Afterschool & the Next Generation Science Standards:

Where to start?

Afterschool Alliance

SCIENCE, TECHNOLOGY ENGINEERING, MATH
STEM & afterschool

girlstart

Today's Speakers

Melissa Ballard
Research Associate, STEM
Afterschool Alliance

Katelyn Wamsted
Program Director
Girlstart

Afterschool Alliance | SCIENCE, TECHNOLOGY ENGINEERING, MATH STEM & afterschool | girlstart

The Next Generation Science Standards

- Great need for new standards
- Conceptual shifts
- Performance expectations not curriculum
- Consistent with Common Core
- Diverse populations & underserved students

Online version from NSTA here: http://standards.nsta.org/Standards/AccessStandardsByTopic.aspx

NEXT GENERATION SCIENCE STANDARDS

Afterschool Alliance | STEM & afterschool | girlstart

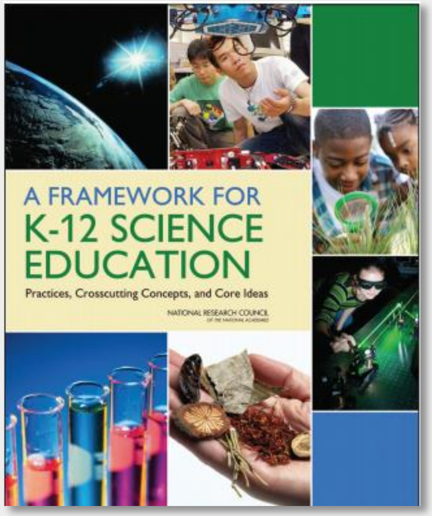
Development Process

- National Academy of Sciences, American Association for the Advancement of Science (AAAS) & the National Science Teachers Association (NSTA), managed by Achieve
- *A Framework for K-12 Science Education*
- 26 lead states, 40 writers
- Teachers; college/university faculty; science & engineering, workforce experts
- Twice open to public feedback

The NRC's *Framework*

Free online: www.nap.edu/catalog.php?record_id=13165

- Science education should resemble the way scientists actually work and think
- Instruction should reflect research on learning
- Importance of building coherent understandings over time



Practices

Concepts

Core Ideas

Afterschool Alliance

SCIENCE, TECHNOLOGY ENGINEERING, MATH
STEM & afterschool

girlstart

NGSS Practices

http://standards.nsta.org/Standards/PracticesFull.aspx

Scientific inquiry + Engineering design

1. Asking Questions, Defining Problems
2. Planning & Carrying Out Investigations
3. Analyzing & Interpreting Data
4. Developing & Using Models
5. Constructing Explanations, Designing Solutions
6. Engaging in Argument from Evidence
7. Using Mathematics and Computational Thinking
8. Obtaining, Evaluating & Communicating Information

NGSS: Disciplinary Core Ideas

http://standards.nsta.org/Standards/DisciplinaryCoreIdeasTop.aspx

- Reduces range of content, deepens learning
- Build coherently K-12, every single year

Physical Science

- Matter
- Force & Motion
- Energy
- Waves

Earth & Space Science

- Earth & the Universe
- Earth's Systems
- Human Impacts

Life Science

- Organisms
- Ecosystems
- Heredity
- Evolution

Engineering, Tech & Applications

- Engineering Design
- Links between engineering, tech, science & society

NGSS Crosscutting Concepts

http://standards.nsta.org/Standards/CrosscuttingConceptsFull.aspx

1. Patterns
2. Cause and effect
3. **Scale, proportion and quantity**
4. Systems and system models
5. Energy and matter
6. Structure and function
7. Stability and change

