children learn to add in school. When they begin to put things together into like and unlike sets, children are beginning to develop the basic idea of addition. Students need to learn more than simply the procedures for adding; they must understand the *why* and *how* behind the process as well. A firm understanding of the process of repeated addition leads to comprehension of multiplication, which is another reason to be sure that young learners build a foundation for future math with strong addition skills.

The vocabulary of addition is key for students to master. Words such as *addend*, *sum*, *result*, *solution*, and *altogether* are content words that young addition learners must know. Teachers should be careful to use the term *addition symbol* rather than *plus sign* when discussing what is happening in an addition problem. “Plussing” is not a word, and the word *plus* only represents the symbol of the math, not the action. Teachers of mathematics should use the action of the math so that students can attach words to their understanding of the process of adding numbers.

The strategies garnered from mastery of early skills such as counting on, counting back, and one more than provide a strong foundation for understanding addition (Cathcart et al., 2014). Researchers have identified four distinct types of problems children need to learn to solve: join, separate, part-part-whole, and comparisons problems. These processes match the way the brain works when solving word problems. The use of direct modeling is beneficial to young learners because it provides a visual representation that leads to the understanding behind the action of the math (Cathcart et al., 2014).

Cathcart, W. George, Yvonne M. Pothier, James H. Vance, and Nadine S. Bezuk, *Learning Mathematics in Elementary and Middle Schools: A Learner-Centered Approach*. Boston: Pearson Education, 2014.

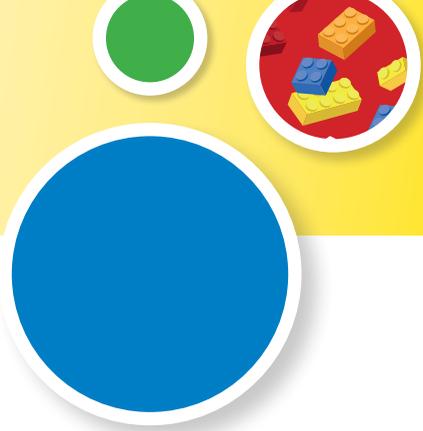


## Why use LEGO® bricks to learn about addition?

LEGO® bricks help students learn mathematical concepts through modeling. If a student can model a math problem and then be able to understand and explain the model, he or she will begin the computational process without struggling. Using LEGO® bricks to model addition helps show the action of addition so that students can visualize what is happening to numbers being joined together in a problem. Modeling with LEGO® bricks is an easy way for students to demonstrate their understanding of the vocabulary and the concept of addition.

LEGO® bricks are great tools for bringing many mathematical concepts to life: basic cardinality and counting, addition and subtraction, multiplication and division, fractions, data and measurement, and statistics and probability. Using LEGO® bricks fosters discussion, modeling, collaboration, and problem solving. These are the 21st century skills that will help students learn and be globally competitive.

The use of a common child's toy to do math provides a universal language for math. Children everywhere recognize this manipulative. It's fun to learn when you're using LEGO® bricks!



# HOW TO TEACH WITH THE BRICK MATH SERIES

## **Using the *Teaching* and *Learning* Books:**

Start by taking students through the **Part 1: Show Them How** section of each chapter. Build the models, show them to the students, and ask students questions. Where directed, have students build the same models themselves so they are manipulating the bricks as you are guiding them. A document camera is helpful to display your models to the whole class as you build them. The step-by-step directions in the *Teaching* books work through several problems in Part 1. If you are using the companion *Learning* books, which are the Student Editions, have students draw their models and answer the questions in those books as you teach using the *Teaching* book.

Once students have mastered the modeling processes from Part 1, move to the **Part 2: Show What You Know** section of the chapter. Ask students to complete each of the problems using bricks and drawing their models. The companion *Learning* books (Student Editions) have space for writing answers and baseplate paper for drawing models. Move through the room and check that students are building their models correctly, drawing them clearly, and understanding the concepts being taught.

The *Learning* books (Student Editions) include an assessment for each chapter, as well as additional problems for practice and challenge. The books also include an Assessment Chart



to track each student's performance on all the skills taught in the *Addition* book.

*Note:* Active learning breeds active learners! Students will be motivated and engaged in math when they are using bricks. It will not be silent in your classroom, but it will be full of chatter about the math!

