Inquiry In Instruction

Global Watershed Teacher Workshop-
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Learning Goals

- Teachers will be able to identify inquiry in a classroom setting.
- Teachers will be able to facilitate an inquiry lesson.
- Teachers will be able distinguish when inquiry is most effective teaching strategy.
“Learning science is something students do, not something that is done to them.”

- National Science Education Standards
The 5E Learning Cycle

I. Engage
II. Explore
III. Explain
IV. Elaborate or Extent
V. Evaluate

Teaching High School Science Through Inquiry, D. Llewellyn, NSTA Press, p. 47
Inquiry Activity: “The Coupled Pendulum”

Engage

Observe the coupled pendulums

Record observations
Individual Quick Write

Engage

What did you observe that was interesting?

What do you know about pendulums?

What do you want to learn about pendulums?
Large Group Discussion

Engage

What did you observe that was interesting?

What do you know about pendulums?

What do you want to learn about pendulums?
Explore coupled pendulum by changing variables. Form testable questions.

What are the characteristics of a testable question?
Small Group Exploration

Choose a question to test
Form a hypothesis based on secondary research
Design an investigation to test the question
Conduct an investigation and collect evidence.
Graphic Organizer

Explain and Elaborate

Formulated an explanation to your question based on evidence (primary research) and connections to scientific knowledge (secondary research).
Mindful Listening

Elaborate

Consider alternative explanations.
Small Group Presentations

Explain- share your

- question
- hypothesis
- procedure
- data and evidence
- explanation based on evidence and connected to scientific knowledge
Large Group Discussion

Evaluate
What questions am I left with?
How can I improve my investigation?
Why is the knowledge important in the real world?
How can I use what I learned to answer other questions?
What was your experience as a learner in this inquiry activity?
Classroom Inquiry Continuum

Where does the pendulum investigation fall on the inquiry continuum? Why?

What skills do students need to effectively participate in this type of inquiry activity?

What role does the teacher play in preparing students to engage in this type of inquiry activity?
<table>
<thead>
<tr>
<th>Stages of the Instruction Model</th>
<th>What the Student Does . . .</th>
<th>That is <strong>Consistent</strong> With the 5E Model</th>
<th>That is <strong>Inconsistent</strong> With the 5E Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engage</strong></td>
<td>Asks questions, such as: Why did this happen? What do I already know about this? Shows interest in the topic</td>
<td></td>
<td>Asks for the “right” answer Offers the “right” answer Insists on answers or explanations Seeks one solution</td>
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<tr>
<td><strong>Explore</strong></td>
<td>Thinks freely, but within the limits of the activity Tests predictions and hypotheses Forms new predictions and hypotheses Tries alternatives and discusses them with others Records observations and ideasSuspends judgment</td>
<td></td>
<td>Lets others do the thinking and exploring (passive involvement) Works quietly with little or no interaction with others (only appropriate when exploring ideas or feelings) “Plays around” indiscriminately with no goal in mind Stops with one solution</td>
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<tr>
<td><strong>Explain</strong></td>
<td>Explains possible solutions or answers to others Listens critically to others’ explanations Questions one another’s explanations Listens to and tries to comprehend explanations the teacher offers Refers to previous activities Uses recorded observations in explanations</td>
<td></td>
<td>Proposes explanations from the “thin air” with no relationship to previous experiences Brings up irrelevant experiences and examples Accepts explanations without justification Does not attend to other plausible explanations</td>
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<tr>
<td><strong>Elaborate</strong></td>
<td>Applies new labels, definitions, explanations, and skills in new but similar situations Uses previous information to ask questions, propose solutions, make decisions, and design experiments Draws reasonable conclusions from evidence Records observations and explanations Checks for understanding among peers</td>
<td></td>
<td>“Plays around” with no goal in mind Ignores previous information or evidence Draws conclusions from “thin air” Uses only those labels that the teacher provided</td>
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<tr>
<td><strong>Evaluate</strong></td>
<td>Answers open-ended questions by using observations, evidence, and previously accepted explanations Demonstrates an understanding or knowledge of the concepts or skill Evaluates his or her own progress and knowledge Asks related questions that would encourage future investigations</td>
<td></td>
<td>Draws conclusions without using evidence or previously accepted explanations Offers only yes or no answers and memorized definitions or explanations Fails to express satisfactory explanations in his or her own words Introductory new, irrelevant topics</td>
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<td><strong>Engage</strong></td>
<td>That is Consistent With the 5E Model</td>
<td>Creates interest</td>
<td>Explains concepts</td>
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<td>Generates curiosity</td>
<td>Provides definitions and answers</td>
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<td>Raises questions</td>
<td>States conclusions</td>
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<td>Elicits responses that uncover what the students know or think about the concept/topic</td>
<td>Provides closure</td>
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<td><strong>Explore</strong></td>
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<td>Provides answers</td>
<td>Lectures</td>
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<td>Tells or explains how to work through the problem</td>
<td>Provides answers</td>
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<td></td>
<td>Provides closure</td>
<td>Tells the students that they are wrong</td>
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<tr>
<td></td>
<td></td>
<td>Leads the students step-by-step to a solution</td>
<td>Gives information or facts that solve the problem</td>
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<td><strong>Explain</strong></td>
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<td>Accepts explanation that have no justification</td>
<td>Introduces unrelated concepts or skills</td>
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<td>Neglects to solicit the students’ explanations</td>
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<td>Introduces unrelated concepts or skills</td>
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<td><strong>Elaborate</strong></td>
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<td>Provides definitive answers</td>
<td>Tell the students that they are wrong</td>
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<td><strong>Evaluate</strong></td>
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<td>Tests vocabulary words, terms, and isolated facts</td>
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<td>Introduces new ideas or concepts</td>
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<td>Creates ambiguity</td>
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<td>Promotes open-ended discussion unrelated to the concept or skill</td>
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What is a structured or cookbook lab?

What is the purpose?

When is appropriate to use this type of lab experience with students?
National Science Teachers Association (NSTA) Articles:
“Developing the Essential Features of Inquiry”
“Reforming Cookbook Labs”
Small Group Work

Convert an activity from the MEEC Water Quality into an activity that:

- requires more engagement from student and incorporates more components of inquiry.
- Incorporates a writing strategy
Small Group Presentations

What did you do to the lab?

How did your changes incorporate more components of inquiry?

What will your role as the teacher be?