Ask Questions

Encourage Scientific Thinking

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Planning Guide

Cultivate Rich Dialogue

Make Connections

What kinds of experiences help learners feel interested and excited about science, technology, engineering, and math (STEM)?

What role can you, the educator, play in shaping those moments?

If the end goal for your learners is to have positive, memorable experiences with STEM, you can create those experiences in many different types of activities, from experiments to crafts to games, by:

- highlighting STEM skills, practices, and ideas in the activity
- encouraging positive emotions and confidence in connection with those STEM ideas
- sparking curiosity and engaging learners' brains in different ways to make the memory stronger

The Core Four strategies are flexible and can be incorporated into most teaching and facilitation scenarios, from large group classroom discussions to one-on-one conversations during an afterschool activity time.

This Planning Guide includes:

- an introduction to each of the Core Four strategies
- a planning tool to help you incorporate the Core Four into your activities and lessons

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For an interactive, in-depth look at the Core Four Strategies, including videos of the strategies in action with students, check out the *Core Four Strategies for Engaging Science Learning* digital course.

	**Ask Questions**
Ask open-ended questions	**Ask open-ended questions—questions with multiple possible responses—to help children explain their thinking.** ***Examples:*** *Why do you think that happened?* *How can we figure that out?*
Ask closed-ended questions	**Ask closed-ended questions—questions with one or a few possible responses—to guide children toward a particular area of focus.** ***Examples:*** *What colors are the leaves you see?* *Are these leaves from the same tree? Why do you think that? How can you tell?*
Prepare “back pocket“ questions	**Practice a few all-purpose questions that you can keep "in your back pocket" for use in many different situations.** ***Examples:*** *What do you notice?* *What makes you think that?* *Have you seen anything like this before?*
Turn telling into asking	**Look for times when you would make a statement or give an instruction, and try turning them into questions.** ***Example:*** *Instead of "The first thing we need to do to put our robots together is...," you could ask, "What do you think we need to do first? Where should we start?"*

Encourage Scientific Thinking

Call out scientific practices

Name the science skills your learners are already using.

Examples:

Great observation!
Did what you predicted would happen actually happen?
You redesigned, and now it's working! Great!

Avoid giving answers

When learners have a problem with something not working, or make a prediction you know is incorrect, resist the urge to correct them or give the answers right away.
Encourage them to try their own ideas and look for solutions.

Examples:

If your light bulb isn't lighting up, what could the problem be?
Where in your circuit could the electricity not be getting through?
How could you find out more about that idea?

Model scientific thinking

If something doesn't work the way you planned, use the opportunity to show excitement over retesting- not disappointment in failure.

Examples:

If you don't know the answer to a child's question, respond with: I don't know! Let's find out together!

Focus on the process, NOT the product

Focusing on the process of science rather than a specific product or outcome frees children to explore and take risks.

Examples:

Wow! I love how you planned out your experiment!
Did you have fun using that tool?
Can we use these materials in a different way?

Cultivate Rich Dialogue

Use key vocabulary	**Even when the goal is not to necessarily teach vocabulary, using the correct science terms and defining them can help learners to become more comfortable with the language around science.** ***Examples:*** *A planetary geologist is a scientist who studies the surface of other planets. Let's be planetary geologists today!*
Connect vocabulary to context	**Once you've introduced science words, use them with learners during their explorations to help them connect the concepts with real-life examples.** ***Examples:*** *I see that you built your amplifier with two cups instead of one. Tell me about how you decided on that design.*
Use partners and small groups	**Plan times for learners to discuss ideas in pairs or small groups during a science exploration.** ***Examples:*** *Partnering at the end of an individual activity to discuss and compare results* *Encouraging a learner to ask for advice or input from another learner*
Check in at all stages of the process.	**Give learners a chance to explain their work throughout the process, not just at the end to give them more opportunities to verbalize their thought process.** ***Examples:*** *I see you added this piece here. What is it for? How will it help you to solve this problem?*

	**Make Connections**
Ask questions about learners' experiences	**To make connections with a learner's interests and experience, you need to first know what they are—and the best way to find out is to ask!** ***Examples:*** *What have you seen or heard about_____?* *Have you ever used something like this before? When?* *What does this remind you of?*
Define and use science vocabulary	**Give learners a safe space to "try out" using the language of science can be. Define key words, use them often, and encourage learners to use them.** ***Examples:*** *We're going to make a prototype or test version.* *Can you tell me about your prototype?* *How did you use your prototype to test your prediction?*
Introduce science role models	**Introduce children to science role models who reflect their race, ethnicity, gender, and/or cultural background, either in person or through books, photos, articles, or credible websites** ***Examples:*** *Offer examples of science roles models either in person or through books, photos, articles, or credible websites.* *Remember you're a science role model, too!*
Make time to reflect	**Encourage learners to reflect on the ways they were scientists** ***Examples:*** *How were you like a scientist today?* *Did you ask questions or make predictions?* *Did you use tools like a scientist?*

Activity Planning Tool

Use the following too when you plan or adapt an activity

Engage

Learners are Introduced to the content and activity

How will you incorporate the Core Four into the introduction of your activity?

- How can you turn **telling into asking** as you introduce the content?

- Are there **science role models** doing this work that reflect your learners? Where can you include them?

- What is the **necessary vocabulary** for this activity? How will you define it and where will you use it during the introduction?

- How will you encourage learners right from the start to **appreciate about the process** and not get too caught up in getting the right answer?

Engage

General Notes

Activity Planning Tool

Use the following too when you plan or adapt an activity

Explore

Learners engage in Investigations, experiments, engineering challenges

How will you incorporate the Core Four into main section of your activity?

- What are your **back pocket questions** for this activity? When will you use them?

- Where are there places to **connect the activity to learners' lives and experiences?**

- Are there places where learners can **work together in pairs or groups**? Are the places where they learn from each other?

- If learners get stuck during the activity, how will you help them problem solve? How can you s**upport them without giving them the answer**?

Explore

General Notes

Activity Planning Tool

Use the following too when you plan or adapt an activity

Reflect

Learners share their results and reflect on the experience

How will you incorporate the Core Four into the conclusion of your activity?

- What **open-ended questions** will you use to get learners thinking about what they did during the activity?

- How will you help learners to **feel like scientists** as they reflect on the activity?

- How will you support all of the learners in your class **to express their ideas** about the activity?

- What parts of the activity will you highlight during the reflection? Which **science skills** used during the activity will you ask learners to reflect on?

Reflect

General Notes