The Standards

http://standards.nsta.org/Standards/AccessStandardsByTopic.aspx

3-PS Forces & Interactions

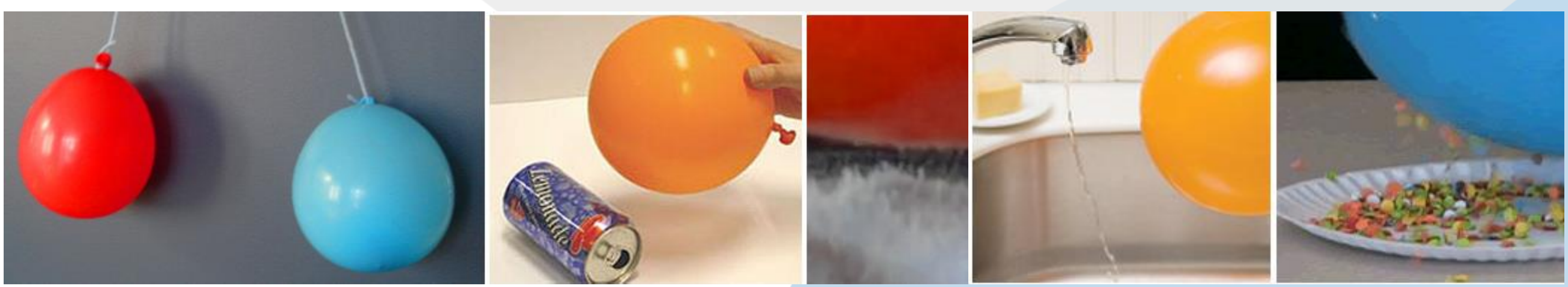
1. **Plan and conduct an investigation** to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
2. **Make observations and/or measurements** of an object's motion to provide evidence that a pattern can be used to predict future motion.
3. Ask questions to **determine cause and effect relationships** of electric or magnetic interactions between two objects not in contact with each other.
4. **Define a simple design problem** that can be solved by applying scientific ideas about magnets.

The Standards

3-PS Forces & Interactions

3. Ask questions to **determine cause and effect relationships** of electric or magnetic interactions between two objects not in contact with each other.

- **Electric** - force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper
- **Magnetic** - force between two permanent magnets, electromagnet and steel paperclips…
- **Cause and effect** - how the distance between objects affects strength and how the orientation of magnets affects the direction.



Assessment

3. Forces and Interactions

Students who demonstrate understanding can:

3-PS2-1. **Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.** [Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]

3-PS2-2. **Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.** [Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.] [Assessment Boundary: Assessment does not include technical terms such as period and frequency.]

3-PS2-3. **Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.** [Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.] [Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.]

3-PS2-4. **Define a simple design problem that can be solved by applying scientific ideas about magnets.*** [Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Foundations

Science and Engineering Practices

Asking Questions and Defining Problems

Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- Ask questions that can be investigated based on patterns such as cause and effect relationships. (3-PS2-3)
- Define a simple problem that can be solved through the development of a new or improved object or tool. (3-PS2-4)

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-PS2-1)
- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (3-PS2-2)

Connections to Nature of Science

Science Knowledge is Based on Empirical Evidence

- Science findings are based on recognizing patterns. (3-PS2-2)

Scientific Investigations Use a Variety of Methods

- Science investigations use a variety of methods, tools, and techniques. (3-PS2-1)

Disciplinary Core Ideas

PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3-PS2-1)
- The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3-PS2-2)

PS2.B: Types of Interactions

- Objects in contact exert forces on each other. (3-PS2-1)
- Electric, and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3-PS2-3),(3-PS2-4)

Crosscutting Concepts

Patterns

- Patterns of change can be used to make predictions. (3-PS2-2)

Cause and Effect

- Cause and effect relationships are routinely identified. (3-PS2-1)
- Cause and effect relationships are routinely identified, tested, and used to explain change. (3-PS2-3)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process. (3-PS2-4)

Connections

Connections to other DCIs in third grade: N/A

Articulation of DCIs across grade-levels: **K.PS2.A** (3-PS2-1); **K.PS2.B** (3-PS2-1); **K.PS3.C** (3-PS2-1); **K.ETS1.A** (3-PS2-4); **1.ESS1.A** (3-PS2-2); **4.PS4.A** (3-PS2-2); **4.ETS1.A** (3-PS2-4); **5.PS2.B** (3-PS2-1); **MS.PS2.A** (3-PS2-1),(3-PS2-2); **MS.PS2.B** (3-PS2-3),(3-PS2-4); **MS.ESS1.B** (3-PS2-1),(3-PS2-2); **MS.ESS2.C** (3-PS2-1)

Common Core State Standards Connections:

ELA/Literacy –

RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. *(3-PS2-1)*,(3-PS2-3)

RI.3.3 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. (3-PS2-3)

What's next for schools?

NGSS will require <u>big changes</u> in K-12 classrooms!

