ILLINOIS STATE BOARD OF EDUCATION

REGIONAL OFFICE OF EDUCATION #47
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SCIENCE EDUCATORS SESSION 5:

Sparking Curiosity: Cultivating Student-Driven Questions in Science

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 (Tech, Chat)

Heather Galbreath, 6th Grade Science Teacher Galesburg, IL

Brian Gibbs, Educator, Bradley School District 61

Sarah Meador, Director of ROE Services, ROE 8

Dawn Novak, Professional Learning Designer, Northwestern University

Nate Nugent, High School Science Teacher, Streator, IL

Kristin Rademaker, Professional Learning Specialist, NSTA

Misty Richmond, Middle School Science Teacher, CPS

Richard Stokes, University of Illinois - Springfield

Nicole Vick, Curriculum Developer, Northwestern University

You! Breakout Participant, Speaker

Purpose & Desired Outcome

Desired Outcome

By the end of this meeting we will have:

- Experience the science practice of **Asking Questions** from the perspective of their students.
- Engage in **phenomena-based tasks** that spark curiosity and prompt authentic, investigable questions.
- **Refine and improve questions** through collaborative routines and discussion.
- Develop a clearer understanding of how **effective questioning supports sensemaking** and drives investigations across grade levels.
- Leave with **questioning structures, talk moves, and classroom-ready tools** that empower students to take ownership of their learning.

Purpose

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

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

Please rename yourself and include your grade level. e.g. 2nd Grade, Anji Garza.

What do we do with student questions?

- NOT About the one right way to respond

- What could this do for student learning?
- What can we do next?

Anchoring Phenomenon: Seed Dispersal

Student Question A:
"Are those dandelion seeds?"

Anchoring Phenomenon: Seed Dispersal

Student Question B:

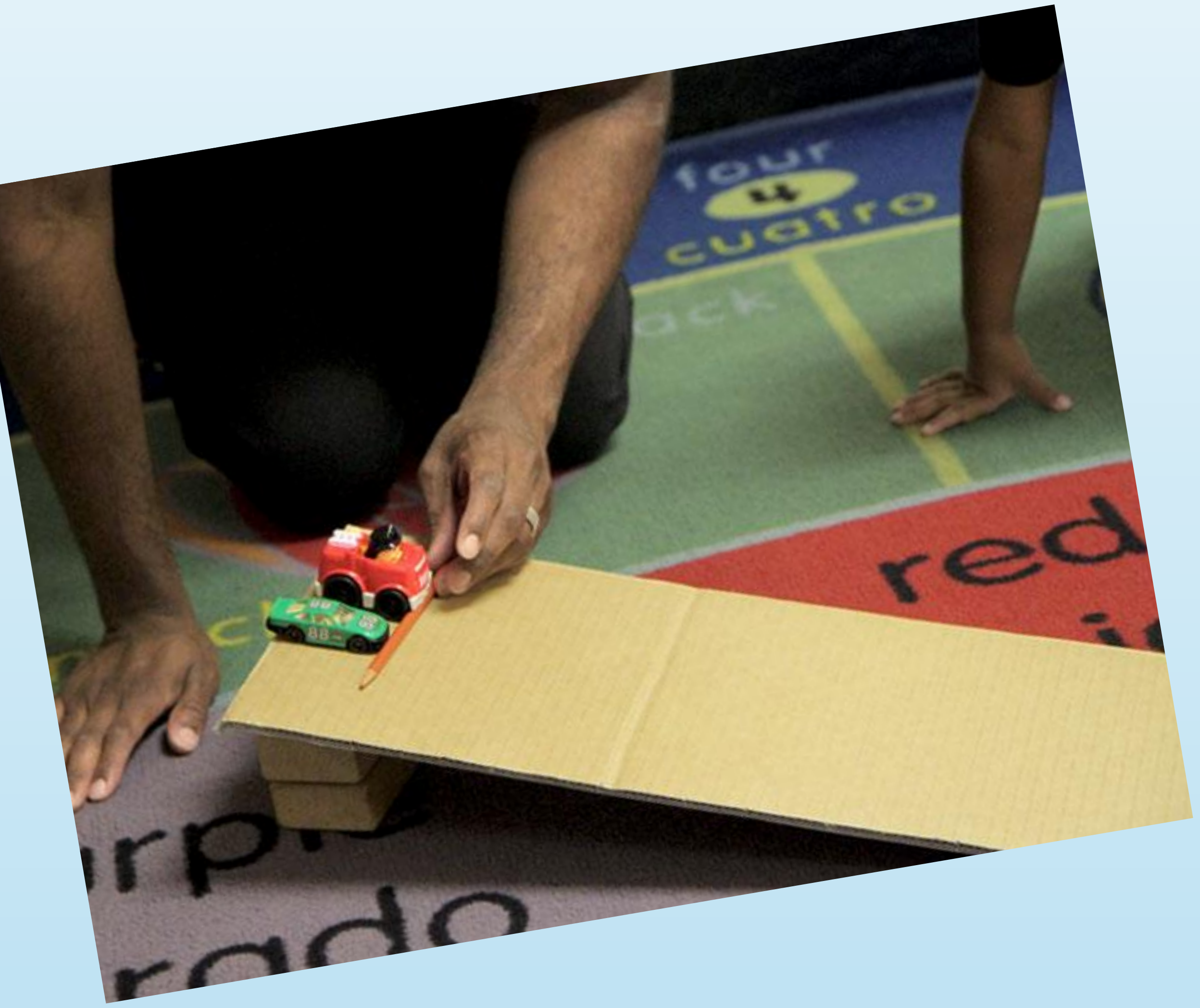
"How do seeds move away from the plant?"

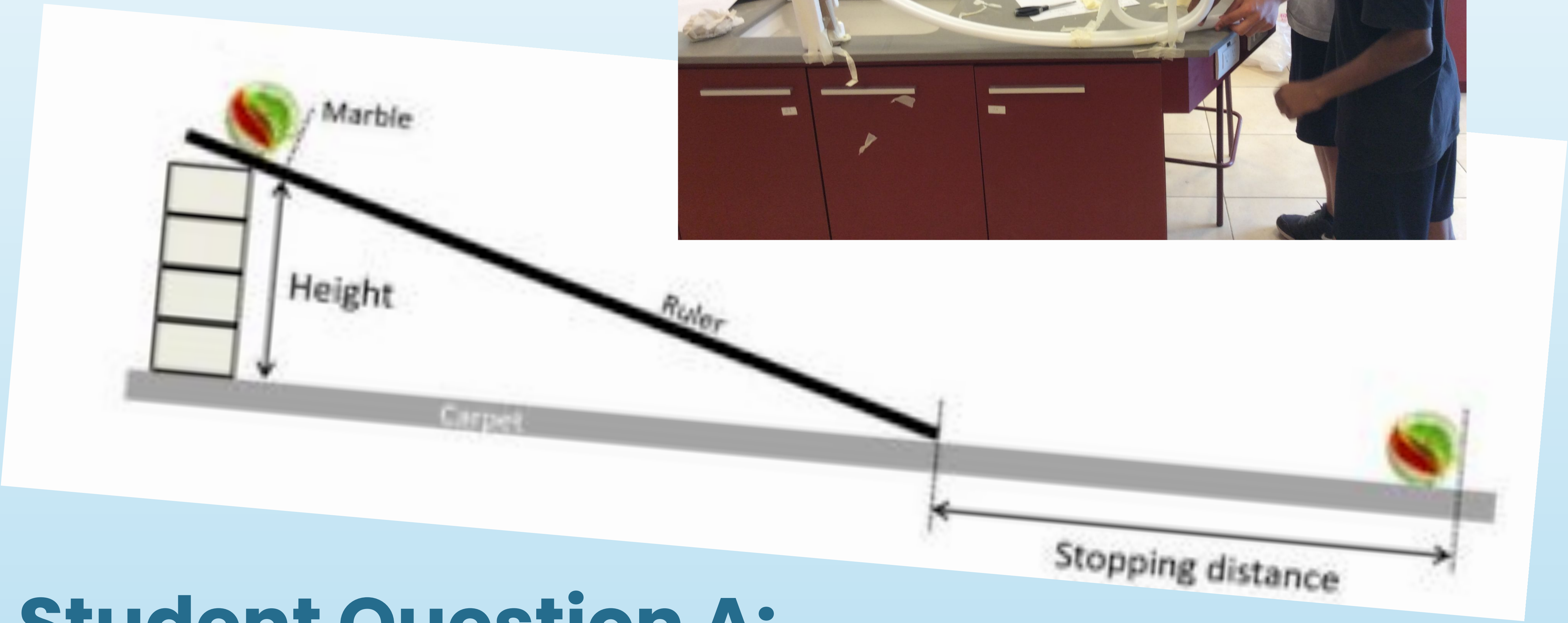
Anchoring Phenomenon: Seed Dispersal

Student Question C:

"Do different seeds move in different ways?"