### **Suggested Bricks:**

The Brick Math Series is designed to be used with basic LEGO® bricks. If you already have LEGO® bricks in your classroom, your students should be able to use them to make the models. They may have to combine smaller bricks together when the directions call for longer bricks such as 1x10s or 2x12s. Each student also needs a baseplate on which to build brick models.

Each chapter lists the bricks suggested for the lessons in that chapter for every two students, and the book includes a total brick inventory that lists all the bricks suggested for the program for every two students.

Brick Math Series brick sets are available through Brigantine Media if you would like to purchase complete sets designed for the program. The sets are packaged in divided boxes and are intended for use by two students. Two baseplates are included with each Brick Math Series brick set.

### **Classroom Management Ideas:**

- Before starting, have a conversation with the students about using bricks as a learning tool rather than a toy.
- Teach students the language of bricks (baseplate, stud, 1x1, 1x2, etc.).
- Assign brick sets to specific students and always give the same students the same sets. An easy way to do this is to number each brick set and assign the sets to pairs of students by number. When students know that they will always have to work with the same brick set, they are more likely to be careful that the bricks are returned to the set.
- Do not teach using bricks—or any manipulative—every day. Students also need to have opportunities to think through the math processes without having a physical object for modeling. Sometimes it helps to have students draw models without building them with bricks



first. Remember, they won't have access to manipulatives during most tests when they have to show what they have learned.

- To keep bricks clean: Put the bricks in a hosiery bag and wash them on the top rack of the dishwasher. Let them air dry. Clean bricks before assigning sets to new students.
- To keep bricks from sliding off desks, use foam shelf liner cut into rectangular pieces, or large meat trays (you can often get these free from a local supermarket).
- Inventory the sets twice a year and replace bricks as needed. There are a variety of vendors online that sell specific bricks, both new and used. LEGO® retail stores also sell a variety of individual bricks.



### SUGGESTED BRICKS

Size	Number
1x1	10 each of 4 colors
1x2	8
1x3	6
1x4	6
1x6	4
1x8	4
1x10	4
1x12	1

Note: Using a baseplate will help keep the bricks in a uniform line. One large baseplate is suggested for these activities.

Note: There are no 5, 7 or 9-stud bricks, so students will need to use a combination of bricks to create those models.

## HOW MANY WAYS?

### Students will learn/discover:

- How to use multiple statements to find the same sum

### Why is this important?

Being able to model sums using various addend combinations helps students develop a firm base for mental math, fact recognition, and number relationships.

### Vocabulary:

- Sum
- Addend
- Equation

### How to use the companion student book, *Learning Addition Using LEGO® Bricks*:

- After students build their models, have them draw the models and explain their thinking in the student book. Recording the models on paper after building them with bricks helps reinforce the concepts being taught.
- Discuss the vocabulary for each lesson with students as they work through the student book.
- Use the assessment in the student book to gauge student understanding of the content.

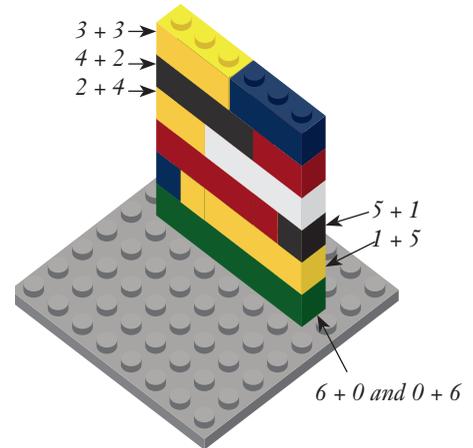


## Part 1: Show Them How

1. Build a base model of 6 using a 1x6 brick. Have students build the same model, or display your model to the class. Explain that this model shows the sum. Ask students how many ways there are to make the number 6.
2. Begin with  $1 + 5$ . Use two different colors of bricks for the two addends. Stack the bricks on top of the 1x6 brick to represent the 2 addends that make the sum.

Show the next two addends,  $5 + 1$ , using different colors. Stack the bricks showing  $5 + 1$  on top of the model of  $1 + 5$ . Continue building the model until all the equations that equal 6 are represented.

Have students draw the model and label all the equations represented by each row of bricks.

