Welcome!

Making Sense of Three-Dimensional Teaching and Learning-Grade 8 Unit 1

Day 1

June 25-26, 2024
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</table>
Today’s Presenter

Brianna Reilly Oliveira
NSTA Professional Learning Specialist
breilly39@gmail.com
Learning Goals

● Build an understanding of what three-dimensional teaching and learning looks like, feels like, and sounds like in the classroom.

● Be able to foster a community of evidence-based thinkers and position students as the “knowers” in the classroom.

● Gain strategies to leverage students’ assets (experiences, prior learning, curiosity, etc.) to learn science.

● Experience as learners and learn how to teach Grade 8 Unit 1.
Housekeeping

- This will be an interactive, action/thinking-packed two days. Please engage as an active participant to maximize your own and other’s experiences.
- Please tell me how I can support you along the way. There is a parking lot for questions and requests.
- Lunch is 1 Hour - from 12-1 ish
- There will be an AM Break.
- Take care of your own needs along the way.
Meet Our Learning Community

Alone Zone (independent thinking time)
❖ Why do you think it is important for all students to learn science?
❖ What are your goals for your students in science?
Meet Our Learning Community

**Alone Zone** (independent thinking time)
- Why do you think it is important for all students to learn science?
- What are your goals for your students in science?

**Small Group**
- Share your thinking with your group.
- What is your group’s top science goal for students in your school district?
Sensemaking and Constructing Norms
The framework is designed to help realize a vision for education in the sciences and engineering in which 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 students with their own fundamental questions about the world and with how scientists have investigated and found answers to those questions.
Meet Ms. Katsanos’ Third-Graders

Students experienced the phenomenon of kidney beans *germinating*. (The beans look like kidney beans one day and then a few days later some kidney beans look like plants.)

Students have completed an investigation in which kidney beans with water and kidney beans without water were placed in sunny places and dark places.
Elementary Students Sensemaking

Students complete two tasks in this classroom video

Task 1. **Reach a consensus** [using patterns in data] on what it means for a seed to *germinate* (0:24-3:25)

Task 2. **Make a claim** in answer to the question about the phenomenon, “What do kidney beans need to successfully *germinate*?” (3:40-6:25)
Elementary Students Sensemaking

**Alone Zone**

1. What are the students doing?

2. What is the teacher doing?

3. Based on what you observed, what is sensemaking?

https://www.teachingchannel.org/video/lesson-claims-evidence-reasoning
Elementary Students Sensemaking
Elementary Students Sensemaking

Small Group

1. What are the students doing?
2. What is the teacher doing?
3. Based on what you observed, what is sensemaking?

https://www.teachingchannel.org/video/lesson-claims-evidence-reasoning
Sensemaking in a High School Classroom
High School Students Sensemaking

High school biology students explore the question, “Can nature change populations?” (populations change over time)

Task 1: Use a simulation to identify cause-and-effect relationships between an organism’s ability to avoid prey and changes in that organism’s population over time.

Task 2: Construct an explanation(s) using science ideas and cause-and-effect relationships to help answer the question about what causes population change. (2:53-7:11)
High School Students Sensemaking

Alone Zone

1. What are the students doing?

2. What is the teacher doing?

3. Based on what you observed, what is sensemaking?

Video not available to the public
What is Sensemaking?

Small Group

• Discuss with your group members:
  o What were the students doing?
  o What was the teacher doing?
  
    *Cite specific examples from the classroom video.*

• As a group, define *sensemaking*. 
Supports for Sensemaking

In the **Alone Zone**, consider the following:

- What types of **support might students need** to engage in a sensemaking lesson like the ones you observed?

- What types of **support might you (teachers) need** to engage students in a sensemaking lesson like the ones you observe?
Supports for Sensemaking

Small Group Discussion:

Together, identify your agreed upon:

- **top 5 supports that a student needs** to engage in a sensemaking lesson,
- **and, top 5 supports that teachers need** to engage students in a sensemaking lesson.

Record these on your poster.
Supports for Sensemaking

Small Group Discussion:
Think of classes you have had (as a student or a teacher) that you have enjoyed being in.

- Can you identify **5 things** that made that classroom enjoyable or comfortable/safe?
- How do these overlap with the necessary supports for sensemaking?
Supports for Sensemaking

Small Group Discussion:

Think of classes you have had (as a student or a teacher) that you have enjoyed being in.

- Can you identify **5 things** that made that classroom enjoyable or comfortable/safe?
- How do these overlap with the necessary supports for sensemaking?

On your poster, identify supports for sensemaking that are essential for making students feel comfortable/safe.
Supports for Sensemaking

Science is a social endeavor! Your classroom is a community of learners in which students and teachers actively try to make sense of the natural and built worlds.

- We figure out the science ideas.
- We figure out where we are going at each step.
- We figure out how to put the ideas together over time.

Source: Next Generation Science Storylines
Co-Constructing Norms for Equitable Sensemaking

Small Group

Consider the **GOAL**: Our classroom environment needs to be safe/comfortable for students to engage in sensemaking.

- How do we (students and teachers) achieve these goals together *(norms)*? *Think: words and actions - What do we do?*
- Develop 1-2 classroom norms with your group.

Be ready to share how the norms your group created support this community with figuring things out.
Co-Constructing Norms for Equitable Sensemaking

7 · ESTABLISH SHARED NORMS

MATERIALS: Science Classroom Norms, science notebook, scissors, tape

Introduce the idea of coming to consensus as a class. Tell students, Soon, we'll try to come to agreement with all our diagrams. The purpose of introducing the consensus task before talking about classroom norms is to get students thinking about how difficult it will be to get all members of the learning community to agree and how we want to make sure everyone is included and all voices are heard.

Introduce science classroom norms. Tell students that before the class moves on with further investigations, it is time to set up some norms for how the class wants to work and learn together. You may want to reiterate productive behaviors you witnessed in the first day of Lesson 1 as a way of communicating to students that they were already operating using some positive norms, but they had not yet talked about them.