Anchoring Phenomenon: Toy Cars/Ramps

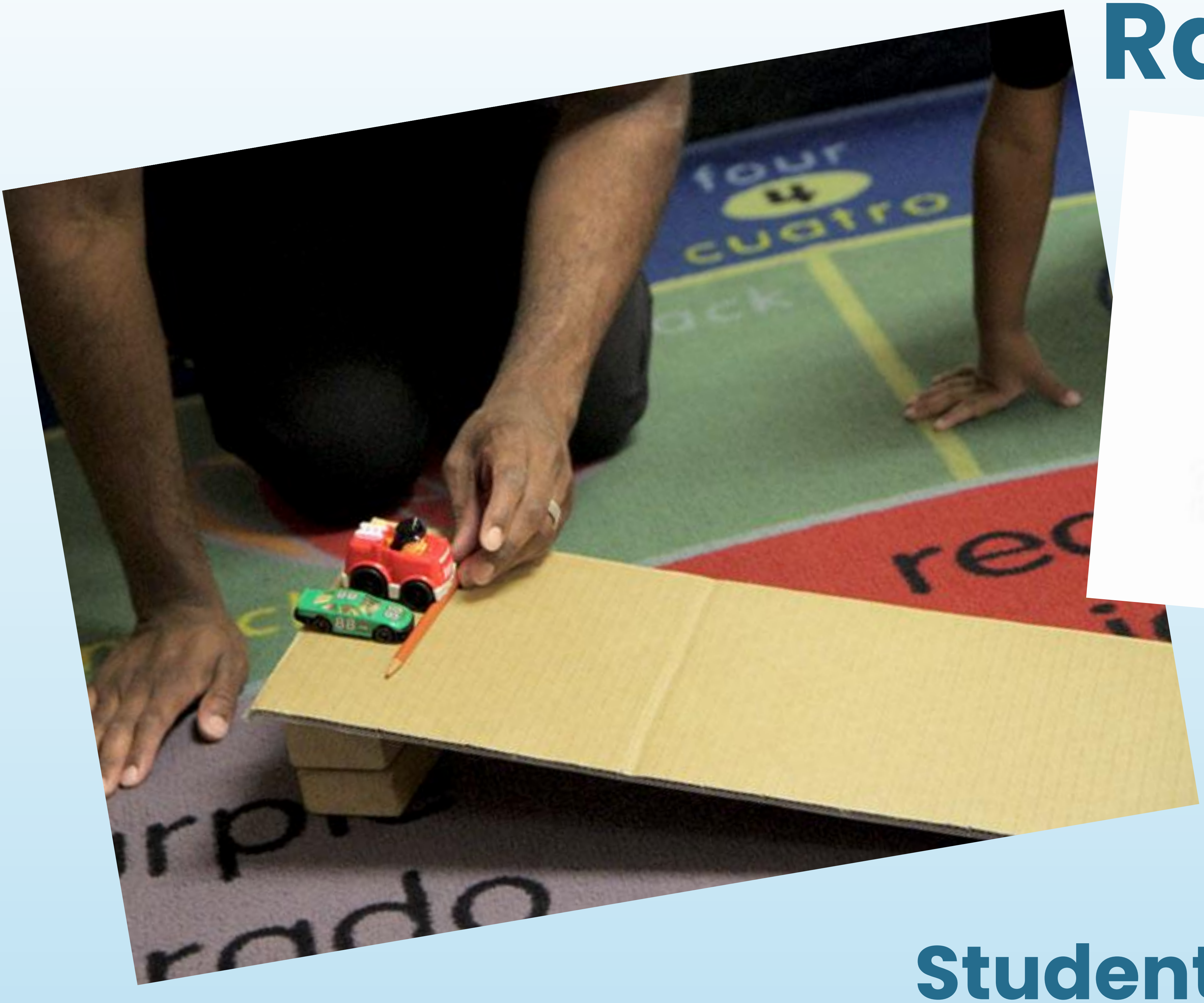


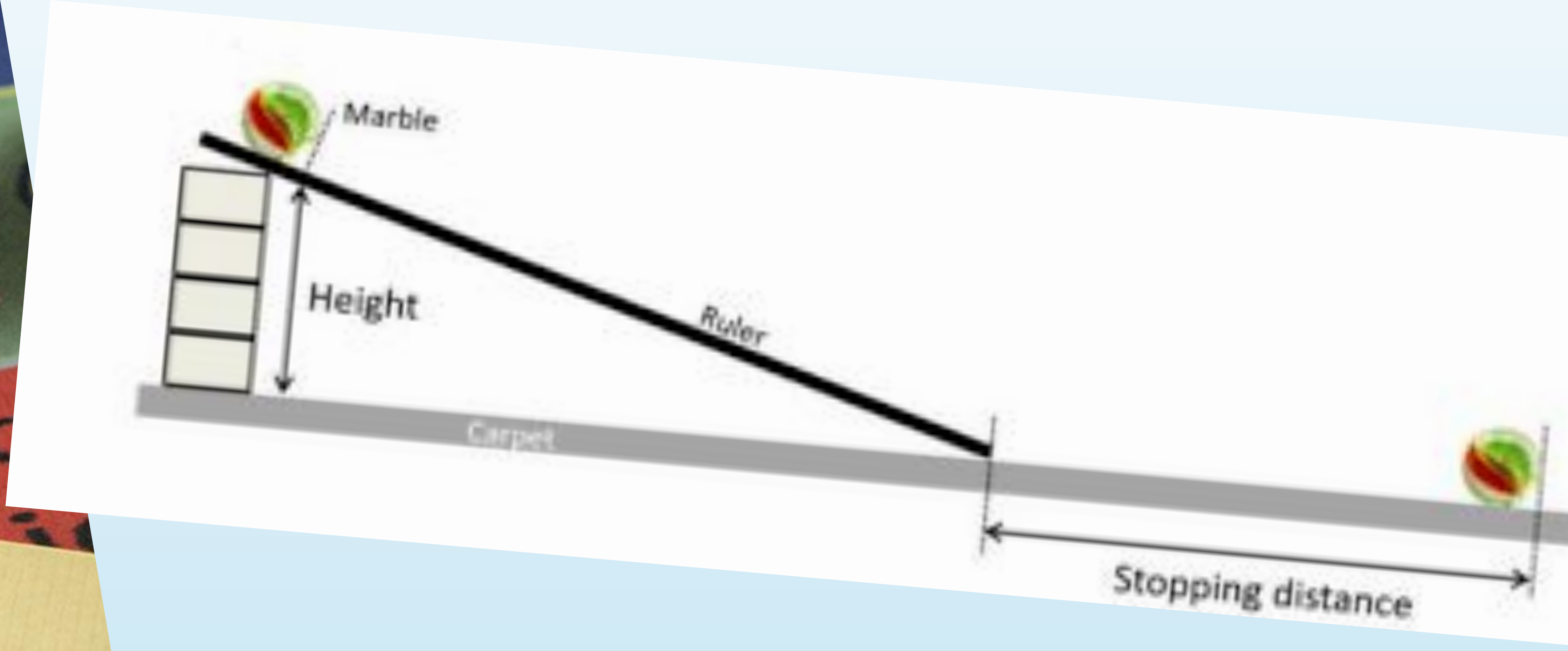


Student Question A:

"How do they decide how tall real roller coaster should be?"

