Science and Numeracy: Engaging in the Practices

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Later today I will post this on bit.ly/GACISSCI2019
Take a minute to think about this….

What do scientists, engineers, and mathematicians do?

Let’s discuss.
The Vision for Science Education in the GSE

- Students, _over multiple years_ of school, actively engage in science and engineering practices and _apply_ crosscutting concepts to _deepen_ their _understanding_ of the core ideas in these fields.

- The learning experiences provided for students should _engage_ them with fundamental questions about the world and with how scientists have investigated and found answers to those questions.
What Do We Mean By 3-D Science?

Students Actively Engage in the...

And apply...

To deepen their understanding in the...

<table>
<thead>
<tr>
<th>Science and Engineering Practices</th>
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<tbody>
<tr>
<td>• Asking questions and defining problems</td>
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<tr>
<td>• Developing and using models</td>
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<tr>
<td>• Planning and carrying out investigations</td>
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<tr>
<td>• Analyzing and interpreting data</td>
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<tr>
<td>• Using mathematics, information and computer technology, and computational thinking</td>
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<tr>
<td>• Constructing explanations and designing solutions</td>
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<tr>
<td>• Engaging in argument from evidence</td>
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<td>• Obtaining, evaluating, and communicating information</td>
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<table>
<thead>
<tr>
<th>Crosscutting Concepts</th>
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<tbody>
<tr>
<td>• Patterns</td>
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<tr>
<td>• Cause and effect</td>
</tr>
<tr>
<td>• Scale, proportion, and quantity</td>
</tr>
<tr>
<td>• Systems and system models</td>
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<tr>
<td>• Energy and matter</td>
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<tr>
<td>• Structure and function</td>
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<td>• Stability and change</td>
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<tr>
<th>Core Disciplinary Ideas</th>
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<tr>
<td>• Matter and its interactions</td>
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<tr>
<td>• Motion and stability: Forces and interactions</td>
</tr>
<tr>
<td>• Energy</td>
</tr>
<tr>
<td>• Waves and their applications in technologies for information transfer</td>
</tr>
<tr>
<td>• Structure and processes in living organisms</td>
</tr>
<tr>
<td>• Ecosystems: Interactions, energy, and dynamics</td>
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<tr>
<td>• Heredity: Inheritance and variation of traits</td>
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<tr>
<td>• Biological evolution: Unity and diversity</td>
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<tr>
<td>• Earth’s place in the universe</td>
</tr>
<tr>
<td>• Earth’s systems</td>
</tr>
<tr>
<td>• Earth and humanity</td>
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<tr>
<td>• Engineering design</td>
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What is 3D Standard Construction?

Our science standards include three dimensions meant to be integrated simultaneously in the classroom:

1. Disciplinary Core Ideas: The Content
   The standards contain a limited number of disciplinary core ideas

2. Science and Engineering Practices: How Students will Engage with the Content and Show Mastery
   All K-12 science use the same eight science practices

3. Crosscutting Concepts: The Big Ideas that Span Science Disciplines
   These provide structures to support learning; all courses/grades use the same crosscutting concepts
A Visual - Standard Construction

Each standard in K-12 science begins with the science practice of obtaining, evaluating, and communicating information. Each standard element contains a separate science practice. Here is how they are constructed:

**SPS8. Obtain, evaluate, and communicate information to explain the relationships among force, mass, and motion.**

b. **Construct an explanation** based on experimental evidence to support the claims presented in Newton’s three laws of motion.

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**The WHAT (disciplinary core idea)**

**The HOW (science and engineering practice)**

Color-coded standards are available in the SLDS-TRL-Essential Toolkit under “What do I teach”
The Power of the Practices

Science and Engineering Practices

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Mathematical Practices

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

**Math**
- **MP1.** Make sense of problems and persevere in solving them
- **MP2.** Reason abstractly and quantitatively
- **MP6.** Attend to precision
- **MP7.** Look for and make use of structure
- **MP8.** Look for and express regularity in repeated reasoning

**Science**
- **SP1.** Ask questions and define problems
- **SP3.** Plan and carry out investigations
- **SP4.** Analyze and interpret data
- **SP6.** Construct explanations and design solutions

