ILLINOIS STATE BOARD OF EDUCATION

REGIONAL OFFICE OF EDUCATION #47
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STRONGER SCHOOLS - STRONGER FAMILIES - STRONGER COMMUNITIES

EDUCATIONAL LEADERS SESSION 2:

What Should High Quality Science Education Look Like?

Illinois Science Capacity Builders Series

CONTEXT , INTRODUCTIONS, and ROLES:

October – June 2026 Professional Learning

Synchronous virtual sessions, Asynchronous virtual sessions (spring 2026), Face to Face Session (June 2026). All professional learning supported by funds through the Illinois State Board of Education.

IL SCIENCE STEERING COMMITTEE

Meagan Budke, ISBE

Anji Garza, PD & Ed Service Director, ROE 47 (Presenter, Chat)

Heather Galbreath, 6th Grade Science Teacher Galesburg, IL

Brian Gibbs, Educator, Bradley School District 61

Sarah Meador, Director of ROE Services, ROE 8 (Presenter, Chat)

Dawn Novak, Professional Learning Architect, Northwestern

Nate Nugent

Kristin Rademaker, Professional Learning Specialist, NSTA (Presenter, Chat)

Misty Richmond, Middle School Science Teacher, CPS

Richard Stokes, University of Illinois - Springfield

Nicole Vick (Presenter, Chat)

You! Breakout Participant, Speaker

Purpose & Desired Outcome

Purpose

To deepen your understanding of the Illinois Science Standards, build your capacity to teach science, and support greater student success.

Desired Outcome

By the end of this meeting we will:

- Understand the key components of three-dimensional, phenomenon-based science instruction so that we recognize what high-quality science teaching looks like
- Understand how to identify indicators of effective teaching and learning in a science classroom so that we can support educators in refining instructional practice
- Understand how leadership decisions shape the quality and equity of science instruction so that we can align systems and supports

Participant Guidelines

- Cameras on if possible
- Participate though chat, hands up feature, and breakout sessions
- Resist the temptation to multitask
- Take care of your own needs

Poll: How have you supported teachers or engaged with the Illinois Learning Standards for Science (NGSS)?

1. Unpacking the standards activities.
2. Developing lessons and/or units aligned to the standards.
3. Creating assessments aligned to the standards.
4. Other.

What are the Illinois Learning Standards for Science (NGSS)?

- Consist of three dimensions:
  - **Science and Engineering Practices (SEPs)**
  - **Disciplinary Core Ideas (DCIs)**
  - **Crosscutting Concepts (CCCs)**

- Each statement, performance expectation, contains one element of each dimension.

What are the Illinois Learning Standards for Science (NGSS)?

Students who demonstrate understanding can:

K-ESS2-2.	**Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.** [Clarification Statement: Examples of plants and animals changing their environment could include a squirrel digs in the ground to hide its food and tree roots can break concrete.]

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

What are the Illinois Learning Standards for Science (NGSS)?

Students who demonstrate understanding can:

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

The performance expectation above was developed using the following elements from the NRC document *A Framework for K- 12 Science Education*:

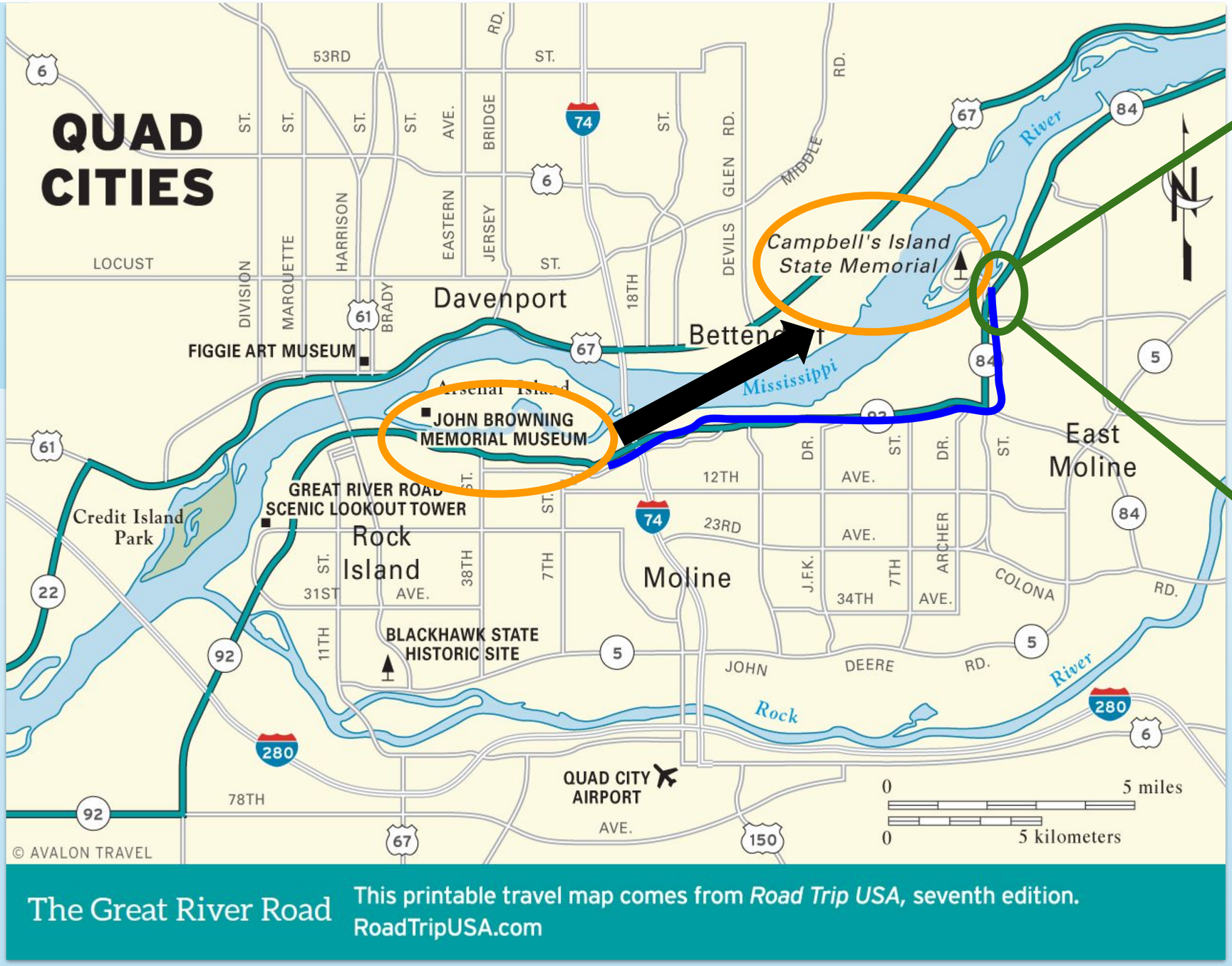
* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

Students who demonstrate understanding can:

HS-ESS3-4. **Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*** [Clarification Statement: Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

How do the three dimensions work together to support student sensemaking?



