Science as a Verb — STEAM in Action (Grade K-2)

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What Does STEM Instruction Look Like?

STEM instruction is an integrated/interrelated model that bridges Science, Technology, Engineering, and Mathematics. Through design and problem/project-based learning situations, students begin to weave their understanding of STEM into an interrelated use of skills rather than four discrete subjects. As a result concepts once solely taught in isolation are made relevant and tangible through students' application of these interdisciplinary skills.

Here are the four basic elements for crafting a STEM lesson:

- Question/Problem Posed—Real-world problems/questions are posed to students.
- Inquiry-Based Lesson—Students "conduct original research" through inquiry-based and inspired lessons to test, gather, and analyze data.
- Collaborative Learning—Students work collaboratively to re-design and improve potential solutions.
- Findings Communicated—Solutions and findings are communicated to peer communities

What is STEAM?

STEAM is the same acronym as STEM, except the “A” refers to the arts. The STEAM movement aims to place a significant importance on including arts education into the classroom curriculum. Each discipline is not isolated, but integrated, in order to support deeper understanding and interest. STEAM education allows for more creativity through artistic expression, and is constantly needed in order to promote innovation and intellectual risk. Researchers cite the fact that students are interested in the media and arts for justification of STEAM in schools.

Safety in the Science Classroom
Rules of the Laboratory

- Listen to and read all directions.
- Never eat or drink anything during lab.
- Wear safety goggles when directed.
- Report any breakage, chemical spills, or other accidents immediately to the teacher.
- Obtain permission from the teacher before performing experiments you have modified or designed.
- Wash hands thoroughly at the end of the lab.

Glitter Germs

Grade Level(s): K. 1-2
By: Terry Sayre

Objectives:
Students will have a concrete example as to why they should wash their hands with soap and warm water.
Students will understand that germs are smaller than the eye can see.

Materials:
Glitter
Paper Towels
Hand Lotion
Bucket (to catch glitter)

Procedure:
(Be sure to find out if any students have allergies to hand lotion.)

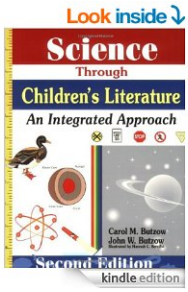
- Ask: What is a germ? How big is it? Why is it important to wash your hands? Put a small amount of hand lotion in each student's hands. Have them rub it all over their hands.
- Sprinkle, over a bucket, a small amount of glitter into each student's hands. Have them rub their hands to spread the glitter evenly.
- Next, have a few kids try to get the glitter off with dry paper towel.
- Then, have a few kids try to get the glitter off with plain, cold water.
- After that, have a few kids use warm water, with soap, to get the glitter germs off.
- Let everyone wash his or her hands with warm, soapy water.
- Bring everyone back to circle and ask, "What does the glitter represent (Germs)? What happened when you tried to get it off with just paper towels? Cold water? Warm, soapy water? Why is it important to properly wash your hands?

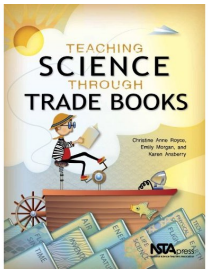
Evaluation:
Assessment will be informally based on the Following Criteria:

- Students will demonstrate proper hand washing with warm, soapy water.
- Each student will understand that germs can be spread by not properly washing their hands.

Using Children's Trade Books For Teaching Science

http://www.nsta.org/publications/ostb/
http://www.thereadingnook.com/science/





STEM Education

Expert Advice on Effective STEM Education for Elementary School Teachers by Erin MacPherson

Retrieved from: http://www.weareteachers.com/hot-topics/special-reports/stem-for-elementary-school

Task #1: Change Your Lens

Here's the secret: most don't have to overhaul the way they teach in order to become strong STEM educators. "It's all about changing the lens through which we view our teaching practices," says Green. "Elementary teachers need the opportunity and the confidence to be engineers alongside their students," says Dr. Green. This can be as simple as changing the kinds of questions we ask our students. "By adding a few words to your classroom questioning vocabulary—words like *design, experiment* and *model*—a whole world of STEM learning can be opened up for students." It's all about tweaking the lessons, activities, homework and language just enough to create an environment where STEM is a natural but effective part of the curriculum.

Task #2: Enlist a Village of STEM Educators

As a teacher, you're always busy innovating, finding new ways and cobbling together resources to help your students learn. But teachers shouldn't have to carry the entire responsibility for STEM education; we need partners. "Community partnerships—both with education businesses and higher education institutions," agrees Dr. Green, "are a key factor in the success of STEM programs."

