

NCTM 2012 Presentation # 7634, Campbell/West, Using Photographs to Illustrate Math Stories

Visualizing Math Stories

Visualizing Math Stories is a multidisciplinary unit designed to engage students in solving mathematical problems through writing and photography. The goal of this project is for students to work in small groups to create math story books, illustrated with photographs and, where appropriate, charts. This project is standards-based, and meets objectives in mathematics, reading, language arts, visual arts, and technology. While the project as developed is aimed at 3rd graders, it can be adapted easily for younger and older students.

Visualizing Math Stories was piloted in 2012 with 23 third graders at Davis Magnet Elementary School in Jackson, Miss. The content of the pilot project stories – patterns and measurement – was dictated by the objectives in the district's pacing guides during the term in which we worked.

Visualizing Math Stories could be adapted to any mathematical concepts.

Big Ideas

Mathematics is a language that is expressed visually, symbolically, and verbally.

In this project, all students will communicate mathematical concepts through written, oral, symbolic, and visual forms of expression.

Standards

Visualizing Math Stories meets objectives outlined in the Common Core State Standards for Mathematics, the Common Core State Standards for English Language Arts, National Standards for Arts Education, and National Educational Technology Standards.

For a full list of the specific standards addressed in the 3rd grade pilot project, visit www.sarahccampbell.com.

Resources and Preparation

Equipment List

pencils
lightweight paper 12" x 18" for storyboards (manilla paper works fine)
watercolor paper (student grade) 22" x 30" for final books
sticky notes
scissors
glue sticks or double-sided tape
rulers
markers
digital cameras, media cards
computer with internet access
props for photographs (will be unique to each story)

Handouts/Instructions

Books and Online Resources

Writing Prompts

Elements of a Successful Math Story
Writing a Math Story
Make an Instant Book

Instructional Plan

Read Growing Patterns

Examine trade books

- what do you notice?

Students select main topic

- brainstorm in teacher assigned groups

Analysis of teacher created stories

- Elements of a successful math story
 - teacher guided sample
 - independent student sample with questions
 - sample with missing elements

Graphic organizer

- teacher model with class input
- students work in topic groups
 - select story focus and complete graphic organizer
 - each student writes a story based on the graphic organizer

Group writing and revisions

- utilize the beginning, middle, end organizer, with students choosing best elements from each individual story

Storyboarding

- all students learn to make instant books, using manilla paper
- students work in groups to divide the text into page-sized chunks
- students work in groups to plan the photographs, assign photographers

Taking Photographs in Groups

- review images as they are taken, retake if necessary
- note the number of each selected photograph on its page in the storyboard book

(Teacher will get 4 x 6 prints made of student photographs)

Final Bookmaking

- students work in groups based on role (folder, chartist, assembler, scribe), which they've mutually decided upon
- folders (make instant books using good paper)
- chartists (make chart or graph to illustrate pattern or other concept, if needed)
- assemblers (using storyboard book as a guide, glue/tape photographs and chart in position)
- scribes (using storyboard, write text into book)

Have a Book Party

Elements of a Successful Math Story

___ The story includes characters and describes a situation in which math is used.

___ The story asks a math question or poses a math problem.

___ The story includes appropriate math words.

___ The story provides all the information needed to answer the math question or solve the problem.

___ The story correctly explains how to use a math skill to answer a question or solve a problem.

Math Story Graphic Organizer

Group members: _____

Topic: _____

Directions: Read and respond to the questions and statements with your group to help you think about your math story. After you complete the graphic organizer, write the first draft of your math story on a piece of notebook paper.

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graph TD; A[Describe the setting of your story. List the characters. What are the characters doing with patterns or measurement?] --> B[What math question do you want the characters to figure out? (Write the question as a complete sentence.)]; B --> C[What information do the characters need to answer the question? (Include details and label any numbers you use.)]; C --> D[How will the characters solve the math question? (Tell what the characters will do to answer the question and why they will do it.)]
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Describe the setting of your story. List the characters. What are the characters doing with patterns or measurement?

What information do the characters need to answer the question? (Include details and label any numbers you use.)

What math question do you want the characters to figure out? (Write the question as a complete sentence.)

How will the characters solve the math question? (Tell what the characters will do to answer the question and why they will do it.)

Names: _____

Working Title: _____

Directions: Organize your math story by determining the beginning, middle, and end of the story.

