KANSAS STATE DEPARTMENT OF EDUCATION

SCIENCE OBSERVATION COACHING TOOL

About the Tool

The KSDE Science Observation Coaching Tool illustrates the most important elements of quality science instruction as articulated in the **Vision for Quality Instruction in Science**. It provides a common language to articulate what quality science instruction looks like in practice for each focus area:



The tool consists of the following components:

- **Focus Areas:** Core components, or elements, of quality instruction as defined by the vision
- **Indicators:** Brief descriptions of observable teacher actions that are most significant for the focus area (indicators are not exhaustive)
- **Look-Fors:** Student and teacher actions that can provide evidence for the indicator

This tool can be used in a variety of ways to support coaching, peer observations, and professional learning. ***Please note that it is non-evaluative and should not be used for formal teacher evaluation. For recommended uses,*** refer to the Observation Coaching Tools Guidance document.

Best Practices

Observations should be no shorter than 10 minutes, though a minimum of **15-20 minutes** is recommended. Note that you may not observe evidence for all indicators in a single observation. Consider observing at different parts of the lesson to gather information across indicators. Many look-fors describe what students are doing or thinking; these should only be marked when there is evidence that a clear majority of students (over 70%) are participating in the identified action.

Use the note-taking templates to make note of the lesson's topic and objectives, target standard(s), number of students and curricular materials being used (if any). Take low-inference notes to reduce the influence of assumptions, opinions, and judgment on your ratings.

Additional Learning

For additional learning on content-specific terms and concepts embedded in the observation coaching tool, utilize the **Science Standards Alignment Toolkit**. The toolkit includes resources and guidance related to:

- Making sense of the three-dimensional science standards
- Unpacking Science & Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts (CCCs)

For more information, contact Stephanie Alderman-Oler, K-12 STEM Program Manager, at stephanie.alderman-oler@ksde.gov.

Focus 1: Phenomena

1A. The lesson is focused on supporting students with exploring a phenomenon.

1B. Students are provided multiple ways to experience natural phenomena in a variety of ways for the purpose of figuring out how or why the phenomena occurs.

Focus 2: Three-Dimensional Instruction

2A. The lesson integrates *Science & Engineering Practices (SEPs)*, or the major practices scientists employ as they gather and make sense of evidence and develop models and theories, as identified in the Kansas Science Standards.

2B. The lesson integrates *Disciplinary Core Ideas (DCIs)*, or core science content knowledge, as identified in the Kansas Science Standards.

2C. The lesson integrates *Crosscutting Concepts (CCCs)*, or the overarching concepts that provide a schema for connecting knowledge across disciplines, as identified in the Kansas Science Standards.

Focus 3: Sensemaking

3A. The lesson is designed for students to develop knowledge through gathering and making sense of evidence, rather than being given knowledge.

3B. Students use their own ideas, scientific ideas, and the evidence they have gathered to communicate evidence-based explanations of phenomena and/or develop solutions to real-world problems.

Focus 4: Discourse and Collaboration

4A. The lesson includes opportunities to collaborate and dialogue with one another in pairs, small groups, and/or whole group to support building knowledge through.

4B. The teacher supports and encourages students to engage in productive struggle and take intellectual risks to communicate and revise their thinking based on evidence and one another's ideas.

Focus 5: Local and Cultural Relevance

5A. Phenomena and problems are opportunities for students to engage in scientific exploration that is aligned to their interests, lived experiences, and/or related to local needs.