Anchoring Phenomenon: Toy Cars on Ramps

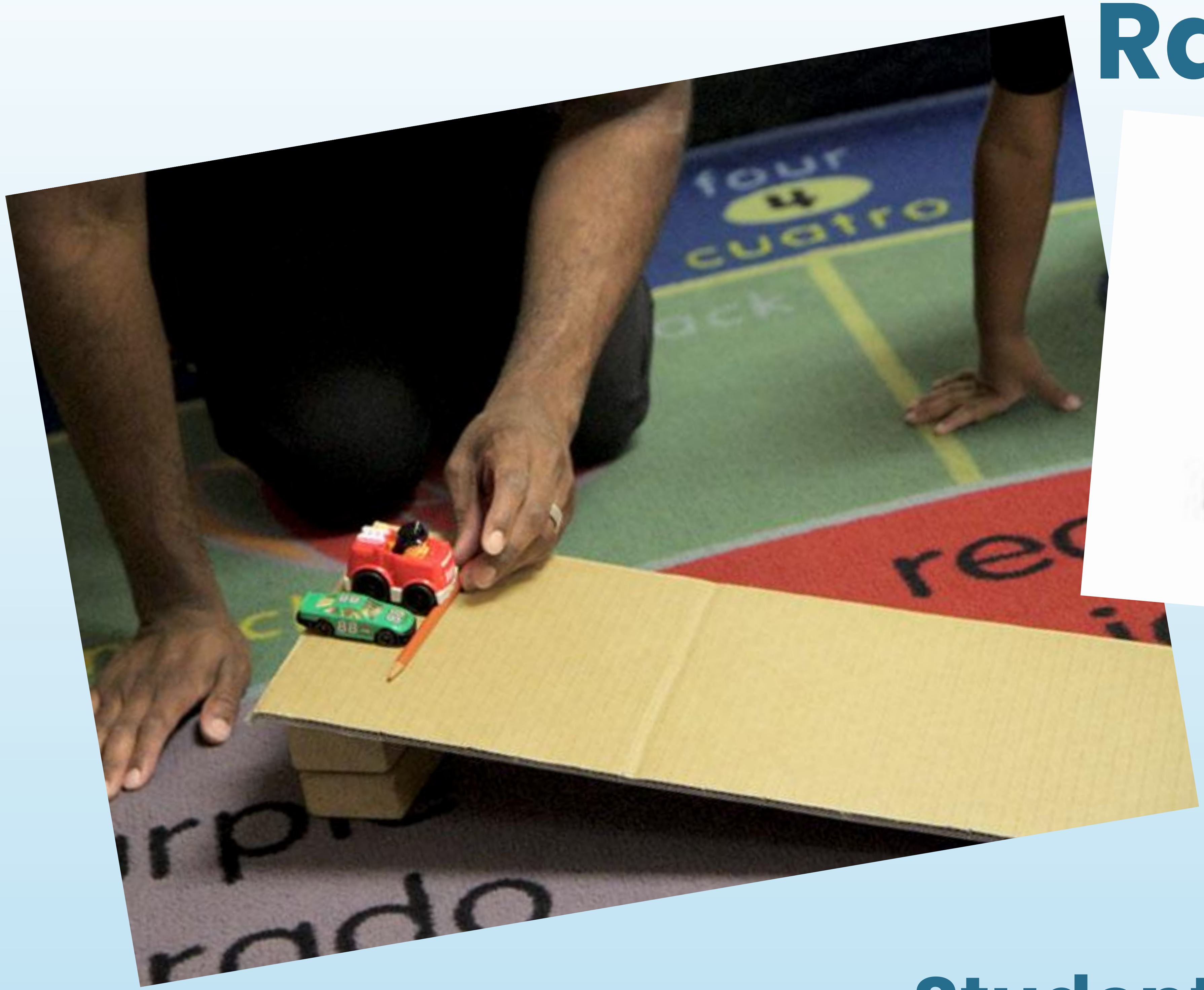


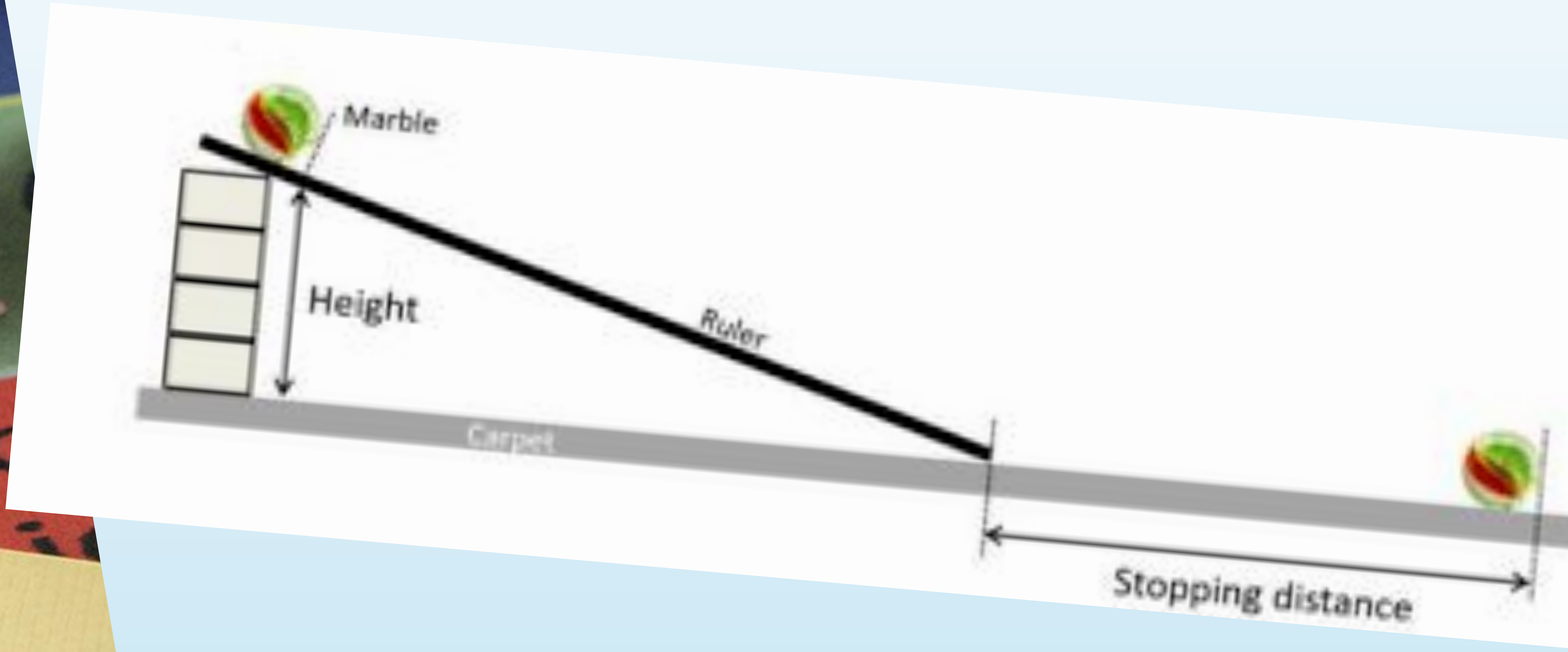


Student Question B:

"Why does one car go faster than the other?"

Anchoring Phenomenon: Toy Cars on Ramps





Student Question C:
"Does making the ramp steeper make the car go faster?"

Anchoring Phenomenon:
Dead Animal Decomposition/Roadkill

Student Question A:
"What happens to the animal over time?"

Anchoring Phenomenon:
Dead Animal Decomposition/Roadkill

Student Question B:
"How did the animals die? Can't we protect them?"

Anchoring Phenomenon: Dead Animal Decomposition/Roadkill

Student Question C:
"Where does the animal go after it dies?"

Classroom Example

Focus- What do you notice the teacher doing to support students in developing questions?


OpenSciEd
Classroom Spotlight
DQB in Action
With Gretchen

Breakout Group Discussion:

3
minutes

- **What do you notice the teacher doing to support students in developing questions?**


OpenSciEd
Classroom Spotlight
DQB in Action
With Gretchen

Post in the chat:

- **What do you notice the teacher doing to support students in developing questions?**


OpenSciEd
Classroom Spotlight
DQB in Action
With Gretchen

Post in the chat:

- **What do you notice the teacher doing to support students in developing questions?**

Resources to Help Students Develop Scientific Questions

With camera off, take a couple of minutes too look through the Asking Questions Tool.

Be ready to share thoughts on how you might use the tool or parts of the tool to help your students refine their questions. (Add ideas into the chat when you are ready.)

A. Strategies & Tools for Supporting the Science and Engineering Practices

Asking Questions and Defining Problems

Asking Questions Tool: Open and Closed Questions

1. What is the question you are working on?

2. What is the purpose of your question? Circle one of the reasons below or write in your reason.

Here are some reasons why people ask questions in science:

- ❑ *We don't understand how the phenomenon (or a part of the phenomenon) works.*
- ❑ *We have a disagreement (in our model or with someone's explanation or argument).*
- ❑ *We need to test an idea we have.*
- ❑ *Other reason:* ______________________________

Close-ended and open-ended questions: Questions that can be answered with "yes" or "no" or with a single word are closed-ended questions. Asking open-ended questions gives you space to figure out more things. Scientific questions are open-ended questions.

3. Is your question close-ended or open-ended? Circle one.
   - close-ended (Complete step 4.)
   - open-ended (Skip to step 5.)

