Session 5 Agenda
3rd Annual CA STEM Symposium

Welcome! 😊

Description: Investigate intriguing hands-on activities to make real life STEM connections engaging. Using the Practices from the Common Core State Standards and the Next Generations Science Standards, integrate science, technology, engineering, and mathematics by investigating properties of simple machines, engineering designs, artistic expression, scientific and mathematical reasoning, and much more!

Hands-on Activities & Connections

- Shake Table explorations
- Windmill explorations
- Vehicle explorations

Conclusion
- Additional comments
- Thank you! 😊
<table>
<thead>
<tr>
<th>GRADES K-2</th>
<th>GRADES 3-5</th>
<th>GRADES 6-8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(1) ASK QUESTIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientists ask questions about the world.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ask a question about the world.</td>
<td>Ask a question that can be investigated.</td>
<td>Formulate a question to answer in the field or lab.</td>
</tr>
<tr>
<td><strong>(2) USE MODELS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientists use models to represent systems.</td>
<td></td>
<td></td>
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<tr>
<td>Make a model of a familiar object.</td>
<td>Use a model to describe a natural process.</td>
<td>Use a model to explain a phenomenon.</td>
</tr>
<tr>
<td><strong>(3) INVESTIGATE</strong></td>
<td></td>
<td></td>
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<tr>
<td>Scientists do investigations to test their theories.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Make observations and measurements.</td>
<td>Make complex measurements.</td>
<td>Conduct investigation with controls/variables.</td>
</tr>
<tr>
<td><strong>(4) ANALYZE DATA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientists collect data to evaluate their theories.</td>
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<td></td>
</tr>
<tr>
<td>Use observations to answer questions.</td>
<td>Use math or logic to analyze data.</td>
<td>Visualize and interpret large amounts of data.</td>
</tr>
<tr>
<td><strong>(5) USE MATH</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientists use math to represent variables and discover patterns.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generate and compare multiple solutions.</td>
<td>Use calculations to discover patterns.</td>
<td>Use mathematics to support a conclusion.</td>
</tr>
<tr>
<td><strong>(6) ANSWER QUESTIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientists answer questions about the world.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distinguish between opinions and evidence.</td>
<td>Base explanation on evidence.</td>
<td>Use science to explain natural phenomena.</td>
</tr>
<tr>
<td><strong>(7) ARGUE USING EVIDENCE</strong></td>
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<tr>
<td>Scientists use evidence to support their explanations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Listen to others' arguments.</td>
<td>Provide and receive critiques of arguments.</td>
<td>Compare two arguments and analyze them.</td>
</tr>
<tr>
<td><strong>(8) SHARE INFORMATION</strong></td>
<td></td>
<td></td>
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<tr>
<td>Scientists share theories and knowledge.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Record observations, thoughts, and ideas.</td>
<td>Combine information from multiple sources.</td>
<td>Read using science and reasoning.</td>
</tr>
<tr>
<td>GRADES K-2</td>
<td>GRADES 3-5</td>
<td>GRADES 6-8</td>
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<td>----------------------------------</td>
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<tr>
<td><strong>(1) ASK QUESTIONS</strong></td>
<td><strong>(2) USE MODELS</strong></td>
<td><strong>(3) INVESTIGATE</strong></td>
</tr>
<tr>
<td>Engineers ask questions about problems and needs.</td>
<td>Engineers use models to visualize and test solutions.</td>
<td>Engineers do investigations to test their designs.</td>
</tr>
<tr>
<td>Define a problem that can be solved with a tool.</td>
<td>Add criteria/constraints to the design process.</td>
<td>Make observations to see if design solves a problem.</td>
</tr>
<tr>
<td>Add scientific knowledge to the design process.</td>
<td>Make a model of something new.</td>
<td>Test two models to see which is best.</td>
</tr>
<tr>
<td><strong>(4) ANALYZE DATA</strong></td>
<td><strong>(5) USE MATH</strong></td>
<td><strong>(6) ANSWER QUESTIONS</strong></td>
</tr>
<tr>
<td>Engineers use data to evaluate and optimize designs.</td>
<td>Engineers use math to represent variables and discover relationships.</td>
<td>Engineers design new things.</td>
</tr>
<tr>
<td>Analyze drawings and writings of observations.</td>
<td>Analyze an engineering problem statement.</td>
<td>Generate and compare multiple solutions.</td>
</tr>
<tr>
<td>Define the operating range of a design.</td>
<td>Measure physical quantities.</td>
<td>Use the design/build/test cycle.</td>
</tr>
<tr>
<td><strong>(7) ARGUE USING EVIDENCE</strong></td>
<td><strong>(8) SHARE INFORMATION</strong></td>
<td></td>
</tr>
<tr>
<td>Engineers use evidence to identify the best design.</td>
<td>Engineers share designs and methods.</td>
<td>Make a claim about the quality of a solution.</td>
</tr>
<tr>
<td>Show how a solution meets requirements.</td>
<td>Collect and share possible solutions.</td>
<td>Support or refute advertised performance.</td>
</tr>
<tr>
<td>Explain the process used to develop a new design.</td>
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</tbody>
</table>
Session 5 Agenda
3rd Annual CA STEM Symposium