Display slide K and pass out the handout Science Classroom Norms. Note: Edit the handout and slide as desired for your classroom.

Remind students that in prior units we have used norms to help develop a productive and respectful learning environment. They are similar to rules but are intended to ensure that all students have a positive learning experience in science class.

The norms on the handout and the slide are a starting point for the class. It is important to talk through each one with students and ask them to provide an example or paraphrase the norm. The purpose of this is to develop a shared understanding of each norm. Also, provide opportunities for students to clarify a norm, ask for a modification, or develop a new norm. Allow students to write on their handouts if the class decides to change something. Norms are intended to be shared by the students and teacher, so even though a set has been provided, it is just a starting point.

Universal Design for Learning: It is important to use this norm-building time to begin to cultivate an equitable learning community that promotes trusting and caring relationships that foster student engagement. The norms should remind students to value the diversity of classroom community members and equity in the sensemaking work they will do together this school year. It is critical that the norms support safe and fair participation and interrupt cultural norms or stereotypes that could make science experiences feel uncomfortable to students (e.g., being someone who is not intelligent).
### Revisiting Norms with Intention

#### 7 · ESTABLISH SHARED NORMS

**MATERIALS:** Science Classroom Norms, science notebook, scissors

Introduce the idea of coming to consensus as a class. Tell students introducing the consensus task before talking about classroom members of the learning community to agree and how we war

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#### 6 · JIGSAW FEEDBACK GROUP DI

**MATERIALS:** science notebook, jigsaw feedback

Discuss norms for giving and receiving feedback. Norms are especially important when giving or asking, listen for ideas such as the following:
- We critique ideas, not people.
- We encourage other voices that have
- We listen carefully and ask questions.

Say, These are all important to help us learn from

### Self Assessment: Giving Feedback

**How well did you give feedback today?**

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gave feedback that was specific and about science ideas.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shared a suggestion to help improve my peer’s work.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used evidence from investigations, observations, activities, or readings to support the feedback or suggestions I gave.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

One thing I can do better next time when I give feedback is:

### Self Assessment: Receiving Feedback

**How well did you receive feedback today?**

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read the feedback I received carefully</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asked follow up questions to better understand the feedback I received</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Said or wrote why I agreed or disagreed with the feedback</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revised my work based on the feedback</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What is one piece of feedback you received?
Sometimes students might be directed to choose a norm they want to work on individually.
Guidelines for Watching Videos of Teaching

- These are real classrooms-teaching and the classrooms we will see are complex.

- **Ground rules:**
  - There is much we do not know about the students and teacher and their history together.
  - Presume positive intentions and expertise on the part of the teacher.
  - Assume what the kids are saying makes sense to them.
  - Focus on how the classroom talk (teacher and students) is serving the learning goals of the lesson and the science and engineering practices involved.

Norms-on-the-Go

Alone Zone

In each of the following classrooms

- What caused the teacher to redirect students’ attention to the norms?
- How did the teachers help students connect the need to attend to the norm(s) to *sensemaking*?
- What might you do the same and/or different (with the benefit of thinking time)?
Norms-on-the-Go

Play video 1:30 - 2:25
Teacher: Interesting. Those seem like different ideas. Right. And that’s interesting and puzzling too, right?
Norms-on-the-Go

Student, you want to grab a stool from the table?

Play video 6:51 - 8:19
Norms-on-the-Go Teacher Reflections

Small Groups
What pattern(s) emerge across the three classrooms with respect to attending to norms “in the moment?”

- What caused the teacher to redirect students’ attention to the norms?
- How did the teachers help students connect the need to attend to the norm(s) to sensemaking?
- What might you do the same and/or different (with the benefit of thinking time)?
SEGMENT 2 PART 1

Lesson Immersion
Anchor Phenomenon
**Student Hat/Teacher “Hat”**

**Student Hat:** Think like a student.

**Student/Teacher Hat:** Think like a student, but note teacher guidance.

**Teacher “Hat”:** Reflect on student experience and educator moves.
Lesson 1

Intro to Chemistry
Warm-up:

- Have you heard of bath bombs before? What is your experience with bath bombs?
- What do you predict will happen when the bath bomb from the store is placed in a bowl of water?
Use the table to record what you notice and wonder about the store-bought bath bomb, before we add it to water.
I Notice… | I wonder…
---|---
What are some things you see happening to the water?
What kinds of observations do you hear?
Do you notice any odors?
If you feel the liquid what do you observe?
What happens to the bathbomb?

Use the table to record what you notice and wonder about the store-bought bath bomb, during and after we add it to water.
Turn & Talk Protocol

Look at your partner

Listen to your partner

Be ready to Speak when it's your turn (at an appropriate voice level)
Turn & Talk

Share with a partner what you NOTICED and what you WONDERED.
What happens when a bath bomb is added to water (and what causes it to happen)?
Create a Model

Show what you saw happened to the solid bath bomb and where the gas bubbles appeared in the system.

Use pictures, symbols, and words to represent this.
Label the following locations in your diagram with the corresponding letter:

A. A spot in the bath bomb before adding it to the water.
B. A spot in the water right before adding the bath bomb to it.
C. A spot in the liquid remaining in the cup a few minutes after adding the the bath bomb to the water.
D. A spot inside of a gas bubble a couple seconds after adding the bath bomb to the water.
Create a Model

Based on your observations, create a model about what you think happened. Each circle represents a “zoom-in” of that part of the system. Use the large circle in the middle to show what you think was happening to this matter that explains:

1. What happened to the solid bath bomb?
2. What do you think caused the gas bubbles to appear?
3. What do you think caused the other changes you observed?
Before putting these together

A: A tiny sample of the bath bomb

A couple seconds after adding the bath bomb to water

B: A tiny sample of the water

C: A tiny sample of the liquid left over after a couple of minutes

As gas bubbles appear

D: A tiny sample of the gas in a bubble

Key:
Please return at 11:00
Small-Group Discussion Protocol

- Give each group member an opportunity to share their model and explanation with the group.
- When it is your turn, turn your model around so that it faces others in your group.
- As your group notices things about each diagram, record the following in pencil (lightly):
  - Place a ✓ by parts of your model or explanations that are similar to those shown on other diagrams from the group.
  - Place a ? by parts of your model or explanations that are different or where your group is less certain.
Whole Group Protocol:

Raise your hand and wait to be called on.

