12:00 - Opening Remarks and Instructions
12:05 – Kathryn R. Mullen, Glowing Pickles, Electron Movement and Literacy
12:25 - Daron Martin, I Scream, You Scream, We All Scream!...For Streamlined Digital Learning
12:45 - Kynisha Okonkwo and Pamela Sosna, Effective Strategies and Lesson Essentials in the Co-Taught Physical Science Classroom
1:05 - Nata Wayne, Don’t Be Direct, Use Phenomena Instead
1:25 – Closing Remarks and Links
Glowing Pickles, Electron Movement and Literacy

Presenter: Kathryn Mullen
Today’s Objectives:

1. ... to define and understand the importance of scientific literacy.

2. ... to understand the components of an effective literacy task, and be able to create one for your students.

3. ... to identify two or more strategies that you can implement in your own classroom to increase students’ content literacy.
What comes to mind?

- Speak and listen; justify and reflect
- Analyze, evaluate text features
- Creating non-verbal representations
Literacy in Science

... what is it?
Scientific Literacy

Neil deGrasse Tyson
Literacy provides students with a foundation for academic achievement, and ‘becomes the currency of other learning’ (Hattie, 2017).
Glowing Pickles and Electron Movement

... a science “literacy task”
<table>
<thead>
<tr>
<th>Literacy Task Name:</th>
<th>Standards &amp; I Can Statement(s) (Benchmarks):</th>
</tr>
</thead>
<tbody>
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</table>

<table>
<thead>
<tr>
<th>Literacy Skill/Category: (Reading, Writing, Speaking Listening)</th>
<th>Pacing:</th>
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<tbody>
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<thead>
<tr>
<th>Strategy Used:</th>
<th>Foundational, Scaffolding or Culminating Task: Or (Opener, Main Lesson, Closer)</th>
</tr>
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| Materials Needed: | |
|-------------------| |
|                   | |

<table>
<thead>
<tr>
<th>Explanation of the Literacy Task:</th>
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<tr>
<th>Instructional Considerations for Exceptional Learners (Gifted, SPED, ELL)</th>
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</table>
1. What is inside a firework?

1. What is your favorite color firework and what chemical is used in it?

1. Explain what happens at the atomic level to cause the colors to be seen?

1. How do fireworks explode?

1. Why is it important to know the rules and regulations regarding firework safety?

1. Give an example of what danger fireworks can pose.

1. Explain what a pyrotechnic chemist does.
Which One Doesn't Belong?
Claims, Evidence and Reasoning

Students write their claim, evidence and reasoning on the question, How does the Pickle glow in the dark?

Swap paper. Three Color Analysing.
Ask for Volunteers to read a really good paper.
“Neon” Lights

Summarizing Activity:
Answer the following question:

*Why are there different color fluorescent lights?*

Think and Write: 5 minutes

Share with a partner: 4 minutes

Share with the class.
Effective Strategies

... ways to engage and extend the NGSS
Commonalities Among the Practices in Science, Mathematics and English Language Arts

E1: Demonstrate independence in reading complex texts, and writing and speaking about them
E7: Come to understand other perspectives and cultures through reading, listening, and collaborations

NGSS@NSTA
www.nsta.org/ngss
Engaging in Argument from Evidence

Argumentation is the process by which evidence-based conclusions and solutions are reached. In science and engineering, reasoning and argument based on evidence are essential to identifying the best explanation for a natural phenomenon or the best solution to a design problem. Scientists and engineers use argumentation to listen to, compare, and evaluate competing ideas and methods based on merits. Scientists and engineers engage in argumentation when investigating a phenomenon, testing a design solution, resolving questions about measurements, building data models, and using evidence to evaluate claims. (NGSS, 2014)
Which One Doesn’t Belong?

- Sodium
- Sodium Ion
- Sodium $^{23}$

Which one doesn’t belong?
Agree to Disagree

Several students observed ice melt. This is what they observed:

- John thought ice melting was a chemical change because there was a change of state.

