Evidence-Based Instructional Practices

Explicit Teaching and Modeling and the Kentucky Academic Standards (KAS) for Science

The Explicit Teaching and Modeling Overview provides the research base associated with this evidence-based instructional practice.

What are connections between the Evidenced-Based Instructional Practice #3: Explicit Teaching and Modeling 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.

The use of these dimensions as students come to conceptual understanding should not be random. Designing instructional sequences should be intentional, and identifying an anchoring phenomenon that will drive the instructional sequence is key. While students may provide input into the instructional design through the use of a driving question board, the instructional sequence should be outlined by the teacher. The instructional design should be driven by both content knowledge and pedagogical content knowledge in which the educator can predict where students may struggle and, hence, plan for specific, direct instruction as needed. Some of the direct instruction that has been identified may include knowing when the teacher will need to model a thought process or procedural skill.

One key element in the instructional design process is knowing where students may possess content-specific "misconceptions." Through an asset-based lens, we can look at these as stepping stones toward a deeper understanding of scientific concepts. Also known as "facets of student understanding", this approach to instruction acknowledges that students do make sense of the world around them using their background knowledge and experiences. This approach is counter to a deficit-based lens in which students are seen to lack any understandings. Knowing the ideas that are most likely to be incomplete, educators can design learning experiences to address gaps in that understanding.

Direct instruction in the science classroom does not entail frontloading of information. That is, educators should not provide all the information at the beginning of the lesson/unit (the "front") followed by activities that confirm this information. Instead, information should be developed such that students are exploring and grappling with conceptual ideas as they make sense and work to explain the phenomenon. If during the learning, however, students are struggling with a procedural issue or an incorrect idea that would hamper the learning, educators may provide direct instruction in order to move the learning forward.

What are planning considerations for the successful implementation of the Evidenced-Based Instructional Practice #3: Explicit Teaching and Modeling to ensure that all students have equitable access and opportunity to learn the standards contained in the *KAS for Science?*

- Identify possible scientific "misconceptions" so that learning experiences can be developed that will initially address these ideas.
    - What does research say about specific misconceptions related to the science concepts?
    - What specific experiences do I need to include to help students in shifting their thinking about these ideas?
- Know the science and engineering practices students will be engaging with in order to identify where direct instruction may be necessary.
    - Do students know how to interpret data that is being presented?
    - What assistance will students require in recognizing bias in texts?
    - Where might students have had limited experiences with planning investigations that would require more explicit instruction?
- Identify methods students will use to demonstrate their current understanding of the phenomenon being investigated.
    - What supports will I need to provide as students develop a model of the phenomenon?
    - What supports will I need to provide for students to write a scientific argument or a scientific explanation?
    - Which crosscutting concepts would I expect students to use to demonstrate their understanding? What questions may I need to ask about these CCCs as students work to understand the phenomenon?

What strategies and resources can support the implementation of Evidence-Based Instructional Practice #3: Explicit Teaching and Modeling within the *KAS for Science?*

- Plan instructional sequences with intentionality.
    - The Kentucky Department of Education (KDE) hosted a webcast in January 2020 entitled "Literacy in Science". This webcast describes what literacy in science

entails and provides some planning guidance to assist students in text interpretation.
  - The STEMTeachingTool Qualities of a Good Anchoring Phenomenon provides guidance in identifying phenomena that will drive instruction.
- Be aware of potential scientific misconceptions.
  - **Beyond "misconceptions": How to recognize and build on Facets of student thinking** is a STEMTeachingTool that provides tools and insights into interpreting student thinking in order to identify gaps in conceptual understanding.
  - The National Research Council's Science Teaching Reconsidered contains a chapter which describes how misconceptions can act as barriers to understanding science.
  - Annenberg Learner has published two seminal professional development video series which demonstrate student misconceptions and how these can be held despite instruction. These videos are A Private Universe and Minds of Our Own.
  - There are numerous books and websites which describe common misunderstandings that students hold. One such website, Understanding Science, has complied a list of common misconceptions about the nature of science and their corrections.
- Students demonstrate their understandings in many ways (diverse sensemaking) and these ideas should not be discredited.
  - The use of science notebooks allows students the opportunity to making meaning of phenomena in a way that makes sense for them. Educators can use these notebooks to gain insight into student thinking in order to determine where gaps in understanding may occur.
  - The KDE professional learning module, Social Justice and Equity, leads educators through experiences that demonstrate how student thinking can be influenced by personal experiences and should be seen as assets to learning and not deficits.
- During instruction, educators are constantly formatively assessing students. In order to move the learning forward, direct instruction can be provided when students are struggling with a procedural issue or incorrect idea.
  - The KDE professional learning modules within the Balanced Assessment series, Interpreting Evidence of Student Learning and Acting on Student Evidence of Learning, describes direct instruction strategies.