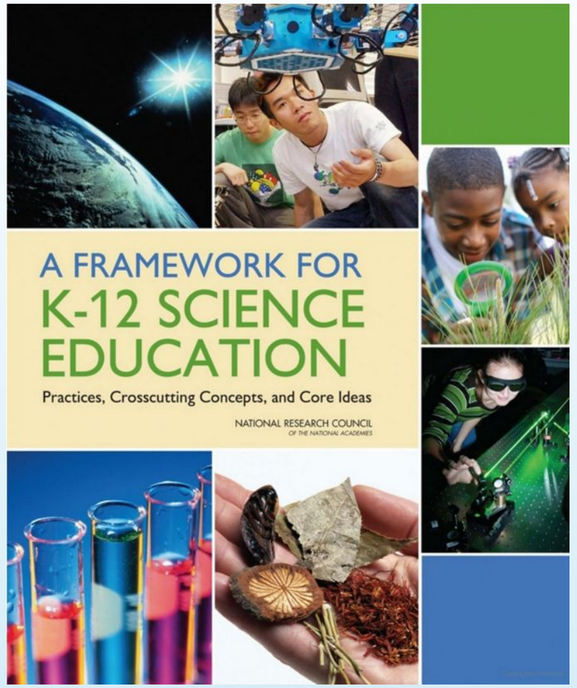
Indicators of Effective Teaching

Reflection:

- What do we currently look for when evaluation effective teaching practices in the science classroom?

- How are you gathering evidence of the three-dimensions?

Indicators of Effective Teaching



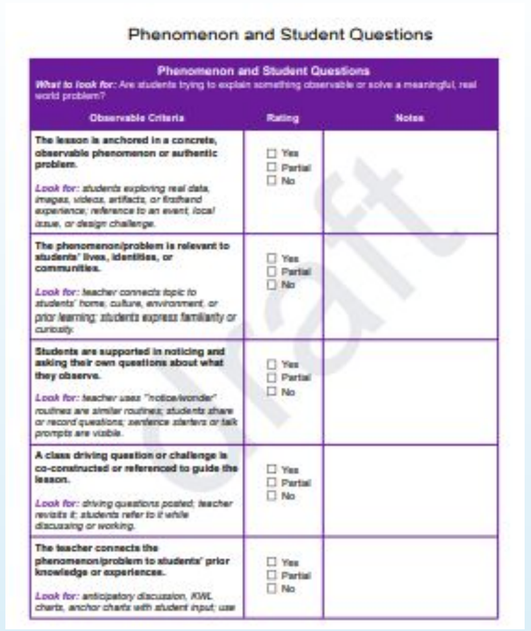
Critical Attributes of Sensemaking:

- Students experience a **phenomenon**;
- engage in **science and engineering practices** and
- **share ideas** to develop or apply the
- **science ideas** and **crosscutting concepts** needed to explain how or why the phenomenon occurs.

Indicators of Effective Teaching

NGSS Walkthrough Tool

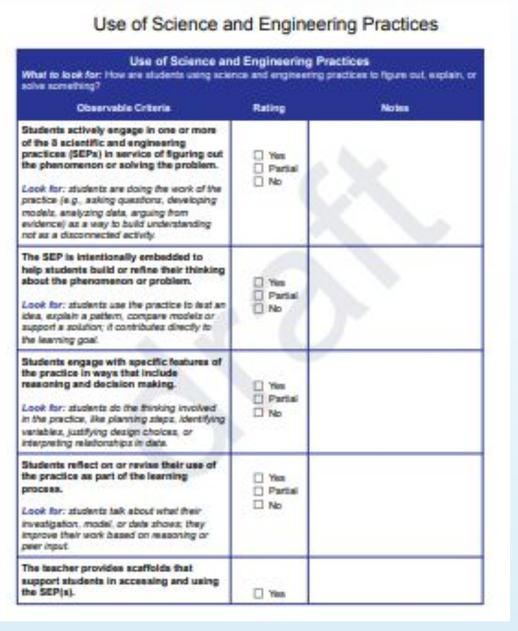
- Students experience a **phenomenon**;
- engage in **science and engineering practices** and
- **share ideas** to develop or apply the
- **science ideas** and **crosscutting concepts** needed to explain how or why the phenomenon occurs.


Phenomenon and Student Questions

Phenomenon and Student Questions

What to look for: Are students trying to explain something observable or solve a meaningful, real world problem?

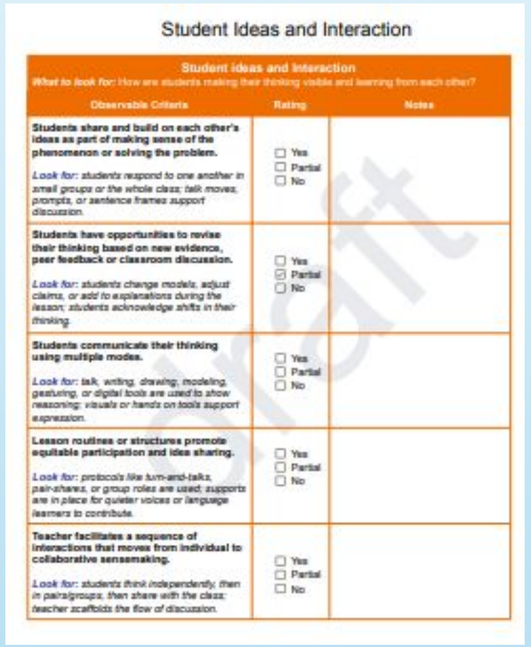
Observable Criteria	Rating	Notes
The lesson is anchored in a concrete, observable phenomenon or authentic problem. *Look for: students exploring real data, images, videos, artifacts, or firsthand experience; reference to an event, local issue, or design challenge.*	☐ Yes ☐ Partial ☐ No	
The phenomenon/problem is relevant to students' lives, identities, or communities. *Look for: teacher connects topic to students' home, culture, environment, or prior learning; students express familiarity or curiosity.*	☐ Yes ☐ Partial ☐ No	
Students are supported in noticing and asking their own questions about what they observe. *Look for: teacher uses "notice/wonder" routines or similar routines; students share or record questions; sentence starters or talk prompts are visible.*	☐ Yes ☐ Partial ☐ No	
A class driving question or challenge is co-constructed or referenced to guide the lesson. *Look for: driving questions posted; teacher revisits it; students refer to it while discussing or working.*	☐ Yes ☐ Partial ☐ No	
The teacher connects the phenomenon/problem to students' prior knowledge or experiences. *Look for: anticipatory discussion, KWL charts, anchor charts with student input; use*	☐ Yes ☐ Partial ☐ No	