Ideally, school districts should be receiving donated resources from local businesses and higher education institutions should provide hands-on and in-depth training to teachers. "Both have a huge stake in making sure this generation of students can take on the challenges of STEM," says Green.

Task #3: Integrate STEM Across the Curriculum

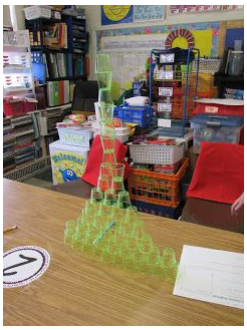
With Common Core, the push to teach reading and writing across the curriculum continues to grow. Likewise, the skills developed through STEM learning need to be integrated. If you're familiar with the STEM to STEAM movement, you'll know that many educators believe that true STEM education can only be accomplished by adding art into the mix. By adding art and music concepts like design, rhythm and movement to STEM education, students are able to fully visualize STEM concepts.

The principles of STEM—critical thinking, asking good questions, observation and exploration—are truly at the heart of every discipline," explains Green. School-wide STEM learning would enable teachers to work together to create unified curricular units that weave STEM concepts into every subject in a meaningful way.

Task #4: Give Kids More than Just Access to Technology

The "T" in STEM stands for technology, but exposure to educational technology is not enough for true STEM learning. Exposing kids to tools like computers, iPads, e-readers and apps early on is important, but it's only through guided learning that these tools become an important part of STEM education, argues Green.

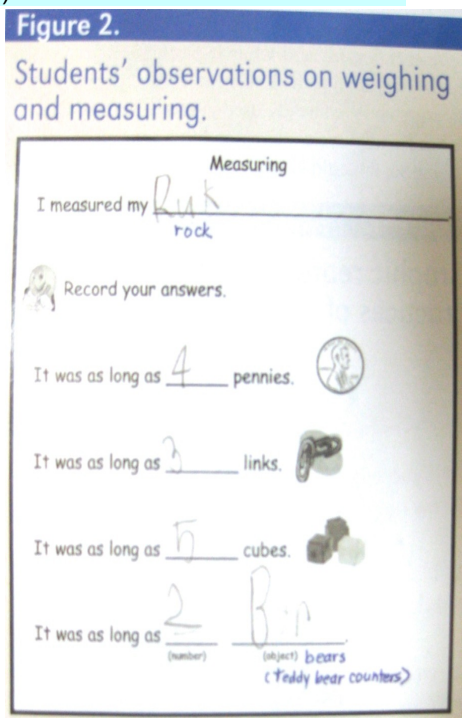
"We need to take a whole-child approach to teaching children about technology," explains Green. "Teachers can help kids make connections across various technologies to real-world concepts simply by strategic questioning and guided learning, especially if they have had access to research-based STEM education and teacher training."



Observations

Using Science Notebooks

(Lisa Rogers and Belinda Basca, 2011)



Students have ownership of their work.
- -free to revisit, make changes, make additions
- -increased responsibility
- -good for self-reflection

Focus feedback on positive aspect of work.
- -careful to pose questions without approval or disapproval
- -proposed ideas for further research or observation

Use notebooks to inform teaching practices.
- -provide insight into understanding of concepts
- -tool to evaluate my own teaching
- -helps with differentiation

Provide adequate time for reflection.
- -students need time to record, interpret, and form conclusions
- -plan for this when making lesson plans

Focus on scientific literacy rather than science literacy.
- -*science literacy* focuses accumulating facts
- -*scientific literacy* emphasizes scientific ways of knowing and processing
- -focus on "how" they can an answer over "what" the answer is:
  - •how detailed are the drawings and observations?
  - •are the measurements accurately labeled?
  - •are conclusions based on observations?
  - •if one student's observations differ from the class's, does the student give reasons for this difference?

SEEDS

Wonder Journal Labels (from *Perfect Pairs*, 2014).

I wonder how wind, water, and animals help some seeds move to new places.

How do wind, water, and animals help some seeds move to new places?

How Seeds Are Dispersed in *Planting the Wild Garden*

Wind	Blows seeds to new places
Bird	Shakes sees loose; eats seeds, & then releases them in droppings.
Rain	Washes seeds to new places
Stream	Carries seeds to new places
Rabbit	Shakes seeds loose
Fox	Seeds catch on fur and fall off in new places
Raccoon	Carries seeds to new places
Squirrel	Buries seeds
Person	Carries seeds to new places; blows seeds to new places

How Seeds Are Dispersed in Miss Maple's Seeds

Who/What Dispersed Seeds	Where Seeds End Up	So What?
River water	Soft, muddy soil	Plants won't have to compete with their parents
Wind	Grassy fields, thick forests	1. Rich soil keeps plants healthy. 2. Sun and rain helps plants grow. 3. Plants avoid weeds.
Squirrels	Field, forest, backyard	Plants will get just the right amount of sun and rain. They will have plenty of room to grow.

