Planning for Effective Science Instruction

Component II of the Science Classroom Observation Protocol: Science Content is Intellectually Engaging

Name: Mark emmet

Curriculum Title: Interactions in Physical Science Grade Level: 10

Target Lesson: Cycle 2: Energy Conservation, Activity 4: Thermal Energy and Phase Change

CTS Study Guide: States of Matter (pg. 173); Heat and Temperature (pg. 216) Page: ←

Element A: Science content is significant, accurate, and worthwhile	
Indicators: ☐**Science content is explicit and apparent to students.** ☐**Science content is primarily focused on big ideas supported by relevant concepts, facts, and terms.** ☐**Science content is within the bounds of an agreed upon body of knowledge.** ☐**Science content is accurate.** ☐**Science content is developmentally appropriate and scaffolded appropriately.** ☐**Science is portrayed as a dynamic body of knowledge that changes based on the best available evidence.**	Drawing upon the indicators for this element of effective instruction (left-hand column) and what you learned from Section III of your CTS Summary, **identify a specific point in the lesson** where you can make the science content "**explicit and apparent to students."** • *I have chosen the "Purpose" section of the lesson to make the science content explicit and apparent to students. This section occurs at the outset of the lesson.* Based upon your experiences in the Content Immersion**, brainstorm strategies** you could use to make the science content "**explicit and apparent to students."** • *I would make explicit to students that the purpose of this lesson is to help us understand what happens to energy that is input during a phase change. I would do this by writing the key question, "What happens to energy that in input during a phase change?" on the board and asking students to copy it into their science notebooks.* • *I would ask students to think of example from everyday life, in addition to the ones provided in the text, of substances changing from a solid to a liquid, or a liquid to a gas.* • *I would tell them that the experiments and explorations of simulations we'll investigate in this lesson will help us answer the key question.*

Planning for Effective Science Instruction

Element B: Science content builds on students' prior ideas or experiences.

Indicators:

- ☐ **Students reveal their preconceptions about the science content, the underlying related concepts, or the nature of science.**
- ☐ **Students reveal their underlying thinking and reasoning and the source of their preconceptions.**
- ☐ **Students recognize links between their preconceptions or previously learned science concepts and the activities or experiences in the science lesson.**

Drawing upon the indicators for this element of effective instruction (left-hand column) and what you learned from Section IV of your CTS Summary, **identify a specific point in the lesson** where you can create an opportunity for students to **"reveal their preconceptions about the science content."**

- *I have chosen the "We Think" section of the lesson as an opportunity for students to reveal their preconceptions about the science content. This section occurs very early in the lesson.*

Based upon your experiences in the Content Immersion**, brainstorm strategies** you could use to allow students to **"reveal their preconceptions about the science content."**

- *This lesson has a nice set of questions to help surface student preconceptions: Imagine some ice melting in a glass: Do you think that the temperature of the ice and water increases, decreases, or remains the same while the ice is melting? Imagine a pot of water boiling on a stove burner. Do you think that the temperature water increases, decreases, or remains the same while the water is boiling?*
- *I would take advantage of these questions by making sure I gave students ample time to consider and respond individually to these prompts. I would then give students white boards and ask them to commit their ideas in writing and share them with the class.*
- *Having students white board their responses makes their choices more permanent. A discussion, by its nature, is more fluid in nature. When students white-board they commit to their thinking at a specific point in time – even if these thoughts are tentative. During a discussion students are influenced by their peers' ideas, and not all ideas present in the minds of students may be surfaced and shared publically without having committed their ideas to the white board.*

Element C: Science content is intentionally connected to the classroom activities and experiences.

Indicators:

- ☐ **Student actions and interactions focus on understanding important and relevant science content.**
- ☐ **Students generate and**

Drawing upon the indicators for this element of effective instruction (left-hand column) and what you learned from Section II and IV of your CTS Summary, **identify a specific point in the lesson** where you can create an opportunity for students to **"articulate the intended science content within the lesson, activity, or experience."**

- *I have chosen the "Make Sense of Your Ideas" section of the lesson as an opportunity for students to articulate the intended science content within the lesson, activity, or experience.*

Planning for Effective Science Instruction

explore questions about the science in the lesson. ☐ **Students can articulate the intended science content of a lesson, activity, or experience.**	Based upon your experiences in the Content Immersion**, brainstorm strategies** you could use to allow students to **"articulate the intended science content within the lesson, activity, or experience."** • *Students are told at this point in the curriculum (in the text book) that, "During the time that the data was collected, heat energy was being transferred from the energy source (hot plate or alcohol burner) to the contents of the beaker." They are asked, "Can you make sense of what happened to the energy transferred to the beaker during the time that the data was collected? Does anything seem strange to you?" The text goes on to say that they have now encountered "another type of energy that an object can have: stored phase energy." The text goes on to explain what stored phase energy is.* • *I would have students hold off on reading the explanation until I had asked them a series of questions selected from the following list: What evidence are you drawing upon to make sense of what might 'seem strange' to you? How did your graph compare to the graph on the simulator? Did the amount of thermal energy transferred to the beaker per unit of time change from the sloped portion of your graph to the flat portion? Did you change the setting on the hot plate? If the amount of heat energy transferred to the beaker remained constant and there was no change in temperature, as your graphs indicate, what explanation might be plausible?* • *I would then give students an opportunity to white board and discuss their thinking.* • *I would follow this with a question: How have these activities helped you to build your understanding of the key question, "What happens to energy that in input during a phase change?"*