**ELA**
- **EP1.** Support analysis of a range of grade-level complex texts with evidence
- **MP3 and EP3.** Construct viable and valid arguments from evidence and critique reasoning of others
- **SP7.** Engage in argument from evidence

**EP2.** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience

**EP4.** Build and present knowledge through research by integrating, comparing, and synthesizing ideas from text

**EP5.** Build upon the ideas of others and articulate their own clearly when working collaboratively

**EP6.** Use English structures to communicate context specific messages
GSE

• Focus on students doing math/science and student figuring out

• The standards are student performance expectations

• The “practices” are ensuring that students are engaging in the work of scientists, engineers and mathematicians

• Making these connections explicit is our job

• Let’s look into a classroom…. 
Can We Replace Bees With Robots?

Interdisciplinary investigation for 7th graders

**Scenario:**

- Pollinator colonies are collapsing around the world.
- Students investigate the feasibility of replacing pollinators with robotic drones.
- Students develop proposals for pollinator replacements.
Standards Correlations

Science

• Interdependence of organisms with one another and their environments

• Use mathematical representations to evaluate explanations of how natural selection leads to changes in specific traits of populations over successive generations.

Mathematics

• Analyze proportional relationships and use them to solve real-world and mathematical problems.

• Solve problems involving scale drawings

• Solve real-world and mathematical problems involving surface area

Social Studies

• Africa, Southwest Asia, Southeast Asia

ELA

• Cite several pieces of textual evidence to support analysis

• Write arguments to support claims with clear reasons and relevant evidence.
Project Outline

- Students research pollinators in different regions
- Develop pollinator replacement drones for specific plants
  - Coffee in Africa, date palms in Middle East, coffee in Southeast Asia
  - Draft scale models of drones and drone adaptations
- Develop simulated flowers for drone testing
  - Consult with fine arts for developing models
- Conduct feasibility study based on drone testing
  - Calculating numbers of drones required
- Present findings for adoption by local “governments”
Assessment

Proposal & Feasibility Report
- Graded each subject area for content
- Student produces only one report with a team
- Includes sum of project parts
  - Summary of expert consultation
  - UGA Extension Office
- Summary of research
- Drone Scale Model Drawing
- Analysis of drone adaptation
- Calculation of feasibility
Resources: Georgia Standards

GSO is undergoing a great deal of updates and changes. So, all updates for science are currently being loaded in the SLDS-TRL

www.georgiastandards.org – 10 Modules in 3D Science to be used in Professional Learning Communities (for sessions less than an hour)
Resources: TRL

[Diagram of a webpage with various settings and filters for selecting data.]

Some settings and filters include:
- **Consider Best Score:** No
- **Admin Group:** Main, Retest
- **Filter Group:** Total
- **Season:** Spring
- **Fiscal Year:** 2018, 2017
- **Filter Activity:** Total

The screen shows results for "Hall County" with a percentage of 100%.
Resources: TRL
Resources: TRL

Select a category based on what you want

What do I Teach?  How do I Teach?  Did they Learn?  Need to Know?

Grades
Subject

Found 686 results

Sort by:  Relevance  View:  10  List  Grid

What do I Teach?  CLEAR
Resources: GaDOE Assessment

- GaDOE EOG/EOC – don’t google / go to source
  - [http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/Georgia-Milestones-End-of-Grade-Assessment-Guides.aspx](http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/Georgia-Milestones-End-of-Grade-Assessment-Guides.aspx)
  - [http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/EOG-Study-Resource-Guides.aspx](http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/EOG-Study-Resource-Guides.aspx)
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  - [http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/EOC-Study-Resource-Guides.aspx](http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/EOC-Study-Resource-Guides.aspx)

- Make sure all teachers review these resources as all teachers are teaching GSE and thus assessing GSE (not just those with a GMAS)
Resources: GaDOE Science


- FAQ
- Teacher Newsletter & Sign Up
- 13 Videos Just Released in September
Resource: Twitter

- Follow us @GaDOEScience