Goals of the Institute

- Improve the understanding and use of the Nature of Science
- Improve the understanding and use of Inquiry in the Elementary Classroom
Who am I?

- Each of you will get a Disney character on your back.
- Your goal—try to find out which character you are but you can only do so by asking yes or not questions.
- You have to think of really good questions to ask!
- Good luck!

The Great Fossil Find

- In this activity, you and your team will play the roles of paleontologists working in the field in Montana, near the town of Kalaka. One clear crisp afternoon in October, you find four well preserved and complete fossils.
Open envelope and remove 4 fossils.

- Take 5 minutes to assemble the bones and make notes in your data chart.
- What kind of animal do you think this is?

Day 2

- Remove 3 fossils from your envelope.
- Take 5 minutes to assemble all 7 bones and make notes.
- What kind of animal do you think this is now?
Day 3

- Remove any remaining fossils.
- Take 5 minutes to assemble all the bones and make notes.
- What kind of animal do you think this is now?

Day 4

- For 5 minutes, compare your fossils with those of a group near you, looking for clues that will help you assemble your fossils. Apply these clues to your interpretation of your skeleton.
- What type of animal do you think you have now?
Day 5

- Use the drawings to assist you in your final assembly of the fossil skeleton.
- What is your final interpretation?
- What animal do you think you have and why?

Poster Session

- Include in your poster:
  - The type of animal you think you have based on your fossil
  - A drawing of what the animal might look like
  - Where the animal might have lived (in water, on land, on land and in the air) and why you think so
  - What you originally thought the animal was on Day 1
  - The biggest piece of evidence that caused you to change your interpretation from Day 1 to Day 5
  - What new pieces of evidence (such as another fossil from the animal) might support your hypothesis about these fossils?
  - What new piece of evidence might prove that your interpretation of these fossils is inaccurate?
What did our data show?

- Discuss investigation
  - What does your data show?
  - How does your data compare with other groups?
Jigsaw

0 Each group will become an expert in one of the elements of the Nature of Science.
0 You will work with your group to come up with a graphic that explains your reading.
0 Teach home group and assemble your “non-linguistic” representation.

Put in the VA State NOS Workshop Slides
The Nature of Science

- The natural world is understandable
- Science demands evidence
- Science is a blend of logic and imagination
- Scientific knowledge is durable
- Scientific knowledge is subject to change
- Scientists attempt to identify and avoid bias
- Science is a complex social activity

Nature of Science

- Found in the SOL K.1, 1.1, 2.1, 3.1, 4.1, 5.1
- Emphasis is on students working like scientists
Magical Fish

- Place the magical fish on your desk without touching it.
- Make observations of your fish.
- Pick up your fish and place in your hand.
- Make some more observations.
- What questions do you have?

Break!
Be back in 15 minutes!
Inquiry and Essential Features of Inquiry

Question

What makes popcorn pop?
Popping Popcorn

Make observations of the popcorn kernels and the popped popcorn

Compare and Contrast
Let’s Pop Some Popcorn

- Check the boxes as you complete each step.
- Use an eye dropper to place 10 drops of cooking oil into the bottom of each test tube.
- The following safety rules apply to this activity:
  • Roll up long sleeves and tie back long hair.
  • Wear safety goggles over your eyes.
  • When you heat anything in a test tube, point the open end away from yourself and others.
  • Keep your work area clean and clear of materials that might catch on fire.
  • Do not eat the popcorn!

Observations

- Observe your popcorn carefully!
- Write down what you see as it pops.
**What do you think?**

- Working with your team, come up with a statement that describes what you think makes popcorn pop and why.

**What did our data show?**

- Discuss investigation

  - What does your data show?

  - How does your data compare with other groups?
Let’s examine the research

Read the article—what makes popcorn pop.

Have you ever wondered what actually makes popcorn pop? It’s really simple … water! Well, actually pressure makes it pop, but the pressure comes from steam (water).

Here’s the deal. Inside each kernel of popcorn is a little bit of water. As you heat the popcorn, the water turns to steam. The steam has nowhere to go and once the pressure gets great enough it explodes (pops) the kernel. The process of heating cooks the kernel as well so it’s tasty. Now, not all corn can pop, at least pop up light, fluffy and crunchy. Varieties of corn are bred to have just the right amount of water left in the kernel after drying. Too little, no pop. Too much … hmm don’t know, but I don’t think I’d like to be around to find out!
**It says, I say, and So**

<table>
<thead>
<tr>
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**Developing a Scientific Explanation**

- What is the question that you want to answer?
- List the sources used for the evidence that will be used to support your explanation.

**Evidence to support your explanation**

<table>
<thead>
<tr>
<th>Claim(s) that you think answer the question</th>
<th>Evidence that supports your claim(s)</th>
</tr>
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</table>

**Explanation for your answer to the question = Claim + Evidence + Reasoning**

I think ___________ answers the question because ___________.

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**Essential Features of Inquiry**

0. Jigsaw-

- This time in your home group:
  - Read your assigned section and then teach your group member-draw a non-linguistic picture that represents all features of inquiry
  - Use the thinking routine Headline to come up with a title for your drawing
Essential Features of Inquiry

- Learners are engaged by scientifically oriented questions.
- Learners give priority to evidence, which allows them to develop and evaluate *explanations* that address scientifically oriented questions.
- Learners formulate *explanations* from evidence to address scientifically oriented questions.
- Learners evaluate their *explanations* in light of alternative *explanations*, particularly those reflecting scientific understanding.
- Learners communicate and justify their proposed *explanations*.

Essential Features of Classroom Inquiry

### 1. Learner engages in scientifically oriented questions

| A | Learner engages in question provided by teacher, materials, or other source |
| B | Learner sharpens or clarifies question provided by teacher, materials, or other source |
| C | Learner selects among questions, poses new questions |
| D | Learner poses a question |

### 2. Learner gives priority to evidence in responding to questions

| A | Learner given data and told how to analyze |
| B | Learner given data and asked to analyze |
| C | Learner directed to collect certain data |
| D | Learner determines what constitutes evidence and collects it |

### 3. Learner formulates explanations from evidence

| A | Learner provided with evidence |
| B | Learner given possible ways to use evidence to formulate explanation |
| C | Learner guided in process of formulating explanations from evidence |
| D | Learner formulates explanation after summarizing evidence |

### 4. Learner connects explanations to scientific knowledge

| A | Learner given all connections |
| B | Learner given possible connections |
| C | Learner directed toward areas and sources of scientific knowledge |
| D | Learner independently examines other resources and forms the links to explanations |

### 5. Learner communicates and justifies explanations

| A | Learner given steps and procedures for communication |
| B | Learner provided broad guidelines to use sharpen communication |
| C | Learner coached in development of communication |
| D | Learner forms reasonable and logical argument to communicate explanations |
Moving from Dependence to Independence through Support Autonomy

1
I Do
You Watch

2
I Do
You Help

3
You Do
I Watch

4
You Do
I Help

Modeled
Shared

Interactive
Guided
Independent

Hedrick & Flanagan 2006

Exit Ticket

0 Circle – what questions are still rolling around in your mind?

0 Triangle – what three things did you learn today?

0 Square – what are you solid about?