Teaching Science Through Trade Books

Presented by: Christine Royce

December 3, 2012
7:30 p.m. – 9:00 p.m. Eastern time
Introducing today’s presenter…

Christine Royce
• Professor at Shippensburg University
• NSTA Press author
Teaching Science Through Trade Books

Christine Anne Royce, Ed.D
* How often do you utilize a children’s trade book as part of a science lesson?

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TEACHING
SCIENCE
THROUGH
TRADE BOOKS

Christine Anne Royce,
Emily Morgan, and
Karen Ansberry
The Authors!
Format of Book

- Historical Use of Trade Books in the Science Classroom
- Why Use Trade Books to Teach Science?
- 50 Chapters
  - K-2/3 Activity
  - 4-6
- 100 of our Favorite Activities
- Standards/Framework Matrices
### National Science Education Standards: Content Standards K–4

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Chapter 4
A Closer Look
By Karen Ansberry and Emily Morgan

Growing a child hand lens or a microscope, and they quickly become fascinated with the hidden worlds these tools reveal. These lessons provide opportunities for students to take a closer look at the properties of objects and organisms and to explore how magnifying instruments help scientists make observations and discoveries.

Trade Books

You Can Use a Magnifying Glass
By Wiley Blevins
Children’s Press, 2004
ISBN 978-0-516-27328-0
Grades K–4
SYNOPSIS
Through simple text and photographs, this Rookie Read-About Science book describes how to use a magnifying glass and what kinds of things can be seen with it.

Hidden Worlds: Looking Through a Scientist’s Microscope
By Stephen Krasner
Houghton Mifflin, 2001
Grades 4–8
SYNOPSIS
Hidden Worlds takes you behind the scenes of scientists Dennis Kunkel’s work and explains how he captures remarkable images of microscopic life and objects. Stephen Krasner’s engaging text and Kunkel’s dramatic photographs provide a fascinating look at a microscope and the hidden worlds he explores.
Chapter 4
A Closer Look

By Karen Anthony and Emily Morgan

Curricular Connections

According to the National Science Education Standards (NSES, 1996), students in kindergarten through grade 2 should learn how scientists depend on certain tools to help them make better observations. Instruments such as magnifying glasses and microscopes help observation all across the world see, measure, and do things that they could not otherwise see, measure, or do. The Standards also highlight the importance of giving students opportunities to increase their understanding of the characteristics of objects and materials that they encounter daily. The lessons presented in this column provide students opportunities to observe, describe, and observe objects and organisms while teaching them how magnifying glasses or microscopes can enhance observation, drawings, and descriptions.

Grades K–3:
With a Hand Lens

Materials
- Coins Observation student page (p. 19)
- Dimes (one per student)
- Hand lens
- Ink pad

Engage
Hand out the Coins Observation student page. Ask students to draw the features of a dime “tail side” in detail. From memory, in the first circle. Have students share their drawings with another, then discuss the limitations of drawing details from memory. Next, give each student a dime to observe with the naked eye. Have them use the second circle as an outline to draw the features of a dime “tail side” again in more detail. Then ask, “What scientific tool could you use to observe the details of an object better than you could with your eyes alone?” (e.g., magnifying glass or hand lens, microscope, binoculars, or telescope). Next, hold up a magnifying glass and tell students that it is a scientific tool that can help them see the features of an object in detail. Then, read aloud pages 8–11 of You Can Use a Magnifying Glass: Keep a Secret. What can you see?

Explore
A magnifying glass or plastic hand lens will help students see an even closer look at a dime. Model the proper way to use a magnifier (holding the lens close to one eye,charting the other eye, and bringing the object toward the lens until it comes into focus), and caution them that touching things with the lens can scratch it. Then pass out plastic hand lenses to all students, and have them use the lenses to observe the details of their coins, fingerprints, pennies, and other objects. Some students may have trouble bringing the lens onto coins, so you may want to have them cover one eye, with a hand or hold the hand lens out farther and use both eyes. After a few minutes of exploration and sharing, have students use the third circle as an outline to draw the tail side of a dime as seen through a hand lens.

Explain
Have students explain how the hand lenses helped them see details of things that they could not otherwise see. Then ask, “How does a hand lens work? What other things can you see with a hand lens?” Read the rest of You Can Use a Magnifying Glass and then discuss the answers to your questions. (A light helps hand lens. This makes things look bigger. You can have a fly’s eye is made up of lots of small pieces, you can look closely at jewelry, and you can see the pattern in a fingerprint.)

