Kentucky Department of EDUCATION

Evidence-Based Instructional Practices

Discussion and the Kentucky Academic Standards (KAS) for Science

The Discussion Overview provides the research base associated with this evidence-based instructional practice.

What are connections between the Evidenced-Based Instructional Practice #4: Discussion 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.

Science is a social enterprise. Scientists and engineers utilize productive talk not only to make sense of the world, but also to refine their ideas. Students, too, should have multiple opportunities to interact with one another through such discourse as it forces them to think about their ideas. This kind of interaction also provides the opportunity for students to reflect on what they may, or may not, understand.

Science is also a cultural enterprise in which personal experiences influence the way scientists begin to make sense of the world. Diverse linguistic practices for making sense of phenomena can provoke learning and, thus, be leveraged in instruction. As stated in *The Framework for K-12 Science Education*, "Recognizing that language and discourse patterns vary across culturally diverse groups, researchers point to the importance of accepting, and even encouraging, students' classroom use of informal or native language and familiar modes of interaction." By first acknowledging and honoring student discourse patterns, teachers can build upon students' current understanding of scientific ideas towards a more formal scientific understanding of phenomena.

The eight science and engineering practices within the *KAS for Science* provide the mechanism through which science discourse can occur. In addition, the crosscutting concepts provide a sensemaking tool that may "jumpstart" discussion. For example:

A group of sixth graders are exploring how the sun, earth and moon interact as a system that results in a lunar eclipse (ESS1.B). One student observes that a lunar eclipse occurs when the moon is full (CCC—Patterns). Others in the group then begin to generate questions (SEP—Asking Questions) about how the three bodies would need to be positioned (CCC—System and System Models) for a lunar eclipse to occur. Having access to various manipulatives, students interact to develop a model (SEP—Developing Models) of the 3-body system (CCC—System and System Models). They question and challenge one another's ideas (SEP—Engaging in Argument) as they work to come to a common understanding of how the SEM system can result in a lunar eclipse (ESS1.B).

Through this continued discussion, students can work towards a consensus model and explanation.

Providing opportunities for student discourse also provides the teacher with important formative assessment information. As students are engaging with one another, the instructor can listen for gaps in scientific conceptual understandings.

The goal of science education is for students to engage in the SEPs and apply CCCs to deepen their understanding of core ideas. As such, teachers should listen for how students understand these core ideas as they make sense of phenomena, not simply listen for students using scientific terms. It is as students are demonstrating this understanding, then scientific terms can be introduced and continue to be utilized throughout future lessons.

What are planning considerations for the successful implementation of the Evidenced-Based Instructional Practice #4: Discussion to ensure that all students have equitable access and opportunity to learn the standards contained in the *KAS for Science?*

- Is there a classroom culture that is conducive for science discourse?
    - With students, generate class norms that reflect respectful and constructive discussions.
- What role does student home experience or background knowledge have during the discussion?
    - Science meaning making has cultural roots. That is, students use their personal experiences to make personal connections to the world around them.
    - Encourage students to utilize common, nonscientific language, especially when they are beginning to make meaning of phenomena. Students may hide their lack of understanding by simply using scientific terminology.
    - While science talk helps English learners in language acquisition, these students may also have rich family experiences that can be leveraged during discussion.
- What support or scaffolds may be needed that will help students as they engage in productive talk?
    - Students may need help in engaging in productive talk with their classmates. The use of sentence starters or graphic organizers may be needed to guide students in this shift in classroom practice.

- Where in the instructional sequence would science discourse be the most meaningful?
    - As demonstrated in the example, the use of science discourse as students are engaging in the SEPs assists in student understanding of core ideas. At the same time, this engagement provides students opportunities for developing and honing their skills in constructive, as well as productive, discussion techniques.

What strategies and resources can support the implementation of Evidence-Based Instructional Practice #4: Discussion within the *KAS for Science?*

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

- The STEMTeachingTools practice briefs provide further strategies in support of science discourse.
    - How can I get my students to learn science by productively talking with each other? This practice brief describes the importance of talk during sensemaking.
    - How can I foster curiosity and learning in my classroom? Through talk! This practice brief describes actions that may support student thinking through talk.
    - How can teachers guide classroom conversations to support students' science learning? This practice brief provides tools and resources to support student discussion in the science classroom.
    - Engaging English Learners in the Science and Engineering Practices. This practice brief provides guidance and supports in the use of discourse and culture to help English learners engage in the science classroom.
    - This practice brief describes how students use various forms of communication as they work towards access and fluency of scientific terminology.
- Chapter 5 in the National Research Council (NRC) report *Ready, Set, Science!*, Making Thinking Visible: Talk and Argument provides further explanation of the importance of talk in the science classroom.
- Ambitious Science Teaching has a series of tools and videos that supports teachers in working with "student ideas over time." To see what productive talk could look like, review the video "Using models to develop a scientific explanation: A sound unit overview."