Peter Pan Theory of Seed Dispersal

Hooks (Captain Hook)
Wings (Tinkerbell)
Flying (Peter Pan)
Sailing/Water (Ocean/boats)
Exploding (Pirate ships, muskets, and cannons)
Digesting (Crocodile)

Design a Seed:

A. First sketch a plan of a seed outlining the main features of the seed including:
- its size and shape
- features that help it disperse from its parent plant
- labels of the parts of the seed and its unique features

What kind of environmental conditions does the see require?

B. Build your seed using art materials like paper, cardboard, clay, etc. Don't forget to include the features of the see that are listed above.

C. Apply the seed-design tests for the seed to assess its performance.
- What worked?
- What needs to be improved?

D. Communicate the your results to another student.

E. Provide feedback on another student's seed and report.

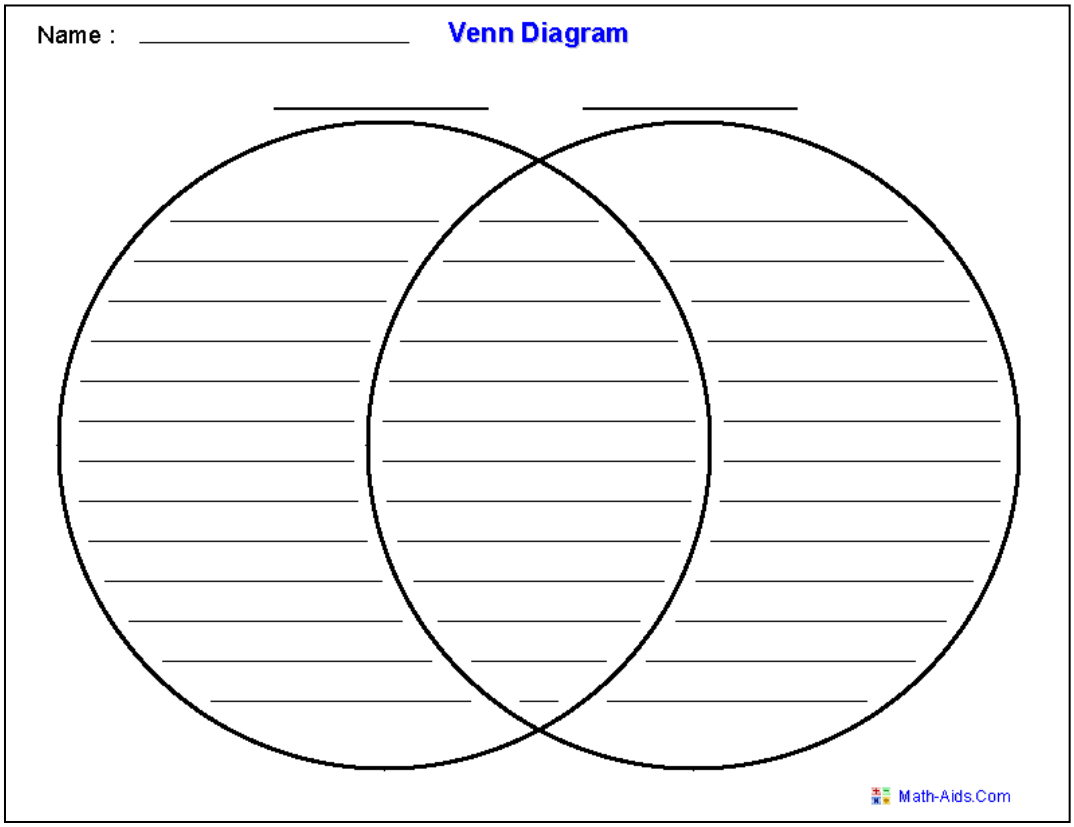
F. Reflect on what you thought of when designing your seed.
- What did you think of first?
- Did you follow a plan?
- Do you like your seed? Why?

1. Seed from the Butterfly Eating Blob Plant. The seed is dispersed by the explosion of the seed pod and it falls gently to the ground because of its feathers. Then legs pop out and it walks away.

2. Seed from the Target Plant. The seed has lots of hooks so it can attach itself to animals.

3. Seed from the Leaf Poison Plant. This seed is an attractive color to animals who will eat it. It will then pass through the animal's body. The outside of the seed cracks open so that it can start growing when it touches the ground.

