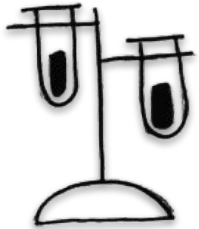
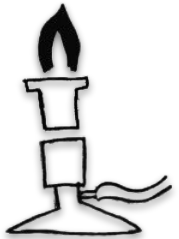
Student Friendly

SEP Progressions

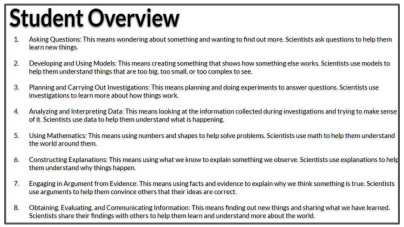




Source: Tara Koehler & John Sammon, via Edutopia

How to use this resource

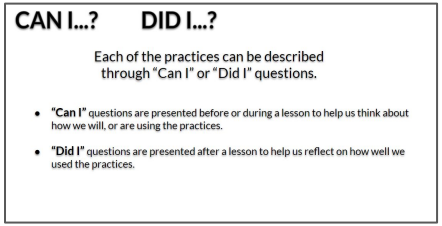
Use the the student overview to discuss with the students the descriptors of each of the Science & Engineering Practices.



Student Overview

1. Asking Questions: This means wondering about something and wanting to find out more. Scientists ask questions to help them learn new things.
2. Developing and Using Models: This means creating something that shows how something else works. Scientists use models to help them understand things that are too big, too small, or too complex to see.
3. Planning and Carrying Out Investigations: This means planning and doing experiments to answer questions. Scientists use investigations to learn more about how things work.
4. Analyzing and Interpreting Data: This means looking at the information collected during investigations and trying to make sense of it. Scientists use data to help them understand what is happening.
5. Using Mathematics: This means using numbers and shapes to help solve problems. Scientists use math to help them understand the world around them.
6. Constructing Explanations: This means using what we know to explain something we observe. Scientists use explanations to help them understand why things happen.
7. Engaging in Argument from Evidence: This means using facts and evidence to explain why we think something is true. Scientists use arguments to help them convince others that their ideas are correct.
8. Obtaining, Evaluating, and Communicating Information: This means finding out new things and sharing what we have learned. Scientists share their findings with others to help them learn and understand more about the world.

Use “CAN I” “DID I” questions with the students to prepare for and reflect on their use of the Science & Engineering Practices.

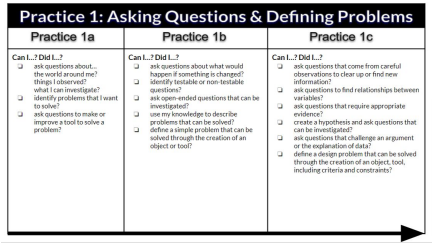


CAN I...? DID I...?

Each of the practices can be described through “Can I” or “Did I” questions.

- **“Can I”** questions are presented before or during a lesson to help us think about how we will, or are using the practices.
- **“Did I”** questions are presented after a lesson to help us reflect on how well we used the practices.

The progressions are formatted with a, b, c to represent the grade bands K-2, 3-5 and 6-8. Use the progressions to facilitate student self-assessment, goal setting, collaboration, feedback and reflection with each of the Science & Engineering practices.



Practice 1: Asking Questions & Defining Problems

Practice 1a	Practice 1b	Practice 1c
Can I...? Did I...?	Can I...? Did I...?	Can I...? Did I...?
❑ ask questions about... the world around me? things I observed? what I can investigate?	❑ ask questions about what would happen if something is changed?	❑ ask questions that come from careful observations to clear up or find new information?
❑ identify problems that I want to solve?	❑ identify testable or non-testable questions?	❑ ask questions to find relationships between variables?
❑ ask questions to make or improve a tool to solve a problem?	❑ ask open-ended questions that can be investigated?	❑ ask questions that require appropriate evidence?
	❑ use my knowledge to describe problems that can be solved?	❑ create a hypothesis and ask questions that can be investigated?
	❑ define a simple problem that can be solved through the creation of an object or tool?	❑ ask questions that challenge an argument or the explanation of data?
		❑ define a design problem that can be solved through the creation of an object, tool, including criteria and constraints?

