

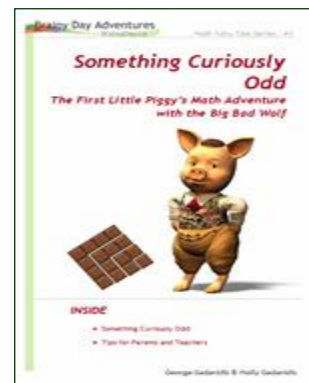
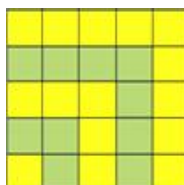


MATH TALES - LESSON PLAN #1

ABOUT THIS LESSON PLAN

This lesson plan is based on the Brainy Day book, *Something Curiously Odd*. In this story, the First Little Pig meets the Big Bad Wolf and discovers odd numbers hiding in squares! This makes the First Little Pig wonder, “Where do even numbers hide?”

The story is purposely written to draw student attention to and interest in big math ideas by eliciting mathematical surprise: “There are odd numbers hiding in squares?” This realization sets the stage for students exploring, “Where do even numbers hide?”



This lesson plan has been classroom-tested in Grade 2 and in Grade 8, and it can easily be adapted for use in other grades.

- In Grade 2, this lesson plan addresses the following learning goals
 - Number
 - Concrete representations of odd and even numbers
 - Representing the sums of consecutive odd and even numbers as rectangular arrays
 - Patterning
 - Growing patterns (describing how the concrete representations of patterns grow; extending patterns; predicting the representations and numeric values of future stages of patterns)
 - Communication
 - Using words, symbols, diagrams, and storytelling/drama to communicate learning
- In Grade 8, this lesson plan addresses the following learning goals
 - Algebra
 - Using algebraic expressions to represent the sum of consecutive odd numbers $[N^2]$, even numbers $[N^2+N$ or $N(N+1)]$, and natural numbers $[N(N+1)/2]$
 - Using algebraic expressions to represent odd numbers $[2N-1]$, even numbers $[2N]$, and natural numbers $[N]$
 - Using concrete representations of sums of odd, even and natural numbers as visual “proofs” of the algebraic expressions developed
 - Communication
 - Using words, symbols, diagrams, and storytelling/drama to communicate learning

MATERIALS

Core material

- 1 teacher copy of *Something Curiously Odd* (from www.BrainyDay.ca)
- Linking cubes (25 cubes in a plastic baggie, for each pair of students)
- Chart paper and markers

Optional material

A class set of *Something Curiously Odd* so students can take the story home, with a baggie of linking cubes, read it with their parents or guardians, and share and discuss their math learning (then return the story and linking cubes to their teacher).

This type of home math connection helps develop students' mathematical and communication skills, and helps parents get a better sense of the mathematics their children are studying.

Here are some comments from parents:

•She loved the math based on a story.ö

•This was surprising. I had not thought of math that way.ö

•Doing math based on a story made it feel like drama.ö

•He enjoyed that the math he was learning surprised me.ö

•She did a great job explaining her thinking.ö

LESSON DEVELOPMENT, Gr. 2

Reading of *Something Curiously Odd*

Introduction

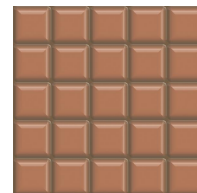
The students sit on the carpet or at their desks in pairs, with a set of 25 cubes in a plastic baggie for each pair of students. The 25 linking cubes will be used to model the 5x5 chocolate bar in the story.

The teacher starts by telling the class that the story they will read involves the Wolf and the Three Little Pigs. The teacher tells the class that this is a different version of the Three Little Pigs story, and it also involves math. The teacher asks for volunteers to retell the gist of The Three Little Pigs story.

Reading

The teacher starts reading the story *Something Curiously Odd*, showing the class the pages as they are read. The teacher pauses at the end of page 5 and students work in pairs to construct the 5x5 array of linking cubes.

The teacher holds up a 5x5 array of linking cubes and asks, "What is a good estimate of how many cubes make up the 5 by 5 chocolate bar?" After some students volunteer answers, the teacher asks, "How can we find out the exact number of linking cubes?"