Look at the person that is speaking.

Listen to everyone's ideas.

Speak loudly and clearly.
Let’s develop a whole-group record of what we agree on and where we have competing ideas across the initial models and explanations.

- What do we all seem to agree on?
- What do we disagree on?
- What are some new ideas we might want to consider?
Before putting these together:

A: A tiny sample of the bath bomb

B: A tiny sample of the water

A couple seconds after adding the bath bomb to water:

Key:

As gas bubbles appear:

D: A tiny sample of the gas in a bubble

C: A tiny sample of the liquid left over after a couple of minutes
Based on what you saw in the videos and what we discussed as a group, what revisions do you want to make to your initial model? Remember to show what you think was happening to this matter that explains:

1. What happened to the solid bath bomb?
2. What do you think caused the gas bubbles to appear?
3. What do you think caused the other changes you observed?
On a sticky note, jot down any questions you have that relate to what we have observed so far about bath bombs. Write down one question per sticky note. Put your name on the back side (sticky side).

To help you brainstorm your questions, look back through your I notice, I wonder observations.

Possible Sentence Starters
Why...?
How...?
What causes...?
Bring your sticky notes with questions to our Scientists Circle, along with your science notebook.

Either stand or sit in a circle facing each other. One volunteer will share their question and place it on the Driving Question Board.

Any student that has a similar question to the first one, raises their hand. The first student will choose which student will share their question next. Repeat until all questions are on the Driving Question Board.
Driving Question: Can we make something new that wasn’t there before?

Let’s organize our questions on the Driving Question Board so that they are near questions that are similar to each other.

What connections do you see?
What patterns do you notice?
What kind of investigations could we do and/or what additional sources of data might we need to figure out how bath bombs work?

Let’s make a record of ideas for future investigation we can do to answer some of our questions on the DQB.
Based on our DQB, what should we explore first to better help us understand what happens to a bath bomb in the water?

I think we should explore _____ because ____________
__________________________________________.

*Be sure to use complete sentences.
SEGMENT 2 PART 2

Anchor Phenomenon Routine Reflection
## Anchoring Phenomenon Routine

<table>
<thead>
<tr>
<th>Element 1: Explore the Phenomenon</th>
<th>Element 2: Attempt to Make Sense of the Phenomenon</th>
<th>Element 3: Identify Related Phenomena</th>
<th>Element 4: Develop Questions and Next Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>What do we notice?</td>
<td>How can we explain this? Do our explanations agree?</td>
<td>Where else does something similar happen?</td>
<td>What should we do to figure out how to explain this?</td>
</tr>
</tbody>
</table>

**Notes about what you or the students did:**

**How does this support **figuring out**?**

**How does this support a classroom culture where all students have access?**

---

### How do the elements of the Anchoring Phenomenon Routine support all students in figuring things out?

[OpenSciEd logo]
Individually jot down some notes about what you did as students in Elements 1-4.

### Anchoring Phenomenon Routine Tracker

<table>
<thead>
<tr>
<th>Element 1: Explore the Phenomenon</th>
<th>Element 2: Attempt to Make Sense of the Phenomenon</th>
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<td>Where else does something similar happen?</td>
<td>What should we do to figure out how to explain this?</td>
</tr>
</tbody>
</table>

- Notes about what you or the students did.
- How does this support **figuring out**?
- How does this support a classroom culture where all students have access?
Add a “Related Phenomena” title to your science notebook and record:

- What experience have you had with other phenomena (events that we can’t explain but know that it happens) that reminds you of what you saw happen with the bath bombs?

Whole Class Shares Out & Teacher records on poster paper

Be prepared to share these with the whole class.
We will watch 2 brief videos on similar phenomena.

As you watch the videos add to your notice and wonder chart.
• What was similar between these phenomena and the bath bomb?
• What was different between these phenomena and the bath bomb?
How can the steps of the Anchoring Phenomenon Routine support all students in figuring things out?

- Work with a partner to reflect on each element using the **Anchoring Phenomenon Routine Tracker**.
SEGMENT 4

Students Doing Science

Lesson 3 Immersion SEP Reflection
Students DOING Science
Lesson 3

Law of Conservation of Mass and Lab
As you come in, bring your science notebook and gather around our Driving Questions Board. Review the DQB and your science notebook for:

- What questions did we have about where the gas bubbles came from?
- What ideas did we have about where the gas bubbles came from?

Let’s share some of our thinking.
What additional information did we learn about the bath bomb?

What do we still need to figure out about our bath bombs?
Last Class

Let’s share some of our responses from last class about where the gas in the bath bomb came from.

States of Matter

During the lesson we observed solids, liquids, and gases. The bath bomb was a solid, and the water was a liquid, but where did the gas come from?
Where does the gas in the bath bomb come from?
One of our claims is: The gas is part of the bath bomb itself, trapped inside it.

- How can we investigate whether the gas is trapped inside the bath bomb?
- What do we need to measure?
- What data should we record? How should we collect and organize that data?
- What would we see if the gas is trapped in the bath bomb itself? What would you see if the gas does not come from inside the bath bomb?
One way we can test whether the gas is a part of the bath bomb is by crushing it, making close observations, and recording the mass before and after it is crushed.

Your group should have the following materials:
1 - ziploc bag
1 - small bath bomb
1 - digital scale

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Starting mass in closed system (g)</th>
<th>Ending mass in closed system (g)</th>
<th>Ending mass in open system (g)</th>
<th>Change in mass (g)</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crushing the bathbomb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Discuss the following questions with your group:

1. What did you observe about the bag after we crushed the bath bombs in it?
2. What did you notice about the mass of the system?
3. Can we use any of this data as evidence to support the claim that the gas is trapped inside the bath bombs themselves.
Another of our claims is: The gas is something new, made from the bath bomb.