October 30, 2015 (8am – 9:15am/ Middle Grades/ Room 205B)

Make Real Life STEM Connections Come Alive!
By: Jeanne Lazzarini, RAFT Math Master Teacher/R&D Specialist
jlazzarini@raft.net

Welcome! 😊

Description: Investigate intriguing hands-on activities to make real life
STEM connections engaging. Using the Practices from the Common Core
State Standards and the Next Generations Science Standards, integrate
science, technology, engineering, and mathematics by investigating
properties of simple machines, engineering designs, artistic expression,
scientific and mathematical reasoning, and much more!

Hands-on Activities & Connections

• Windmill explorations
• Shake Table explorations
• Vehicle explorations

Conclusion

• Additional comments
• Thank you! 😊
What do good problem solvers do?

- Do what makes sense and be persistent
- Use sense when representing a problem
- Look for patterns and connections
- Be precise with words, numbers, and symbols
- Use models to describe a real situation or problem
- Use tools and technology strategically
- Make conjectures and prove or disprove them
- Look for and create efficient strategies
Some Commonalities among the Practices of the Common Core

**Science**
- Communicate:
  - Ask Questions: 1
  - Argue with evidence: 7
  - Be precise with words, numbers, & symbols: 6
  - Answer questions: 6
  - Share information: 8

**Engineering**
- Investigate:
  - Observe: 3
  - Test ideas: 3
  - Look for patterns: 5
  - Look for strategies: 3
  - Make conjectures: 3

**Mathematics**
- Demonstrate:
  - Use models: 2
  - Prove or disprove: 3
  - Be strategic: 7
  - Use tools strategically: 7

**Reason/Evaluate**
- Problem solve: 5
- Be persistent: 1
- Prove or disprove: 3
- Use Math: 5
- Make conjectures: 3
- Analyze data: 4
- Be precise: 5
- Critique: 7
- Make sense: 7
RAFT

STEM Relationships

Science
Technology
Engineering
Math
Where Does Wind Come From?

Wind is a renewable energy source because the wind will blow as long as the Sun shines!

Warmer/lighter expanding air

Cooler/heavier air rushes inland to take the place of rising warm air

Land heats up faster than water
What’s blowin in dah wind?

heat released from fuel

water boiled to make steam

steam turns a turbine

turbine turns a generator

electricity is produced

wind, HEP, wave, tidal
Focus → How to use the energy of the wind to teach a STEM project based lesson & how to organize engaging in this hands-on activity to promote 21st century learning
Wind at Work
Discuss and share what is meant by the energy of the wind -- Compare a variety of objects & situations where the wind is useful/harmful -what could you observe?

- How could this activity relate to the real-world?
- What kinds of questions could you ask?
- What parts of STEM are being used?
Motorized Shake Table

Explore ways to build structures that won’t collapse during an earthquake:

- Compare triangles to other shapes
- Test “Brace Yourself” to investigate ways to add strength to structures
- Compare structural strength found in nature to those made by man
Shake it Up with Motorized Shake Table!