Elaborate/Evaluate
Now students are going to use hand lenses to help them solve a mystery! In advance, prepare the “evidence.” Have a fellow teacher use an ink pad to make a fingerprint at the top of a sheet of paper. Below that, have this person wash as several other teachers make fingerprints on the paper. Write the names below their respective prints. Then, explain
Curricular Connections

According to the National Science Education Standards (1996), students in writing paragraphs, the 5th grade K should learn how scientists depend on certain tools to help them make better observations. Instruments such as magnifying glasses and microscopes help scientists all over the world see, measure, and do things that they could not otherwise use, measure, and do. The Standards also highlight the importance of giving students opportunities to increase their understanding of the characteristics of objects and materials that they encounter daily. The lesson presented in this column provide students opportunities to observe, draw, and describe objects and organisms while teaching them how magnifying glasses or microscopes can enhance observations, drawings, and descriptions.

Grades K-3: With a Hand Lens

Materials
- Coin Observation student page (p. 19)
- Dime (one per student)
- Hand lens
- Exit pad

Engage
Hand out the Coin Observation student page. Ask students to draw the features of a dime’s “tails” side in detail, from memory, on the first circle. Have students share their drawings with one another, then discuss the limitations of drawing details from memory. Next, give each student a dime to observe with the exit lens. Have them use the second circle as an outline to draw the features of a dime (“tails” side again) in more detail. Then ask, “What scientific tool could you use to observe the details of an object better than you could with your own eyes alone?” (e.g., magnifying glass or hand lens, microscope, binoculars, or telescope). Next, hold up a magnifying glass and tell students that it is a

**Coin Observation**

<table>
<thead>
<tr>
<th>Draw a dime from memory.</th>
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<tbody>
<tr>
<td>Look at a dime. Draw it.</td>
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<tr>
<td>Use a hand lens to look at a dime. Draw it.</td>
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Which picture has the best details?

Why do you think so?

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## Breakdown of Chapters

<table>
<thead>
<tr>
<th>Engineering, Technology and Applications of Science</th>
<th>Physical Science</th>
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<td>8 topics</td>
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<td><img src="image2.png" alt="Physical Science" /></td>
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<th>Earth and Space Science</th>
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<td>12 topics</td>
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<td><img src="image3.png" alt="Life Science" /></td>
<td><img src="image4.png" alt="Earth and Space Science" /></td>
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Historical Use of Trade Books in the Science Classroom

- AAAS – Science Books and Films since 1965
- NSTA/CBC - Outstanding Science Trade Books since 1973
- S&C - Teaching Through Trade Books - 2003
Let’s Get To It

Name a children’s trade book that you have used in your science lessons.
Survival Skills

* K-3 Activity– Hide and Seek – Students investigate how camouflage helps animals blend in with their surroundings.

* 4-6 Activity – Beaks Are for the Birds – Students explore how a bird’s beak helps it obtain food.
# Beaks Are for the Birds

**DATA SHEET**

<table>
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<tr>
<th>BEAK TYPE</th>
<th>FOOD SOURCE</th>
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<tr>
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<td>Rice (Seeds)</td>
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<td>Predicted</td>
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<td>SMALL SPOON</td>
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<td>LARGE SPOON</td>
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<td>EYEDROPPER</td>
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<td>STRAINER</td>
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<td>TONGS</td>
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Hide and Seek

- What are some ways animals protect and defend themselves?
- Key term: camouflage
- Simple materials
- Out of the mouths of babes!!
- Predict which fabric would work best
CC Tie In: Vocabulary Development

* Description: Allows students to identify words they know and need to look up
* Uses: New stories, science texts, media
* Critical Questions:
  * What is the meaning of the word?
  * What do I think/know the word means?
  * What does the word mean?
* Reading Skill: Vocabulary
* Science Skill: Vocabulary
## Vocabulary Development

<table>
<thead>
<tr>
<th>Vocabulary Words</th>
<th>Already know the meaning</th>
<th>What I looked up if necessary</th>
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<tbody>
<tr>
<td>Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies. (ELA Standard – 3rd grade Vocabulary Acquisition)</td>
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<td><img src="image1.png" alt="Insect Book" /></td>
<td><img src="image2.png" alt="Buzz Book" /></td>
<td><img src="image3.png" alt="Stripes Book" /></td>
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Questions
And research behind the strategy
Teaching Science
Through Trade Books
So why use children’s books in the science classroom?

