STEM TEACHING TOOL #41

Prompts for Integrating Crosscutting Concepts Into Assessment and Instruction

The new vision for science education features a three dimensional view of learning that involves: science and engineering practices, crosscutting concepts, and disciplinary core ideas. Many educators already incorporate crosscutting concepts into their teaching, but may still be looking for ways to amplify these concepts or to make them more explicit for their students, including in their classroom assessments.

This set of prompts is intended to help teachers elicit student understanding of crosscutting concepts in the context of investigating phenomena or solving problems.

These prompts should be used as part of a multi-component extended task. They should not be used in isolation, and the blanks provided are intended to be filled using the content of the scenario presented at the beginning of the multi-component task. The prompts can be open-ended, as shown below. They can also be turned into multiple-choice questions. These prompts were developed using the Framework for K-12 Science Education and Appendix G of the Next Generation Science Standards, along with relevant learning sciences research.

These prompts are currently being tested or evaluated in the field. We request you send feedback and information about how you have used the prompt to william dot penuel at colorado dot edu.

Please note that some prompts may not be suitable for students in early grades, while others may be low-level for high school students. Designers should consult the learning progressions in Appendix G of the NGSS to choose a prompt that is appropriate for different grade level bands.

Our team has also created a similar tool to help educators create tasks that incorporate the science and engineering practices into their teaching, found at stemteachingtools.org/brief/30. You can learn how to develop 3D formative assessments here: http://tinyurl.com/3Dassessmentdevelopment

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Crosscutting Concept: Stability and Change

A Framework for K-12 Science Education description of **stability and change:** For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

When the scenario presents a system that periodically experiences equilibrium:

- Is the system described in the scenario stable or unstable? Present evidence to support your claim.
- How was this system affected by [sudden event described in the scenario]?
- How might this system be affected by [sudden event not described in the scenario]?
- What are the factors causing this system to be stable at [time point identified in scenario where the system is at equilibrium]?
- What are the factors causing this system to be unstable at [time point named in scenario where the system is changing or not at equilibrium] ?
- What is happening at the [specify scale, such as atomic] scale to make this system stable at [time point identified in scenario where the system is at equilibrium]?
- What is happening at the [specify scale, such as atomic] scale to make this system unstable [time point named in scenario where the system is changing or not at equilibrium]?

When the scenario presents a system or phenomenon where there are repeating patterns of change:

- What things change in [the system presented in the scenario]?
- What is the rate of change in [the system presented in the scenario]?
- What patterns do you observe in the way that [the system presented in the scenario] changes over time?
- What explains why [repeating pattern] is happening in this system over time?

When the scenario presents a designed system:

- In what ways is [the system presented in the scenario] stable?
- What might cause [the system presented in the scenario] to become unstable or imbalanced?
- How can you design [the system presented in the scenario] to be more stable?

When the scenario presents a system or phenomenon with feedback loops:

- How does [process or mechanism A] affect [process or mechanism B]?
- What explains why when [process or mechanism] happens, _____ changes and then affects [process or mechanism]?

When the scenario presents a system that looks stable at one scale and unstable at a different scale:

- How was this system affected in the long term by [gradual changes described in the scenario]?
- When the scenario presents a system or phenomenon where competing effects are balanced?
- How might this system be affected in the long term by [gradual changes not described in the scenario]?
- How does is the effect of [process or mechanism A] offset by the effect of [process or mechanism B] in this system?