4. Seed from the Truncheranium plant. This seed has wheels so when it falls from the parent plant it rolls away and begins to germinate.



Outdoor Education

Project Learning Tree (PLT) is an award-winning environmental education program designed for teachers and other educators, parents, and community leaders working with youth from grades PK-12. PLT uses the forest as a "window" on the world to increase students' understanding of our environment; stimulate students' critical and creative thinking; develop students' ability to make informed decisions on environmental issues; and instill in students the commitment to take responsible action on behalf of the environment. http://www.plt.org/

Project W.I.L.D./Aquatic Project WILD is an interdisciplinary, supplementary environmental and conservation education program for educators of grades K-12. The program emphasizes wildlife because of its intrinsic and ecological values, as well as its importance as a basis for teaching how ecosystems function. http://www.projectwild.org/

Project W.E.T. Project WET (Water Education for Teachers) is a nonprofit water education program and publisher for educators and young people ages 5-18. The program facilitates and promotes awareness, appreciation, knowledge, and stewardship of water resources through the dissemination of classroom-ready teaching aids and establishment of internationally sponsored Project WET programs. http://www.projectwet.org/

In the Mix

(from 3M Science of Everyday Life)

http://scienceofeverydaylife.discoveryeducation.com/teachers/pdfs/K2_InTheMix.pdf

A mixture contains two or more substances that are not chemically joined together. Even though the composition of a mixture is variable, each component retains its characteristic properties. Solid objects mixed together in a tossed salad, solutions such as sugar and water, suspensions such as oil and vinegar salad dressing, and colloids such as milk are all examples of mixtures.

To separate a mixture, it is helpful to know some of the properties of the components. Are any of the objects magnetic? Do any of the objects float? What size are the particles? Do any of the substances dissolve? These are all questions that touch on the physical properties of objects. Thinking about these properties helps scientists to determine strategies for separating mixtures. For example, using a magnet to separate mixtures of magnetic and non magnetic metals at a recycling plant may be a more efficient method than separating the objects by hand. Objects that float when placed in water can be easily skimmed off the surface to separate them from a mixture. The particle size of objects will affect the size and type of filters that can be used to separate them out from a mixture. Using filters, evaporation, distillation, and absorption are just a few of the methods industries use to separate mixtures.

From oil spills to the need for clean drinking water, scientists are constantly trying to find creative ways to separate mixtures. Filtering impurities from water is a practical way students can explore a real world connection to the concept of combining and separating mixtures. While this lesson focuses on using simple instruments such as strainers and funnels to separate particles by size, many home water filtration systems may use more advanced methods to clean water. For example, some filtration systems use charcoal to absorb harmful chemicals from water. By understanding how simple tools can be used to separate mixtures, students in this primary lesson will be gaining a foundation for understanding more advanced methods of filtering.

Materials:

For the teacher

- Container of dried beans
- Container of sand
- Empty container for mixing dried beans and sand
- Broom and dustpan for spills

For the student

- In the Mix Student Resource Page
- In the Mix Home Connection Resource
- Science journal
- pencil

(For each Student Group)

- Objects good for sorting by size (e.g. buttons, beans, or blocks)
- Containers of dried beans and sand

- strainers
- Containers of “polluted water.” (Water with Styrofoam, soil, leaves, and pebbles.)
- Cheese cloth
- Coffee filters
- Funnels
- Cotton
- Spoons and other scoopers
- Mesh screens with safe edges
- Bins or boxes for catching filtered materials

Classroom Activities:

1. Divide students into small groups. Provide students with a group of objects to sort by size (e.g. buttons, dried beans, or blocks of different sizes)

2. Discuss how a mixture is a combination of two or more substances that are not chemically joined together. Just as students separated the group of objects based on physical properties, mixtures can be physically separated.

3. Show students a container of dried beans and a container of sand. Allow students to observe and describe the physical properties of the beans and the sand. Tell students to watch as you mix together the beans and sand. Ask: What are some strategies that could be used to separate the beans and sand? Allow students to brainstorm some ideas. Which strategies would be the most efficient? (e.g. Strainers would be more efficient than separating the mixture by hand.)

4. Show students a strainer. Allow students to predict what might happen if the mixture is poured into the strainer. Students should explain the reasoning behind their predictions. (e.g. The sand would fall through the holes while the beans would remain on the surface because the beans are larger than the holes.) Provide students with the opportunity to test their predictions. Be sure to discuss methods for catching the filtered materials to avoid too much mess.