5B. The lessons incorporate students' prior knowledge, lived experiences, and ways of thinking in order to support understanding of phenomena or to solve design problems

LESSON CONTEXT			
Teacher:	**Date/Time:**	**Grade/Subj:**	**# of Students:**
Materials: ☐ Teacher-Created ☐ Adopted (name below)	**Learning Target:**	**Standard(s):**	

Focus 1: PHENOMENA	
Indicator	**Look Fors**
1A. The lesson is focused on supporting students with exploring a phenomenon.	☐ *Students explore phenomena though videos, photos, articles, data, or other sources of evidence.* ☐ *Students make observations and ask questions about phenomena.* ☐ *Students make predictions about how the world works.*
1B. Students are provided opportunities to experience natural phenomena in a variety of ways for the purpose of figuring out how or why the phenomena occurs.	☐ *Students gather a variety of evidence, such as observations, cited sources, data, computer simulations, and the results of their own investigations, to figure out how or why the phenomena occur.* ☐ *Students use evidence to construct a scientific explanation for how or why a phenomena occurs.*
Direct Observation Notes	

Focus 2: THREE-DIMENSIONAL INSTRUCTION*	**A quality science lesson will include all three dimensions, but will likely include only one "look-for" from each indicator.*
Indicator	**Look Fors***
2A. The lesson integrates *Science & Engineering Practices (SEPs)*, or the major practices scientists employ, as they gather and make sense of evidence and develop models and theories, as identified in the Kansas Science Standards.	*Students engage in the SEPs as they make sense of phenomena by:* ☐ *Asking questions* ☐ *Defining problems* ☐ *Developing and/or using models* ☐ *Planning and/or carrying out investigations* ☐ *Using math and computational thinking* ☐ *Analyzing and interpreting data* ☐ *Designing solutions* ☐ *Engaging in argumentation* ☐ *Obtaining, evaluating, and communicating information* ☐ *Constructing explanations*
2B. The lesson integrates *Disciplinary Core Ideas (DCIs)*, or core science content knowledge, as identified in the Kansas Science Standards.	*Students acquire and use knowledge of DCIs in the areas of:* ☐ *Earth and Space Science* ☐ *Life Science* ☐ *Physical Science*
2C. The lesson integrates *Crosscutting Concepts (CCCs)*, or the conceptual lenses that help students interpret and connect scientific ideas, as identified in the Kansas Science Standards.	*Students use CCCs as the lens to make sense of phenomena, including:* ☐ *Patterns* ☐ *Cause and effect* ☐ *Scale, proportion, and quantity* ☐ *System and system models* ☐ *Structure and function* ☐ *Stability and change* ☐ *Energy and Matter*
Direct Observation Notes	

Focus 3: SENSEMAKING	
Indicator	**Look Fors**
3A. The lesson is designed for students to develop knowledge through gathering and making sense of evidence, rather than being given knowledge.	☐ *Students are doing the work of scientists by gathering evidence in a variety of ways.* ☐ *Students are using evidence they have gathered to make inferences and draw conclusions and develop their scientific understanding.* ☐ *There is a clear and shared intention to the learning related to making sense of a phenomena or solving an authentic problem.*
3B. Students use their own ideas, scientific ideas, and the evidence they have gathered to communicate evidence based explanations of phenomena and/or develop solutions to real world problems.	☐ *Students have the opportunity to share their initial ideas about phenomena.* ☐ *Students have the opportunity to revise their thinking based on new evidence and understanding.* ☐ *Students construct explanations or develop solutions based on the evidence they have gathered.*
Direct Observation Notes	

Focus 4: DISCOURSE AND COLLABORATION	
Indicator	**Look Fors**
4A. The lesson includes opportunities to collaborate and dialogue with one another in pairs, small groups, and/or whole group to support building knowledge through sensemaking.	☐ *Students work together and encourage each other to engage in productive struggle as they engage in the science practices and make sense of the evidence gathered.* ☐ *Student talk and collaboration is focused on making sense of the phenomena or solving a problem.*
4B. The teacher supports and encourages students to engage in productive struggle and take intellectual risks to communicate and revise their thinking based on evidence and one another's ideas.	☐ *Supports, including norms, expectations, and routines, are evident and promote a classroom culture where students feel comfortable sharing ideas.* ☐ *Supports including sentence stems, collaboration group roles, and routines or structures for student collaboration and discourse are available to students.* ☐ *Students share their ideas with each other, even when they aren't sure they have a "right" answer.*
Direct Observation Notes	