4. Revise your question to make it an open-ended question. Think about what you want to explain about the phenomenon.
Try using one of these question stems:
   - *How does ... ?*
   - *Why does ... ?*
   - *What happens when ... ?*
   - *What happens if ... ?*

Resources to Help Students Develop Scientific Questions

The QFT, on one slide…

1) Question Focus
2) **Produce** Your Questions
   - ✓ Follow the rules
   - ✓ Number your questions
3) **Improve** Your Questions
   - ✓ Categorize questions as Closed or Open-ended
   - ✓ Change questions from one type to another
4) **Strategize**
   - ✓ Prioritize your questions
   - ✓ Action plan or discuss next steps
   - ✓ Share
5) **Reflect**

1. Ask as many questions as you can
2. Do not stop to discuss, judge or answer
3. Record *exactly* as stated
4. Change statements into questions

Closed-Ended: Answered with "yes," "no" or one word

Open-Ended: Require longer explanation

RQI

Source: The Right Question Institute

rightquestion.org

Name_______________ Hour______ Date________

Thermal Energy Lesson 1

Organizing our Questions & Planning Investigations

Look back at our Lesson 1 Investigation Data, Initial model and our related phenomena. What are some questions you have about how energy changes in or around objects when electricity is not involved. Be ready to share soon!

My top questions I want to investigate:	How we might investigate this question:

Resources to Help Students Develop Scientific Questions

Building Better Questions

Three dialogic strategies to promote students' scientific thinking

By Ronald Rinehart and Mason Kuhn

Exploring a new energy-related phenomenon in class, whether it is electrical circuits lighting up light bulbs, toy cars crashing, or even videos of great horned animals butting heads, can be exciting for students. However, even when highly engaged, students may not necessarily develop high quality scientific questions about the phenomenon. Although students are naturally curious, research suggests that higher quality science questions often do not emerge spontaneously (Chin and Kayalvizhi 2002). Teachers can support students with specific strategies to elicit questions that lead to higher quality investigations (Chin 2007). As part of a multi-year project working with teachers on a fourth-grade unit exploring energy concepts, we have adapted several strategies to use as a toolkit of dialogic instructional techniques for productively managing student discussions around building better scientific questions. These insights are drawn from a series of 13 lessons in which students engaged in phenomena explorations while constructing open-ended investigable questions aimed at knowledge transformation around concepts of energy as described in the *Next Generation Science Standards* for energy (4-PS3-1 to 4-PS3-4; NGSS Lead States 2013).

Our toolkit focuses on dialogic scaffolding techniques for *building* questions rather than merely *posing* questions. In many classroom science investigations, students spontaneously pose questions. These questions can be off-target, unmanageable, and not amenable to scientific investigation (Chin and Kayalvizhi 2002). Typical questions involve simple concepts or fail to aim at uncovering causes of phenomena. Students may also pose questions that cannot be investigated for various reasons (equipment, safety, access to experimental tools or a geographic location, etc.). A purposefully built question, on the other hand, is one that reflects the deeper aims of the inquiry process like developing a causal explanation, uncovering patterns, and making predictions.

WHY FOCUS ON QUESTIONING?

Learning to ask high-quality questions is a way for students to bridge the cognitive gap between what they currently know and what they would like to know. The formulation of high-quality questions as a creative knowledge-building practice is recognized in the *Next Generation Science Standards* (*NGSS*) as one of the eight core science and engineering practices (SEP), Asking Questions and Defining Problems. Generating, building, revising, and resolving high-quality questions are essential phases that can lead to deep knowledge-building experiences for students.

Teachers can build questions for students ahead of an investigation, but this does not provide students with an authentic science experience. The techniques described in this article help teachers move from teacher-constructed questions and teacher-centered, IRE-style discussions, toward student questions constructed through deeper dialogic forms of discussion. IRE-style discussions (Mehan 1979) focus on the teacher Initiating a question, a student Responding to the question, and the teacher Evaluating the correctness of the response. This provides students and teachers both with superficial cognitive engagement. In this article we outline three techniques that can be used individually or in unison to create a more cognitively rich and scientifically robust classroom environment focused on building scientific questions.