5. Discuss how scientists use knowledge about separating mixtures to solve real world problems. Humans and other animals need clean water to survive. Sometimes, water can get polluted from litter, oil spills, soil erosion, etc. When water is polluted, often scientists look for ways to clean the water. Show students a container filled with “polluted” water. Tell students that the water is a mixture of soil, pebbles, leaves, and Styrofoam.

6. Divide students into small groups. Show students a variety of materials (strainers, mesh screens with safe edges, cheese cloth, coffee filter, funnel, cotton, spoons, etc.) Give students the task of finding a way to separate the components of the mixture to obtain the cleanest water sample they can using the materials provided. After groups have created a plan, allow them to sketch the plan, carry out the plan and record them.

7. Provide students the opportunity to practice communication skills as they share the results of their investigations with the rest of the class. Which strategies and materials obtained the best results? Why? How did the properties of the objects affect how the mixture could be separated? (The size of objects affected the ability of the object to fit through strainers of different sizes. Some objects like Styrofoam floated to the top and could be easily removed by skimming the surface.)

8. Discuss how a filter is a tool used to separate mixtures. Ask students to think about other examples of filters they have seen and why they are used (e.g. coffee filters, water filters, air filters, etc.) Students should describe in their science journals an example of a mixture and how it can be separated.

9. Bring closure to the lesson, by allowing a few students to share their journal responses.

Home Connections:
Allow students to select one of the following activities to complete at home with a parent.

- Predict what will happen when salt and warm water are mixed together then test to determine the results. (The salt will dissolve in the water.) Place the salt and water mixture in a shallow bowl and place it in direct sunlight. Observe and discuss what happens to the contents of the bowl. (The water will evaporate, leaving behind the salt.)

- Search for everyday examples around the house where substances are combined (mixed) and/or separated and record these examples as a list. (e.g. separating pasta and water when cooking, combining drink mixes with water, air and water filters, etc.)

Assessment: Use the following rubric to score student responses to the journal task stated in Step 8 of the lesson.

2- Complete Understanding: Student describes an example of a mixture AND how it can be separated.

1- Partial Understanding: Student describes an example of a mixture OR how it can be separated.

0- Student response is off topic or not related to mixtures.

Name_____ Date_____

Clean it Up!

Engineers use technology to solve problems. Work as a team to solve the problem below:

Problem: Help! Some water has become polluted with extra soil, trash, and other materials. Find a way to clean up the water sample you have been given using materials provided by your teacher.		
1. PLAN Draw a sketch of your plan for leaning the water in the space below. Be sure to label your sketch.	**2. Test**	**3. Results** Use words and/or pictures to describe what happened after testing your plan. **Evaluate** Is there any part of the plan you would have changed? Explain.

WATCH ACIDS AND BASES PRODUCE COLORS!

From Education.com by Ashley West (March 6, 2014)

http://www.education.com/activity/article/acids-bases-produce-rainbow-colors/

Show students how to create a concoction of simple household ingredients that changes colors as acids and bases are added! This magic mixture is called a "pH indicator," a chemical compound that is added to a solution in order to visually determine its acidity or basicity. While many items (such as cabbage juice) have this ability, this mixture of turmeric and rubbing alcohol possesses the unique trait of being able to change BACK to its original color. Science has never been this fun!

What You Need:

Bowl
1⁄4 cup water
1⁄4 cup vinegar
1⁄2 teaspoon turmeric
1⁄2 cup rubbing alcohol
1 teaspoon baking soda
Clear drinking glass

What You Do:

1. Have students combine the turmeric and rubbing alcohol in the bowl.

2. Combine the baking soda and water in the glass.

3. Help students to pour a sufficient amount of the turmeric/alcohol combination into the glass to affect a color change. Ask them to observe the reaction. What color was produced?