1. 
2. 
3. 
4. 
5.
Providing students with rich experiences first, followed by asking them to read, write, and speak about them is key to integrating science and reading (and having students learn).

Too often the process is reversed with experiential learning coming at the end or not at all.

Engaged and inquiry oriented science can bridge the gap between experience and learning as well as between subject areas!
Experience First

- Experience needs to occur first
- Hands-on activities
- Exploration
- Allows students to activate prior knowledge and connect new knowledge
Students need to process and reflect on their experiences.

This helps in the construction of knowledge and the development of mental models and pictures.
Symbols

- Finally, the student should discuss concepts from their experiences.
- Students learn vocabulary in context.
- They develop a symbolic representation of their experiences and can communicate that to others.
The procedure is actually quite simple. First, arrange things into different groups. Of course, one pile may be sufficient depending on how much there is to do. If you have to go somewhere else due to lack of facilities, that is the next step, otherwise you are pretty well set.

What process is occurring above?
It is important not to overdo things. That is, it is better to do too few things at once than too many. In the short run this may not seem important but complications can easily arise. A mistake can be expensive as well. At first, the whole procedure will seem complicated. Soon, however, it will become just another facet of life. It is difficult to foresee any end to the necessity of this task in the immediate future, but then one never can tell.
After the procedure is completed, one arranges the materials into different groups again. Then they can be put into their appropriate places. Eventually, they will be used once more and the whole cycle will then have to be repeated. However, that is part of life.

So what are we doing?
Science gives meaning and purpose to literacy activities by providing a rich field of content that students are naturally curious about.

One literacy builds on the other literacy since language becomes the avenue through which science is communicated.

Science instruction improves reading skills.

Both disciplines profit when science and reading are combined.
Research about Brain-based Learning

The reading process parallels the process of scientific inquiry – both areas require skills in questioning and setting a purpose, analyzing and drawing conclusions, and communicating results.

Yore, Craig, and Maguire (1995)
Questions
More Activities
Thought Provoking Questions

* Students will practice determining what types of questions will help them obtain more information to answer a puzzle.
A Single Answer or Eliminating Answers

- Who has been sitting in my chair?
  - Dog
  - Cat
  - Bird
  - Mother in Law

- Was the person sitting in my chair a boy or a girl?
- Object in bag
- Record “guesses” on board
- Pose question – Is guessing a good method?
- Model think aloud
- Generate list of questions and then analyze
To test your question skills!

* The man was afraid to go home because the man with the mask was there

1. 
2. 
3. 
4. 
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7. 
8.
Structure of a Chapter
Chapter 5

Science Measures Up

By Karen Amsberry and Emily Morgan

Can you measure a dog's tail in dog biscuits? Can you measure a desk without a ruler? Which is better: measuring a room in paces or meters? Which system of measurement do scientists use? Explore these questions and more to help learners understand why we use standard systems of measurement.

Trade Books

Measuring Penny
By Loren Long
Henry Holt and Company, 2000
Grades K-4

SYNOPSIS
Lisa learns about standard and nonstandard units of measurement, including penny, inches, dog biscuits, and cotton swabs.

How Tall, How Short, How Faraway
By David A. Adler, illustrated by Nancy Tobin
Holiday House, 2006
Grades K-4

SYNOPSIS
Simple text and cartoon-like illustrations introduce the history of measurement systems, beginning in ancient Egypt and ending with the modern metric system.

Curricular Connections

The science inquiry standard of the National Science Education Standards (NSES 1996) includes measurement as a fundamental skill necessary to do scientific inquiry. Students should be able to employ simple equipment and tools to gather data and extend the senses. The National Science Education Standards also suggest that children develop some essential understandings about science and technology, including the idea that people throughout history have invented tools and techniques to solve their problems.

Weights and measures were among the first tools invented by man. Ancient people used their body parts and items in their surroundings as their first measurement tools. As societies evolved, measurements became more complex. By the 18th century, England had achieved a greater degree of standardization in measurement than other European countries. The English, or customary system of measurement commonly used in the United States, is nearly the same as the system brought to the colonies from England.

The need for a single, worldwide measurement system was recognized in 1760, when a French priest named Gabriel Monton proposed a measurement system (based on units of 15) that was both reasonable and acceptable. However, a century passed and no action was taken. During the political upheaval of the French Revolution in the 1790s, the French Academy of Sciences proposed a new system, based upon Monton’s, as a way to bring order to the confusing and often contradictory traditional systems of weights and measures that were being used throughout Europe. The metric system got its name from the unit of length, called the meter, which is derived from the Greek word meaning “a measure.” The standardized structure and decimal features of the metric system made it well suited for scientific and engineering work, and wide acceptance of the metric system coincided with an age of rapid technological development. Although the English system of measurement is commonly used in everyday situations in the United States, scientists around the world primarily use the metric system (International System of Units), in their daily work.

