5E-SESE Instructional Brief

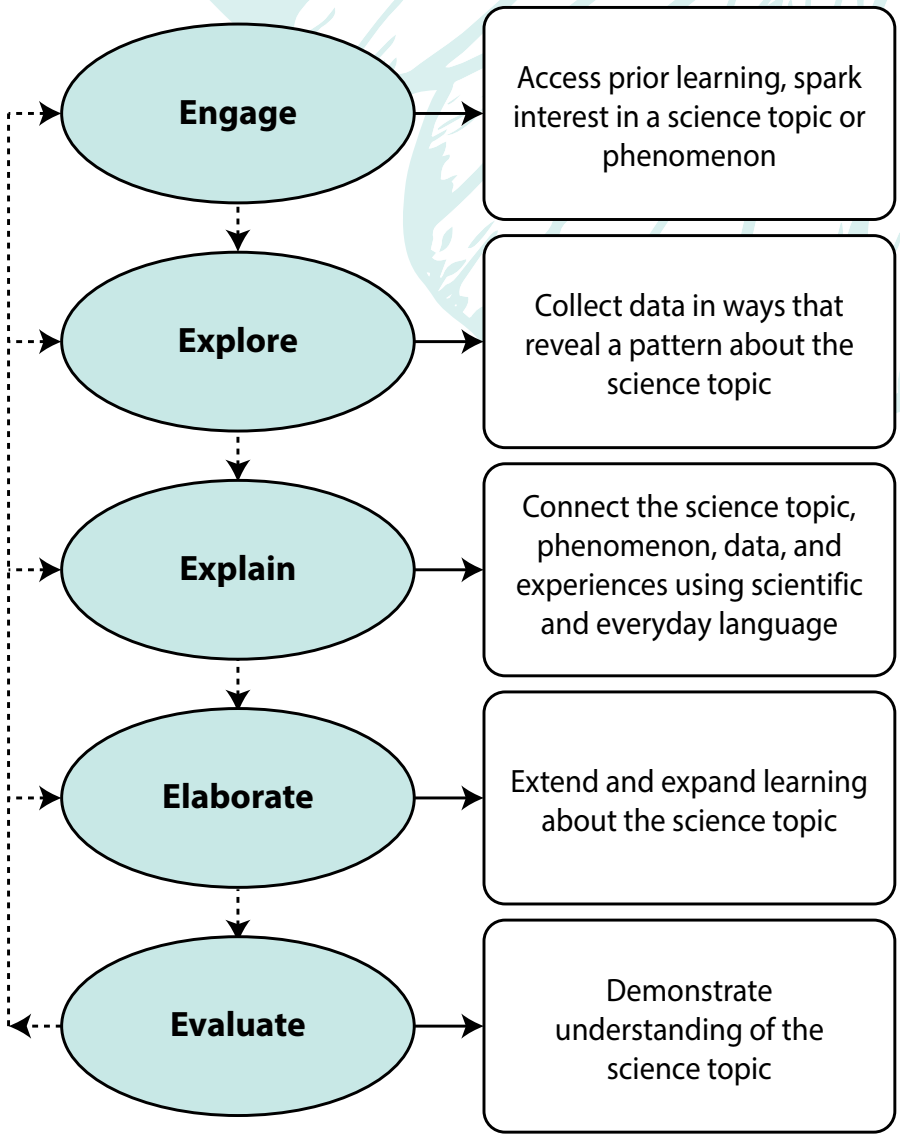
From Activity to Inquiry

Overview

Does "science class" make you think of experiments? Hands-on activities? Teaching scientific vocabulary? For any science activity that you've taught, there is likely a "match" in one of the 5E-SESE inquiry phases. The 5E-SESE project uses the 5E Model (Bybee et al., 2006) of science instruction to help teachers plan for more "hands on, minds on" science teaching (also called "inquiry-oriented instruction"). 5E-SESE lessons include activities related to five phases that make up the 5E model: Engage, Explore, Explain, Elaborate, and Evaluate. The phases work together in a cycle to support student curiosity, questioning, systematic investigation, data gathering, and using data to answer questions about the world around them.

Students who participate in their state's alternate assessment can also participate in and benefit from inquiry-based instruction.

Figure 1: 5E Cycle Phases and Descriptions



Adapted from Chang & Wu, 2015

Phases in the 5E cycle aren't necessarily linear "steps." Depending on their students and the lesson, teachers can move throughout phases to revisit or reinforce particular aspects of learning (indicated by the dashed lines and arrows on the left).

