Goals

• Experience phenomena in a FOSS lesson that highlights the NGSS practices of modeling, argumentation and constructing explanations.

• Explore instructional strategies that support the development of NGSS practices and deepen student learning within a FOSS lesson.
FOSS is a complete, modular, research-based curriculum developed at the Lawrence Hall of Science with support from the National Science Foundation.
Module Components

For Teachers
Investigations Guide and Teacher Resources

For Students
FOSS Science Resources

Equipment
Equipment Kit with materials for 32 students
- 3 class uses – elementary
- 5 class uses – middle school

Technology
Access to FOSSweb for all technology resources
FOSS Next Generation Modules

Complete Kits include

• 1 Teacher Toolkit

• Equipment kit for 32 students
  – Consumables for 3 class uses
  – Measurement tools included

• 32 FOSS Science Resources books

• 1 FOSS Science Resources big book (K-2)

• Access code for FOSSweb content
FOSS Active Investigation

Includes

• Hands-on activities
• Formative assessment
• Science notebooks
• Science-centered language development
• Reading FOSS Science Resources
• Technology-based activities
• Outdoor activities
Stay to the End

- Fill out the evaluation form
- Drawing for $75.00 gift certificate
- Link to today’s PPT
Science and Engineering Practices

- Asking Questions and defining problems.
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking

Developing Models

Engage in argument from evidence.

Constructing Explanations

all while

Obtaining, evaluating, and communicating information
Phenomenon

In FOSS, students are presented with a phenomenon to figure out.

• **Setting the Context** provides a focus question to investigate about the phenomenon.

• In the **Activity** students observe and actively engage with the phenomenon.

• Students record and organize their information about the phenomenon in **Data management**.

• Lastly, students **Analysis** the phenomenon by constructing explanations and engaging in argument from evidence.
Culture of Productive Talk

My Responsibilities

I agree that I will...

• Explain my ideas
• Listen to others and show that I am listening
• Ask questions when I am confused or can’t hear
• Connect my ideas to others’ (explain, add to, respectfully disagree).
• Participate because all ideas lead to learning (speak loud and clear).
Water and Climate

1. Water Observations
2. Hot Water, Cold Water
3. Weather and Water
4. Seasons and Climate
5. Waterwheels
Activating Prior Knowledge

- Pick one image to make observations
- Quick Write

I observe . . .
I wonder . . .
I think . . .
It reminds me of . . .
Observe, Record and Share

• Observe a cup of water
• Record your observations

• Observe a cup of ice water
• Record your observations
• What do you notice?
• What questions do you have?
• Make comparisons
Record your thinking

Focus Question:
What causes moisture to form on the side of the cup?

- Draw a diagram representing what you think is happening.
Develop Initial Model and Explanation

1. One person at your table volunteers to write a claim at the top of a piece of paper and pass the paper. **Claims**- what you know to be true? What do you know?

2. Each person (3) adds a piece of evidence (observation NOT inferences or prior knowledge) **Evidence** How do you know that? Use observations that support the claim.

3. Create a **model** - Explain what you think is happening. Include appropriate labels and annotations to clarify the components.
Share Initial Models and Explanations

Exchange with a neighboring group.
Discuss their model
On sticky notes write questions and comments using sentence frames.

Ask clarifying questions
Suggest a new idea
Ask a question

Can you tell us more about __________
What made you think ___________
What do you mean by ____________
How does ________________ support your claim?
We think ___________ because ___________
Revise Model

• Read comments
• Discuss with your group
• Anything you would like to change in your model?

Add
Revise
Find out more about
Culture of Productive Talk

• Bring your notebook to the circle.

What causes moisture to form on the side of the cup?

My Responsibilities
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• Participate because all ideas lead to learning (speak loud and clear).

• I observed/noticed…
• I think… because…
• I agree/disagree…
• I wonder…
Constructing Explanations

• Write an explanation supported by your evidence of why you think is happening. **Use claim and evidence**.

• **Claims** - what you know to be true. What do you know?

• **Evidence** – How do you know that? Use your data or observations and support the claim.

• **Reasoning** - explains the connection between the claims and evidence. Why does your evidence support your claim?

I claim that air is matter. I know this because we found that the weight of the ball increases each time we pumped more air into it. This shows that air has weight, which is one of the characteristics of matter.
Constructing Explanations

What causes moisture to form on the side of the cup?

• I claim ___________ and my evidence is ________________.

• I claim ___________ and I know this because__________________.

• I think that ___________ because ____________.

• The reason this happened is …
Read an Informational Text

1. Read “Condensation” pg. 41-43

What information in the text helps you explain the phenomenon in the investigation?

– * = Mark information that helps to answer the question & why
– ! = Note interesting ideas & why
– ? = Write questions you have
– Circle= unfamiliar words
As long as the air stays warm, the water stays in the air as water vapor.

But if the air cools, things change. As the air cools, the water vapor condenses. It changes from a gas into a liquid. What invisible water vapor in the air condenses, the water becomes visible again. Clouds are made of the tiniest droplets of liquid water that have condensed from air. . . .
Adding on:

- Provide further evidence from the discussion and reading to your model and explanation in your notebook.

  ✓ In your diagram (1) label components and (2) describe the relationship between your components (3) connections to other theories or phenomena from reading to add?
Student Condensation Claims

Provide evidence for and against each one

I claim . . .

1. Condensation on the outside of a container is water that leaked out of the sides of the container.

2. The coldness comes through the container and produces water.

3. Condensation on the outside of the container comes from water vapor in the air.

4. Condensation is when air turns into liquid.
Revisit your image

Share with a partner and explain condensation in your picture.

• Discuss how you think condensation is connected to weather.
Modeling, Argumentation and Constructing Explanations

Discuss with a partner:

• What does engaging in these three practices do for students?

• What sense-making strategies were used to help students understand and communicate about condensation?
1. Observe image with phenomenon
2. Explore and investigate phenomenon
3. As a group develop initial model and explanation
4. Share with partners and get feedback
5. Add/Revise to model and explanation
6. Sense-making Discussion
7. Construct Explanation and Model individually
8. New information (reading)
9. Add on
10. Look at alternate claims and provide evidence
11. Further Revise
12. Revisit image and make connections to weather
Why modeling . . .

• It makes students’ thinking visible to you.

• Allow students to show more of what they currently know in a variety of ways.

• Makes their reasoning available to their peers.

• Helps students see that it is valuable to change their thinking in response to new evidence and ideas.
Avoid Creating” Posters”

• Modeling is not just drawing. If students are reproducing something that could be found in any textbook, then it is not modeling.

• If there is nothing genuinely puzzling or students all have the same models, it is not modeling (we call this “posterizing”)

Mark Windschitl, Professor of Science Teaching and Learning, University of Washington. Ambitious Science Teaching
Why engage students in argument?

“…research has demonstrated that teaching students to reason, argue, and think critically will enhance students’ conceptual learning. This will only happen, however, if students are provided structured opportunities to engage in deliberative exploration of ideas, evidence, and argument…”

Jonathan Osborne

Arguing to Learn in Science: The Role of Collaborative, Critical Discourse
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Thank you!

- Evaluations
- Drawing for $75 Gift Certificate!

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