Grades K-3

Measuring Pens

Materials
- Unlined paper
- Measuring tapes
- Everyday items that can be used in nonstandard units of measurement (e.g., cotton swabs, dog biscuits, and paper clips)
- Dual-sided rulers
- Measuring tape
- Measuring Penn student page (p. 15)

Engage
Ask, “Can you measure a dog’s tail in dog biscuits?” Then have students take the pages of the book “Measuring Penn.” Explain that in the book, Lisa measures her dog Penn in a variety of ways. Make connections by asking students to share their own experience with measurement, and then read “Measuring Penn” aloud to the class. Pass out measuring Penn student pages 7 and 8, where Mr. Jayson gives the class “Measuring Penn.” Point out that the students use their own parts to a measurement, a number and a unit. Ask students to tell you what each unit of measurement is different from another. Are the units of measurement the same? What is the difference between standard and nonstandard units? Students should realize that standard units are units of measurement that are accepted and used by many people and nonstandard units are everyday objects that can be used for measuring.

Explore/Explain
Have students bring in a favorite animal model to measure in both standard and nonstandard units.
Provide measuring tapes, as well as various items they could use as nonstandard units (e.g., cotton swabs, dog biscuits, and paper clips). After some modeling and guided practice, have students measure the length of their stuffed animals' parts in as many ways as they can using a standard unit and a nonstandard unit for each part. Students should record their results in the Measuring Pets student page (p. 25). At students' measuring, circulate to ask the children how they arrived at their measurements and to explain how they identified each unit as standard or nonstandard. Then have them trade stuffed animals with a partner and check one another's measurements.

**Grades 4–5**

**History of Measurement**

**Materials**
- Meter sticks

**Engage**

Ask, “Can you measure a desk without a ruler?” and then challenge students to measure the length of your desk without using any nonstandard measuring tools. As a class, brainstorm a list of ways that you could measure the desk. Tell students that in ancient times, measurement tools were not readily available, so people had to come up with creative ways to measure things. In ancient Egypt, one way to measure was the “span.” A span is from the tip of the thumb to the tip of the little finger with the hand stretched wide. Have a student measure your desk with his own hand span and record the number of spans on the board. Then measure the desk using your own hand span, and record the number of spans on the board. Ask, “Which measurement is the correct answer for the length of the desk?” Students should understand that there is no “correct” answer in spans because each person's span is a different size.

**Explore/Explain**

Introduce the book How Tall, How Short, How Far Away? and then read through pages 7–8. Ask students about their bodies and the idea of standard units as explained on pages 6–9. With students looking at the book, ask, “If you were measuring the length of your dog’s tail, which metric unit would be best?” Have students measure their dog’s tails. Then ask students to explain why their choice for the best metric unit was best. After students have measured their dog’s tail, ask, “Which metric unit would you use to measure the height of your desk?” Have students measure their desks and then ask, “Which metric unit would you use to measure the height of your desk?” Have students measure their desks with a meter stick. Then ask, “Which metric unit would you use to measure the height of your desk?” Have students measure their desks with a meter stick. Then ask, “Which metric unit would you use to measure the height of your desk?” Have students measure their desks with a meter stick. Then ask, “Which metric unit would you use to measure the height of your desk?” Have students measure their desks with a meter stick. Then ask, “Which metric unit would you use to measure the height of your desk?” Have students measure their desks with a meter stick.
What types of animals can be found at the zoo? What can you count at the zoo? Tally charts and bar graphs in the book.

“When I go home, I’m going to look for graphs in magazines and in the newspaper. Why don’t you look for some graphs, too?”
My graph is called ______________________

It shows ___________________ on the bottom of the graph (horizontal axis) and _____________________ on the side of the graph (vertical axis).
• What does this graph tell you?
• Which animal was the webinar’s favorite? How do you know that?
• Which animal was the webinar’s least favorite?
• How many more votes did the __________________ get than the __________________?
• What does this graph tell you?
• Which animal was the webinar’s favorite? How do you know that?
• Which animal was the webinar’s least favorite?
• How many more votes did the _________________ get than the ________________?
Questions
Contact Information

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• NSTA Press author
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