Mathematics & Curiosity Magnified: STEM in Primary Grades
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HTTP://BIT.LY/MAGNIFYINGSTEM

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Curiosity Magnified STEM Partnership (CMSP) was a TK-2 STEM CaMSP Grant (Cohort 11) for Shasta County teachers funded through the California Department of Education.
Components

1. Intensive Professional Learning
2. Lesson Study
3. Coaching
Curiosity magnified!

Students are:
Inquisitive
Exploring
Investigating
Creating
Excited
We're taking teaching and learning Above & Beyond

Today's students are moving beyond the basics and embracing the 4C's — “super skills” for the 21st century!

**Communication**
Sharing thoughts, questions, ideas, and solutions

**Collaboration**
Working together to reach a goal — putting talent, expertise, and smarts to work

**Critical Thinking**
Looking at problems in a new way, linking learning across subjects & disciplines

**Creativity**
Trying new approaches to get things done equals innovation & invention

For more 4C resources from the Partnership for 21st Century Skills, including the animated film ABOVE & BEYOND by Peter H. Reynolds & FableVision, journey to www.p21.org/4Cs
CHARACTERISTICS OF A QUALITY STEM PROGRAM

- The context is motivating, engaging, and real world.
- Students integrate and apply meaningful and important mathematics and science content.
- Teaching methods are inquiry based and student centered.

Glancey et al. 2014. Examination of integrated STEM curricula as a means toward quality K-12 engineering education.
CHARACTERISTICS OF A QUALITY STEM PROGRAM

- Students engage in solving engineering challenges using an engineering design process.
- Teamwork and communication are a major focus. Students have the freedom to think critically, creatively, and innovatively, and they have opportunities to fail and try again in safe environments.

Glancey et al. 2014. Examination of integrated STEM curricula as a means toward quality K-12 engineering education.
MAGNIFYING THE "T" IN STEM!
LOOK WHAT THEY CAN DO!
(YES, EVEN IN KINDERGARTEN)

Kindergartners used a stop motion movie program to create math videos!
LEGO MOVIE MAKER

× It is a free app
× It is stop motion film
× You don’t have to use legos

https://youtu.be/AnGAogLc2bo

Tutorials: https://goo.gl/o1LA9P
STOP MOTION STUDIOS -- https://goo.gl/UkWjuq

For phones, ipads, and Chromebooks

Stop Motion Videos make objects, like Lego Men, look like they move on their own. Take a picture, move the lego man a bit and take another pic.

After 20 or so pics, use Stop Motion Studios to stitch them together into a movie.

Tutorials – http://goo.gl/6uA3oV
Why Make Movies?

- Students already associate it with something fun
- It can be used as an informal assessment of their understanding
- Possibilities are endless...
  - Student collaboration
  - Group Projects
  - Share outs
  - Reflections
  - Feedback
**iMovie Trailers**

iMovies lets you take photos and turn them into a cool and fun movie trailer. Take your pics and then open iMovie and import pictures you want to use.

- The trailers are easier and quicker
- It spells out what kind of pictures to take
- It restricts the number of pictures
- It is only ~1 minute long
- Tutorials –
  - [https://goo.gl/17QjEu](https://goo.gl/17QjEu)
  - [https://youtu.be/P-3pvvMJv1I](https://youtu.be/P-3pvvMJv1I)
THE LEGO GAME: INTRODUCTION TO CODING IN EARLY GRADES

Bits & Bricks
DIRECTIONAL SQUARES

Forward

Turn Left

Turn Right
LEGO BITS & BRICKS
ONLINE CODING GAME

https://goo.gl/ryKNED
HELPFUL LINKS

Lego Game Arrows
G-Doc
Other Resources
Powerpoint of steps
Little Bins
Research Parent
Hour of Code
Lesson Study: Integrating STEM in the Classroom
Engage
- Ask questions
- Identify problems
- Predict and plan

Explore
- Investigate
- Address problems
- Observe
- Collect and record data

Reflect
- Discuss observations
- Share ideas and findings
- Evaluation solutions
- Draw conclusions

Be the Teacher...
(White text and the teacher icon on these slides.)

Be the Learner...
(Yellow text and student icon on these slides.)
- Choose four legs to write what you already know about spider webs.

- On the other four legs, write four questions you have about spider webs.
Build a Web

You will be building your own spider web! Let’s look at some real webs to give you ideas.
Orb webs are the type you probably envision when you think of spider webs. These wheel-shaped webs are usually found in open areas between trees or buildings where insects are likely to fly. Orb weavers often wait for their prey in the center of the web.
Funnel Web

Funnel (or triangle) webs may be found outdoors in short grasses or shrubs or between buildings. With this type of web, the spider waits for its prey at one end. When an insect touches the web, the spider shakes the strands to trap it.
Tangle webs are a shapeless jumble of threads attached to a support. Cobwebs are tangle webs that have collected dust and dirt. Many types of garden and house spiders make tangle webs, usually in dark places.
Sheet webs are hammock-like. Above the web, sheet-web weavers also spin horizontal threads for knocking down their prey. When a flying insect hits these threads, it bounces into the sheet section. The spider, which hangs under the sheet, quickly pulls it through.
Build a strong web with a partner/team. Try different ideas to see which idea works best for a strong web.

