

## Professional Development Situation: Training

### Skill Focus: Asking Purposeful Questions

Time Required: 90 minutes

# DEVELOPING YOUR OWN PURPOSEFUL QUESTIONS

Participants will watch the “Using Questions for Many Purposes” video-based learning module and design a water filter to learn how to use questions and talk moves to deepen youths’ science thinking.

## Agenda

Welcome – 5 minutes

Introduction – 10 minutes

See the Skill in Action – 20 minutes

- [Using Questions for Many Purposes](#) video-based learning module
- [Transcript: Using Questions for Many Purposes](#)

Hands-on Learning – 40 minutes

- [Filtration Investigation](#)

Conclusion - 15 minutes

## Materials

- Computer with internet connection
- Projector and speakers
- Flip chart paper and markers
- Pens for participants
- Blank paper for table tents and notetaking
- [Using Questions for Many Purposes](#) video-based learning module
- One copy of [Transcript: Using Questions for Many Purposes](#) for each participant
- One copy of [Filtration Investigation](#) for each group
- [Filtration Investigation](#) materials to share:

- Water basin for testing student filter systems
- Supply of "muddied water" which can be made by adding two tablespoons of dirt to clear water
- Other [Filtration Investigation](#) materials for each group
  - Two cups of "muddied water"
  - Framing the filter: Plastic or paper cups, straws, cardboard, tape, rubber bands, toothpicks, paper towels, & plastic wrap
  - Filtering material: Cotton balls, sand, aluminum foil, aquarium or other small rocks, cornmeal, flour, can of iodized salt, tape, and/or other materials (such as grass or charcoal if available)

## Before the Session

- **Read this training guide** to become familiar with the content and allow time to personalize the activities to best suit your presentation style. Watch all videos and read informational materials.
  - *Italics indicate text that can be read aloud or emailed to participants.*
- Send a reminder email about the training. 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 "Asking Purposeful Questions". 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 training.
- Develop a list of possible questions participants might have during the training. Create potential responses to be explored through informal conversation. Review any key terms or ideas that may be unclear.
- On the day of the training, test the audio and video equipment.

## Training Outline

### Welcome (5 min)

- Greet participants as they arrive. Make sure everyone feels welcome and comfortable.
- Introduce yourself and the focus of the session: "Asking Purposeful Questions".
- Ensure participants are aware of the locations of restrooms facilities, refreshments, etc.

### Introduction (10 min)

- Welcome participants to the training.
- Pass out blank paper to each participant with pens or markers. Ask participants to make a name tent with their name and the name of a person who encouraged them to be curious.
  - *Share your nametag with three people and explain who helped you be curious.*
- Introduce today's session.
  - *Today we will be talking about purposeful questions and how they lead to STEM learning. I bet that the person you wrote on your nametag didn't ask you to memorize, repeat, or regurgitate information very often. I bet that the person you wrote thought your ideas were important. Today we will practice encouraging youth to express their ideas through asking purposeful questions.*

### See the Skill in Action (20 min)

- Now participants will see an expert in action as they help out youth who are struggling with a circuitry engineering task.
- Cue up the [Using Questions for Many Purposes](#) video-based learning module and scroll to the video in step 3.
- **Play the video** one time through.
  - *What does Katie say to encourage youth thinking? How does she say it (what is her tone of voice)?*
- Pass out the [Transcript: Using Questions for Many Purposes](#).
  - *Transcripts help us slow down and recognize the powerful statements that both adults and youth say in their interactions. Sometimes when we read or write down spoken language we see things we didn't notice before. Let's watch the video again with the transcript. Follow along as I play the video and listen for the talk moves that the facilitators use.*
- **Play the video** again and ask participants to follow along on the transcript.
- **Reflect** on what kinds of questions the facilitators are asking. (Spend 3-5 minutes here and let participants think and work.)
  - *What kinds of questions does Katie use?*
  - *How do youth respond?*
  - *Can you use any of these in your practice?*

### Hands-on Learning (40 min)

- Participants will complete the Water Filtration Investigation using the engineering design practices.
- Split participants into groups of 3.

- In each group, one person will be the questioner. The questioner’s job is to keep their ideas to themselves and only ask questions to others in order to push their thinking.
  - *This is not a test of anyone’s content knowledge, but rather a way to help everybody make the clearest explanation. Questioner – your job is to help the others in your group build a strong explanation by asking purposeful questions like Katie did in the video.*
- Pass out materials:
  - Building materials
  - Copy of the [Filtration Investigation](#) from IEEE (pp1-13)
- Encourage participants to
  - Plan
  - Build
  - Prototype
  - Talk to other groups
  - Test
  - Share their thinking
  - Do research on their mobile devices
  - Re-design
- After 10 minutes of working, ask the “questioner” to trade roles with someone else. Switch roles a second time to be sure that each person in the group of three has a chance to question others.