• How can we investigate whether the gas is new matter or not?
• Should we test an open system, closed system, or both?
• What do we need to measure? How? When should we measure it?
• How should we record that data?
Instead of testing bath bombs, we’re going to test some similar materials.

Your group should have the following materials:

1 - 200mL Erlenmeyer Flask
Water
2 effervescent tablets
1 balloon
Access to a Digital Scale
Water & Bath Bomb - Open System Procedure

1. Calibrate, or set the balance to zero.
2. Fill a clean Erlenmeyer flask with 50 mL of water.
3. Unwrap 1 effervescent tablet and place it on a square of paper. Crush the tablet.
4. Place the flask and 1 unwrapped effervescent tablet on the balance and record the starting mass.
5. Place the tablet into the flask of water. Gently swirl for 3 minutes.
6. Once the reaction is complete, put the flask back onto the scale and record the ending mass.
7. Calculate the amount of mass changed.

Water & Bath Bomb - Closed System Procedure

1. Thoroughly rinse out the flask and fill it with 50mL of water.
2. Unwrap 1 effervescent tablet and place it on a square of paper. Crush the tablet.
3. Place the crush tablet inside the balloon.
4. Place the balloon around the rim of the flask, but DO NOT let the tablet fall into the water.
5. Find and record the starting mass of the flask & balloon with tablet.
6. Lift the balloon and allow the tablet to fall into the water. Gently swirl for 3 minutes.
7. Once the reaction is complete, record the ending mass.
8. Calculate the amount of mass changed.
Discuss the following questions with your group:

1. What did you observe during our investigation of the bath bombs in the open system? The closed system?
2. Does this data provide evidence to support or refute either of our claims?
What did we observe during our investigations?

Does this data provide evidence to support or refute either of our claims?
Based on the evidence gathered, where do you think the gases came from?
How does our evidence support or refute each of these claims?

- **Claim 1:** The gas is new matter that was not there to start with.
- **Claim 2:** The gas is not new matter, but comes from what was already there.

Consider your evidence and reasoning.

A. *Evidence:* referencing data that support (or refute) the claim and

B. *Reasoning:* explaining what these data mean by connecting them to key ideas.
How does our evidence support or refute each of these claims?

- **Claim 1:** The gas is new matter that was not there to start with.

- **Claim 2:** The gas is not new matter, but comes from what was already there.

Consider your evidence and reasoning.

A. *Evidence:* referencing data that support (or refute) the claim and

B. *Reasoning:* explaining what these data mean by connecting them to key ideas.
Let’s take another look at our initial model and make revisions as needed.

- How do the particles of a bath bomb change during the reaction with water?
Before putting these together

A: A tiny sample of the bath bomb

B: A tiny sample of the water

A couple seconds after adding the bath bomb to water

Key:

As gas bubbles appear

D: A tiny sample of the gas in a bubble

C: A tiny sample of the liquid left over after a couple of minutes
In the closed systems:

• How much mass did we start with?
• How much mass did we end with?

So, what happened to the mass in the open systems?
Key Ideas:

- Gas is matter and has mass.
- Matter cannot be created or destroyed, even when it changes forms - **Law of Conservation of Mass**
Our lesson question was “Where does the gas in the bath bomb come from” Record that under the column that says lesson question.

What did we figure out from the Phet activity?

What new questions do you have?
Update Sensemaking
Posters
Gots & Needs
Please complete the following survey before you leave:

Gots and Needs

As you walk out the door, please add one post it to each of the “Gots” and “Needs” posters

**GOTS**
An “aha!” or something new I understand.

**NEEDS**
A question I still have or something am hoping to learn tomorrow.
See you tomorrow!
Anchor Phenomenon
Routine Reflection
Welcome!

Making Sense of Three-Dimensional Teaching and Learning-Grade 8 Unit 1

Day 2

June 25-26, 2024
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<thead>
<tr>
<th>Segment</th>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
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<tr>
<td>Segment 5</td>
<td>8:00-9:00</td>
<td>Welcome! Lessons 4-5 Deep Dive</td>
</tr>
<tr>
<td>Segment 6</td>
<td>9:00-10:30</td>
<td>Experience Sensemaking In Unit 1 Lesson 11</td>
</tr>
<tr>
<td></td>
<td>15 Min Break</td>
<td></td>
</tr>
<tr>
<td>Segment 7</td>
<td>10:30-12:00</td>
<td>Student Final Model &amp; Evaluating Unit 1</td>
</tr>
<tr>
<td>Lunch</td>
<td>12:15 – 1:30</td>
<td>NSTA Survey - Lunch</td>
</tr>
<tr>
<td>Segment 8</td>
<td>1:15-2:15</td>
<td>Productive Talk</td>
</tr>
<tr>
<td>Segment 9</td>
<td>2:15-2:45</td>
<td>Revisit Sensemaking Posters</td>
</tr>
<tr>
<td>Closing</td>
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Today’s Presenter

Brianna Reilly Oliveira
NSTA Professional Learning Specialist
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Learning Goals

● Build an understanding of what three-dimensional teaching and learning looks like, feels like, and sounds like in the classroom.

● Be able to foster a community of evidence-based thinkers and position students as the “knowers” in the classroom.

● Gain strategies to leverage students’ assets (experiences, prior learning, curiosity, etc.) to learn science.

● Experience as learners and learn how to teach Grade 8 Unit 1.
Housekeeping

- This will be an interactive, action/thinking-packed two days. Please engage as an active participant to maximize your own and other’s experiences.
- Please tell me how I can support you along the way. There is a parking lot for questions and requests.
- Lunch is 1 Hour - from 12-1 ish
- There will be an AM Break.
- Take care of your own needs along the way.
SEGMENT 5

FINAL MODELS

Storyline Activity (Lessons 3-10)
Engaging in Science

With your **Small Group**, discuss where we left off at the end of Lesson 3.

- What did we figure out about the Bath Bomb phenomenon?
- What science ideas did we build?