- Preservice teacher education
- Professional development for current teachers
- Finding classroom time
- Curriculum
- Assessments

NSTA playing a supportive role in implementation.

What Afterschool Offers

- Hands-on, project-based learning
- Expertise with inquiry and engineering design
- Additional time, space to extend classroom learning
- Flexible environment to try new techniques & activities
- Connection to careers, access to mentors
- Topics outside of content areas
- Opportunities for pre-service & practicing teachers to improve classroom teaching techniques, management styles, & confidence


girlstart

Who we are…

Founded in Austin, Texas, Girlstart is the longest-serving, standalone, community-based informal STEM education nonprofit in the nation exclusively dedicated to empowering and equipping girls in STEM through year-round STEM educational programming.

2013 GIRLSTART BY THE NUMBERS

623 EDUCATORS

576 GIRLS IN STEM CONFERENCE (75% SCHOLARSHIPS)

13,718 COMMUNITY STEM PARTICIPANTS

586 GIRLSTART SUMMER CAMPS (37% SCHOLARSHIPS)

918 GIRLSTART AFTER SCHOOL (42 CLUBS)

TOTAL REACHED **16,421**

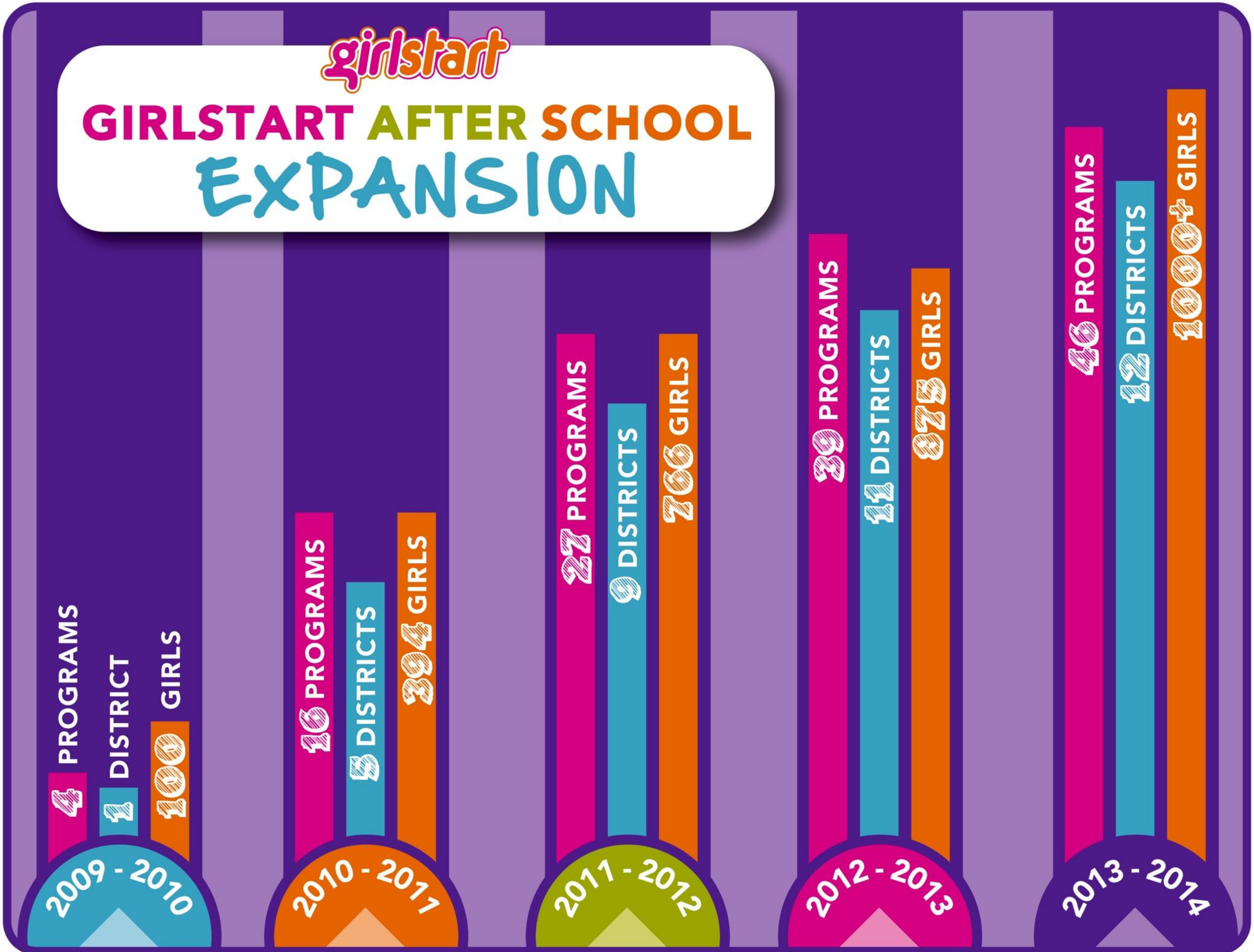
96% PARTICIPATED AT NO COST

www.girlstart.org

g+ You Tube

girlstart

www.girlstart.org


girlstart
GIRLSTART AFTER SCHOOL
EXPANSION
4 PROGRAMS
1 DISTRICT
100 GIRLS
2009 - 2010
16 PROGRAMS
5 DISTRICTS
394 GIRLS
2010 - 2011
27 PROGRAMS
9 DISTRICTS
766 GIRLS
2011 - 2012
39 PROGRAMS
11 DISTRICTS
875 GIRLS
2012 - 2013
46 PROGRAMS
12 DISTRICTS
1000+ GIRLS
2013 - 2014

Girlstart After School By The Numbers 2012-2013