Use of Science and Engineering Practices

Use of Science and Engineering Practices

What to look for: How are students using science and engineering practices to figure out, explain, or solve something?

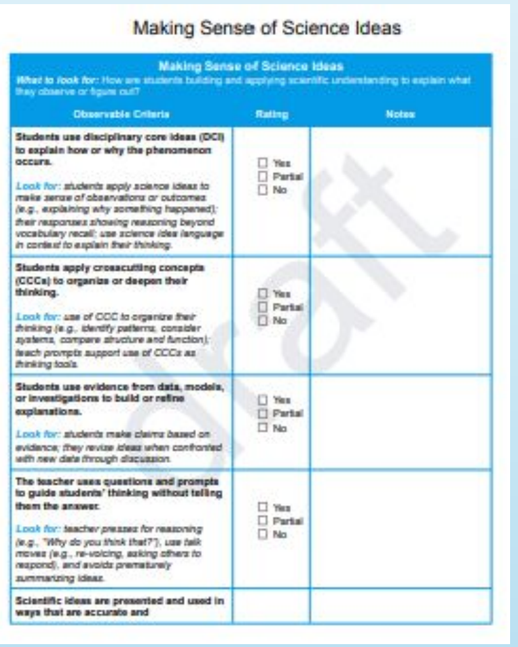
Observable Criteria	Rating	Notes
Students actively engage in one or more of the 8 scientific and engineering practices (SEPs) in service of figuring out the phenomenon or solving the problem. *Look for: students are doing the work of the practice (e.g., asking questions, developing models, analyzing data, arguing from evidence) as a way to build understanding, not as a disconnected activity.*	☐ Yes ☐ Partial ☐ No	
The SEP is intentionally embedded to help students build or refine their thinking about the phenomenon or problem. *Look for: students use the practice to test an idea, explain a pattern, compare models or support a solution; it contributes directly to the learning goal.*	☐ Yes ☐ Partial ☐ No	
Students engage with specific features of the practice in ways that include reasoning and decision making. *Look for: students do the thinking involved in the practice, like planning steps, identifying variables, justifying design choices, or interpreting relationships in data.*	☐ Yes ☐ Partial ☐ No	
Students reflect on or revise their use of the practice as part of the learning process. *Look for: students talk about what their investigation, model, or data shows; they improve their work based on reasoning or peer input.*	☐ Yes ☐ Partial ☐ No	
The teacher provides scaffolds that support students in accessing and using the SEP(s).	☐ Yes	


Student Ideas and Interaction

Student Ideas and Interaction

What to look for: How are students making their thinking visible and learning from each other?

Observable Criteria	Rating	Notes
Students share and build on each other's ideas as part of making sense of the phenomenon or solving the problem. *Look for: students respond to one another in small groups or the whole class; talk moves, prompts, or sentence frames support discussion.*	☐ Yes ☐ Partial ☐ No	
Students have opportunities to revise their thinking based on new evidence, peer feedback or classroom discussion. *Look for: students change models, adjust claims, or add to explanations during the lesson; students acknowledge shifts in their thinking.*	☐ Yes ☑ Partial ☐ No	
Students communicate their thinking using multiple modes. *Look for: talk, writing, drawing, modeling, gesturing, or digital tools are used to show reasoning; visuals or hands-on tools support expression.*	☐ Yes ☐ Partial ☐ No	
Lesson routines or structures promote equitable participation and idea sharing. *Look for: protocols like turn-and-talks, pair-shares, or group roles are used; supports are in place for quieter voices or language learners to contribute.*	☐ Yes ☐ Partial ☐ No	
Teacher facilitates a sequence of interactions that moves from individual to collaborative sensemaking. *Look for: students think independently, then in pairs/groups, then share with the class; teacher scaffolds the flow of discussion.*	☐ Yes ☐ Partial ☐ No	