What did **students** do to build these ideas?
Science and Engineering Practices (SEPs)

1. Asking Questions (Science) and Defining Problems (Engineering)
2. Developing and Using Models

A focus on practices (in the plural) avoids the mistaken impression that there is one distinctive approach common to all science—a single “scientific method.”

6. Constructing Explanations (Science) and Designing Solutions (Engineering)
7. Engaging in Argument from Evidence
8. Obtaining, Evaluating, and Communicating Information
Evaluate Lessons 4 & 5

Making Connections
With your partner, describe how the warm up video connects to the bath bomb model that you created in the first lesson.

What similarities and differences did you notice?

Gallery Walk
Leave your lab sheet on your desk and walk around to see what other students have drawn.
As a class, discuss what patterns you saw in everyone’s pictures.
What was similar?
What was different?

Look For/Listen For:
- Did students look at the molecular level or macro level?
- Did students consider how one moves vs the other?
- Did students consider how?

Teacher Notes:
After time is up, do a gallery walk where students will leave their models on their table and walk around the room to look for patterns in everyone’s models of solids, liquids, and gases. If you’re not comfortable having the students walk around the room, you can adjust this activity by having students hold up their model for each state of matter. Another alternative is you can convert this activity to a small group activity or turn & talk activity.

Close Discussion:
Have students share out what they observed in the gallery walk and teacher could make 3 posters or one poster with 3 columns to record down student ideas/thoughts/models.

Image Credit:

nsta
Evaluate Lessons 4 & 5

Complete a close read of Lessons 4 and 5. As you read, consider the following:

● What are students figuring out in each lesson?
  ○ About science ideas?
  ○ About the Bath Bomb phenomenon?

● What do students do in each lesson (SEPs)?

● What motivates students to move to the next lesson?
Evaluating Lessons 4 & 5

Access lessons on Canvas or by using the links below:

**Teacher Edition:**

**Student Sheets**

As you read, consider the following:

- What are students figuring out in each lesson?
  - About science ideas?
  - About the Bath Bomb phenomenon?
- What do students do in each lesson (SEPs)?
- What motivates students to move to the next lesson?
Evaluating Lessons 4 & 5

Access lessons on Canvas or by using the links below:


With your **Small Group**, discuss your ideas for each lesson:

- What are students figuring out in each lesson?
  - About science ideas?
  - About the Bath Bomb phenomenon?
- What do students do in each lesson (SEPs)?
- What motivates students to move to the next lesson?
Traditional View and Contemporary View

Information Frame

Scientists and Teachers

Knowledge of Science Disciplines

Some Students

Sensemaking Frame

Students as Scientists and Engineers

Making Sense of Phenomena

All Students

Teachers Facilitate
Coherence from the Students’ Perspective

“WE” Culture

● We figure out the science ideas

● We figure out where we are going at each step

● We figure out how to put the ideas together over time
Making Connections

With your partner, describe how the warm up video connects to the bath bomb model that you created in the first lesson.

What similarities and differences did you notice?

Look For/Look For:
- Lots of gases/bubbles created.
- The candle, bath bomb, and alkali metals all turned our as solids.
- The alkali metals, candle, and both bombs all seem to “disappear” or “go away”. Where did they go?

What are these forms different or similar?

Gallery Walk

Leave your lab sheet on your desk and walk around to see what other students have drawn.

As a class, discuss what patterns you saw in everyone’s pictures.

What was similar?

What was different?

Look For/Look For:
- Did students look at the molecular level or macro level?
- Did students consider how one moves vs. the other?
- Did students consider how

Teacher Notes
After time is up, do a gallery walk where students will move their models on their table and walk around the room to look for patterns in everyone’s models of solids, liquid and gases. If you’re not comfortable having the students walk around the room, you can adjust this activity by having students hold up their model for each state of matter. Another alternative is you can convert this activity to a small group activity or turn & talk activity.

Class Discussion:
How students share out what they observed in the gallery walk and teacher could make 3 posters or one poster with 3 columns to record down student ideas/thoughts/models.

Image Credit:
5 Minute Timer: With Relaxing Ocean Waves - https://youtu.be/0DHuTmGej3o; Credit: YouTube

nsta
Assessment Examples

PS.8.1 Understand the properties of matter and changes that occur when matter interacts in open and closed systems.

PS.8.1.1 Construct an explanation to classify matter as elements, compounds, or mixtures based on how the atoms are arranged in various substances.

A scientist performed an investigation with a solution of Silver Nitrate (AgNO₃) and water (H₂O). She heated the sample until all of the water in the solution evaporated and a colorless powder remained.

How would she construct an explanation to correctly classify Silver Nitrate as a compound?

A. Silver Nitrate is a compound because it is a colorless powder.
B. Silver Nitrate is a compound because it has five atoms that are chemically combined.
C. Silver Nitrate is a compound because it can form a solution with water.
D. Silver Nitrate is a compound because it forms when three elements are combined chemically.

1. Which is a compound?
   A. sodium
   B. sugar
   C. nitrogen
   D. air

21. Which is classified as an element?
   A. carbon dioxide
   B. iron
   C. vinegar
   D. water
SEGMENT 7

Classroom Immersion - Lesson 11
Lesson 11

Chemical Equations
Earlier, we discover that Citric Acid and Bicarbonate of Soda were the ingredients in a bath bomb that, when mixed, caused the gas to form.

Below is a molecular model of each.

Are these elements, compounds, or mixtures? How do you know?

Citric Acid  Bicarbonate of Soda
Last class we figured out the differences between mixtures, elements, and compounds at a molecular level and updated our consensus model. Did we have enough evidence to update how we would represent each substance?
Examine the properties of common gases and the results of investigations about the gas in a bath bomb.

Make a claim about which gas (or gases) are produced by the bath bomb.
What does the evidence tell us about what gas(es) could be created by the bath bomb?

