Professional Development Situation: Meeting

Skill Focus: Modeling Science Practices

Time Required: 30 minutes

START WITH A QUESTION

Participants will compare scientific questions and engineering design to learn how to support youth in scientific practices.

Agenda

Reviewing Activities—15 minutes

- STEM Activities Vignettes

Comparing Science Questions and Engineering—15 minutes

- How to Start with a Question handout

Materials

- STEM Activities Vignettes – either printed or projected
- One copy of STEM Activities for each participant
- One copy of How to Start with a Question for each participant.
- Venn Diagram on a shared surface (chart paper or chalkboard)

Before the Session

- **Read this meeting guide** to become familiar with the content and allow time to personalize the activities to best suit your presentation style. Read all informational materials.
    - *Italics indicate text that can be read aloud or emailed to participants.*
- Send reminded email about the meeting. Determine if any participants require accommodations (sight; hearing; etc.).
    - *The next professional development opportunity to enhance our STEM skills will be on DATE at TIME at LOCATION. Our focus for this session will be "Modeling Science Practices". Let me know if you require any accommodations to*

participate in the training. I am happy to answer any questions you have and look forward to seeing you at the workshop. I can be reached at CONTACT INFO.

- Gather all materials needed for the session.
- Develop a list of possible questions participants might have during the meeting. Create potential responses to be explored through informal conversation. Review any key terms or ideas that may be unclear.
- Prepare a large Venn Diagram to fill in during the meeting.

Session Outline

Reviewing Activities (15 min)

- Pass out or project the scenarios indicated in STEM Activities handout.
- Group participants in pairs.
- Your goal for this section of the meeting is to encourage participants to think about what inquiry practices the youth could engage in and how to highlight those practices.
    - *Read each scenario.*
    - *With your partner, come up with a list of things you could say to the youth to help them reflect on the practices they have engaged with.*
- Optional: If time is limited, have participants split into two groups and discuss the scenarios separately, then bring them together to report out. Since one scenario is for seventh graders and the other is for third-graders, you may also choose one for the whole room based on age group they work with.

Comparing Science and Engineering Questions (15 min)

- Pass out the How to Start with a Question handout.
- Ask participants to read the handout aloud in partners or small groups.
- Facilitate a discussion about the similarities and differences between science and engineering based on this reading. Keep notes on a Venn diagram that participants can see. Prompt participants with questions such as:
    - *What is unique about scientific questions?*
    - *What are some examples of engineering questions?*
    - *Can you think of some your students might be answering now?*
- Participant responses will look something like this:
    - *Science starts with a question about the world.*
        - *Often, the question is phrased as: "why does…?" or "how does…?"*
        - *Science uses observations, experiments, and investigation to answer the questions.*
    - *Engineering starts with a problem we can solve.*

        - *Often, the question is phrased as: "how can…?"*
        - *Uses testing to answer the question.*
        - *Relies on scientific knowledge to do the work.*
    - *Both:*
        - *Depend on the other; science is not relevant to our lives without engineering; engineering does not work without science.*
        - *Requires math, communication, and a curious mind.*

After the Session

- Email the participants:
    - *Thank you for your participation in the recent Click2Science meeting. I hope you found it useful and applicable to your practice. Consider sharing your thoughts with a co-worker, supervisor, or friend. Additionally, you can reach me at ____.*
- If possible, attach the Venn diagram they created in the meeting.

Want to Earn Credit? Click2Science has teamed up with Better Kid Care to provide continuing education units. Check it out at: http://www.click2sciencepd.org/web-lessons/about

STEM Activities

Vignette One

Seventh-grade youth have spent one session gathering specimens of plant life in a local meadow. You want youth to think about what kinds of adaptations the plants have made over time to survive in the meadow. Youth have laid out the plants so that they can compare their features.

- What prompting questions could you ask to get youth to focus their thinking on the specific features of the plants?
- What questions could you ask to get youth to focus on the evolutionary process of *adaptation*? (Specifically, you want youth to think about how the plants have come to be the way they are with a focus on (a) seeds that blow in the wind, (b) seeds that travel via embedding in mammals' fur, (c) the shape of grass to reach high to get direct sunlight for photosynthesis.
- What questions could you ask to get youth to focus on their science practices? (gathering evidence, building claims and explanations, sharing their findings, etc.)

Vignette Two - Engineering

Third-grade youth have been building a contraption to clean up a diorama of a "beach" that has been polluted with "oil" (grains of rice). They are working hard, but they are struggling to control their contraptions, which are hard to guide.

- What can you say to youth who are frustrated?
- What questions can you ask to guide youth to think about engineering practices? (highlighting that they are working within constraints, trying to solve a social problem, carefully attending to the nature of a problem, thinking about improving the solutions)

How to Start with a Question

The following description of "Asking Questions and Defining Problems" was taken from A Framework for K-12 Science Education.

Asking Questions and Defining Problems

Science begins with a question about a phenomenon, such as "Why is the sky blue?" or "What causes cancer?" and seeks to develop theories that can provide explanatory answers to such questions. A basic practice of the scientist is formulating empirically answerable questions about phenomena, establishing what is already known, and determining what questions have yet to be satisfactorily answered.

Engineering begins with a problem, need, or desire that suggests an engineering problem that needs to be solved. A societal problem such as reducing the nation's dependence on fossil fuels may engender a variety of engineering problems, such as designing more efficient transportation systems, or alternative power generation devices such as improved solar cells. Engineers ask questions to define the engineering problem, determine criteria for a successful solution, and identify constraints.

GOALS

By grade 12, students should be able to:

- Ask questions about the natural and human-built worlds—for example:
  - Why are there seasons? What do bees do? Why did that structure collapse? How is electric power generated?
- Distinguish a scientific question (e.g., Why do helium balloons rise?) from a nonscientific question (Which of these colored balloons is the prettiest?).
- Formulate and refine questions that can be answered empirically in a science classroom and use them to design an inquiry or construct a pragmatic solution.
- Ask probing questions that seek to identify the premises of an argument, request further elaboration, refine a research question or engineering problem, or challenge the interpretation of a data set—for example:
  - How do you know? What evidence supports that argument?
- Note features, patterns, or contradictions in observations and ask questions about them.
- For engineering, ask questions about the need or desire to be met in order to define constraints and specifications for a solution.