Evidence-Based Instructional Practices

Meaningful Feedback and the Kentucky Academic Standards for Science

What are connections between the Evidenced-Based Instructional Practice #6: Meaningful Feedback and the *KAS for Science*?

The *Kentucky Academic Standards for Science* identify what students should be able to demonstrate by the end of grade-level or grade-band instruction. The standards, written as performance expectations (PEs), are an integration of three different dimensions: disciplinary core ideas (DCIs), science and engineering practices (SEPs) and crosscutting concepts (CCCs). The DCIs are the conceptual content understanding of which students should have knowledge. The SEPs and CCCs are the dimensions that are used in service of the DCIs as students come to the conceptual understandings as they experience and actively engage with the sciences.

Teachers are familiar with the concept of feedback. This could be in the form of written comments associated with a response, questions that probe a student's explanation of an idea or provide guidance in the use of tools during investigations. These *informal* forms of feedback are common, important and necessary to assist students with just-in-time information about their learning. *Targeted* feedback, meant to move learning forward, is equally important and should be connected to the identified learning goal for the given lesson. This targeting plays two roles:

- Ensures the learning is moving in the direction intended by the teacher
- Fosters student self-regulation in their own learning by offering guidance for improvement

As teachers develop lesson sequences, explicit planning for targeted feedback will assist in meeting the stated learning goals.

While feedback is used in education to assist students in their learning, it is important for students to understand its role in scientific understanding. Science is a community endeavor aimed towards explaining the natural world. The very nature of science is both the practice of science and the historical accumulation of knowledge. Peer-to-peer review and feedback is an important component of this scientific endeavor.

> *What engages* all *students, however, is a process of critique and argumentation. Because they examine each other's ideas and look for flaws, controversy and debate among scientists are normal occurrences, neither exceptional nor extraordinary. Moreover, science has established a formal mechanism of peer review for establishing the credibility of any individual scientists' work.*
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> *Framework for K-12 Education, p. 78*

Science is figuring out the natural and designed world. This sensemaking occurs as students utilize the SEPs and CCC as they come to understand, and use, the DCIs. As stated in the quote above, science is not cut-and-dry, but requires active discussion and questioning among individuals in order for consensus understanding to occur. As students work to understand and explain the phenomenon being investigated, or problem being solved, they should be provided opportunities to collaboratively analyze and critique current understanding.

This *peer review and engagement* are important components of the nature of science. For example, the SEP Engaging in Argument from Evidence has students critique one another's "explanation, procedures, models and questions." Students interacting with one another and offering critiques of peer scientific arguments contribute to deeper understanding of the concepts related to the phenomenon.

What are planning considerations for the successful implementation of the Evidenced-Based Instructional Practice #6: Meaningful Feedback to ensure that all students have equitable access and opportunity to learn the standards contained in the *KAS for Science?*

- Classroom culture is conducive for feedback
    - What norms are in place that allow for constructive critique and discussion?

- Teachers utilize the formative assessment process
    - Where in the lesson sequence should feedback be strategically provided?
    - Are students aware of the learning goals and success criteria associated with the lesson?
    - Where will the teacher strategically design opportunities in which students may self-assess their learning related to the learning goals? Where may teachers need to receive feedback from students to understand how the learning is progressing?
    - Are learning goals written to meet the intent of the KAS for Science? Are tasks designed to meet these learning goals?

- Students actively engage in peer-to-peer critique and feedback.
    - When are opportune times within lessons where students may critique one another's work?
    - What supports might be necessary to help students engage in critical critique?

What strategies and resources can support the implementation of Evidence-Based Instructional Practice #6: Meaningful Feedback within the *KAS for Science?*

- For information about developing a classroom climate conducive for questioning, see the Kentucky Department of Education (KDE) resource EBIP 1: Establishing the Learning Environment

- For information about the formative assessment process, see the KDE resources EBIP 2: Clarifying and Sharing Clear Learning Goals and The Balanced Assessment Professional Learning Module.
- For information about task review and design, and learning goal development, see the KDE professional learning module Three-Dimensional Tasks.
- Argument-Driven Inquiry has developed peer review tools for elementary and secondary students.
- Understanding Science 101, developed by the University of California Museum of Paleontology, provides a deep dive into the nature of science and the role of peer-to-peer interaction in the sciences.

- The STEMTeachingTools practice briefs provide further strategies in support of science instructional practices.
    - Research Brief: The Informal Formative Assessment Cycle as a Model for Teacher Practice describes the use of "assessment conversation" as a way to elicit student understanding and act upon it.
    - Beyond the Written C-E-R: Supporting Classroom Argumentative Talk about Investigations provides supports in argumentative discussion, such as lab meetings, in which students critique ideas and come to an understanding of the concept or phenomenon.
    - How can I promote equitable sensemaking by setting expectations for multiple perspectives? describes the importance of various perspectives leading to consensus building.