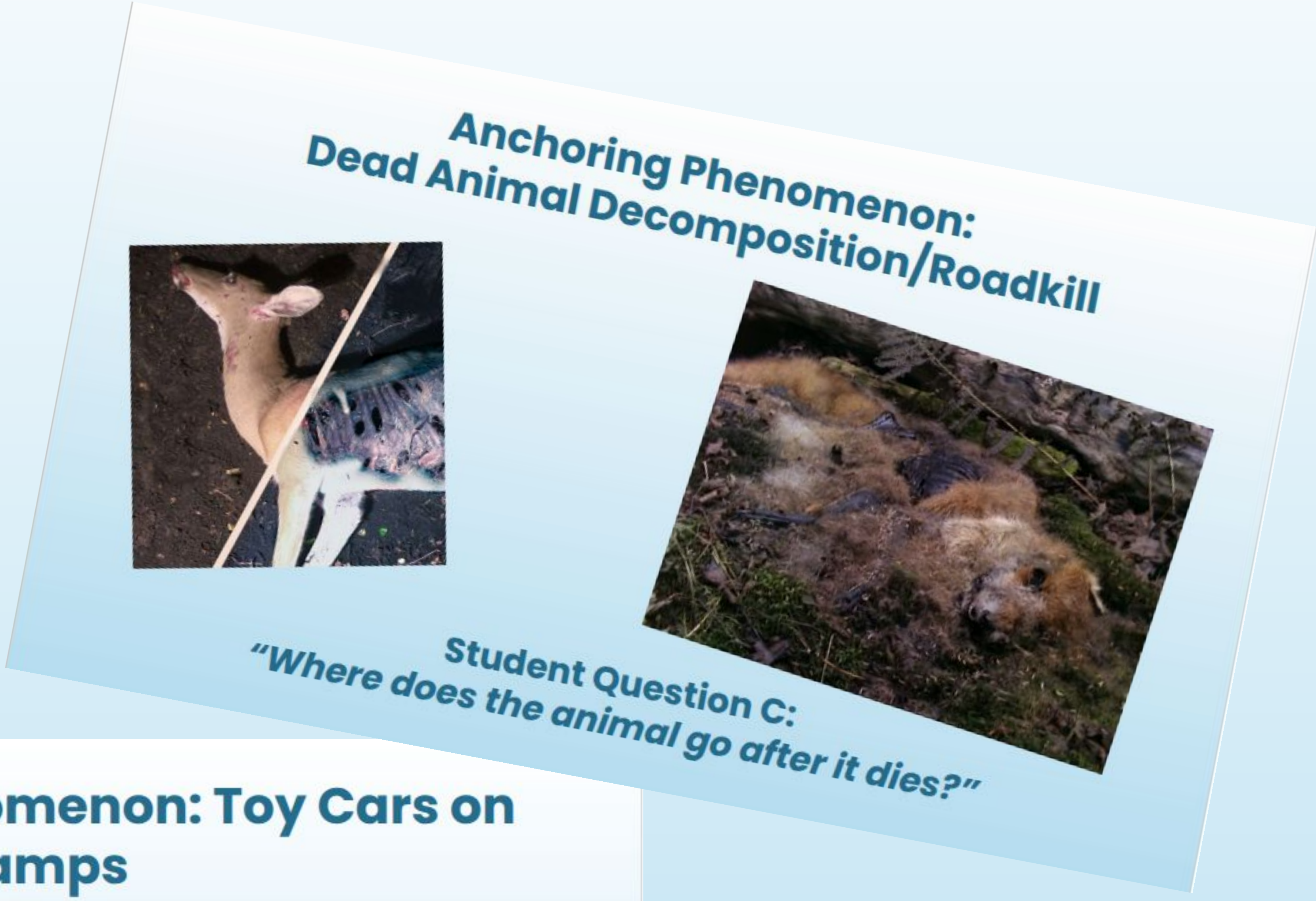
CLOSED VS. OPEN-ENDED QUESTIONS

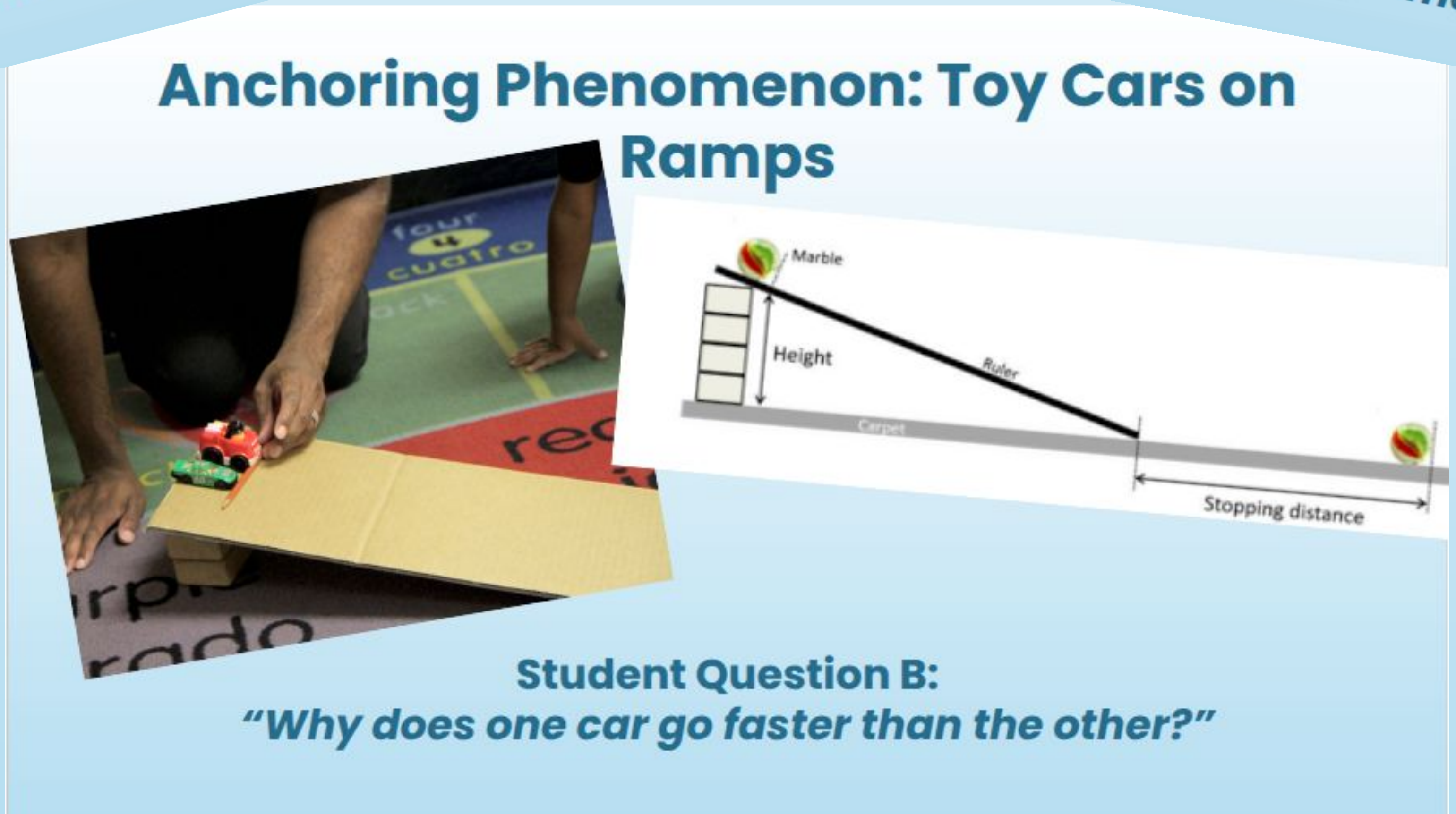
Closed questions provoke a simple response from a respondent. An open-ended question is one that cannot be answered with a "yes" or "no" response, or with a static response like a memorized definition. Open-ended questions require a deeper commitment to cognitive processes like reasoning, elaborating, and explaining (Chin and Kayalvizhi 2002).

The question *Did the ram get hurt?* is focused on a surface feature of the phenomenon, two rams colliding, and does not get at the deeper content (forms of energy and energy transfer). One way to help students make their questions more open-ended is to engage in a dialogic *reflective toss* (van Zee and Minstrell 1997). In the reflective toss, the teacher identifies a key component in need of further reflection by the students and without answering it, puts the question dialogically back

Question Revise!

7 minutes





How does the Driving Question Board support student learning?

Learning about the science idea

Knowing the body systems and levels of organization (cells, tissues, organs, systems)

Vs.

Figuring out HOW and WHY phenomena happen

- Developing a model that explains how we get energy out of food
  - Explain why we have cells
  - Argue why a chemical reaction is needed to get energy from food, why it occurs in cells

How does the Driving Question Board support student learning?

Phenomena are observable events that occur in the world that are opportunities to ask questions about how and why they happen. If we are strategic in selecting the right phenomena and raising productive questions from them, they can be contexts in which students figure out disciplinary core ideas in science.

The Phenomenon (The thing in the world we need to explain)	The Science Idea (What We Figure Out By Explaining the Phenomenon)
,	
.	

What is the role of the Driving Question Board throughout a unit of instruction?

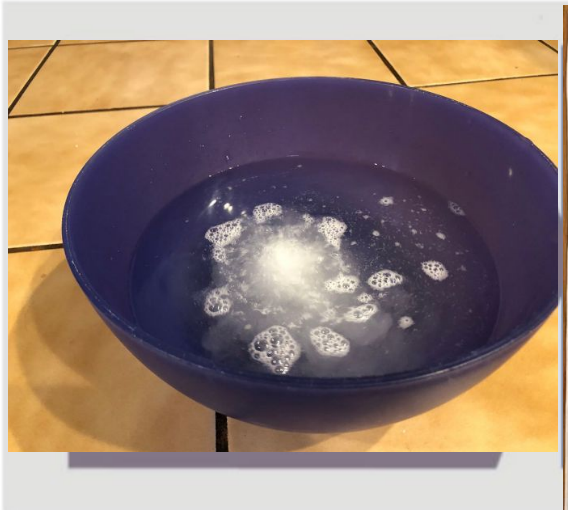
Anchoring Phenomenon Routine	Common experience of phenomenon; develop curiosity; connect to students' lives