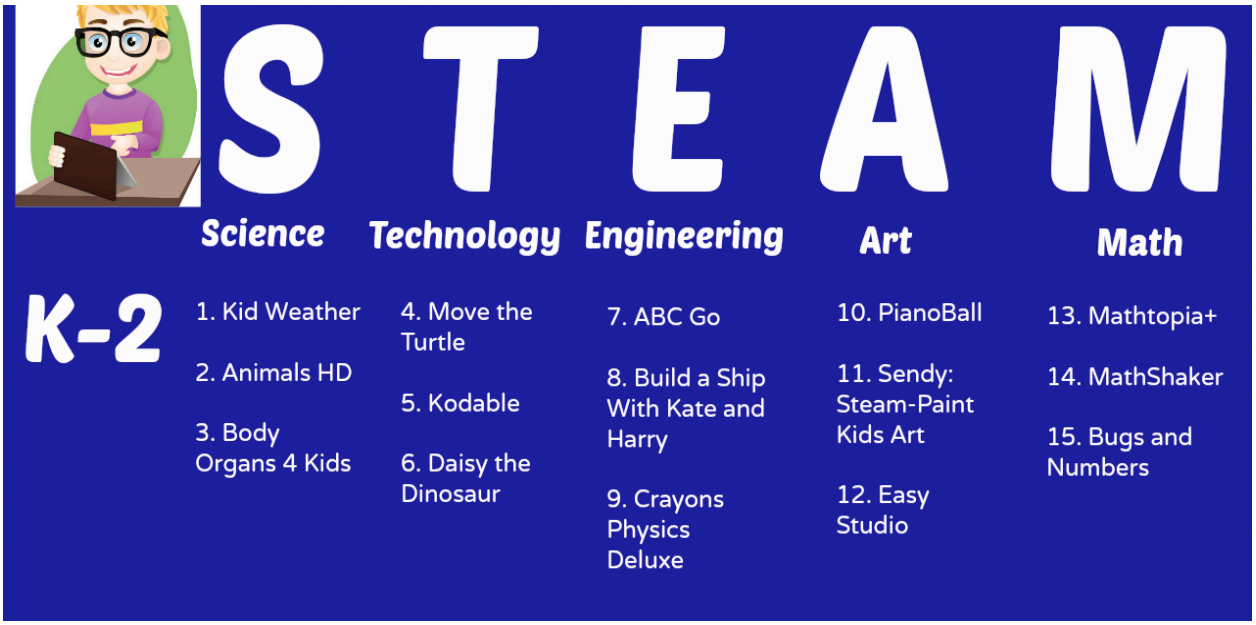
4. Have students pour the vinegar into the glass.

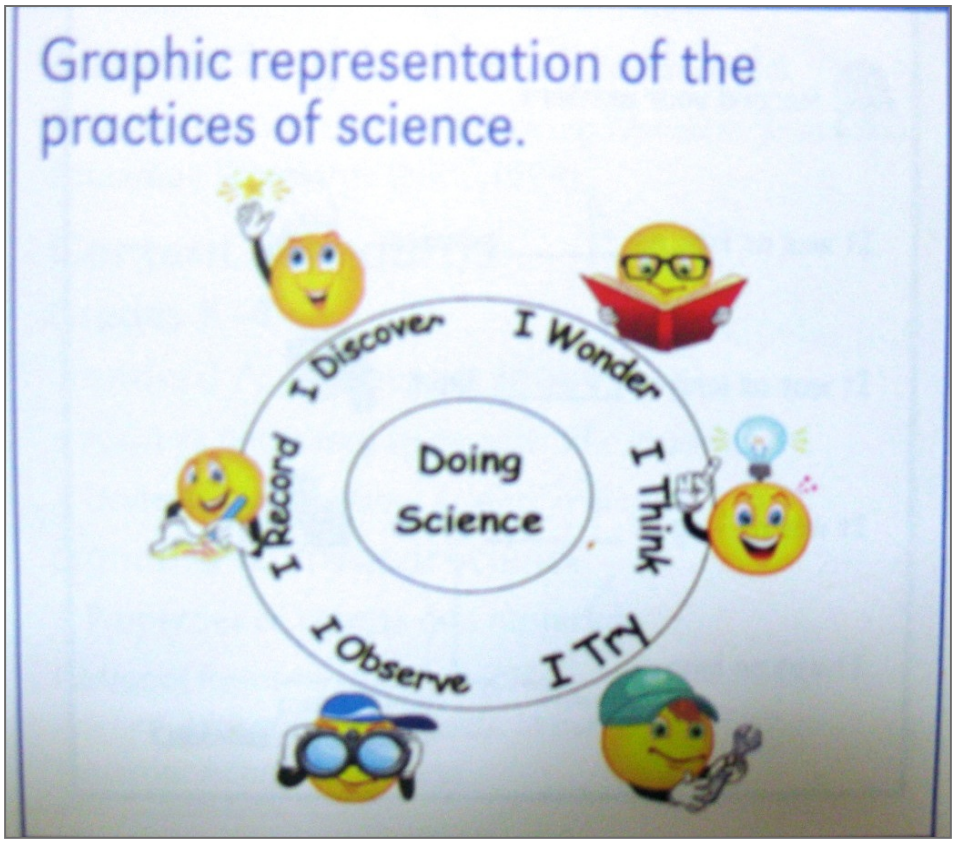
What 's Going On?

Adding the pH indicator to the basic solution should have turned it red. Adding an acid (vinegar) made it foam and revert to its original yellow color.