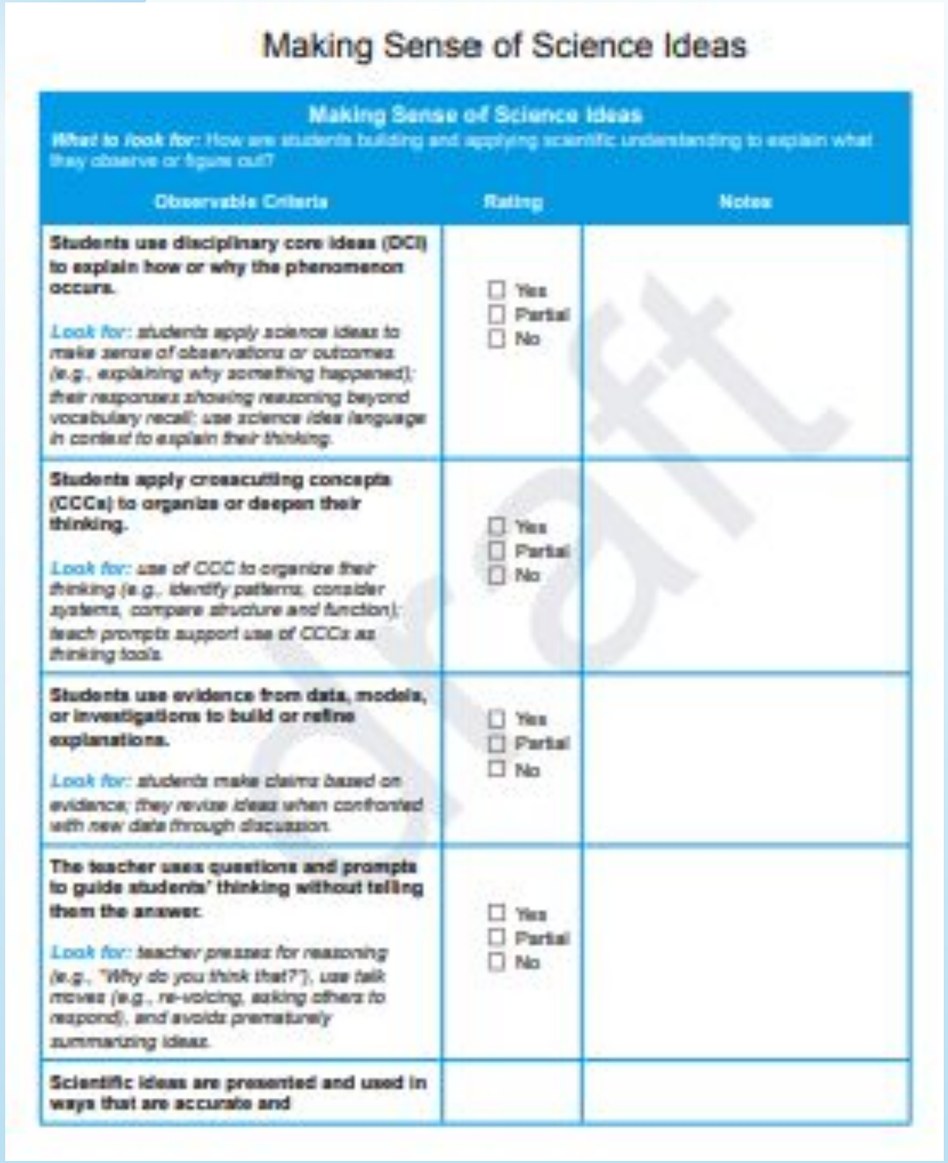

Making Sense of Science Ideas

Making Sense of Science Ideas

What to look for: How are students building and applying scientific understanding to explain what they observe or figure out?

Observable Criteria	Rating	Notes
Students use disciplinary core ideas (DCI) to explain how or why the phenomenon occurs. *Look for: students apply science ideas to make sense of observations or outcomes (e.g., explaining why something happened); their responses showing reasoning beyond vocabulary recall; use science idea language in context to explain their thinking.*	☐ Yes ☐ Partial ☐ No	
Students apply crosscutting concepts (CCCs) to organize or deepen their thinking. *Look for: use of CCC to organize their thinking (e.g., identify patterns, consider systems, compare structure and function); teach prompts support use of CCCs as thinking tools.*	☐ Yes ☐ Partial ☐ No	
Students use evidence from data, models, or investigations to build or refine explanations. *Look for: students make claims based on evidence; they revise ideas when confronted with new data through discussion.*	☐ Yes ☐ Partial ☐ No	
The teacher uses questions and prompts to guide students' thinking without telling them the answer. *Look for: teacher presses for reasoning (e.g., "Why do you think that?"), use talk moves (e.g., re-voicing, asking others to respond), and avoids prematurely summarizing ideas.*	☐ Yes ☐ Partial ☐ No	
Scientific ideas are presented and used in ways that are accurate and		

Indicators of Effective Teaching



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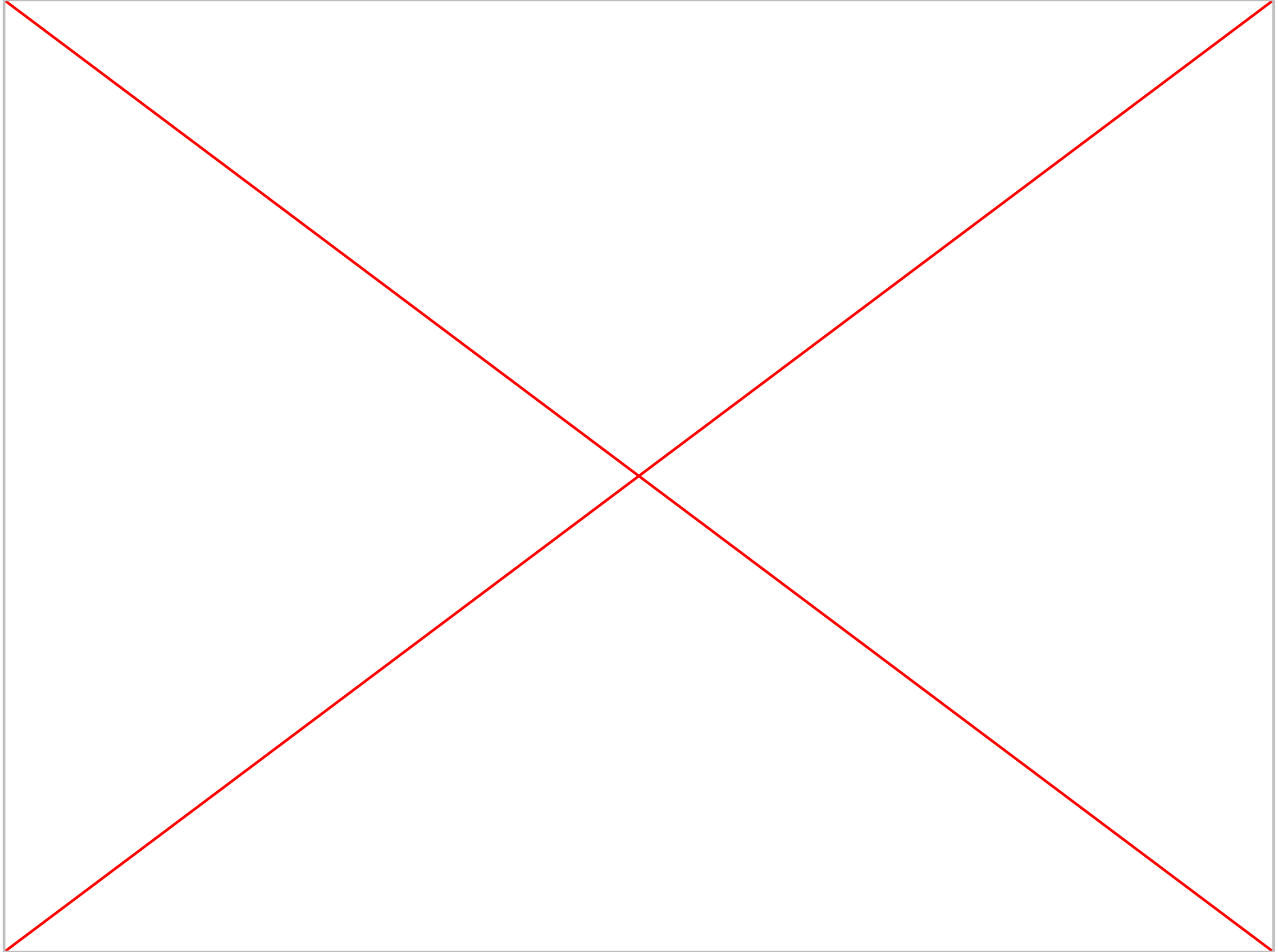
- What is the teacher doing? What were key teacher moves you noticed to support 3D learning?
- What are the students doing? How would you describe student moves as they engaged 3D learning?