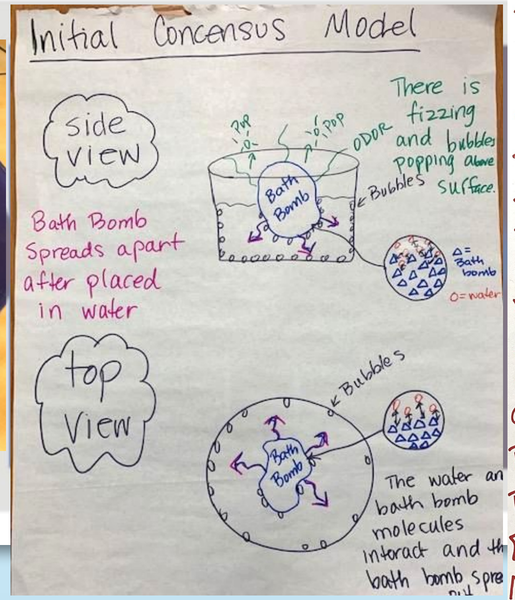
Element #1: Explore the phenomenon

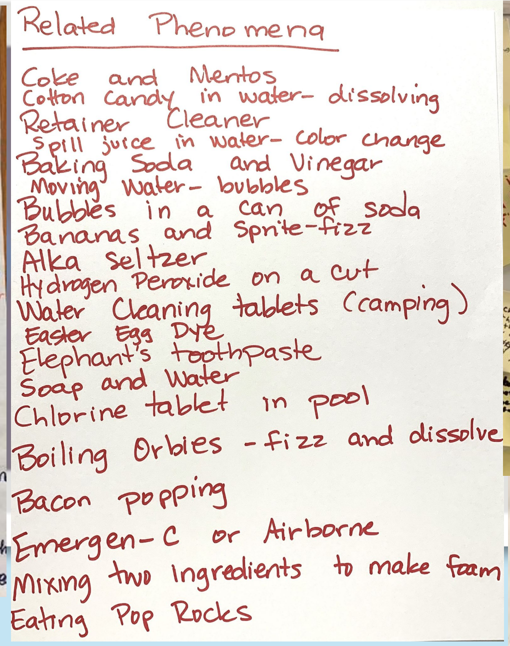
Element #2: Attempt to make sense

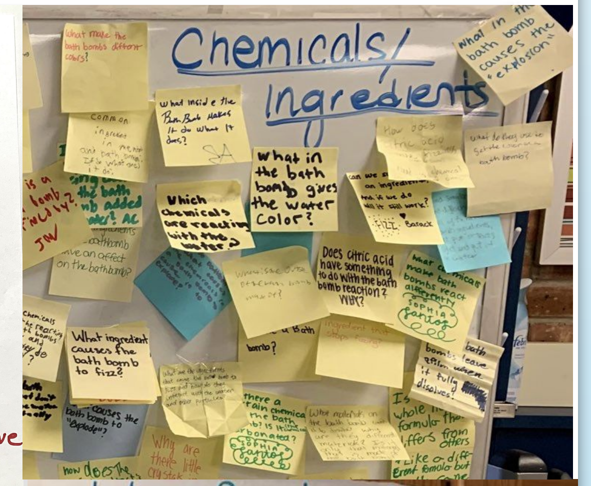
Element #3: Identify related phenomenon

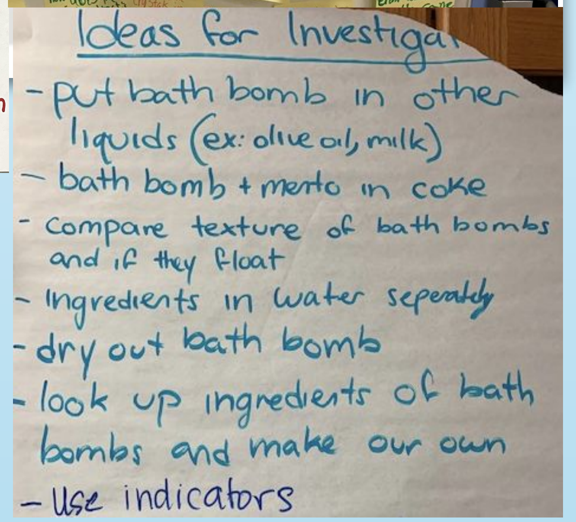
Element #4 Questions and next steps



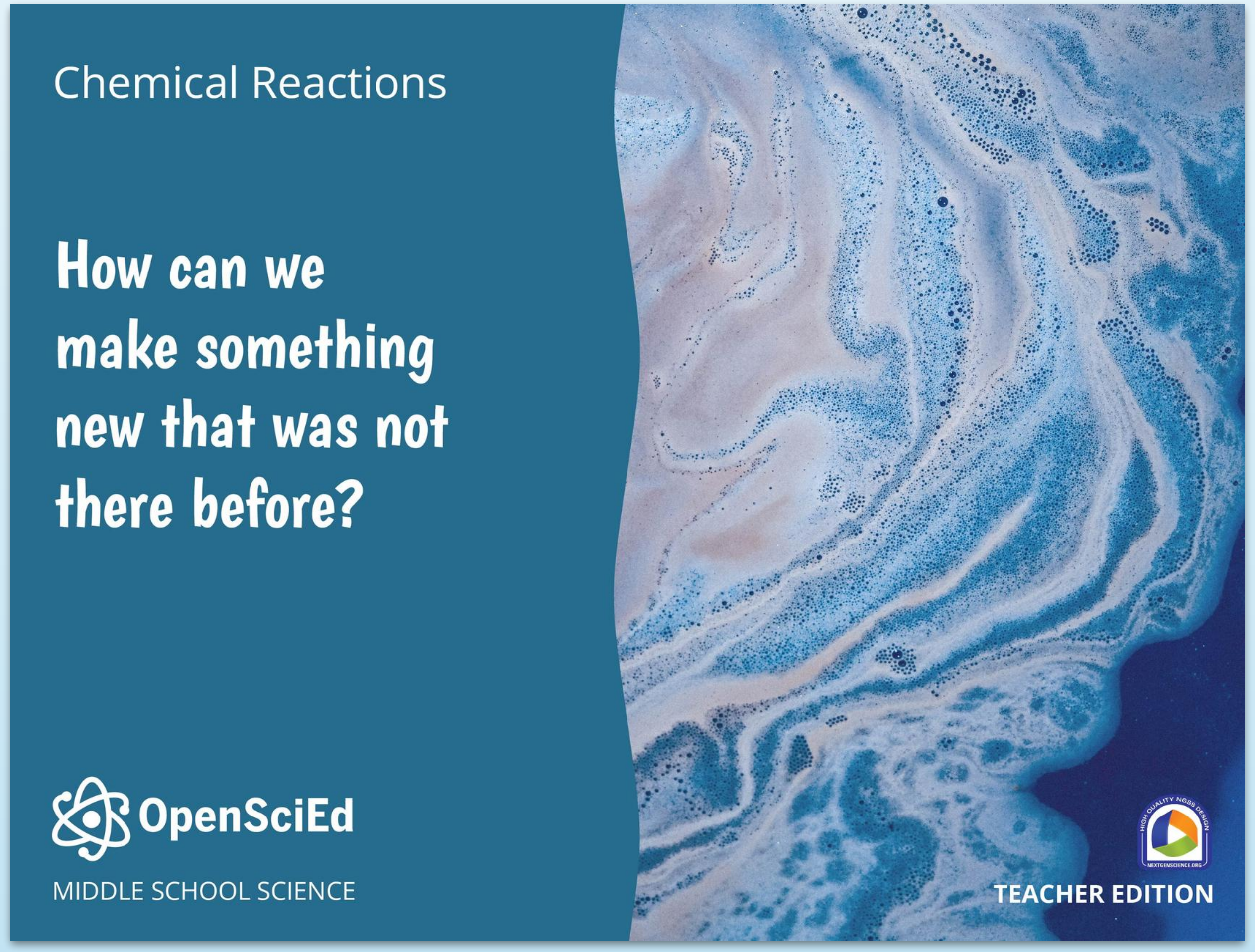






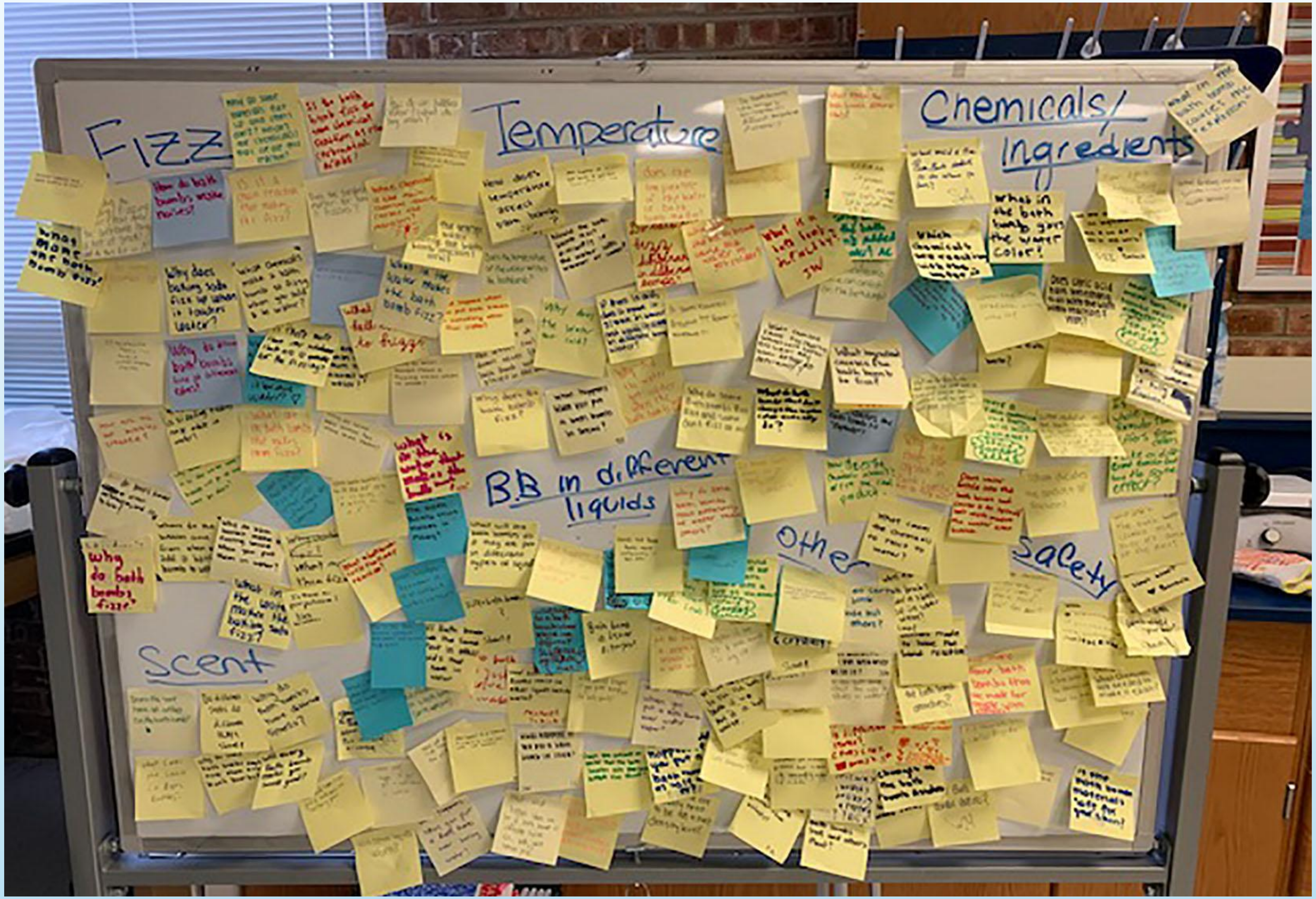


Lesson 1



14 Lessons - 25 days of instruction

What is the role of the Driving Question Board throughout a unit of instruction?