15 Amazing Apps for STEAM

Retrieved from: http://www.weareteachers.com/blogs/post/2014/08/09/60-apps-for-teaching-steam





For excellent ideas about integrating STEM Lessons:

Miranda Reagan
http://maryville-schoolwires.net/Page/4713
Dee Dulin
http:/ /maryville.schoolwires.net/Page/4691

K-3 STEM Lessons
Sam Houston Elementary School

Coming in February 2016 from Corwin Press:
***STEM-Infusing the Elementary Classroom* by**
Miranda Reagan

Cool STEM Websites for Elementary Kids

(retrieved from: http://www.mastersindatascience.org/blog/the-ultimate-stem-guide-for-kids-239-cool-sites-about-science-technology-engineering-and-math/)

- Funology: At Funology, science is bound to get interactive. Make a tornado with water. Build a Jurassic Park terrarium. Or, simply torment your siblings with endless jokes about bugs and insects.
- Helping Your Child Learn Mathematics: Your parents might be interested in this. Curated by the U.S. Department of Education, this website contains math activities (to be completed at home, at the store and on the go) for preschoolers and elementary kids.
- Kids Do Ecology: Every kid should be an ecological hero. Learn about biomes, blue whales and data collecting. You can even create your own classroom experiment. Available en Español.
- Kids.gov: From imaginary jungles to ion experiments, Kids.gov has plenty of resources for a rainy day. Watch an animation on thunder and lightning or take a virtual field trip to the National Zoo.
- The Kids' Science Challenge (KSC): Hands-on science activities, games, cool videos, scavenger hunts … this website is full of fun stuff. KSC also hosts a free, nationwide science competition for students in grades three to six.
- NASA Kids' Club: At NASA Kids' Club, it's perfectly okay to fool around in space. You can use your science and math skills to explore Mars, construct a fleet of rockets or search for NASA spinoffs in your garage.
- NASA Space Place: Build your own spacecraft, play space volcanoes or browse through a gallery of sun images. When you're at the Space Place, the universe is the limit.
- National Geographic Kids: Which do you think is cuter: the puffer fish or the clown fish? On this website, you can vote in polls, take part in eggs-periments, watch videos, play puzzles and learn amazing facts.

- Weather Wiz Kids: Meet meteorologist Crystal Wicker. She's put together a website that explains everything about the weather. Find fun facts, games, flashcards and photos, plus get answers to your meteorological questions.
- TechRocket: Learn programming languages, graphic design in Photoshop, and more!

PBS Kids

1. Cyberchase: Help Jackie, Matt and Inez use math to protect the digital universe from evil. Don't worry: Cyberchase has lots of math games, videos and activities to aid you in your quest.
2. Design Squad Nation: Design anything (!) your mind might imagine. Through Design Squad challenges, videos and tutorials, you'll discover all there is to know about engineering principles.
3. The Cat in the Hat Knows a Lot About That!: Pre-K STEM games, activities and videos galore. The adventurous Cat in the Hat is even ready to lead you on an exotic math safari adventure
4. The Greens: Wondering what you can do to protect the planet? The Greens have some great ideas, including games, activity guides and their very own carbon calculator.
5. Lifeboat to Mars: Explore the world of biology with this free online game. In one simulation (Microland) you control hungry microbes. In another (Ecoland), you have to balance out the space station's ecosystem.
6. Zoom: Hot science and cool ideas. You'll find all kinds of activities and experiments on Zoom's website, including things like lemon juice rockets, crazy straw bridges and bubble cities.

Science Games and Apps

- Amazing Alex App: Amazing Alex has a lot of crazy physics challenges in need of your inventive solutions. You can even build and create your own. Brought to you by the creators of Angry Birds.
- Angry Birds Space App: Those whacky (and wildly successful) birds are now playing their physics puzzles in space, where gravity does some pretty strange things!
- Every Body Has a Brain!: Plunge headfirst into your amazing brain with songs, animations and mini-games. The complete game is available for purchase as a CD-ROM or digital download.
- Geo Walk: 3D World Factbook App: Geography nuts rejoice! This educational app contains pictures and facts on hundreds of places, plants and animals.
- Kinectic City: An amazing collection of science experiments, games, activities and challenges. You might choose to run the blood cell relay race or use a computer model to build your own interstellar slush business.
- Max and the Magic Marker App: In this fun physics-based game, you're in complete control of Max and his incredible magic marker. There are 15 puzzle levels, with challenges, secrets and rewards in each.
- Move the Turtle: Programming for Kids App: You don't have to be a computer genius to code! With this app, any kid can learn the ABCs of programming in a graphic environment.
- Seasons! App: Everywhere you go, always take the weather with you. In this app,

you'll learn how to identify various weather situations in different seasons. For kids age 3 to 6.