Indicators of Effective Teaching

- Classrooms are complex. There are circumstances, relationships, and a shared history that we are not aware of.
- Presume expertise and best intentions on the part of the teacher.
- Remember that the students are learning. Assume what the kids are saying makes sense to them.
- Focus on how what you see and hear is serving the learning goals of the lesson and the science and engineering practices involved.



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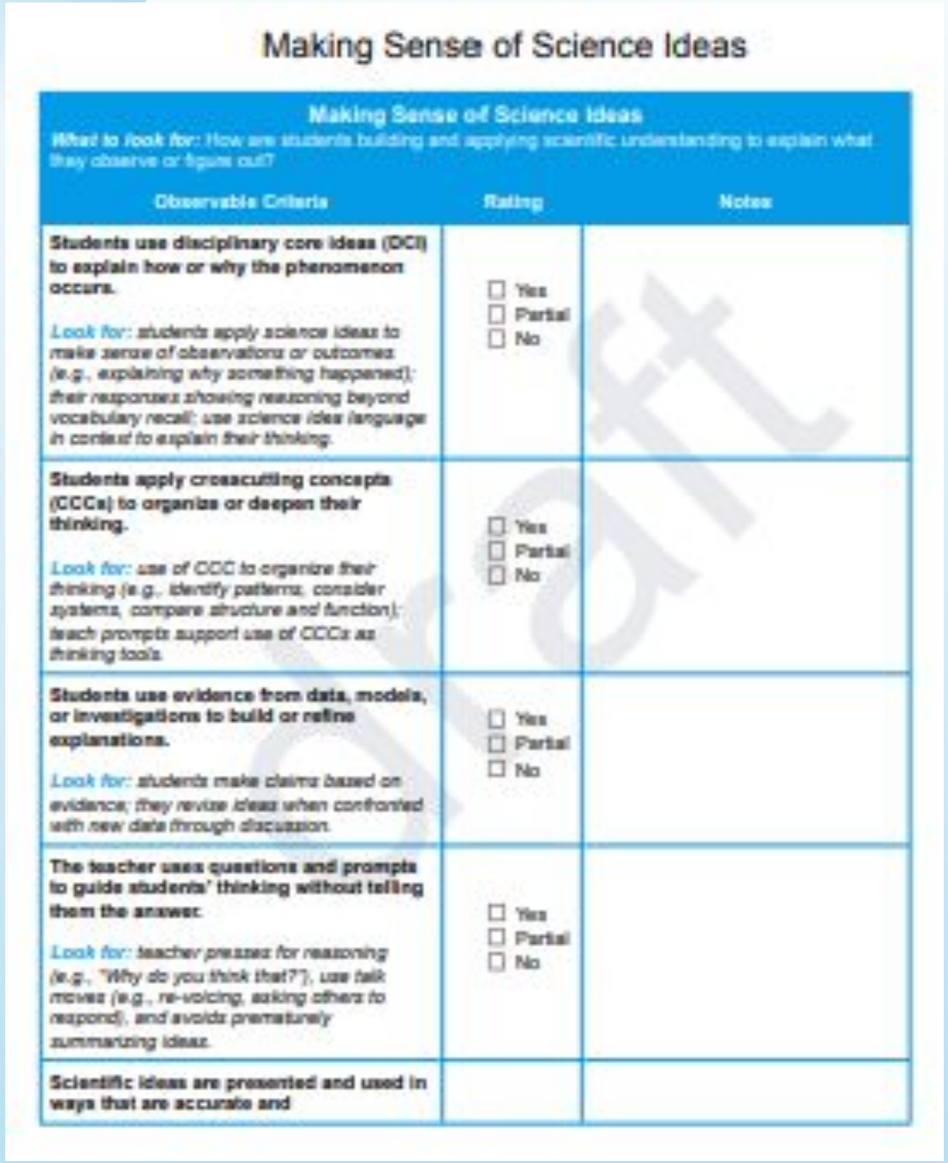