Beginning

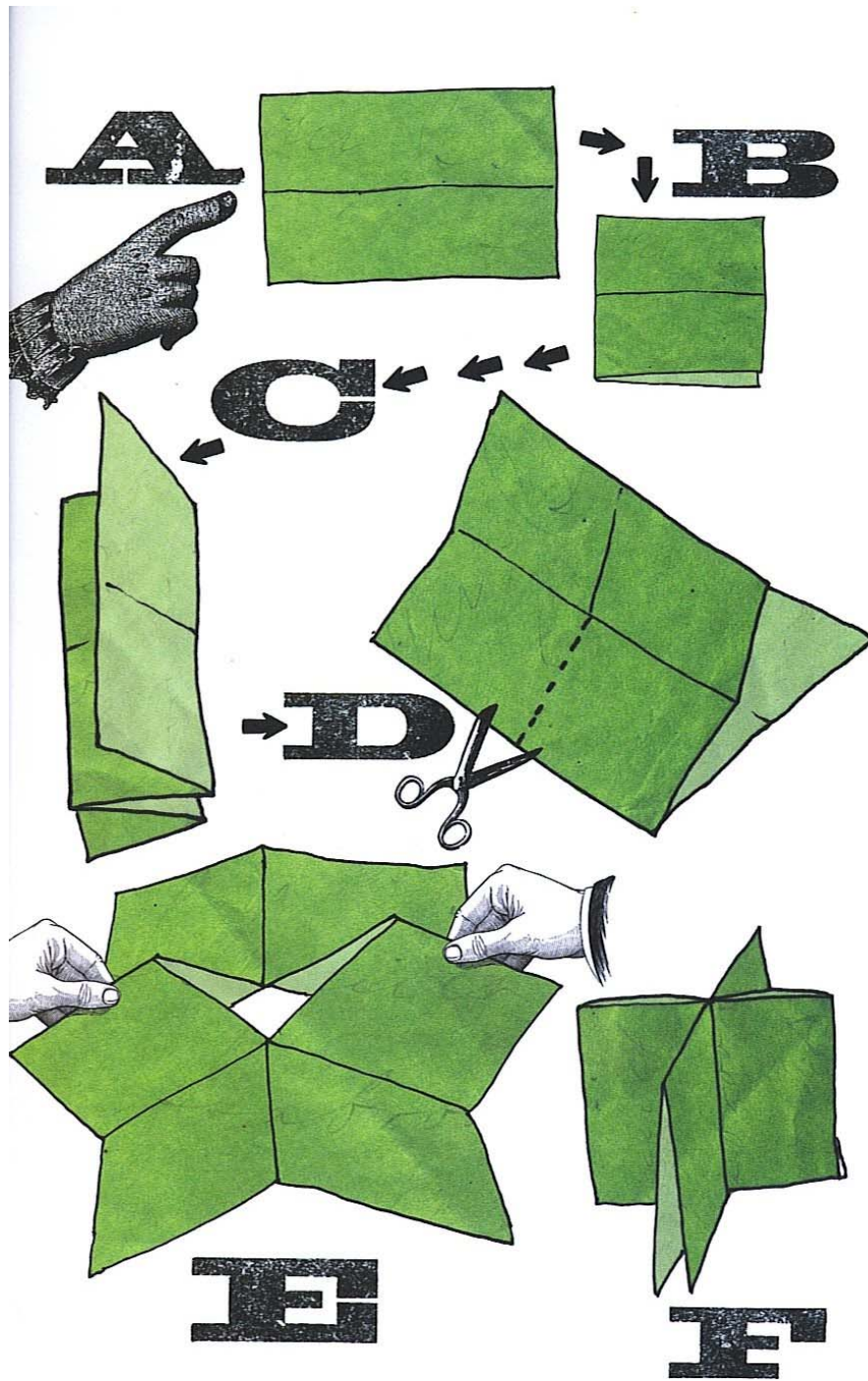


Middle



End

from Esther K Smith's How to Make Books: Fold, Cut & Stitch Your Way to a One-of-a-Kind Book



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Visualizing Math Stories

Resources

Books

For Students

Math Story Books Illustrated with Photographs

- Growing Patterns: Fibonacci Numbers in Nature, by Sarah C. Campbell, photographs by Sarah C. Campbell and Richard P. Campbell, Boyds Mills Press, 2010.
- For Good Measure: The Ways We Say How Much, How Far, How Heavy, How Big, How Old, by Ken Robbins, Flash Point, 2010.
- I Can Count the Petals of a Flower, by John Wahl and Stacy Wahl, National Council of Teachers of Mathematics, 1985.
- Tiger Math: Learning to Graph from a Baby Tiger, written by Ann Whitehead Nagda and illustrated by Cindy Bickel, Owlet Paperbacks, 2002.
- Let's Count, by Tana Hobin, Greenwillow Books, 1999.