- Sid's Science Fair App: Sid from PBS' "Sid the Science Kid" has three science games for your entertainment pleasure: Gabriela's "Collection Inspection," May's "Chart It!" and Gerald's "Time Machine." For kids age 3 to 6.
- Team Umizoomi: The cheerful animated characters from Nick Jr.'s TV program offer lots of math games and activities for preschoolers.

Math Games and Apps

- Geometry Quest App: Travel the world by solving geometry challenges along the way. You'll receive passport stamps for perfect quests. Covers Common Core standards 3MD, 3G, 4MD, 5G, 6G, 7G and 8G.
- Math Blaster: Do you have what it takes to save the galaxy? You're going to need your math skills to complete your training missions in this free online game.
- MathBoard App: One for the parents. This useful app walks kids through the steps to solving addition, subtraction, multiplication and division equations. There's a handy scratchboard area where kids can work problems out by hand.
- Motion Math: Pizza! App: Pizza, pizza! In this math-based game, you buy ingredients, design signature pizzas and sell them to customers (hopefully at a profit).
- Motion Math: Questimate! App: How fast is the world's fastest train? How many jellybeans fill up a soccer ball? In Questimate!, you get to make up your own questions.
- Mystery Math Town: Your mission, should you choose to accept it, is to rescue the fireflies hidden in Mystery Math Town. Be warned: you'll need your math skills to unlock all the rooms and passages on your quest!
- Numbers League: In the Numbers League, only math can save the day. You'll use everything from addition to negative numbers to assemble a team of superheroes and capture a horde of villains.
- Umigo: Bored with everything? The crazy characters at UMIGO might have the answer. Their interactive games are just right for building math and critical thinking skills.

Helpful Internet Sites for Grades K-2

***Science Lesson Plans**
http://www.**prek**inders.com/**science**-page/
Superior website for ideas and resources for primary science teachers. Click on the tab for science.

***Siemens Science Day, Learn by Doing**
http://www.siemensscienceday.com/activities/hands-on-science-activities.cfm
Great activities for grades K-3 with tools and videos that will engage your students in earth science, life science, and physical science.

***Super Science Pre-K Science Activities**
http://bestpractices.gsu.edu/sites/bestpractices.gsu.edu/files/Best%20Practices%20-%20Science%20Activities.pdf
From Georgia State University, excellent PDF file of activities for Pre-K Science. Lots of simple, engaging activities to supplement larger ideas.

Periodical for Elementary Science Teachers

Science and Children (elementary—a journal of the National Science Teachers Association) 3140 N. Washington Blvd., Arlington, VA 22201 http://www.nsta.org

LIST OF RELATED CITATIONS

Abruscato, J. (2001). *Teaching Children Science: Discovery Methods for the Elementary and Middle Grades.* Boston, MA: Allyn and Bacon.

Abruscato, J. (2000). *Teaching Children Science: A Discovery Approach (5th ed.).* Boston, MA: Allyn and Bacon.

Berger, M. (1994). *Oil Spill!* New York, NY: HarperCollins Publishers.

Carin, A. A. & Bass, J.E. (1997). *Methods for Teaching Science as Inquiry*. Upper Saddle River, NJ: Prentice-Hall, Inc.

Carin, A. A. & Bass, J.E. (1997). *Activities for Teaching Science as Inquiry*. Upper Saddle River, NJ: Prentice-Hall, Inc.

Carle, E. (1987). *The Tiny Seed*. New York, NY: Little Simon Publishers.

Galbraith, K. (2011). *Planting the Wild Garden*. Atlanta, GA: Peachtree Publishers.

National Science Teachers Association. (1997). *NSTA Pathways to the Science Standards: Guidelines for Moving the Vision into Practice (elementary school edition).* Arlington, VA: National Science Teachers Association.

Silver, D. (2002). *Drumming to the Beat of a Different Marcher: Finding the Rhythm for Teaching a Differentiated Classroom*. Nashville, TN: Incentive Publications.

Silver, D. (1998). Engaging students in the learning cycle. *Principal*, 77 (4), 62-64.

Stewart, M., & Chelsey, N. (2014). *Perfect Pairs: Using Fiction & Nonfiction Picture Books to Teach Life Science*. Portland, ME: Stenhouse Publishers.

Wheeler, E. (2013). *Miss Maple's Seeds*. New York, NY: Nancy Paulsen Books.