### Some Common Gases

<table>
<thead>
<tr>
<th>Substances in rows A–I (row J is a mixture, row K is an unknown)</th>
<th>Approximate % of this gas in the air outside</th>
<th>Boiling point (in °C)</th>
<th>Density (g/L) measured at 0°C</th>
<th>Flammability Notes on how the gas interacts with flame</th>
</tr>
</thead>
<tbody>
<tr>
<td>A nitrogen</td>
<td>78%</td>
<td>-196</td>
<td>1.250</td>
<td>Will extinguish a flame.</td>
</tr>
<tr>
<td>B oxygen</td>
<td>21%</td>
<td>-183</td>
<td>1.430</td>
<td>Will increase a flame or cause a glowing ember to burst into flame.</td>
</tr>
<tr>
<td>C argon</td>
<td>-1%</td>
<td>-186</td>
<td>1.780</td>
<td>Will extinguish a flame.</td>
</tr>
<tr>
<td>D carbon dioxide</td>
<td>-0.04%</td>
<td>N/A</td>
<td>1.960</td>
<td>Will extinguish a flame.</td>
</tr>
<tr>
<td>E neon</td>
<td>-0.0018%</td>
<td>-246</td>
<td>0.900</td>
<td>Will extinguish a flame.</td>
</tr>
<tr>
<td>F helium</td>
<td>-0.0005%</td>
<td>-268</td>
<td>0.179</td>
<td>Will extinguish a flame.</td>
</tr>
<tr>
<td>G methane (natural gas)</td>
<td>-0.0002%</td>
<td>-161.5</td>
<td>0.714</td>
<td>Will increase a flame. Can create an explosion.</td>
</tr>
<tr>
<td>H hydrogen</td>
<td>0.0001%</td>
<td>-252</td>
<td>0.090</td>
<td>Will increase a flame. Can create an explosion.</td>
</tr>
<tr>
<td>I propane</td>
<td>&lt;0.0001%</td>
<td>-42</td>
<td>2.000</td>
<td>Will increase a flame. Can create an explosion.</td>
</tr>
<tr>
<td>J air</td>
<td>N/A</td>
<td>N/A</td>
<td>1.160</td>
<td>Can maintain an open flame.</td>
</tr>
<tr>
<td>K Unknown Gas from Bath Bomb</td>
<td>unknown</td>
<td>unknown</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
How could Citric Acid and Bicarbonate of Soda combine to make one (or more) of the gases we identified?

What questions do we need to answer in order to figure this out?

**KEY**
- Red - Oxygen Atoms
- Gray - Carbon Atoms
- White - Hydrogen Atoms
- Purple - Sodium Atoms

Citric Acid

Bicarbonate of Soda
We learned about what makes elements, compounds, and mixtures different on a microscopic level.

What are we trying to figure out?
How can a new substance form out of particles of an old substance?
Create a Model to show your ideas about how Citric Acid and Bicarbonate of Soda could create a new substance when mixed together.

**KEY**
Red - Oxygen Atoms
Gray - Carbon Atoms
White - Hydrogen Atoms
Purple - Sodium Atoms

![Citric Acid](attachment://citric_acid.png)
![Bicarbonate of Soda](attachment://bicarbonate_of_soda.png)
Create a Model to show your ideas about how Citric Acid and Bicarbonate of Soda could create a new substance when mixed together.

KEY
Red - Oxygen Atoms
Gray - Carbon Atoms
White - Hydrogen Atoms
Purple - Sodium Atoms

Citric Acid
Bicarbonate of Soda
What did we discover about matter changing forms in Lesson 3?

How can that idea be used to support which type of gas is produced when Bicarbonate of Soda and Citric Acid mix?
Use the physical models of citric acid and bicarbonate of soda to create Carbon Dioxide.

What do you **Notice and Wonder** about how Carbon Dioxide is created?
What Evidence do we have to explain how a new substance can form out of particles of an old substance?

What can we not yet explain.

Citric Acid

Bicarbonate of Soda

Carbon Dioxide

Gas
Gathering Evidence

Citric Acid

Bicarbonate of Soda

Carbon Dioxide Gas
Citric Acid

Bicarbonate of Soda

Carbon Dioxide Gas

Water

Sodium Citrate
With your group, use your physical models to create **water**, **Carbon Dioxide Gas**, and **Sodium Citrate** molecules from **Citric Acid** and **Bicarbonate of Soda**.
With your group, use your physical models to create water, Carbon Dioxide Gas, and Sodium Citrate molecules from **Citric Acid** and **Bicarbonate of Soda**.

What science ideas must be included?
Walk around the room and observe your classmates' models.

Use post-its to make comments on your peers’ models.

-I like that you included...
-I forgot to add ___ to my model
-I disagree with _____ because_______
What questions do you have for other classmates’ posters?

What made sense to you?

What didn’t make sense to you?

Update your posters with your group.
Let’s build this model together - What do we all agree should be included in our model?
**Consensus Model**

- **Citric Acid**
- **Bicarbonate of Soda**
- **Water**
- **Carbon Dioxide Gas**
- **Sodium Citrate**

Chemical reaction:

\[
\text{C}_6\text{H}_8\text{O}_7 + 3\text{NaHCO}_3 \rightarrow 3\text{H}_2\text{O} + 3\text{CO}_2 + \text{Na}_3\text{C}_6\text{H}_5\text{O}_7
\]

Bath Bomb Reaction in Water:

\[
\text{BATH BOMB} \quad \text{chemical reaction in water} \quad \text{H}_2\text{O}
\]

- citric Acid + bicarbonate of soda
- water + carbon dioxide + sodium citrate
Chemical equations are models that show how atoms are rearranged during a chemical reaction.

The Law of Conservation of Mass says that during a chemical reaction, matter cannot be created or destroyed, in only changes forms.
Elephant Toothpaste
Occurs when Hydrogen Peroxide (H₂O₂) breaks down very quickly into water (H₂O) and Oxygen gas (O₂). The addition of dish soap makes a large number of bubbles.

Create a model to show this reaction at a molecular scale.
Record the Lesson Question in the correct column of your Growing Ideas Chart:

“How do chemical changes form new compounds?”

What have you figured out as a result of this lesson?

What new questions do I have?
Okay, okay, I get it. Different chemicals can react to create new substances and during the reaction elements aren’t created or destroyed, they’re just rearranged.