WWW.GIRLSTART.ORG

Acumen

95%

Demonstrated that they understand the scientific method and the engineering design process.

94%

Responded positively to the statement: 'I understand that it is okay if my Girlstart activity does not work on the first try'.

92%

Realized after participating that they use science outside of school.

ACUMEN INDEX
8.24
Out of 10

Interest

89%

Responded positively to the statement 'I want to try more science activities.'

97%

Expressed intent to attend college after high school.***55% would be first generation college students.***

92%

Demonstrated the awareness that doing well in STEM at school means that they are more likely to get into college.

INTEREST INDEX
8.48
Out of 10

Confidence

92%

Demonstrated the awareness that doing well in STEM at college means that they are more likely to have a better career.

82%

Reported that after participating in Girlstart, STEM careers seem more interesting to them.

95%

Indicated an interest in entering a STEM career.

CONFIDENCE INDEX
8.23
Out of 10

875 Girls

39 Programs

11 Districts

34 STEM CREW

Girlstart After School

Girlstart After School seeks to enhance and supplement girls' science learning in the classroom through engaging activities that introduce important STEM concepts in a hands-on and informal environment.

girlstart
www.girlstart.org

Girlstart & NGSS

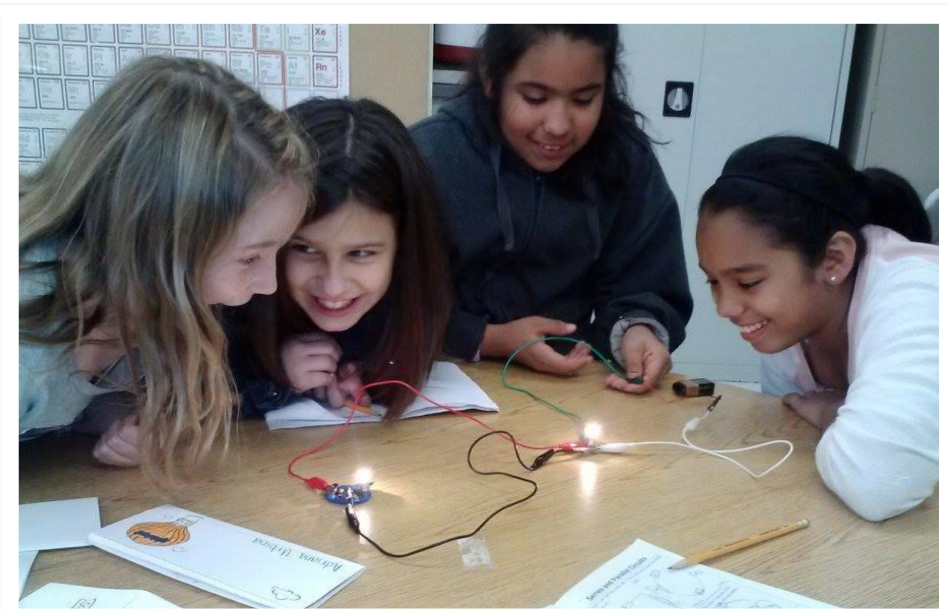
Girlstart participates in the national conversation about OST programming, and we conduct some of our programs on a national level.