Math Story Books

- One Grain Of Rice: A Mathematical Folktale, by Demi, Scholastic Press, 1997.
- The Grapes of Math: Mind-Stretching Math Riddles, written by Greg Tang and illustrated by Harry Briggs, Scholastic Press, 2001.
- Twelve Snails to One Lizard: A Tale of Mischief and Measurement, written by Susan Hightower and illustrated by Matt Novak, Simon & Schuster Books For Young Readers, 1997.
- Ton, by Taro Mura, Chronicle Books, 2004.
- Millions To Measure, written by David M. Schwartz and illustrated by Steven Kellogg.

For Teachers:

- New Visions for Linking Literature and Mathematics by David J. Whitin and Phyllis Whitin, published by NCTE (with NCTM), 2004.
- Math Is Language Too: Talking and Writing in the Mathematics Classroom by David J. Whitin and Phyllis Whitin, published by NCTE (with NCTM), 2000.
- How to Make Books by Esther K Smith, Potter Craft , 2007.

Websites

- <http://www.readwritethink.org>
 - (especially lessons by Phyllis Whitin and David J. Whitin)
- <http://writingfix.com/index.htm>
 - (especially, NumberFix at <http://writingfix.com/WAC/numberfix.htm> by Holly Young)
- <http://www.jologriffin.com/journal.cfm>
 - (a list of 101 writing prompts for math journaling)
- <http://www.purgatorypiepress.com/howto.html>
 - (website for Esther K. Smith, bookmaker)

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Standards

Visualizing Math Stories meets objectives outlined in the Common Core State Standards for Mathematics, the Common Core State Standards for English Language Arts, National Standards for Arts Education, and National Educational Technology Standards.

Specific standards addressed in the 3rd grade pilot project:

Common Core State Standards for Mathematics

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
4. Model with mathematics.
8. Look for and express regularity in repeated reasoning.

Standards for Mathematical Content

Operations and Algebraic Thinking 3.OA

Solve problems involving the four operations, and identify and explain patterns in arithmetic.

9. Identify arithmetic patterns (including in the addition table or multiplication table), and explain them using properties of operations.

Measurement and Data 3.MD

Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.

2. Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.

Represent and interpret data.

Common Core State Standards for English Language Arts

Reading Standards for Informational Text

Key Ideas and Details

1. Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
3. Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.

Craft and Structure

4. Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 3 topic or subject area.
5. Use text features and search tools (e.g., key words, sidebars, hyperlinks) to locate information relevant to a given topic efficiently.

Integration of Knowledge and Ideas

7. Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).

Writing Standards

2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

- a. Introduce a topic and group related information together; include illustrations when useful to aiding comprehension.
 - b. Develop the topic with facts, definitions, and details.
 - c. Use linking words and phrases (e.g., also, another, and, more, but) to connect ideas within categories of information.
 - d. Provide a concluding statement or section.
3. Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.
- a. Establish a situation and introduce a narrator and/or characters; organize an event sequence that unfolds naturally.
 - b. Use dialogue and descriptions of actions, thoughts, and feelings to develop experiences and events or show the response of characters to situations.
 - c. Use temporal words and phrases to signal event order.
 - d. Provide a sense of closure.

Speaking and Listening Standards Comprehension and Collaboration

1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on *grade 3 topics and texts*, building on others' ideas and expressing their own clearly.
 - a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
 - b. Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
 - c. Ask questions to check understanding of information presented, stay on topic, and link their comments to the remarks of others.
 - d. Explain their own ideas and understanding in light of the discussion.
2. Determine the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

Language Standards Conventions of Standard English

1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

Knowledge of Language

3. Use knowledge of language and its conventions when writing, speaking, reading, or listening.
 - a. Choose words and phrases for effect.
 - b. Recognize and observe differences between the conventions of spoken and written standard English.
6. Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships (e.g., *After dinner that night we went looking for them*).

National Standards for Arts Education

1. Understanding and applying media, techniques, and processes.
 - Students use different media, techniques, and processes to communicate ideas, experiences, and stories
 - Students use art materials and tools in a safe and responsible manner

6. Making connections between visual arts and other disciplines.

- Students identify connections between the visual arts and other disciplines in the curriculum

National Educational Technology Standards

1a. Apply existing knowledge to generate new ideas, products, or processes.

1b. Create original works as a means of personal or group expression.

6a. Understand and use technology systems.