But my question is why? Why do some substances react like bath bombs and water and others don’t? If you put your pencil on your desk, nothing happens.

What do you think is happening? Why do some things react and others do not?
Teacher Hat Reflection

Lesson 11 targeted the following objective:

Objective PS.8.1.5 Use models to illustrate how atoms are rearranged during a chemical reaction so that balanced chemical equations support the Law of Conservation of Mass (in both open and closed systems).

Clarification Statement:
- Models include equations, graphical representations, drawings, diagrams, computer models, conceptual models, or physical models (two-dimensional or three-dimensional).
- Emphasis is on students determining if a chemical equation obeys the law of conservation of mass based on a given chemical equation or particle diagram. Students are not expected to determine coefficients for an unbalanced chemical equation.

Dimension 3: Disciplinary Core Ideas (DCI):

- **PS1.B: Chemical Reactions**
  Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. The total number of each type of atom is conserved, and thus the mass does not change. Some chemical reactions release energy, others store energy. *(NRC Framework, p. 111)*

**Benchmarks for Science Literacy**
- **4D/M13** The idea of atoms explains chemical reactions: When substances interact to form new substances, the atoms that make up the molecules of the original substances combine in new ways.
- **4D/M7b** The idea of atoms explains the conservation of matter: If the number of atoms stays the same no matter how the same atoms are rearranged, then their total mass stays the same.
Teacher Hat Reflection

With your **Small Group**, discuss the following:

- What motivates students to build these science ideas?
- What do students **do** in the lesson to build the science ideas (SEPs)?
-grade 8 unit 1 target objectives

- **ps.8.1.1** construct an explanation to classify matter as elements, compounds, or mixtures based on how the atoms are arranged in various substances.

- **ps.8.1.2** use models to illustrate the structure of atoms in terms of the protons, electrons, and neutrons (using the location, charges and comparative size of these subatomic particles), without consideration of isotopes, ions, and energy levels.

- **ps.8.1.3** analyze and interpret data to explain how the physical properties of elements and their reactivity have been used to produce the current model of the periodic table of elements.

- **ps.8.1.4** construct an explanation to classify changes in matter as physical changes (including changes in size, shape, and state) or chemical changes that are the result of a chemical reaction (including changes in energy, color, formation of a gas or precipitate).

- **ps.8.1.5** use models to illustrate how atoms are rearranged during a chemical reaction so that balanced chemical equations support the law of conservation of mass (in both open and closed systems).
Whole Group Discussion

From a student perspective, what is the goal of Unit 1?

To explain what happens when a bath bomb is added to water (and what causes it to happen).
In the **alone zone**, create a final version of a student’s explanatory model of the anchor phenomenon. Consider the following:

- Based on the **science ideas** described in the NC Standards, what would you expect student final models to look like?
- What **evidence** would you look for in final models to show understanding of the targeted unit objectives?
Grade 8 Unit 1 Target Objectives

- **PS.8.1.1** Construct an explanation to classify matter as elements, compounds, or mixtures based on how the atoms are arranged in various substances.

- **PS.8.1.2** Use models to illustrate the structure of atoms in terms of the protons, electrons, and neutrons (using the location, charges and comparative size of these subatomic particles), without consideration of isotopes, ions, and energy levels.

- **PS.8.1.3** Analyze and interpret data to explain how the physical properties of elements and their reactivity have been used to produce the current model of the Periodic Table of Elements.

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- **PS.8.1.5** Use models to illustrate how atoms are rearranged during a chemical reaction so that balanced chemical equations support the Law of Conservation of Mass (in both open and closed systems).

North Carolina 8th Grade Support Document

Grade 8 Unit 1 Target Objectives

- **PS.8.1.1** Construct an explanation to classify matter as elements, compounds, or mixtures based on how the atoms are arranged in various substances.

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- **PS.8.1.5** Use models to illustrate how atoms are rearranged during a chemical reaction so that balanced chemical equations support the Law of Conservation of Mass (in both open and closed systems).

**Share and discuss with your small group:**

- For each objective, what evidence of understanding would you expect to see in students’ final models?

- What similarities do you have? What differences? What does this tell you about the acceptable differences in student models?
Small Group: Final Consensus Models

What would you expect student final models to look like?

What evidence would you look for in final models to show understanding of the targeted unit objectives?

Share your final consensus model with your group.

What similarities can you find in the models? What differences do you see?
Building Coherence

Discuss with your small group:

- What types of investigations or tasks might you expect students to engage with to gather evidence to explain the bath bomb and develop these necessary science ideas across the unit?
Evaluating the Unit

Look through the remaining lessons for evidence of students engaging in activities similar to those you discussed with your group.
Science and Engineering Practices (SEPs)

1. Asking Questions (Science) and Defining Problems (Engineering)
2. Developing and Using Models

A focus on practices (in the plural) avoids the mistaken impression that there is one distinctive approach common to all science—a single “scientific method.”

6. Constructing Explanations (Science) and Designing Solutions (Engineering)
7. Engaging in Argument from Evidence
8. Obtaining, Evaluating, and Communicating Information
Consider what scientists did to explain the phenomenon they observed. How does this compare to what we are asking students to do in our science classrooms?

https://www.youtube.com/watch?v=Jj9iNphbY88
Feedback Survey

Your feedback is valuable to us! We use it to provide follow-up support as well as inform choices about future professional learning opportunities.

Presenter 1: Brianna Reilly Oliveira
Presenter 2/3: BLANK
Where this workshop took place: Charlotte, NC Grade 8

OR
https://www.surveymonkey.com/r/NSTA3DPD
IT'S LUNCH TIME
Productive Talk
Sensemaking Discussions

How can we support students in sensemaking discussions?
Each of the eight practices, as it is introduced and elaborated and experienced in the classroom, requires that students externalize their reasoning. It requires that they work with the reasoning of other students. …teacher and student talk is the vehicle by which every student can make his or her way into a deep and productive relationship with the science and engineering practices.
Reflect on Current Science Talk

Alone Zone

- What kinds of science talk happen most frequently in your classroom?
- What kinds of science talk would you like students to engage in within your classroom?
Productive Talk

Being able to identify and support productive talk is an important part of building a culture of equitable sensemaking.