### Conclusion (15 min)

- Ask participants to reflect on the filter they created using the Student Evaluation Form on pages 9-10 of the [Filtration Investigation](#).
- Ask participants how they responded to having a questioner.
  - *What kinds of questions did your questioner ask?*
  - *Were they open-ended? Did they make you think?*
- Nominate a Questioner of the Day.
  - *Who would like to nominate their questioner for the title of “Questioner of the day?” What did your questioner do well? How can we learn from your questioner?*

### After the Session

- Compile a list of strategies used to support documentation of STEM as a resource of ideas for participants. Share this in your follow-up email to participants.
- Within 2-3 weeks of the training, email participants:

- *Thank you for your participation in the recent Click2Science training on “Asking Purposeful Questions.” I hope you found it useful. Attached are some strategies the group discussed during the training. Consider meeting with a co-worker, supervisor, or friend to share the goals you are working on. I look forward to continuing our learning at the next session on SKILL/FOCUS on DATE at TIME at LOCATION. Please let me know if you have any questions. I can be reached at CONTACT INFO.*

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>

## Transcript: Using Questions for Many Purposes

- 1 (intro) [0:30]
- 2 Katie: So, with your partner, the first step that you're gonna be doing is you're gonna be brainstorming how to make your water filter, you're gonna build your filter in this top part, and then we're gonna test them out as a group in the end to see whose filter does what. Which group would like to start sharing their material?
- 3 Youth: We were thinking we would have the dirty materials on top of this and we would put the water through and it would come out and leave the dirty materials behind.
- 4 Katie: What do you think the different functions might be?
- 5 Youth: They all catch gravel or dirt.
- 6 Katie: Okay so gravel or dirt is being caught. Do you think they'll catch the same size dirt?
- 7 Youth: No
- 8 Katie: Why not?
- 9 Youth: All different things get passed through the materials.
- 10 Katie: Do you think the different size might affect it?
- 11 Youth: (nod)
- 12 Katie: Okay
- 13 [1:18]
- 14 Katie: Can you talk me through what you were thinking here?
- 15 Youth: We can put a little slit right there!
- 16 Youth 2: And then we can put the straw!
- 17 Youth: And the straw will just go through there.
- 18 Katie: Oh, so you're saying the straw will come up
- 19 Youth: But then a little dirty water might go. Because this is supposed to filter out some dirty water and this is supposed to filter out the rest.
- 20 [1:34]
- 21 Katie: Next, what do you see?
- 22 Youth: It's a little bit yellow and like, one or two pieces of charcoal got in it. So maybe we'll skip the charcoal next time.
- 23 Katie: What do you think you could try to maybe get rid of that yellow color?
- 24 Youth: Maybe um, a little bit more of the cotton or a little of the cheesecloth.
- 25 Katie: So maybe that's part of your redesign where do you wanna put that. Everyone's gonna get a chance to redesign these.

## Planning Purposeful Questions

Use this table to plan where you can use purposeful questions in the water filter design activity. Consider including the following purposeful questions, and come up with your own:

- Walk me through what you're thinking.
- Why are you trying that?
- What is happening there?

I want youth to... (circle one)	What I'll Say	When (Place in Activity)
Explain science Justify a design choice Give evidence Rethink something		
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## Resources: Asking Purposeful Questions

This skill focuses on asking purposeful questions to deepen STEM learning in youth. Questions asked purposefully, with direction, tend to increase and focus learning. Effective types of questions or comments help learners think about concepts in different ways, thereby expanding their learning experience. Facilitators should vary question types and formats. A facilitator's strategic questioning can encourage youth to think more deeply about what they are observing, predicting, testing and discovering, and to further explain their thinking.

Why is asking purposeful questions important in STEM? All of the STEM fields, to some degree, essentially focus on answering questions. Scientists begin with a question related to a natural phenomenon, such as "Why are leaves green?" and their work focuses on finding an answer through methodical investigation. Engineers and technologists work to solve a problem and often use questioning as they define their problem statements, determine criteria for success and identify constraints. The questions youth ask will be enhanced by seeing adults ask meaningful questions. One of the ultimate goals of STEM education is training youth to be inquisitive and ask questions on their own.

Youth learn more effectively when they need to observe, think, reflect, use their critical thinking skills, explore, discover, document their findings, share their findings and apply that information to their real world. This can all be done through facilitator talk moves.

Choose one of the following free, research-driven resources to help educators ask purposeful questions in STEM:

Michaels, S., & O'Connor, C. (2012). Talk Science Primer. TERC. Retrieved from [http://inquiryproject.terc.edu/shared/pd/TalkScience\\_Primer.pdf](http://inquiryproject.terc.edu/shared/pd/TalkScience_Primer.pdf)

National Research Council. (2012). A Framework for K-12 Science Education: Practices, Crosscutting Concepts and Core Ideas. Washington DC: National Academy Press. [Read here for more on the role of questions in "Constructing Explanations and Designing Solutions."](#)