- How does this activity simulate real-life?
- How does this activity relate to STEM?
- Design a challenge – then share!
- What do you want to observe?
- What questions can you ask?
- What Practices can you use?

Hey, yah, I’m all shook up!
Car on a Roll --- zoom!

- Create a theme with the car(s) and share ways you can relate the themes to STEM topics
- Produce a contest --- what do you want to observe?
- How could this activity relate to the real-world?
- What kinds of questions could you ask?
- What practices are being used?
What will YOU do to make real-life STEM Connections Come Alive?

Engineering Flowchart

- DOES IT MOVE?
  - No
    - Should it?
      - No
        - No Problem
      - Yes
        - No Problem
  - Yes
    - Should it?
      - No
        - No Problem
      - Yes
        - No Problem

Inspire

Scientific method
- data
- research
- variables
- conclusion
- data
- hypothesis
- observation
- question
- experiment

Technology & Learning

This Way to the FUN
- Compression
- Tension

Discover
# TEACHING MATHEMATICS PRACTICES

*Use this overview to see the big picture!*

## FOR ALL GRADES K - 12

### (1) SOLVE PROBLEMS
**Mathematicians make sense of problems and are persistent**

<table>
<thead>
<tr>
<th>Analyze givens, constraints, relationships, and goals</th>
<th>Develop a plan</th>
<th>Check the answer and see if it makes sense</th>
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</thead>
</table>

### (2) REASON ABSTRACTLY AND QUANTITATIVELY
**Mathematicians use number sense when representing a problem**

<table>
<thead>
<tr>
<th>Make sense of quantities and relationships symbolically with equations and expressions</th>
<th>Besides computing, manipulate equations</th>
<th>Understand and use different properties and operations</th>
</tr>
</thead>
</table>

### (3) CREATE VIABLE ARGUMENTS AND CRITIQUE THE REASONING OF OTHERS
**Mathematicians make conjectures and prove or disprove them**

<table>
<thead>
<tr>
<th>Understand and use definitions when justifying results</th>
<th>Use examples and counterexamples</th>
<th>Use objects, drawings, diagrams, actions, verbal and written communication</th>
</tr>
</thead>
</table>

### (4) MODEL WITH MATHEMATICS
**Mathematicians use math to describe a real situation or problem**

<table>
<thead>
<tr>
<th>Assume and approximate to simplify complicated tasks</th>
<th>Use tools such as diagrams, tables, graphs, flowcharts and formulas</th>
<th>Analyze results to decide if a conclusion makes sense</th>
</tr>
</thead>
</table>

### (5) USE APPROPRIATE TOOLS STRATEGICALLY
**Mathematicians use a variety of tools and technology**

<table>
<thead>
<tr>
<th>Decide which tools will be most helpful (e.g., ruler, calculator, protractor)</th>
<th>Use estimation and math to detect errors</th>
<th>Use models and technology to see results and to understand concepts</th>
</tr>
</thead>
</table>

### (6) ATTEND TO PRECISION
**Mathematicians are precise with words, numbers, and symbols**

<table>
<thead>
<tr>
<th>Use clear definitions when communicating with others</th>
<th>Define the meaning of symbols consistently and appropriately</th>
<th>Calculate accurately; be precise in labeling and in measurement</th>
</tr>
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</table>

### (7) LOOK FOR AND MAKE USE OF STRUCTURE
**Mathematicians look for and use patterns and connections**

<table>
<thead>
<tr>
<th>Look closely to detect a pattern or structure</th>
<th>Step back for an overview; shift perspective</th>
<th>See complicated things as collections of smaller parts</th>
</tr>
</thead>
</table>

### (8) LOOK FOR AND EXPRESS REGULARITY IN REPEATED REASONING
**Mathematicians look for and create efficient strategies**

<table>
<thead>
<tr>
<th>Identify calculations, methods, and shortcuts that repeat</th>
<th>Keep the main problem in mind while attending to details</th>
<th>Continually evaluate the reasonableness of results</th>
</tr>
</thead>
</table>

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Based on the Common Core State Standards for Mathematics

RAFT Tip Sheet