We believe it is important to demonstrate our commitment to high quality informal STEM education.

General Reasons to Align

- Opportunity to partnership with schools
- Strengthen current relationships
- Reflect current trends & standards in science education
    - May resonate with funders or potential STEM-rich partners

Best Practices for Partnering with Schools



- Communication plan
- School liaison
- Reporting
- Share how you support formal education

Communication Plan

- Letter of Understanding
  - Defines responsibilities & expectations
- Weekly Email
- Weekly Blogs
- Semester Newsletter
- Yearly By the Numbers

www.girlstart.org

24 MARCH AFTER SCHOOL 'TO GO' WEEK 6

Exploring Water Pollution

During the sixth week of Girlstart After School 'to Go,' the girls learned how our every day actions can affect our water supply. They created a sample of polluted water by adding materials that represented trash left behind, run off from oil in parking lots and fertilizers, chemicals poured down the drain and more.

Girlstart After School By The Numbers 2012-2013

WWW.GIRLSTART.ORG

Acumen

ACUMEN INDEX **8.24** Out of 10

95%

Demonstrated that they understand the scientific method and the engineering design process.

94%

Responded positively to the statement: 'I understand that it is okay if my Girlstart activity does not work on the first try'.

92%

Realized after participating that they use science outside of school.

Interest

INTEREST INDEX **8.48** Out of 10

89%

Responded positively to the statement 'I want to try more science activities.'

97%

Expressed intent to attend college after high school.***55% would be first generation college students.***

92%

Demonstrated the awareness that doing well in STEM at school means that they are more likely to get into college.

Confidence

CONFIDENCE INDEX **8.23** Out of 10

92%

Demonstrated the awareness that doing well in STEM at college means that they are more likely to have a better career.

82%

Reported that after participating in Girlstart, STEM careers seem more interesting to them.

95%

Indicated an interest in entering a STEM career.

875 Girls

39 Programs

11 Districts

34 STEM CREW

Canyon Formation

Lesson Activity Overview *Lessons written in 5E*	**TEKS Correlations with Girlstart Lessons**	**Next Generation Science Standards (NGSS)**
.esson 2: Canyon Formation tudents create models of edimentary layers that epresent millions of years of me. Students observe the ffects of wind and ice on a iodel to determine if these orces can create canyons, and ien simulate and calculate the mount of time it takes for a iver to form a canyon.	**4.7B)** Observe and identify slow changes to Earth's surface caused by weathering, erosion, and deposition from water, wind, and ice **(5.7B)** Recognize how landforms such as deltas, canyons, and sand dunes are the result of changes to Earth's surface by wind, water, and ice. **(4.2), (5.2)** The student uses scientific methods during laboratory and outdoor investigations. **(4.3), (5.3)** The student uses critical thinking and scientific problem solving to make informed decisions.	4-ESS2 Earth's Systems **Performance Expectations:** 4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation **Science and Engineering Practices:** • Planning and carrying out investigations **Disciplinary Core Ideas:** • ESS2.A: Earth Materials and Systems **Cross cutting Concepts:** • Patterns • Cause and Effect

Canyon Formation

- Students create models of sedimentary layers that represent millions of years of time.
- Students observe the effects of wind & ice on a model to determine if these forces can create canyons.
- Then they simulate & calculate the amount of time it takes for a river to form a canyon.

Observations

400 million years ago Color of sand: Type of environment that existed:	
200 million years ago Color of sand: Type of environment that existed:	
100 million years ago Color of sand: Type of environment that existed:	
50 million years ago Color of sand: Type of environment that existed:	

Sedimentary Layers:

- Record the information on the left side of the table.
- Make a sketch of the model on the right side of the table.

Career Connection

A **geomorphologist** studies landforms and the processes that shape them.

Scientists in this field seek to understand why landscapes look the way they do, to understand landform history and dynamics, and to predict future changes through a combination of field observations, physical experiments, and modeling.