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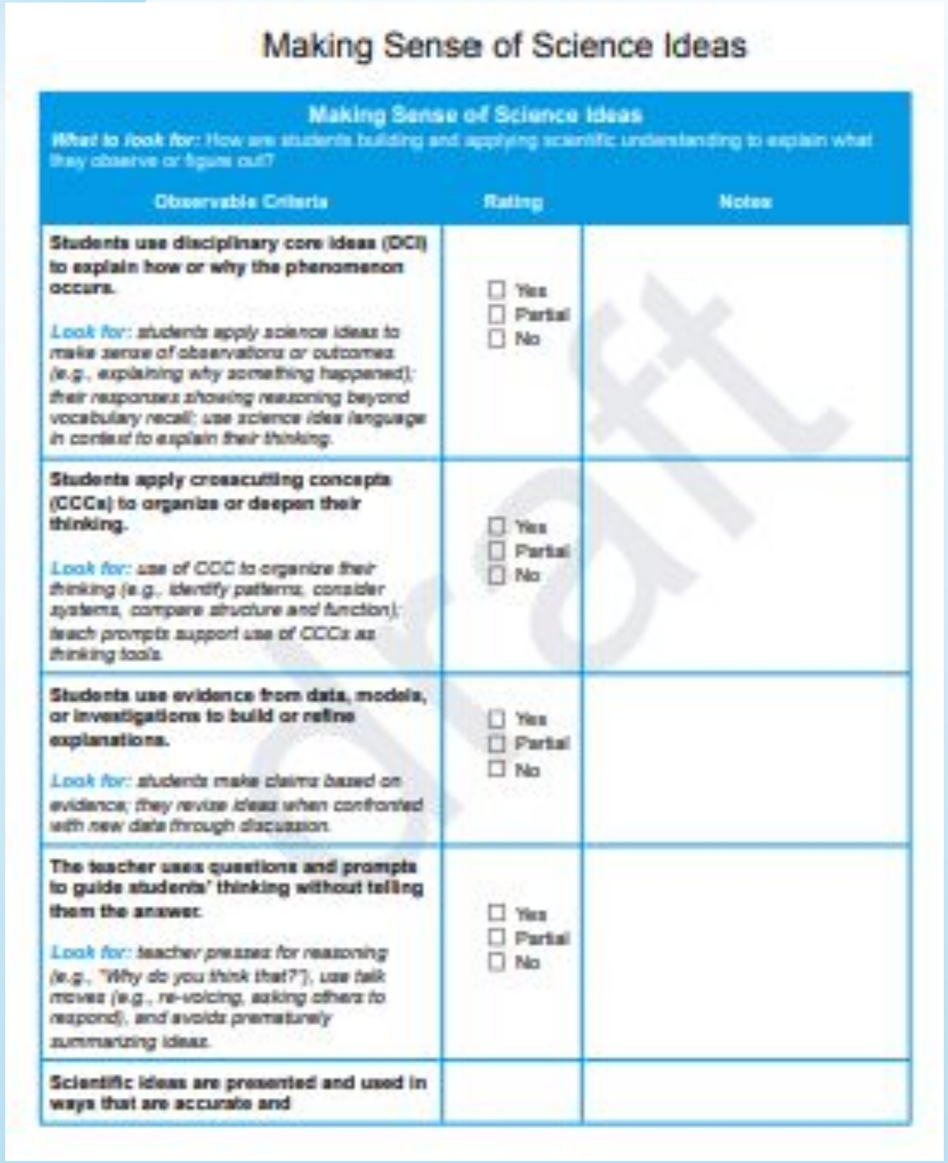

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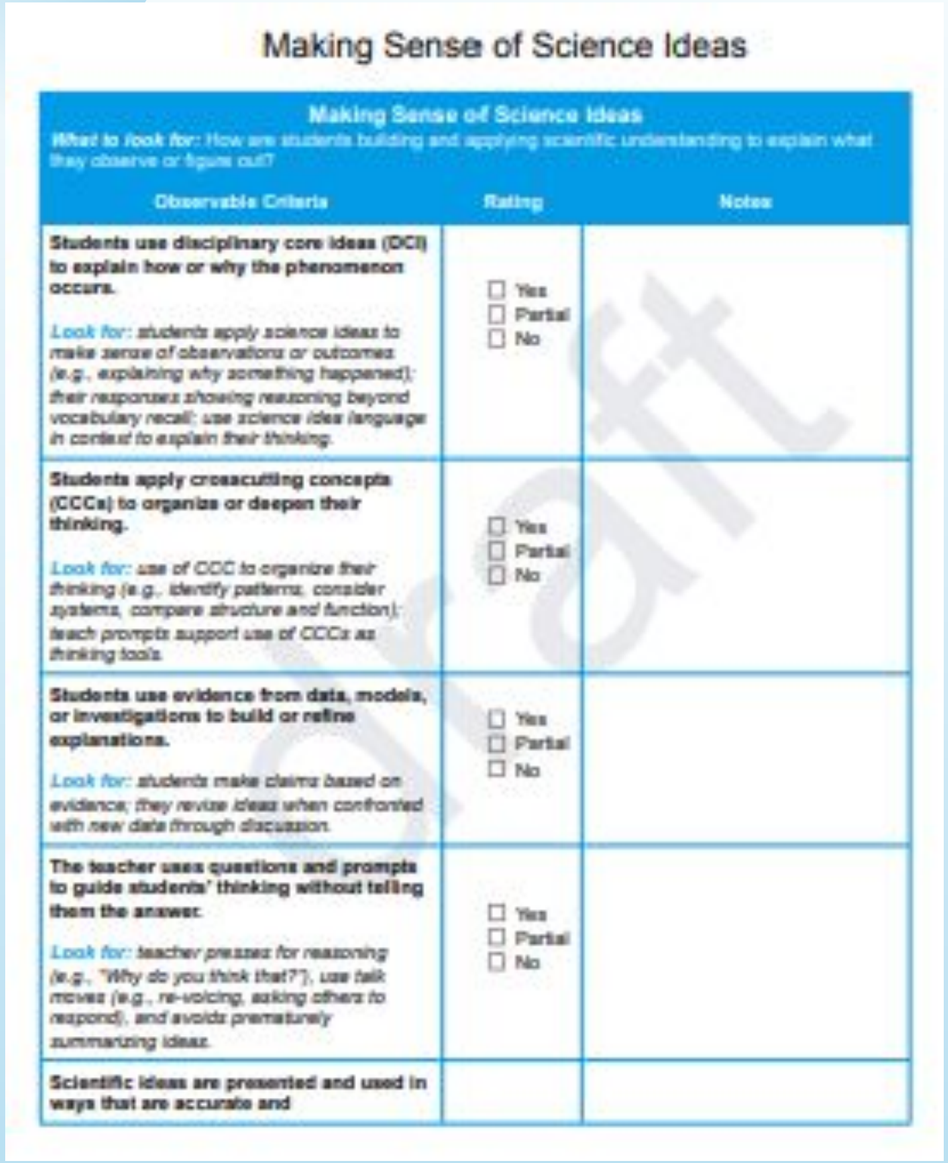