Productive talk allows students to:

- make their thinking public
- reason about complex ideas
- develop arguments and evidence-based explanations
Goals for Productive Talk

- **Goal 1**: Help individual students share, expand, and clarify their own thinking
- **Goal 2**: Help students listen carefully to one another
- **Goal 3**: Help students deepen their reasoning
- **Goal 4**: Help students think with others
Alone Zone

● Read through the Goals and Talk Moves Handout.

● Reflect: Have you observed an instance of one or more of these moves today?

### Productive Talk Goals and Moves

<table>
<thead>
<tr>
<th>Goal One: Help individual students share, expand, and clarify their own thinking</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Time to think:</strong> Partner talk: writing as think time; wait time</td>
<td></td>
</tr>
<tr>
<td>2. <strong>Say more:</strong> “Can you say more?” “What do you mean by that?” “Give an example”</td>
<td></td>
</tr>
<tr>
<td>3. <strong>So, are you saying...?</strong> “So, let me see if I’ve got what you’re saying. Are you saying...?” (always leaving space for the original student to agree or disagree and say more)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Goal Two: Help students listen carefully to one another</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. <strong>Who can rephrase or repeat?</strong> “Who can repeat what Javon just said or put it into their own words?” (After a partner talk) “What did your partner say?”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Goal Three: Help students deepen their reasoning</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. <strong>Asking for evidence or reasoning:</strong> “Why do you think that?” “What’s your evidence?” “How did you arrive at that conclusion?”</td>
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</tbody>
</table>

| 6. **Challenge or Counterexample:** “Does it always work that way?” “How does that idea square with Sonia’s example?” “What if it had been a copper cube instead?” |

<table>
<thead>
<tr>
<th>Goal Four: Help students think with others</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. <strong>Agree/Disagree and Why?</strong> “Do you agree/disagree? (And why?)” “What do people think about what Ian said?” “Does anyone want to respond to that idea?”</td>
</tr>
</tbody>
</table>

| 8. **Add On:** “Who can add onto the idea that Jamal is building?” “Can anyone take that suggestion and push it a little further?” |

| 9. **Explaining What Someone Else Means:** “Who can explain what Aisha means when she says that?” “Why do you think he said that?” |

Other Observations:

Adapted from TERC (2012), Talk Science in the Inquiry Project
Goals and Talk Moves

Share with a partner:

- Which Goal (1, 2, 3, or 4) is most in use in your own classroom?
- Which Goal (1, 2, 3, or 4) is newest or newer to you?

Productive Talk Goals and Moves

Goal One: Help individual students share, expand, and clarify their own thinking

1. Time to think: Partner talk; writing as think time; wait time

2. Say more: “Can you say more?”; “What do you mean by that?”; “Give an example”

3. So, are you saying...? “So, let me see if I’ve got what you’re saying. Are you saying...?” (always leaving space for the original student to agree or disagree and say more)

Goal Two: Help students listen carefully to one another

4. Who can rephrase or repeat?: “Who can repeat what Javon just said or put it into their own words?” “After a partner talk “What did your partner say?”

Goal Three: Help students deepen their reasoning

5. Asking for evidence or reasoning: “Why do you think that?” “What’s your evidence?” “How did you arrive at that conclusion?”

6. Challenge or Counterexample: “Does it always work that way?” “How does that idea square with Sonia’s example?” “What if it had been a copper cube instead?”

Goal Four: Help students think with others


8. Add On: “Who can add onto the idea that Jamal is building?” “Can anyone take that suggestion and push it a little further?”


Other Observations:

Adapted from TERC (2012), Talk Science in the Inquiry Project
Observing Productive Talk

Record observations related to the Goals and Moves.

Video Context:
After previously creating individual models, students now share ideas and the class begins to develop their initial class consensus model. (Everest unit)

<table>
<thead>
<tr>
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</table>

Other Observations: Adapted from TERC (2012), Talk Science in the Inquiry Project
Classroom Video Analysis

Alone Zone

- What talk moves do you notice from this video clip?
- What other strategies do you notice the teacher using?

Use the transcript as evidence of the talk or other moves.
Teacher: Interesting. Those seem like different ideas. Right. And that's interesting and puzzling too, right?
Observing Productive Talk

Small Group:

● What talk moves do you notice from this video clip?
● What other strategies did you notice the teacher using?
● How did the talk moves and other strategies support all students in engaging in equitable sensemaking?
Observing Productive Talk

Small Group:

● What talk moves do you notice from this video clip?
● What other strategies did you notice the teacher using?
● How did the talk moves and other strategies support **all students** in engaging in equitable sensemaking?

Whole Group:

● Share some key ideas from your small group
Rationale for Talk Moves
Teacher Interview
Reflecting on Talk Moves and Other Strategies

What are talk moves and/or strategies you would like to try to support productive talk in your own classroom? Why?
and what I'm thinking is that the magnet isn't the main thing that's making the sound.
Watch 0:47 - 2:26
https://youtu.be/E4NNvHbfYMw?si=TwDJB9lReyLLjkry
Update Sensemaking

Posters

Gots & Needs
What is Sensemaking?

Small Group

Revisit your initial ideas about sensemaking and discuss the following with your group members:

- What ideas might you want to add?
- What ideas might you want to say more about?
- What ideas might you want to change?

Consider what new examples of student and teacher actions you have from our immersion experiences.
What is Sensemaking?

Small Group

Revisit your initial ideas about sensemaking and discuss the following with your group members:

- What ideas might you want to add?
- What ideas might you want to say more about?
- What ideas might you want to change?

Consider what new examples of student and teacher actions you have from our immersion experiences.
What is Sensemaking?

Whole Group Gallery Walk

- Observe each group’s poster.
- What are some patterns in our ideas about how we describe sensemaking?
CMS PD Survey

Please complete the following survey before you leave:
thank you