Focus 5: LOCAL AND CULTURAL RELEVANCE	
Indicator	**Look Fors**
5A. Phenomena and problems are opportunities for students to engage in scientific exploration that is aligned to their interests, lived experiences, and/or related to local needs.	☐ *Students make connections between the scientific concepts they are investigating, the scientific practices they are using to gather evidence, and their lives outside of the classroom.* ☐ *Students can answer the question, "how does this relate to your life?"* ☐ *Students have opportunities to consider related phenomena that are more familiar to them as they explore less familiar phenomena.*
5B. The lessons incorporate students' prior knowledge, lived experiences, and ways of thinking in order to support understanding of phenomena or to solve design problems.	☐ *Students receive feedback that demonstrates that the cultural knowledge, language, and ways of thinking that students bring into the classroom are valued in the scientific learning process.*
Direct Observation Notes	

For Reference

Focus 1: Phenomena

Phenomena vs. Concepts

Phenomena are observable events or processes that occur in the natural or designed world and can be explained using science concepts. They are things students can see, experience, or investigate to spark curiosity and drive instruction. Phenomena can also include real-world problems that can be solved through the application of scientific ideas.

Science concepts are the underlying ideas that students use to make sense of those phenomena. Through the exploration of phenomena, students build their understanding of increasingly complex science concepts with the goal of developing scientific explanations or evidence-based design solutions.

Examples:

Phenomena	Science concept that explains the phenomena
If you hold up an object and let go, it will always fall towards Earth, no matter what the object is made of.	The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. *5th-grade standard*
When the bass in music is turned up loud, you can feel it more than when music is quieter.	A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. The amplitude of a wave is related to the energy in a wave. A sound wave requires a medium to travel *Middle school standard*
When you get sick, you may get a fever, a rash, or other symptoms. Depending on the illness, you can get better without medications.	Systems of specialized cells within organisms help them perform the essential functions of life. *High school standard*

Focus 2: Three-Dimensional Instruction

Science and Engineering Practices

The science and engineering practices describe the ways that scientists and science students do the work to make sense of complex science ideas. Practices go beyond learning "skills" because engaging in scientific investigation through practices requires skill and knowledge together. The science and engineering practices should not be taught in isolation, students should learn and demonstrate competence within the context of specific science content.

Science and Engineering Practices:

- **Asking Questions:** Scientific questions require answers that are supported by explanations and empirical evidence. Questions can arise throughout the learning process including questions driven by curiosity about the world, prompted by models or investigations, or based on competing arguments.
- **Defining Problems:** Engineering begins with defining a problem to solve. Engineering problems should be defined by the need for a solution, the criteria for a successful solution, the constraints of the design, and potential trade-offs.

- **Developing and/or Using Models:** Models are used to represent a concept being studied. Students can use models to develop questions, generate data, make predictions, and communicate scientific ideas. *Modeling often involves revising and refining models throughout the learning process*. Models can include diagrams, physical replicas, mathematical representations, analogies, and computer simulations and other representations of the content.

- **Planning and/or Carrying Out Investigations:** The goal of investigations is to collect data related to the science questions that have been asked. Data can be used as evidence with reasoning, scientific ideas, principles, and theories when drawing conclusions or making claims about a given concept. Investigations should have a stated goal, identify the types of data that needs to be collected for the goal, and plans for how to carry out the investigation.

- **Analyzing & Interpreting Data:** Analyzing data involves organizing the data into tables or graphs and identifying the patterns and relationships in the data.: Interpretation is the process where students determine the meaning of the data and the relevance to scientific questions so that data can be used as evidence.