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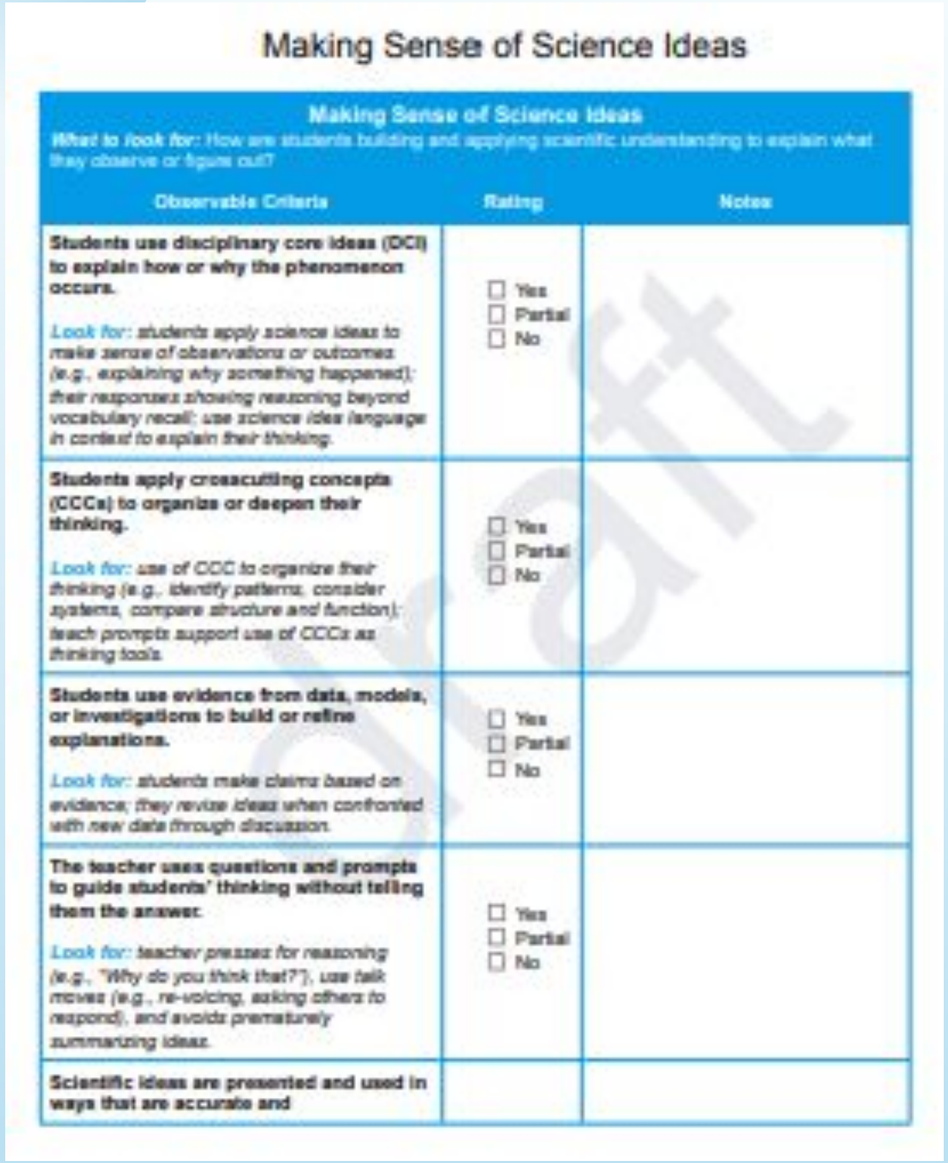

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What patterns did you notice across the three videos:

- Please use the hand raise feature to share
- Or type your noticings in the chat

Indicators of Effective Teaching

3c Engaging Students in Learning

Rich Learning Experiences: Students demonstrate agency and critical thinking in completion of tasks and activities that require high levels of intellectual engagement.

Collaboration and Teamwork: Student collaboration is a key component of learning and engagement, and students take initiative to collaborate in new or unplanned ways that further their learning and make it more engaging and meaningful.

Use of Instructional Materials and Resources: Instructional materials and resources are used effectively to support intellectual engagement and deep learning of the content.

Opportunities for Thinking and Reflection: Individual lessons, activities, and tasks, as well as instructional pathways, have multiple and effective opportunities to think, reflect, and consolidate understanding.

Indicators of Effective Teaching

3d Using Assessment for Learning

Clear Standards for Success: Collaborative goals, the characteristics of high-quality work, and the criteria established as evidence of success are clear to students and those supporting them.

Monitoring Student Understanding: Teachers and students are constantly monitoring learning and making use of specific strategies to elicit evidence of understanding.

Timely, Constructive Feedback: High-quality feedback comes from many sources, including students; it is specific and focused on improvement.

Indicators of Effective Teaching

Science Education Will Involve More
Facts and terminology learned as needed while developing explanations and designing solutions supported by evidence based arguments and reasoning
Systems thinking and modeling to explain phenomena and to give a context for the ideas to be learned
Students conducting investigations, solving problems, and engaging in discussions with teachers' guidance
Students discussing open-ended questions that focus on the strength of the evidence used to generate claims
Students reading multiple sources, including science-related magazines, journal articles, and web-based resources
Multiple investigations driven by students' questions with a range of possible outcomes that collectively lead to a deep understanding of established core scientific ideas
Students writing journals, reports, posters, media presentations that explain and argue
Providing supports so that all students can engage in sophisticated science and engineering practices

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School administrators who do not understand the nature of the changes required by the NGSS may place demands on teachers, including criteria for evaluating teachers, which undermine implementation of the new strategies needed. It is unrealistic, for example, to assume that each day or two the classroom should move onto a different performance expectation or to assume one-to-one mappings between sequences of lessons and performance expectations. Multiple lessons will need to build toward performance expectations over time (Krajcik et al., 2014). **It is essential that administrators themselves learn about the goals and strategies to meet them that are implied by the adoption of the NGSS so that they recognize the changes that teachers are attempting and support teachers in implementing them effectively.**

(*Guide to Implementing the next Generation Science Standards*, 2015)