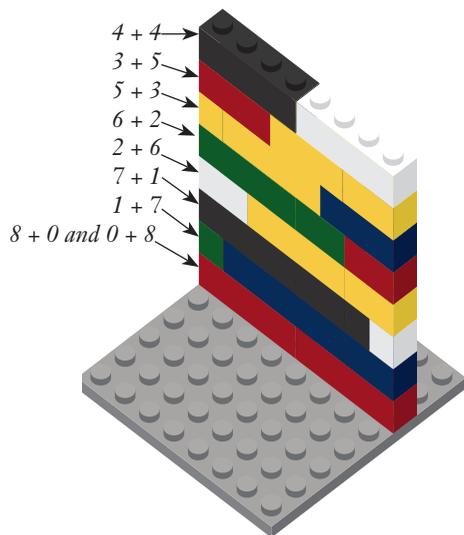


3. Ask students how many ways there are to make the number 8. Have students begin by placing one 1x8 brick on the baseplate to represent the number 8.

Ask students what would be the first way to make 8. Answers will vary, but try to get students in the habit of beginning with the number 1. Lead students by saying “1 plus blank equals 8,” and asking students what number goes in the blank.

Have students use one 1x1 brick to represent the number 1 and find a combination of bricks in one other color that total 7 studs. Student could use a 1x3 and a 1x4 brick, or a 1x1, 1x2, and a 1x4 brick, etc. Write a math equation for this model:  $1 + 7 = 8$ .

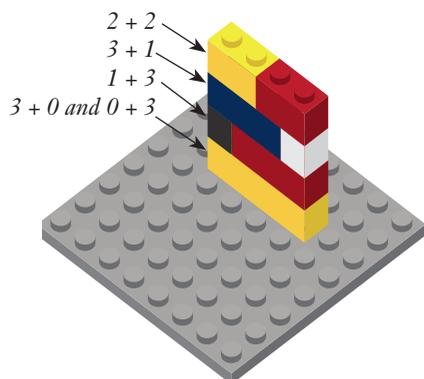
Have students build another layer reversing the colors. Ask students what new math equation is shown with the reversed color bricks. ( $7 + 1 = 8$ )



4. Have students continue the process until they think they have found all the ways to make 8. Ask students how they know they have all the ways to make 8. (The pattern will begin to repeat.)

5. Have students share their models with a partner and discuss the ways to make 8. *Note:* Discuss with students that you cannot show  $8 + 0$  and  $0 + 8$  two different ways.

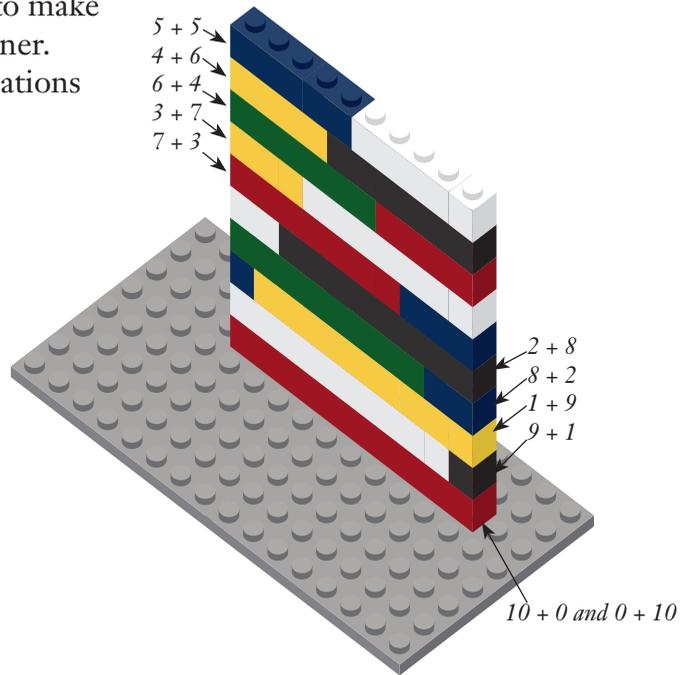
## Part 2: Show What You Know



1. Can you build a model to show all the ways to make the sum of 4? Share your model with a partner. Draw your model and write all the math equations for your model.



- 2.** Can you build a model to show all the ways to make the sum of 10? Share your model with a partner. Draw your model and write all the math equations for your model.



- 3.** Can you build a model to show all the ways to make the sum of 12? Share your model with a partner. Draw your model and write all the math equations for your model.