Engineering Criteria
- Your web needs to be attached to the wire hanger.
- Your web needs to be able to hold as many insects (cubes) as possible.
- Spiders only survive if their webs are strong enough to hold insects (cubes) and not break with the wind and rain.

Question to ask
- “I wonder if it will work if we try…”
- “That didn’t work because…”
- “I think we should try…” because…”
1. Think about the engineering process you just used and list the things you did. Did you plan? Assess? What else?
Engineering Design Process
<table>
<thead>
<tr>
<th>As Stated in Standards</th>
<th>Adapted for K–2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asking questions (science) / Defining problems (engineering)</td>
<td>Wondering (science) / Deciding the 'rules' (engineering)</td>
</tr>
<tr>
<td>Developing and using models</td>
<td>Drawing diagrams and building models to represent how things work.</td>
</tr>
<tr>
<td>Planning and carrying out investigations</td>
<td>Doing “exploriments”</td>
</tr>
<tr>
<td>Analyzing and interpreting data</td>
<td>Comparing and looking for patterns</td>
</tr>
<tr>
<td>Using mathematical and computational thinking</td>
<td>Counting and measuring</td>
</tr>
<tr>
<td>Constructing explanations (science) / designing solutions (engineering)</td>
<td>Describing what happened (science) / Tinkering (engineering)</td>
</tr>
<tr>
<td>Engaging in argument from evidence</td>
<td>&quot;I think _____ because I see or know _____.&quot;</td>
</tr>
<tr>
<td>Obtaining, evaluating, and communicating information</td>
<td>Writing, drawing, or talking (acting out) about what we know, read, and understand about new discoveries (things) (ELA connections)</td>
</tr>
</tbody>
</table>
Science Practices and DCIs

What Science and Engineering Practice do you feel was emphasized in this activity? Bonus if you know the Disciplinary Core Ideas. too!

K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Practice (science) Constructing Explanations and Designing Solutions
How many insects/cubes?

When you think your web is strong enough to test, try to place insects/cubes onto your web to see if the web can hold the insects/cubes.

1) How many of the insects/cubes can your web hold? Place 1 cube at a time to see if your web can hold more. When your web cannot hold any more cubes/insects, count the total number of cubes/insects the web held.

2) Remove cubes/insects from the web and stack the cubes to show how many.

3) Write the number on an index card or post-it to show how many cubes/insects.

4) Create a whole group graph by comparing how many insects/bugs each group’s web held.
Standards for Mathematical Practice

1. Make sense of problems & persevere in solving them
2. Reason abstractly & quantitatively
3. Construct viable arguments & critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for & make use of structure
8. Look for & express regularity in repeated reasoning
Math Practices and Standards

What Standard for Mathematical Practice do you feel was emphasized in this activity? Bonus if you know the exact standard!

SMP #4: Modeling with Mathematics

Common Core Mathematics Standard(s) addressed:
K.C.C.4 Count to tell the number of objects.
Understand the relationship between numbers and quantities; connect counting to cardinality.
 a. When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object.
b. Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted.
c. Understand that each successive number name refers to a quantity that is one larger.

K.C.C.6 Compare numbers.
Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.
Evidence of Student Learning and AH-HAs!

- Having students work in trios was effective.
- Students that may have struggled with behavior or academics may have taken on leadership roles.
- Students were able to collaborate and self-assign roles.
- Give students the opportunity to evaluate a variety of materials including materials that might not have been appropriate for the task.
- More hands on investigations!
What would this lesson be like if the math was removed?

What would this lesson be like if the science was removed?

How do the math, science, and engineering support each other?

What options for technology do you think could be added?
### The Five Dimensions of Powerful Classrooms

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Content</td>
<td>How do important disciplinary ideas and practices develop in this lesson/lesson sequence? How can we create more meaningful connections?</td>
</tr>
<tr>
<td>Cognitive Demand</td>
<td>What opportunities do students have to make their own sense of ideas? To work through authentic intellectual challenges? How can we create more opportunities?</td>
</tr>
<tr>
<td>Equitable Access to Content</td>
<td>Who does and does not participate in the intellectual work of the class, and how? How can we create more opportunities for each student to participate meaningfully?</td>
</tr>
<tr>
<td>Agency, Ownership, and Identity</td>
<td>What opportunities do students have to see themselves and each other as powerful thinkers and learners? How can we create more of these opportunities?</td>
</tr>
<tr>
<td>Formative Assessment</td>
<td>What do we know about each student’s current thinking? How can we build on it?</td>
</tr>
</tbody>
</table>
YOUR TURN

- Choose a lesson.
- Analyze the lesson for STEM integration.
- What would you change to enhance the mathematics?
- What would you change to enhance the science?
- How could you incorporate technology?
- Consider the TRU Dimensions.
STEM Lesson Resources


Thank you!

Link to presentation: bit.ly/magnifyingstem

Any questions?
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