More of this…	*Less of this…*
Students engage in the NGSS practices to build a **deeper understanding** of science and engineering content and make sense of phenomena and design solutions	Students study the meaning of science content that **teachers explain** to them. Students memorize definitions and rote procedures
Students develop models of systems within the natural world and use them to explain phenomena or solve problems	**Teachers present** models that describe phenomena in the natural world
Students learn science as an **iterative, dynamic, creative, and collaborative process** similar to how real scientists and engineers do their work	Students learn **science as a collection of facts** and learn that these facts were found using a singular and linear "scientific method," disconnected from how real scientists and engineers do their work
Practices provide students with relevant, **real world learning** in which they must investigate and problem solve using critical thinking	Students learn to conduct investigations following **step-by-step** instructions
Students build science and engineering understanding using a **variety of practices in investigations, experiments, and project-based experiences**	Students use **one practice** per investigation/ experiment
Science content and science practice are **integrated**	Science content and practices taught in **isolation**
Student **reasoning and argumentation** play a central role in understanding labs and text	Student thinking is limited by a **"cookbook"** approach to lab experiences and problems or end-of-the-chapter questions and test experiences
Science and engineering notebooks reflect student thinking using the science and engineering practices to understand content and show **development and revision of students' scientific models**	Science notebooks reflect only students' ability to **take notes or copy** teacher models

2016 Science Framework FOR CALIFORNIA PUBLIC SCHOOLS Kindergarten Through Grade Twelve Chapter 11 Instructional Strategies for CA NGSS Teaching and Learning in the Twenty-First Century. (n.d.). https://www.cde.ca.gov/ci/sc/cf/documents/scifwchapter11.pdf?utm_source=chatgpt.com

More of this…	***Less of this…***
Engineering is integrated into all science disciplines	Engineering is treated as an **add-on**
Engaging in science and engineering practices allows students to **revise their thinking** and understanding	The science process is just a thing to learn/ apply and **“be done”.**
Students are actively engaged in the practices through investigations and experiments and technologies they have generated	Students are passively engaged in watching or participating in teacher-directed investigations and experiments
Crosscutting concepts build a **deeper and more connected** understanding of science as a whole	**No connection** among science content
Connection of the practices to the goals of **literacy** in science (purposeful reading and writing to strengthen science understanding)	Reading and writing **disconnected** from the purpose of learning
Student-to-student **discourse** is productive, using practices to explain phenomenon or solve problems	Student-to-student **discourse is limited** due to activities that provide only one exact outcome
Teacher **questioning** prompts and facilitates students’ discourse and thinking	Teacher questions students to seek a **confirmatory** right answer
Learning takes place routinely in a **variety of settings**: in the classroom, outdoors, in school gardens and in the field, in museums and aquariums, and in the community	Learning only **occurs indoors** in the classroom

2016 Science Framework FOR CALIFORNIA PUBLIC SCHOOLS Kindergarten Through Grade Twelve Chapter 11 Instructional Strategies for CA NGSS Teaching and Learning in the Twenty-First Century. (n.d.). https://www.cde.ca.gov/ci/sc/cf/documents/scifwchapter11.pdf?utm_source=chatgpt.com

Impact of Leadership on Science Instruction

1. Leadership decisions determine whether students receive **coherent, equitable, and NGSS-aligned** science instruction.

2. When science is not intentionally prioritized, instructional time becomes inconsistent and inequitable across classrooms and schools.

3. Leaders set the **conditions** that make high-quality science teaching possible — or unintentionally undermine it.

Leadership Decisions

✔️ **Prioritize Science in Scheduling and Policy**

- Ensure science is treated as a **core subject**, not something taught "if time allows."
- Protect dedicated instructional minutes for science across all grade levels.
- Avoid relying on reading series or ELA curricula as proxies for science instruction — **science cannot be taught effectively through literacy programs**.
- Establish policies that reinforce the importance of hands-on investigation and student sensemaking.

✔️ **Create Time for Science Instruction**

- Ensure classroom schedules include **regular, consistent blocks** for science instruction.
- In early elementary grades (K–2), science can look like **15–20 minutes per day** of structured investigations and sensemaking.
- As students get older, instructional time should expand into **longer, more sustained investigation blocks**.
- Protect time for teachers to plan science lessons and collaborate in PLCs.

✔️ **Align Professional Learning**

- Provide ongoing PD that supports NGSS shifts: modeling, discourse, investigations, and 3D integration.
- Ensure all instructional leaders (administrators, coaches, teacher leaders) share a **common understanding** of what high-quality science instruction looks like.
- Provide teachers with opportunities to analyze student work, plan units, and rehearse SEPs (e.g., modeling, explanation, argumentation).

✔️ **Adopt High-Quality, NGSS-Aligned Curriculum**

- Select science instructional materials specifically designed for NGSS and not retrofitted from older content.
- Support teachers with rollout, unit planning time, and frequent opportunities for coaching and reflection.
- Monitor implementation through walkthroughs and examination of student work.

✔️ **Build Coherent Assessment Systems**

- Use NGSS-aligned classroom assessments that measure sensemaking, not recall.
- Ensure assessments provide insight into **how students think**, not just what they can answer.
- Support teachers in designing or using 3D performance tasks.

Leadership Next Steps

✔️ Continue to Build Your Science Knowledge

- Develop a strong understanding of NGSS, SEPs, CCCs, and 3D learning.
- Participate in science-focused PD and walkthroughs.
- Build confidence in identifying strong vs. weak science instruction.

✔️ Use Evidence to Identify Patterns

Analyze:

- Classroom walkthrough data
- Student work samples
- PLC conversations
- Assessment data
- Teacher self-assessments

Look for patterns in:

- Instructional strengths
- Gaps or inconsistencies
- Equity in access to high-quality instruction
- Supports teachers need to be successful

✔️ Prioritize High-Leverage Shifts

Examples of actionable, high-impact next steps:

- Increase student discourse in science
- Strengthen modeling and evidence-based reasoning
- Expand use of NGSS-aligned investigations and performance tasks
- Improve coherence across grade bands
- Increase protected minutes for science instruction

✔️ Create Coherent Improvement Plans

- Set focused, measurable goals
  - *Example: "Increase student use of models across grades K–5."*

- Provide time, materials, and coaching to support the shift.
- Communicate clear expectations and supports.
- Monitor progress through student work, walkthroughs, and teacher feedback.

Next Steps

- Follow up email from Anji Garza, includes slides, agenda, and video recording
- Encourage your teachers to attend the educator sessions each month.
- Join us for the next session.
- Complete the Science Survey and share with teachers.

Science Professional Learning in Illinois

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THANK YOU!