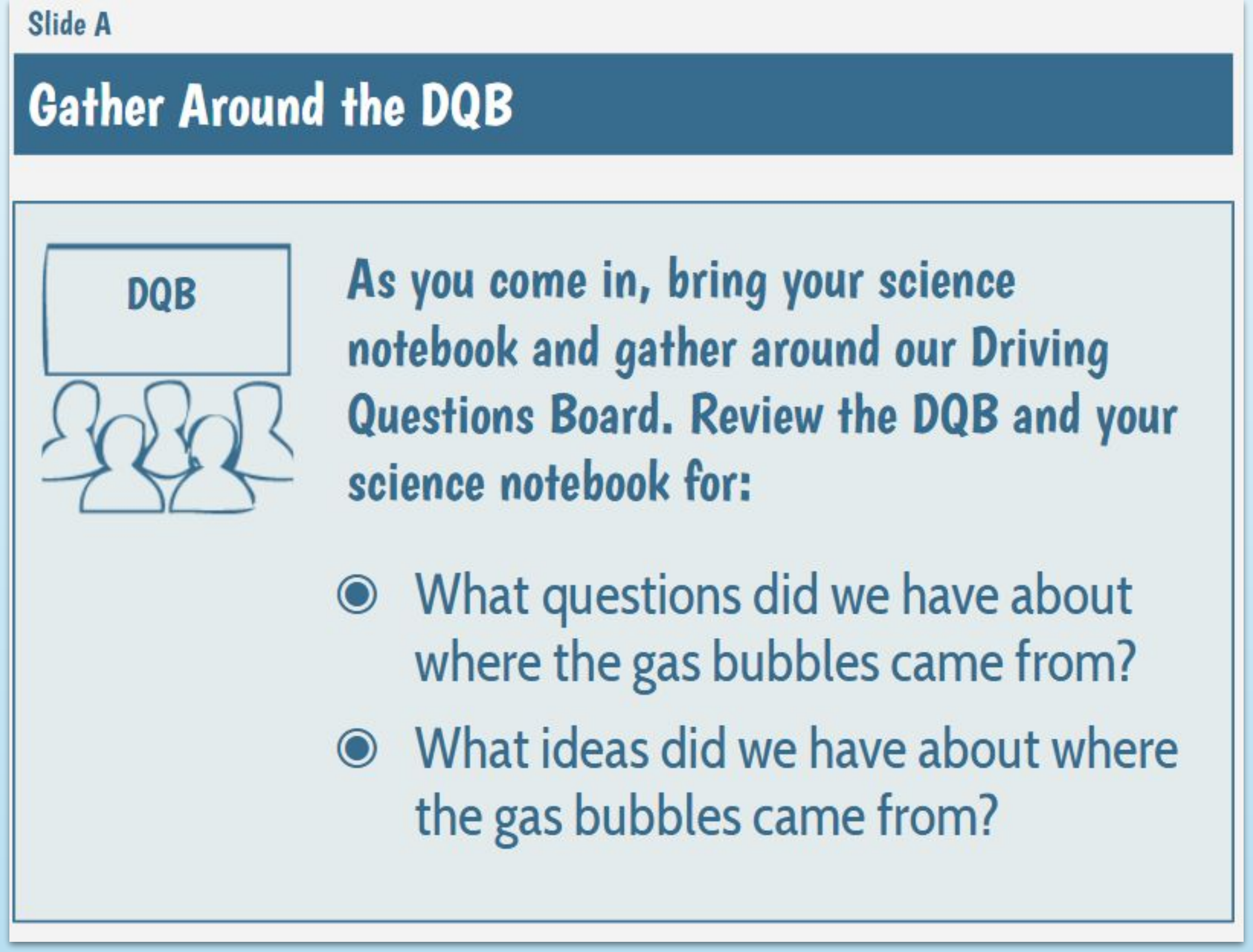


1.B Ask questions that arise from our observations of different bath bombs before and after they were added to water in order to seek additional information about what caused the changes (effects) we saw occurring. This includes what happened to the matter in the solid bath bombs and what caused the gas bubbles to appear as well as what kind of changes are happening to the matter in examples of other related phenomena we raised.

What is the role of the Driving Question Board throughout a unit of instruction?

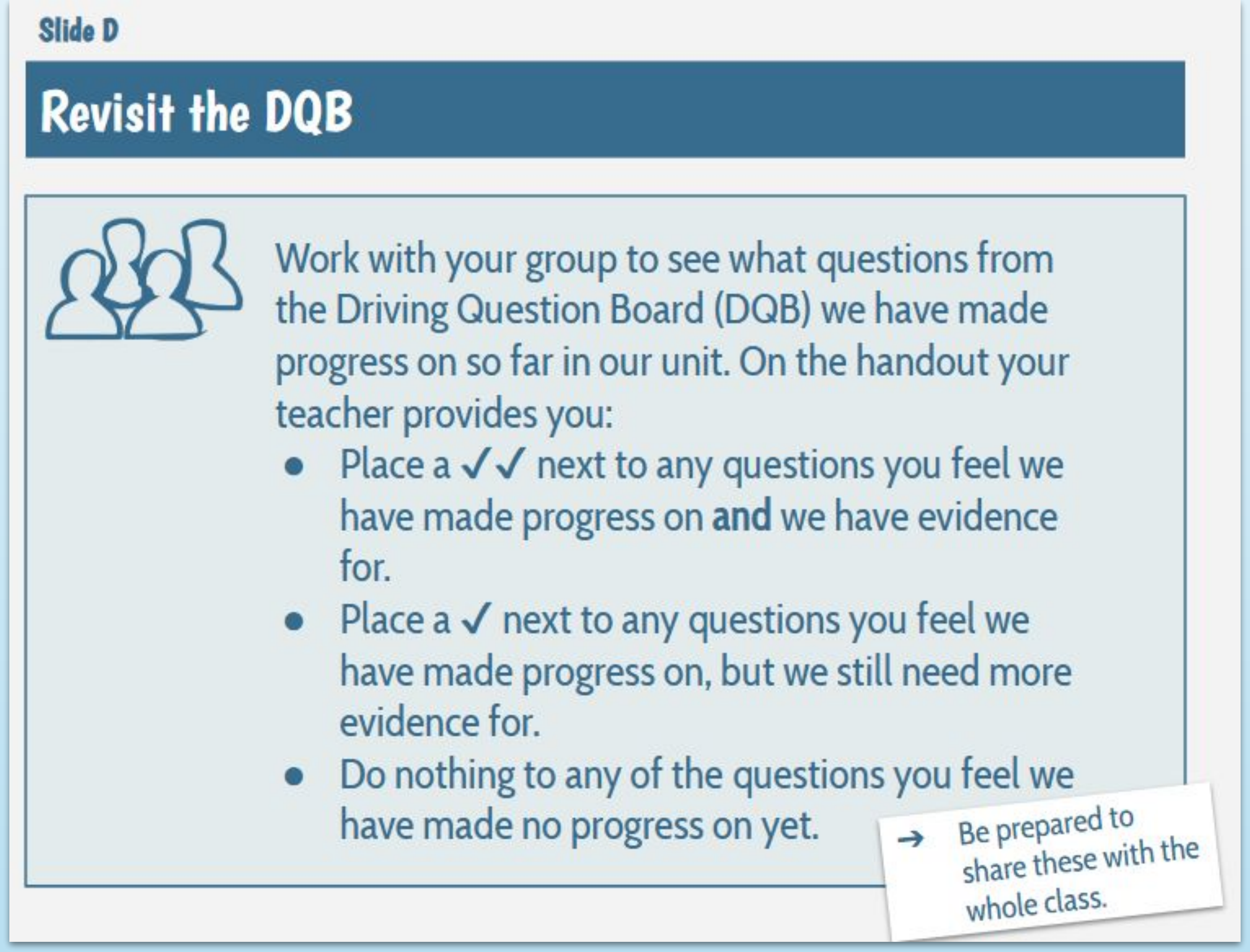
Navigation

- Lesson 2



Taking Stock

- Lesson 6
- Lesson 12



Analyzing "Asking Questions and Defining Solutions"

6 minutes

With your breakout room:

1. Read through the elements of the Science and Engineering Practice (SEP) of Asking Questions and Defining Solutions across the different grade bands.
2. Note where the description includes students needing to use one or more of the crosscutting concepts.
3. Use the digital sticky notes to the left of the slide with your Breakout Room # to record which of the cross cutting concepts and place it near the element.

