**Constructing Explanations**

*Time: 45 minutes*

**Goals:**

* To understand the role that the science practice of “Constructing Explanations” plays in science
* To experience how students might engage in this science practice in the science classroom. Specifically, participants will construct explanations.
* To examine students’ constructed explanations

**Materials:**

* PBS Spool Racer Instruction handout
* Spool Racer Data handout
* Student Work Samples handout
* *\*Optional – Photosynthesis Disk Lab handout*

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| **Activity** | **Description** | **Time** |
| Introduction to “Constructing Explanations” | * Explain to participants that the focus of this module is on the practice of “constructing explanations and designing solutions”
	+ The first part of this practice (i.e. constructing explanations) pertains to science, while the second part of this practice (i.e. designing solutions) pertains to engineering.
	+ This module focuses on the science portion of this practice
* Read the text from the 2016 MA Science and Technology/Engineering Standards that defines this science practice
* Conduct a whole group discussion around the following questions:
	+ How is this definition similar to and/or different from how your students construct explanations?
	+ What are some specific examples of how your students have constructed explanations in the past?
* Key points to highlight during the discussion:
	+ Students should be actively engaged in the practice of constructing an explanation rather than simply memorizing one that is given to them in a passive manner.
	+ Science practices are what we want students to be doing in the science classroom. As students engage in science practices they will gain greater proficiency in them, and will also develop a stronger understanding of the disciplinary core ideas.
 |  10 min |
| Constructing Explanations Activity | * Explain that an explanation is made up of three key components: a CLAIM (a clear answer to a question about *how* or *why* a phenomenon occurs), EVIDENCE (data from the investigation that supports the claim being made) and REASONING (an explanation of why the evidence supports the claim, which often includes scientific principles)
* Explain to the group that they will be using data collected from an investigation that used spool racers to explore how energy enables objects to move.
	+ Target standard: *Use evidence to construct an explanation relating the speed of an object to the energy of that object [MA 4-PS3-1]*
* If participants do not know what “spool racers” are, show the brief video which illustrates how spool racers are made, and how they function
	+ <http://www.pbslearningmedia.org/resource/phy03.sci.phys.mfe.zsplcar/potential-and-kinetic-energy-spool-racer/>
* Review the definitions for “potential energy” and “kinetic energy” with participants, since both scientific principles are important to understand when making sense of the spool racer investigation. The information for these definitions came from the Support Materials in the link above.
* Distribute the PBS Spool Racer Instruction handout (which was taken from the Support Materials in the link above), and the Spool Racer Data handout. Remind participants that in the interest of time they will not be conducting the investigation, but instead will be using data from it to construct explanations
	+ If teachers are interested, the PBS Spool Racer Instruction handout includes detailed instructions on how to construct and test the racers
* Ask teachers to use the data in the Spool Racer Data handout to construct a scientific explanation that answers the question – *What happens if you change the number of twists (i.e. winds) in the rubber band? Explain why this occurs.*
	+ Teachers can write their explanations in the space provided below the data table
* Once participants are done constructing their explanations, ask them to share them with another person
* Afterwards, facilitate a whole group discussion around the following questions:
	+ How was your explanation similar/different from the explanation of the person you shared with?
	+ Where parts of the explanation (claim, evidence and/or reasoning) easier or more difficult than others? Why?
	+ How could you envision your students engaged in this science practice? What challenges might they have? How would you address them?
 | 15 min |
| Examine Student Work  | * Explain the context from which the student work samples came from – high school biology students engaged in a photosynthesis laboratory activity where they explored the question, “How do leaf disks respond to exposure to light?”
	+ If necessary, copies of the *Photosynthesis Disk Lab handout* can be made and distributed.
* Distribute the Student Work Samples handout, and give participants time to annotate the student work, specifically identifying the claim, evidence and reasoning in students’ written explanations
* Afterwards, have participants share and compare their annotations with either the whole group or another teacher.
* Facilitate a whole group discussion around the following discussion questions:
	+ What similarities and differences did you observe in the manner by which students wrote their scientific explanations?
	+ What do you see as a benefit of using the claim-evidence-reasoning structural format to help students write scientific explanations?
	+ What other supports might your students need to engage in this science practice?
 | 15 min |
| Reflection on Current Instruction | * Conduct a Think-pair-share around the following questions:
	+ Now that you have a better understanding of this science practice, to what extent do you think your students have opportunities to construct explanations in your classroom?
	+ What are some barriers that you feel interfere with your ability to provide opportunities for students to construct their own scientific explanations?
	+ What are some ways you might address and overcome these barriers?
 | 5 min |