Biofuels

Lesson Activity Overview *Lessons written in 5E*	**TEKS Correlations with Girlstart Lessons**	**Next Generation Science Standards (NGSS)**
esson 7: Biofuels udents define nonrenewable sources and participate in a nulation to demonstrate how they ll not last forever. Students nduct investigations to determine e types of plant products that can nerate biofuels by combining yeast th corn products to produce hanol, a source of energy obtained om recently harvested plant aterials. Students complete a card tivity to identify the different types d characteristics of renewable sources.	**(5.7C)** Identify alternative energy resources such as wind, solar, hydroelectric, geothermal, and biofuels. **(4.7C)** Identify and classify Earth's renewable resources, including air, plants, water, and animals; and nonrenewable resources, including coal, oil, and natural gas; and the importance of conservation **(4.2), (5.2)** The student uses scientific methods during laboratory and outdoor investigations.	4-ESS3 Earth and Human Activity **Performance Expectations:** 4-ESS3-1 Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. **Science and Engineering Practices:** • Constructing Explanations and Designing Solutions **Disciplinary Core Ideas:** • ESS3.A: Natural Resources • ETS1.B: Designing Solutions to Engineering Problems **Cross cutting Concepts:** • Cause and Effect
		5-PS1 Matter and Its Interactions **Performance Expectations:** 5-PS1-4 Conduct an investigation to determine whether the mixing of two or more substances results in new substances. **Science and Engineering Practices:** • Planning and Carrying Out Investigations **Disciplinary Core Ideas:** • PS1.B: Chemical Reactions **Cross cutting Concepts:** • Cause and Effect

Biofuels

- Students define nonrenewable resources and participate in a simulation to demonstrate how they will not last forever.
- Students conduct investigations to determine the types of plant products that can generate biofuels by combining yeast with corn products to produce ethanol, a source of energy obtained from recently harvested plant materials.
- Students complete a card activity to identify the different types and characteristics of renewable resources.

Biofuels

girlstart
www.girlstart.org

Observations

Bottle	prediction	Observations	
Water and yeast		Time:	Time:
Water, yeast, and corn syrup		Time:	Time:
Water, yeast, and bran		Time:	Time:

- Predict what you think will happen with each bottle.
- Draw and label what happens to each bottle as you make observations.

Career Connection

Biofuel engineers work to find uses for fuels derived from plant materials and animal waste.

They design and devise tools, processes, and procedures with which to generate biofuel such as ethanol and biodiesel, for the purpose of powering automobiles, heating homes, and generating electricity.

Opportunities for Pre-Service Teachers

- Improve classroom management skills
- Learn & modify teaching style
- Gain curriculum writing experience
- Hands-on work experience in an educational setting
- Deliver fun, informal STEM curriculum
- Opportunities to work with formal educators

Role Models

- Make it personal
- Use kid-friendly language
- Share academic and/or career path
- Share challenges and triumphs
- Show how STEM professionals can change the world

FabFems
www.fabfems.org

girlstart
www.girlstart.org

Additional Resources

- **Girlstart 'For Educators':** www.girlstart.org
- **Texas Girls Collaborative Project:** www.txgcp.org
- **SciGirls:** http://pbskids.org/scigirls
- **Engineer Your Life:** http://www.engineeryourlife.org/
- **Engineer Girl:** http://www.engineergirl.org/
- **Engineering, Go For It:** http://egfi-k12.org/
- **Design Squad:** http://pbskids.org/designsquad/
- **Dot Diva:** http://dotdiva.org
- **How to Smile:** http://howtosmile.org
- **NCWIT:** http://www.ncwit.org

Girlstart
Austin, TX

Read Girlstart's profile for information on demographics, outcomes, & more!