Asking Questions and Defining Problems Progression

Break out Room #1

K–2 Condensed Practices	3–5 Condensed Practices	6–8 Condensed Practices	9–12 Condensed Practices
Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.	Asking questions and defining problems in 3–5 builds on K–2 experiences and progresses to specifying qualitative relationships.	Asking questions and defining problems in 6–8 builds on K–5 experiences and progresses to specifying relationships between variables, clarify arguments and models.	Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.
• Ask questions based on observations to find more information about the natural and/or designed world(s).	• Ask questions about what would happen if a variable is changed.	• Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information. • Ask questions to identify and/or clarify evidence and/or the premise(s) of an argument. • Ask questions to determine relationships between independent and dependent variables and relationships in models. • Ask questions to clarify and/or refine a model, an explanation, or an engineering problem.	• Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information. • Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships. • Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables. • Ask questions to clarify and refine a model, an explanation, or an engineering problem.
• Ask and/or identify questions that can be answered by an investigation.	• Identify scientific (testable) and non-scientific (non-testable) questions. • Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.	• Ask questions that require sufficient and appropriate empirical evidence to answer. • Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.	• Evaluate a question to determine if it is testable and relevant. • Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.
		• Ask questions that challenge the premise(s) of an argument or the interpretation of a data set.	• Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of the design.
• Define a simple problem that can be solved through the development of a new or improved object or tool.	• Use prior knowledge to describe problems that can be solved. • Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.	• Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.	• Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical and/or environmental considerations.

Be ready to share in the whole group!

Asking Questions and Defining Problems Progression

Break out Room #2

K–2 Condensed Practices	3–5 Condensed Practices	6–8 Condensed Practices	9–12 Condensed Practices
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Be ready to share in the whole group!

Asking Questions and Defining Problems Progression

Break out Room #3

K–2 Condensed Practices	3–5 Condensed Practices	6–8 Condensed Practices	9–12 Condensed Practices
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Asking Questions and Defining Problems Progression

Break out Room #4

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Asking Questions and Defining Problems Progression

Break out Room #5

K–2 Condensed Practices	3–5 Condensed Practices	6–8 Condensed Practices	9–12 Condensed Practices
Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.	Asking questions and defining problems in 3–5 builds on K–2 experiences and progresses to specifying qualitative relationships.	Asking questions and defining problems in 6–8 builds on K–5 experiences and progresses to specifying relationships between variables, clarify arguments and models.	Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.
• Ask questions based on observations to find more information about the natural and/or designed world(s).	• Ask questions about what would happen if a variable is changed.	• Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information. • Ask questions to identify and/or clarify evidence and/or the premise(s) of an argument. • Ask questions to determine relationships between independent and dependent variables and relationships in models. • Ask questions to clarify and/or refine a model, an explanation, or an engineering problem.	• Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information. • Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships. • Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables. • Ask questions to clarify and refine a model, an explanation, or an engineering problem.
• Ask and/or identify questions that can be answered by an investigation.	• Identify scientific (testable) and non-scientific (non-testable) questions. • Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.	• Ask questions that require sufficient and appropriate empirical evidence to answer. • Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.	• Evaluate a question to determine if it is testable and relevant. • Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.
		• Ask questions that challenge the premise(s) of an argument or the interpretation of a data set.	• Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of the design.
• Define a simple problem that can be solved through the development of a new or improved object or tool.	• Use prior knowledge to describe problems that can be solved. • Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.	• Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.	• Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical and/or environmental considerations.

Be ready to share in the whole group!

Asking Questions and Defining Problems Progression

Break out Room #6

K–2 Condensed Practices	3–5 Condensed Practices	6–8 Condensed Practices	9–12 Condensed Practices
Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.	Asking questions and defining problems in 3–5 builds on K–2 experiences and progresses to specifying qualitative relationships.	Asking questions and defining problems in 6–8 builds on K–5 experiences and progresses to specifying relationships between variables, clarify arguments and models.	Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.
• Ask questions based on observations to find more information about the natural and/or designed world(s).	• Ask questions about what would happen if a variable is changed.	• Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information. • Ask questions to identify and/or clarify evidence and/or the premise(s) of an argument. • Ask questions to determine relationships between independent and dependent variables and relationships in models. • Ask questions to clarify and/or refine a model, an explanation, or an engineering problem.	• Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information. • Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships. • Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables. • Ask questions to clarify and refine a model, an explanation, or an engineering problem.
• Ask and/or identify questions that can be answered by an investigation.	• Identify scientific (testable) and non-scientific (non-testable) questions. • Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.	• Ask questions that require sufficient and appropriate empirical evidence to answer. • Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.	• Evaluate a question to determine if it is testable and relevant. • Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.
		• Ask questions that challenge the premise(s) of an argument or the interpretation of a data set.	• Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of the design.
• Define a simple problem that can be solved through the development of a new or improved object or tool.	• Use prior knowledge to describe problems that can be solved. • Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.	• Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.	• Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical and/or environmental considerations.

Be ready to share in the whole group!

Integration of the three dimensions

Reflection:

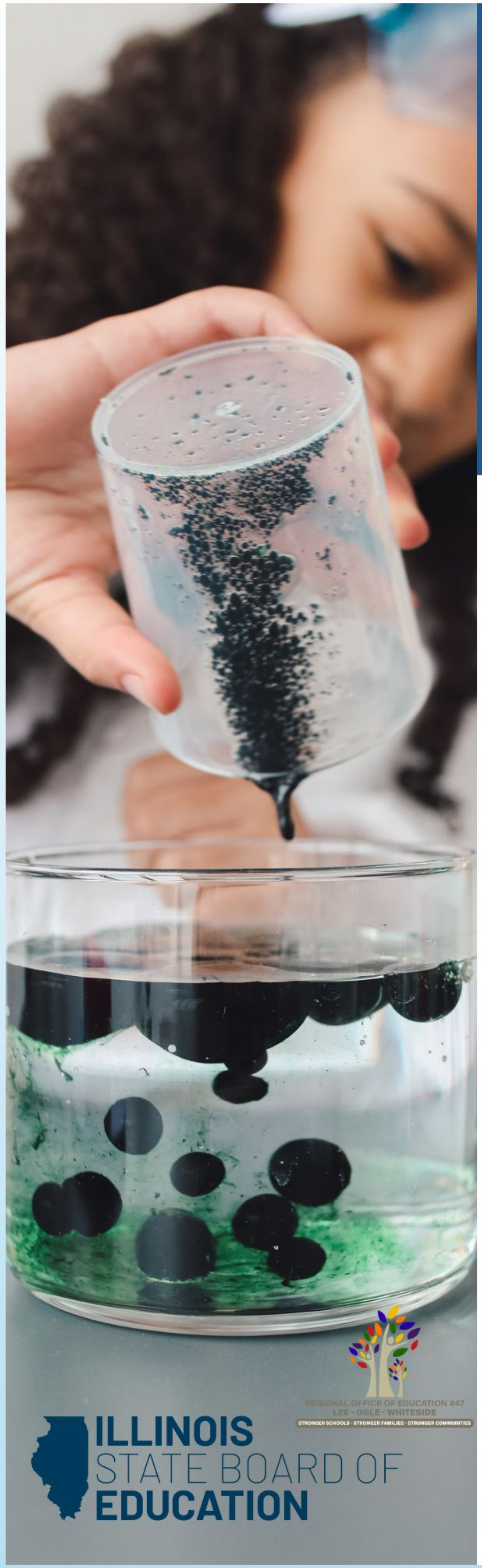
- Each week we have been reflecting on how the three dimensions work together in various ways to support student sensemaking such as *Analyzing data and patterns, developing models and matter progression.* Using what we did before and after analyzing the progressions for Asking Questions and Defining Problems today, **share in the chat**:
    - What are some of your takeaways about how the dimensions work together?
    - How can unwrapping the the dimensions help you support your students in sensemaking?

Exit Ticket in the chat

I used to think __________ about supporting kids in asking questions, now I think_____________.

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!



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EVIDENCE IN ACTION: SUPPORTING STUDENTS IN MAKING SCIENCE CLAIMS THAT STAND

In this session, teachers will immerse themselves in the science practice of Constructing Arguments from Evidence by working through phenomena as students do. Participants will gather and analyze evidence, develop claims, and engage in structured argumentation routines to justify their thinking. By experiencing the practice firsthand, teachers will better understand how students build evidence-based explanations across grade levels and what supports strengthen their reasoning. Attendees will leave with CER tools, discourse routines, and practical strategies for elevating student argumentation in the classroom.

Monday, March 9, 2026

4:00 - 5:30 p.m.
Zoom

Register Now

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Making Meaning from Data:

Building Student Science Skills in Analysis and Interpretation

In this data-rich session, teachers will experience Analyzing and Interpreting Data from the perspective of K–12 students. Participants will work with multiple forms of data, identify patterns, construct visual representations, and make evidence-based interpretations to explain phenomena. By engaging in the practice as learners, teachers will better understand the developmental progression of data skills and what scaffolds help students make meaning from information. Educators will leave with data routines, graphic organizers, and ready-to-use tools that support student success in data sensemaking.

Monday, April 20, 2026
4:00 - 5:30 p.m.
Zoom

Register Now

This session is offered free of charge, made possible by funding from the Illinois State Board of Education.

Meeting Evaluation

PLUS

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DELTA

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THANK YOU!