Warm-up Activity
"Seeing Science and Engineering Practices" Using NautilusLive

When and Why?

Warm-up routines like "Seeing Science and Engineering Practices" can be used daily to engage students immediately when they enter the classroom. You may also choose to use this routine to launch each new unit of study, revisiting the media throughout the unit to see how student ideas grow and change as they learn more. Engaging in a routine at least weekly will create familiarity with the routine among your students, allowing them to develop listening and speaking skills when discussing science ideas. This routine is also a great way for teachers to assess students' prior knowledge and understanding. The ideas that students uncover in these routines can be used to guide instruction.

The routine is described for in-person, synchronous instruction. However, notes for adapting to remote and/or asynchronous instruction are provided.

If you like the "Seeing Science and Engineering Practices" approach, consider checking out these other warm-up ideas!

- Notice / Reminds Me Of / Wonder
- Seeing Crosscutting Concepts

Standards Alignment

This routine supports student growth in the NGSS Science and Engineering Practices of "Asking Questions and Defining Problems" and "Engaging in Argument from Evidence." In addition, students will gain familiarity with all of the other SEPs as they notice and discuss them with peers. For more information on the SEPs, including detailed information about what each SEP entails at each grade band (K-2, 3-5, Middle School, High School), see below.

Selecting a NautilusLive Resource

A wide variety of photos and video clips will offer students the opportunity to engage in these routines. Here are some general guidelines for choosing the OET resource for these general goals:

- Photos and videos featuring people will work best for "Seeing Science and Engineering Practices," because these images will allow students to see a SEP in action.
- Still images that have at least one recognizable element are best to use when students are learning this routine. Very odd or confusing images may not allow students to connect to an SEP.
- Short video clips (30 seconds or less) work best. Consider watching videos with the sound off, especially if the dialog is distracting or "gives away" information.
- Consider choosing media that will allow students to make connections between their own experiences, previous science learning, and new science learning.

Here are some images featuring members of the Corps of Exploration engaged in their work.

- LOUNGE_MILENE_CORMIER.jpg
- LOUNGE_IDGUIDE.jpg
- ROV_PILOT_JESSICA_SANDOVAL.jpg
- ROVHERCULES_CONTROLS.jpg
- SCIENCE_INTERN_BRYCE_CORBETT.JPG
- SAMPLE_PHOTOS_JUAN_MAYORGA.jpg
- CORE_SAMPLES.jpg
- NA124_JLF_1520947.jpg
- Video Engineer in Control Van
- Ocean Science Intern Leilani Sablan

- Data Logging Career video
- Data Engineering Career video
- Seafloor Mapping Career video

Seeing Science and Engineering Practices

The Science and Engineering Practices (SEPs) from the Next Generation Science Standards (NGSS) describe what it means to do science or engineering. The SEPs represent verbs and actions that increase in sophistication as students progress through the grades. The SEPs are intended to replace the "Scientific Method" as a more flexible and realistic representation of the work of scientists and engineers.

There are eight SEPs. They are:

- Asking Questions and Defining Problems
- Developing and Using Models
- Planning and Carrying Out Investigations
- Analyzing and Interpreting Data
- Using Mathematics and Computational Thinking
- Constructing Explanations and Designing Solutions
- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information

For a short summary of each SEP, visit: https://ngss.nsta.org/PracticesFull.aspx. More detailed versions, including what each practice looks like at Grades K-2, Grades 3-5, Middle School, and High School can be found here: https://static.nsta.org/ngss/MatrixOfScienceAndEngineeringPractices.pdf

To engage your students in the "Seeing Science and Engineering Practices" routine:

1. Decide on the prompt or prompts you will use and display the prompts for students. Some prompts (in order from beginner to advanced) could include:
    a. How is the SEP _____ shown in this image/video? (Use this prompt if you are focusing on a specific SEP.) If your students are new to the SEPs, consider providing the grade-appropriate details of the SEPs founds here: https://static.nsta.org/ngss/MatrixOfScienceAndEngineeringPractices.pdf
    b. What SEP is the person doing?
    c. (For media where more than one person is shown) Are they doing the same or different SEPs? Explain your idea.
    d. What SEP do you think happened just BEFORE this? Explain your idea.
    e. What SEP do you think will happen next? Explain your idea.
2. Display the image, map, or video clip that you have selected, and ask students to observe and think on their own for at least one minute. If you are using a video clip, consider playing it on a loop so that students can see it more than once. It may also make sense to play the clip with the sound off if the dialog "gives away" too much or distracts from what students might be seeing.
3. After students have had some solo time to think and observe, consider asking them to share with a partner before sharing as a class. This step is optional, but will allow all students to share ideas (which may not occur in a whole-class discussion). In addition, this step allows students to organize their thoughts with a partner before sharing out loud.
4. Take student ideas. Remember, the goal is to get students talking about the SEPs, not to arrive at one "right" answer. A helpful sentence starter for students to use during this discussion is "Yes, and _____", which helps them to understand that there is no one right answer. Based on the specific prompt used above, follow-up questions could include:
    a. Did anyone else see that SEP for a different reason?
    b. Did anyone else see a different SEP?
    c. Did anyone see something new or change their idea based on what someone else said?
5. If you are using this routine to connect to a specific standard or idea, as a final step consider saying something like "We are going to explore _____ now. Why do you think I chose this picture/video?" A more "open" option could be. "As we explore together today, consider why you think I chose this image/clip to start the class." If you use this prompt, revisiting the image or clip at the end and asking students to explain the connection to the day's learning could serve as an exit ticket.

<u>Adaptations for Remote or Asynchronous Learning</u>

- Once students know the routine and are familiar with the SEPs, consider asking older students to bring their SEP ideas to class based on an image or video clip you provide.
- Consider using an application like Jamboard, Flipgrid, or some other collaborative format for students to share their noticings and wonderings.