Curriculum Resources

www.afterschoolalliance.org/STEM-RESOURCES.CFM

Train your staff to facilitate STEM!
www.click2sciencepd.org

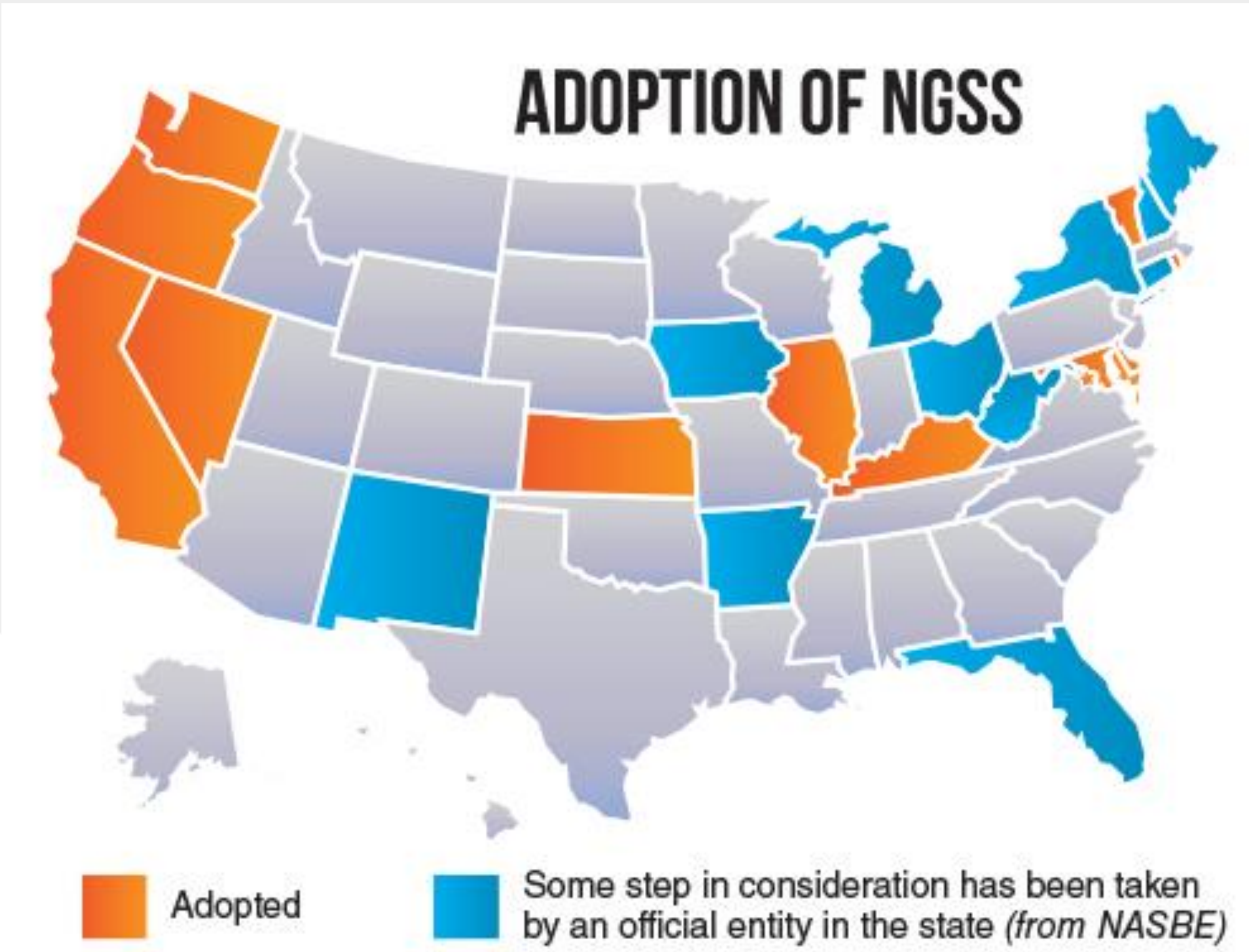
www.techbridgegirls.org/index.php?id=21

NASA's Afterschool Universe

OTHERS:
Exploratorium AfterSchool Activities
Exploratorium EXPLORE

Will my state adopt?

- Rhode Island
- Kentucky
- Kansas
- Maryland
- Vermont
- California
- Delaware
- Washington
- D.C.
- Nevada
- Oregon
- Illinois



Afterschool Alliance | STEM & afterschool | girlstart

Source: http://ngss.nsta.org

Possible Next Steps

- Keep learning!
- Find out what the district and schools are doing
- Improve relationships & communication with schools
- Align curriculum
- Cultivate partnerships with other science education organizations

Thanks for attending!

Melissa Ballard
Afterschool Alliance
mjballard@afterschoolalliance.org
www.afterschoolalliance.org/STEM

Katelyn Wamsted
Girlstart
katelyn@girlstart.org
www.girlstart.org

Follow Us

@afterschool4all

@girlstart

Like Us

/afterschoolalliancedc

/girlstart

Read Us

Afterschool Snack Blog

Girlstart Blog