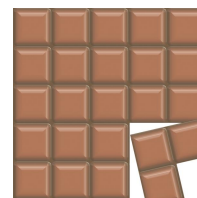


The teacher suggests one method, by counting all of the linking cubes individually. The teacher counts slowly, "1, 2, 3, 4, 5" and stops at the number 12. The teacher then says, "If we continue like this, we will find out the number of cubes, but it's a slow method. Could someone suggest a different method of counting, which would be faster than my method?"

Some students may suggest counting by 2s or by 5s. For the 5s method, the teacher asks the class to count along as she points to each row in the 5x5 square: "5, 10, 15, 20, 25." Then the teacher repeats the process by pointing to each column: "5, 10, 15, 20, 25." The teacher draws a 5x5 chocolate bar on the board or on chart paper and writes: "5 rows of 5 make 25" and "5 columns of 5 make 25."

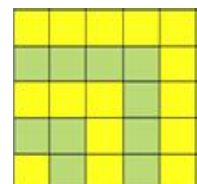
"There is a shorter mathematical way of writing this," says the teacher and writes, " $5 \times 5 = 25$."

The teacher continues reading the story and the students follow along by constructing the pieces of chocolate the break off each time that the First Little Pig takes a piece. At the end of page 8 the teacher asks, "What might be the next piece the breaks off?"



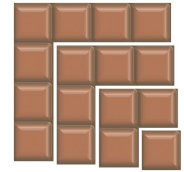
The teacher continues reading the story and the students follow along by constructing the pieces of chocolate the break off next. At the end of page 11 the teacher asks, "What does the First Little Pig mean when he asks, 'There are odd numbers hiding in squares?'"

After students volunteer explanations, the teacher draws a 5x5 grid on the board or on chart paper and shades in the odd numbers using two different colours, so that the odd numbers are easily identified. The teacher counts the number of odd numbers in the 5x5 square and says, "There are 5 odd numbers hiding in a 5 by 5 square." Then the teacher asks a series of questions:



"How many odd numbers are hiding in a 4 by 4 square?"

- How many odd numbers are hiding in a 3 by 3 square?
- How many odd numbers are hiding in a 2 by 2 square?
- How many odd numbers are hiding in a 1 by 1 square?
- How many odd numbers are hiding in a 6 by 6 square?
- How many odd numbers are hiding in a 7 by 7 square?
- How many odd numbers are hiding in a 10 by 10 square?
- How many odd numbers are hiding in a 100 by 100 square?
- How many odd numbers are hiding in a 1000 by 1000 square?



At the end of page 13, the teacher holds up a 4x4 array of linking cubes and asks, "What is a good estimate of how many cubes make up the 4 by 4 'chocolate bar'?" After some students volunteer answers, the teacher asks, "How can we find out the exact number of cubes?"

The teacher suggests the first method, by counting all of the linking cubes individually. The teacher counts slowly, "1, 2, 3, 4..." and stops at the number 10. The teacher then says, "If we continue like this, we will find out the number of cubes, but it's a slow method. Could someone suggest a different method of counting, which would be faster than my method?"

Some students may suggest counting by 2s. The teacher asks the class to count along as she points to each pair of linking cubes in the 4x4 square: "2, 4, 6, 8, 10, 12, 14, 16."

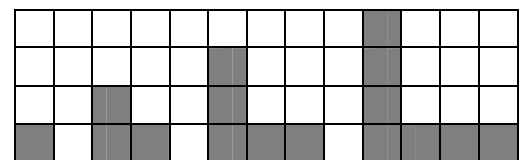
Some students may suggest counting by 4s. The teacher asks the class to count along as she points to each row in the 4x4 square: "4, 8, 12, 16." Then the teacher repeats the process by pointing to each column: "4, 8, 12, 16." The teacher draws a 4x4 chocolate bar on the board or on chart paper and writes: "4 rows of 4 make 16" and "4 columns of 4 make 16."

"There is a shorter mathematical way of writing this," says the teacher and writes, " $4 \times 4 = 16$."

The teacher finishes reading the story and asks students to share what they learned from the story.

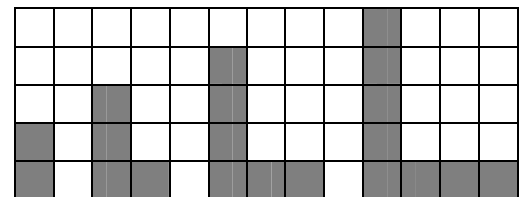
Student activity

Introduction



The teacher constructs the first 4 odd numbers using linking cubes, as shown above. Then the teacher asks, "How could we represent the first 4 even numbers using linking cubes?"