- **Using Math & Computational Thinking:** Computational thinking involves strategies for organizing and searching data, developing algorithms, and developing simulations. Mathematics can be a tool to make raw data more usable and mathematical thinking and logic are keys to understanding much of science.

- **Constructing Explanations:** Scientific explanations include a claim based on evidence made in response to a question. Students are expected to construct their own explanations of science content or phenomena. Students are also expected to identify the evidence that supports claims in provided explanations.

- **Designing Solutions:** The engineering process of designing solutions involves defining the problem, then generating solutions based on scientific ideas. The iterative process of engineering involves testing the solution and making improvements.

- **Engaging in Argumentation:** Argumentation in science is a process for reaching agreements about explanations and is critical to understand science. Argument is a process based on evidence and reasoning leading to claims acceptable to the scientific community. Argumentation requires students to compare and evaluate competing ideas and determine the validity and merits based on evidence.

- **Obtaining, Evaluating & Communicating Information:** Being able to read, interpret, and produce scientific and technical text are fundamental practices of science and engineering, as is the ability to communicate clearly and persuasively.

To explore grade-level expectations for each Science and Engineering Practice, visit:
https://static.nsta.org/ngss/resources/MatrixForK-12ProgressionOfScienceAndEngineeringPracticesInNGSS.8.14.14.pdf

Disciplinary Core Ideas

The Disciplinary Core Ideas are key science content related to physical science, life science, and earth/space science. The DCIs are not details or facts to be memorized or taught in isolation. Student learning of the disciplinary core ideas should be through the science and engineering practices and cross cutting concepts.

To explore grade level expectations for each Disciplinary Core Idea, visit:
https://www.nextgenscience.org/sites/default/files/Handout%2004%20-%20NSTA%20DCIs%20Matrix.pdf

Cross Cutting Concepts

The Cross Cutting Concepts provide the lens to support making sense of the world with a particular purpose. For example, when making observations is the purpose identifying patterns or determining cause and effect? These concepts are an intellectual tool that can be used across all science disciplines to help students deepen their understanding of the disciplinary core ideas.

Cross Cutting Concepts:

- **Patterns:** Students identify patterns in natural and designed systems as a way to organize and make sense of phenomena. Recognizing patterns helps students notice similarities, differences, and trends in data, which can lead to questions and deeper investigation.
- **Cause and effect:** Students investigate cause-and-effect relationships to explain why phenomena occur. They use observations, experiments, and evidence to identify causes and effects, which supports predictions, explanations, or design solutions. Understanding cause and effect relationships helps students analyze systems, test hypotheses, and construct evidence-based arguments about how or why events happen.
- **Scale, Proportion, and Quantity:** Students use concepts of scale, proportion, and quantity to measure, compare, and understand natural and designed systems. These concepts help students identify the size, amount, or magnitude of objects and processes, and understand how different mechanisms operate at different scales.
- **Systems and System Models:** Students use systems and models to simplify and study complex phenomena by identifying a system and examining its components, interactions, and boundaries. Models help students describe and predict the relationships within a system, including flows of matter, energy, or information. Students acknowledge that all models have limitations in what they can show and represent.
- **Structure and Function:** Students examine how the shape, arrangement, and properties of parts in natural and designed systems determine their function. Understanding structure and function helps students explain phenomena and design objects to serve specific purposes.
- **Stability and Change:** Students investigate how systems maintain stability or undergo change over time. Stability occurs when a system resists or recovers from disturbances, while change may happen gradually or over long time scales. Understanding the mechanisms that influence stability and change helps students explain patterns in systems and predict how systems may respond to internal or external influences.
- **Energy & Matter**: Energy and Matter: Students analyze how energy and matter flow into, out of, and within systems to explain and predict phenomena. Tracking these transfers helps students understand cycles, interactions, and constraints in natural and designed systems.

To explore grade level expectations for the Cross Cutting Concepts, visit:
https://static.nsta.org/ngss/MatrixOfCrosscuttingConcepts.pdf