- Aimee thought it was a chemical change because a new substance water was created.

- Malik thought it was a physical change because the chemical formula for water and ice are the same.

- Sara thought it was a physical change because no fire was produced.

Which student do you agree with and why?
Other Ideas?

**Working Backwards**

Students are given evidence on strips of paper, and they must construct an argument that aligns with the provided facts.

**Debates**

**Error Analyses**

**Annotation**

**Flipgrid**
Analyzing and Interpreting Data

Scientific investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists use a range of tools—including tabulation, graphical interpretation, visualization, and statistical analysis—to identify the significant features and patterns in the data. Scientists identify sources of error in the investigations and calculate the degree of certainty in the results. Like scientists, engineers require a range of tools to identify patterns within data and interpret the results. Advances in science make analysis of proposed solutions more efficient and effective. (NGSS, 2014)
Examine the chart above. Which element is more likely to form an anion? Justify your answer.

<table>
<thead>
<tr>
<th>Element</th>
<th>State at Room Temperature</th>
<th>Reactivity</th>
<th>Conductivity</th>
<th>Malleable</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Solid</td>
<td>Very</td>
<td>High</td>
<td>Yes</td>
</tr>
<tr>
<td>B</td>
<td>Gas</td>
<td>Very</td>
<td>Low</td>
<td>No</td>
</tr>
</tbody>
</table>
**Story of Data**

Students are presented with charts, graphs, etc., and tasked with “telling the story” of the data. This forces application of concepts and fosters creativity.

**Reciprocal Teaching**

**Think Alouds!**

**Annotation**
Obtaining, Evaluating, and Communicating Information

Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity. Communicating information and ideas can be done in multiple ways: using tables, diagrams, graphs, models, and equations as well as orally, in writing, and through extended discussions. Scientists and engineers employ multiple sources to obtain information that is used to evaluate the merit and validity of claims, methods, and designs. (NGSS, 2014)
I See, I Think, I Wonder...
Write 3 ionic formulas.

Write 2 covalent formulas.

Write one sentence explaining the difference between a covalent and ionic formula.
Memes and #hashtags

#science

MY SCIENCE TEACHER SAID I HAD POTENTIAL

THEN SHE PUSHED ME OFF A BUILDING
Other Ideas?

**Text Structure**
- Chronological?
- Cause and effect?
- Problem and solution?
- Compare and contrast?

**Journaling**

**Non-Linguistic Representations**
- POMS
- Graffitti

**Annotation**

**Possible Sentences**
Developing and Using Models

A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations. Modeling tools are used to develop questions, predictions and explanations; analyze and identify flaws in systems; and communicate ideas. Models are used to build and revise scientific explanations and proposed engineered systems. Measurements and observations are used to revise models and designs.
Frayer Model

**Definition:**
A change in size, shape or state of matter where the composition of the substance does not change

**Facts/Characteristics:**
New materials are not formed. Same materials are present before and after change.

**Examples:**
- Melting ice
- Cutting hair
- Dissolving sugar

**Non Examples:**
- Burning wood
- Baking a cake
- Baking soda with vinegar (carbon dioxide is produced)

(Source: Using Literacy Strategies in Mathematics and Science Learning in Adolescent Literacy in Perspective, 2009)
Other Ideas?

- Analogies, Scenarios
- Graffitti
- Prezi, etc.
- Journaling
- Non-Linguistic Representations
Part of what it is to be scientifically-literate, it's not simply, 'Do you know what DNA is? Or what the Big Bang is?' That's an aspect of science literacy. The biggest part of it is do you know how to think about information that's presented in front of you.

– Neil deGrasse Tyson
Resources

Helpful links, files, and sites to support you in nurturing the scientists of tomorrow!
Padlet code in order to access resources, slides, and more!

https://padlet.com/kathryn_mullen1/gg70bi9bf72e5pfx
Contact Information:  Kathryn R. Mullen, Gwinnett County Schools
kathryn.mullen@gcpsk12.org