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Professional Development in SCIENCE EDUCATION for SPECIAL EDUCATORS

How can teachers shift to an inquiry teaching approach with their students with extensive support needs?

Many teachers are already teaching science in a way that connects to one of the 5E phases. The shift to inquiry means building the rest of the inquiry cycle around those original ideas. Inquiry approaches can be flexible routines that work across a wide range of science topics.

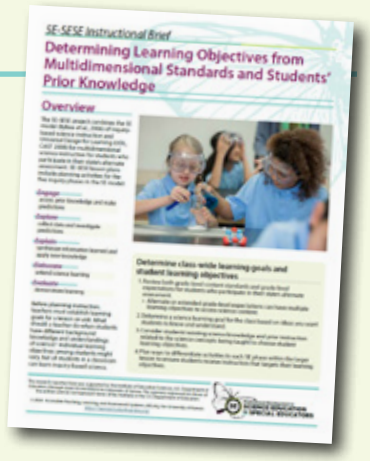
Many teachers find it useful to start by identifying which phase of the 5E cycle goes with activities they have previously taught. The chart below shows three example lessons. The bold text shows the phase that the lesson's original science activity best represents. From that starting point, the teacher then adds ideas for instruction that could come before or after. The goal is for students to build their understanding of the science concept through the series of activities so the focus is on what students would be doing at each 5E phase. Teachers use questions throughout the cycle to check student understanding, using informal or formal assessments to gauge student learning at the end of the cycle.

Science Focus	Grades 3–5 Life Science: Food Chains and Webs	Middle School Physical Science: Forces and Motion	Middle School Earth Science: Weather Prediction
Lesson Theme	Investigate how ocean animals get their food	Investigate which cars go farther using different ramp heights	Build a classroom barometer and use it to predict local weather
Engage	**Read and watch a video about an Arctic food chain**	Predict which ramps might make cars go farther and why	Watch local weather forecast and video about how barometers work
Explore	Use picture cards and arrows to pair up organisms with the food they eat in an Arctic food chain	**Test different ramp heights: run multiple trials and record data using a floor graph, T-chart, or data table**	Build a classroom barometer and use it to record daily readings
Explain	Use food chain cards to model how Arctic animals get their food from plants and other animals	Use data from the floor graph to communicate that a car travels farther with a higher ramp	**Compare barometer data to actual weather to connect and explain changes in each**
Elaborate	Investigate if food moves in a similar way through forest plants and animals	Use a different car on the same ramps to see if it also travels farther on a higher ramp	Use the classroom barometer to predict weather during a different season
Evaluate	Complete an exit ticket that asks where a polar bear gets its food	Use the graphic organizer to show which ramp resulted in cars traveling the farthest	Identify which tools are used to measure which aspect of weather

In each case, the teacher thought about how a single activity could be made more robust by adding at least one additional activity that matches another phase in the 5E Cycle and that has students doing and communicating about science. As teachers get comfortable with instruction at two phases of the cycle, they can continue to add more activities or phases.

For more information

Check out the 5E-SESE Instructional Brief: Determining Learning Objectives from Multidimensional Standards and Students' Prior Knowledge, to read more about how to choose learning objectives using multidimensional standards.



Using the 5E phases, teachers can teach in ways that shift more of the thinking and "action" to the students as they question, explore, investigate, gather data, and then analyze the data to communicate what they found to answer the question. This approach can work even for students who are working on less complex science ideas (e.g., noticing differences between solids and liquids) and for students who need accessibility supports such as communication devices and graphic organizers to actively participate in lessons.

The 5E model gives teachers a way to shift science instruction towards students actively questioning and engaging in real science practices around science topics that interest them.

What are the benefits of shifting to teaching science as inquiry?

- Students become engaged, interested, and excited about learning.
- Students connect learning to their experiences or something they already know.
- Students can work toward grade-level expectations in a variety of settings, including the same setting as their peers.
- Inquiry-based instruction connects to strategies supported by Universal Design for Learning (i.e., those that include multiple means of engagement, accessing science representations, and showing what they know and can do in science). These strategies serve students as they learn in other domains.

References

Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J. C., Westbrook, A., & Landes, N. (2006). The BSCS 5E instructional model: Origins and effectiveness. https://bscs.org/wp-content/uploads/2022/01/bscs_5e_full_report-1.pdf

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Visit the 5E-SESE Project Website for more ideas, including lesson plan examples and professional development modules

https://5eproject.atlas4learning.org/