With teacher prompts as needed, students use their linking cubes to construct the first 4 even numbers (shown on the right).



Exploring where even numbers hide

Students work in pairs or small groups to determine "Where do even numbers hide?"

Students summarize their learning following teacher prompts such as: What did you learn? What surprised you? How did you feel? Students use chart paper and colourful markers, and they communicate their ideas using words, symbols, diagrams and pictures. They then share their learning with their peers, in a whole-class setting.

Authoring skits for sharing learning at home and for other classes

The teacher asks for a student volunteer, and the teacher and student improvise a skit of a math dialogue that might take place at home. The teacher helps guide the development of the dialogue, drawing attention to plot directions that would help parents experience math ideas in a surprising and meaningful way. This process is repeated with other volunteers, and eventually with only students performing. Here is a possible dialogue:

Hi Mom.

Hi honey. What did you do in math today?

It's a surprise, Mom.

Please tell me.

OK.

[The student holds a 5x5 square of 25 linking cubes. The square has concrete representations of the odd numbers 1, 3, 5, 7 and 9 fitting together like spoons.]

Take a piece, Mom.

That's 1 cube.

Take another

That's 3 cubes.

And another.

Hey, That's 5.

And another.

That's 7. And then 9.

What kind of numbers are these, Mom?

They are odd numbers.

Did you know that odd numbers hid in squares?

That's a surprise!

Where do you think even numbers hide, Mom?

That's a good question, honey.

Let's explore.

OK!

The students work in pairs or small groups to write their own skits of student-parent dialogues. As students gain experience with this process, they write their dialogues without teacher modeling.

Teachers who use this method notice a difference in their students. One teacher commented: "They are excited about communication. Before it was hard to get them to write anything. Now they are excited about writing." Another teacher added: "They are not just sharing answers. They are explaining. They are teaching each other. They show a real understanding." One teacher gave an example of a student whose group "finished early, and he usually wants to go back to his seat and do his own thing. But he wanted to help this group, he wanted to help that group so he was excited about it."

Authoring songs based on student writing

Using selected phrases that students write on their chart paper to summarize their learning and for their skits, the teacher could create 3-4 stanzas that summarize key math ideas and celebrate student thinking. The lyrics could be put to music using the melody from Row, Row Your Boat, or other such songs. A recording of the song could be submitted to the Math Performance Festival (www.MathFest.ca).

LESSON DEVELOPMENT, Gr. 8

Reading of *Something Curiously Odd*

The grade 2 students visit the grade 8 class:

- They read to them the story, *Something Curiously Odd*
- They share with them their findings about where even numbers hide
 - By sharing their written work on chart paper (each group of grade 2 students shares with a group of grade 8 students)
 - By performing their skits

Student activity

Exploring concrete and algebraic representations

Students work in small groups to:

- Construct concrete representations of odd, even and natural numbers
- Determine the 10th, 100th, and Nth term for each set of numbers
 - Odd: 19, 199, $2N-1$
 - Even: 20, 200, $2N$
 - Natural: 10, 100, N
- Find the sum of the first 10, 100 and N numbers in each set
 - Odd: 10×10 , 100×100 , $N \times N$
 - Even: 10×11 , 100×101 , $N(N+1)$
 - Natural: $10 \times 11/2$, $100 \times 101/2$, $N(N+1)/2$

The teacher may need to scaffold student thinking for determining the sum of the first N natural numbers. The picture on the right shows how 2 copies of concrete representations of the natural numbers 1-5 can be joined to create a 5×6 rectangle, which also represents the sum of the first 5 even numbers. Dividing this by 2 gives the sum of the first 5 natural numbers.



Communicating their learning

Students use chart paper and markers to communicate their ideas using words, symbols, diagrams and pictures.

They also create short skits that could be shared at home.

Using selected phrases that students write on their chart paper to summarize their learning and for their skits, the teacher or the students could create 3-4 stanzas that could be made into a song that summarizes key math ideas and celebrates student thinking. The lyrics could be put to music using melodies from popular songs. A recording of the song could be submitted to the Math Performance Festival (www.MathFest.ca).

The grade 8 students visit the grade 2 class, they share their learning and perform some of their skits (and possibly their song).