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Practice 1: Asking Questions & Defining Problems

Practice 1a

Can I...? Did I...?

- ❑ ask questions about...
  the world around me?
  things I observed?
  what I can investigate?
- ❑ identify problems that I want to solve?
- ❑ ask questions to make or improve a tool to solve a problem?

Practice 1b

Can I...? Did I...?

- ❑ ask questions about what would happen if something is changed?
- ❑ identify testable or non-testable questions?
- ❑ ask open-ended questions that can be investigated?
- ❑ use my knowledge to describe problems that can be solved?
- ❑ define a simple problem that can be solved through the creation of an object or tool?

Practice 1c

Can I...? Did I...?

- ❑ ask questions that come from careful observations to clear up or find new information?
- ❑ ask questions to find relationships between variables?
- ❑ ask questions that require appropriate evidence?
- ❑ create a hypothesis and ask questions that can be investigated?
- ❑ ask questions that challenge an argument or the explanation of data?
- ❑ define a design problem that can be solved through the creation of an object, tool, including criteria and constraints?

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Practice 2: Developing & Using Models

Practice 2a

Can I…? Did I…?

- ❏ tell the difference between a model and the real-world?
- ❏ compare two models?
- ❏ create a model that shows what I observed?
- ❏ develop or use a model to show…
  - amounts
  - relationships
  - size (bigger, smaller)
  - patterns

Practice 2b

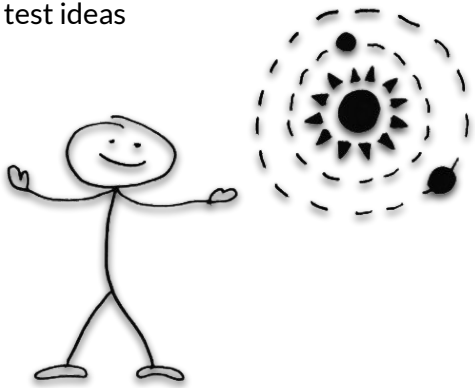
Can I…? Did I…?

- ❏ find strengths and weaknesses of models?
- ❏ use a model to test cause and effect relationships?
- ❏ work with others to improve or make a model?
- ❏ make a model to…
  - describe or predict something?
  - test cause and effect relationships?
  - make a prototype for a tool or object?

Practice 2c

Can I…? Did I…?

- ❏ judge the limitations of two different models about the same idea?
- ❏ develop or modify a model to match what happens if a variable is changed?
- ❏ develop or use a model to…
  - make predictions
  - describe unobservable relationships
  - generate data
  - test ideas



Source: Tara Koehler & John Sammon, via Edutopia

Practice 3: Planning & Carrying Out Investigations

Practice 3a

Can I…? Did I…?

- ❑ work with others to plan and do an investigation?
- ❑ work with others to create or measure data?
- ❑ collect data and compare data?
- ❑ observe solutions to tell if it solves a problem or meets a goal?

Practice 3b

Can I…? Did I…?

- ❑ work with others to plan and do an investigation?
- ❑ decide what tools would be used to get data?
- ❑ produce data to serve as evidence?
- ❑ run fair tests (changing one thing)?
- ❑ make predictions about what would happen if one thing changed in an experiment?
- ❑ compare two different models to see which one work better?

Practice 3c

Can I…? Did I…?

- ❑ plan an investigation with others or alone, and identify independent and dependent variables and controls?
- ❑ discuss different ways to observe, measure and gather data?
- ❑ decide how much and what type of data to gather?
- ❑ plan and carry out a test for a design solution?

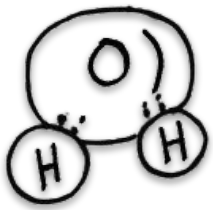
Source: Tara Koehler & John Sammon, via Edutopia

Practice 4: Analyzing & Interpreting Data

Practice 4a

Can I…? Did I…?

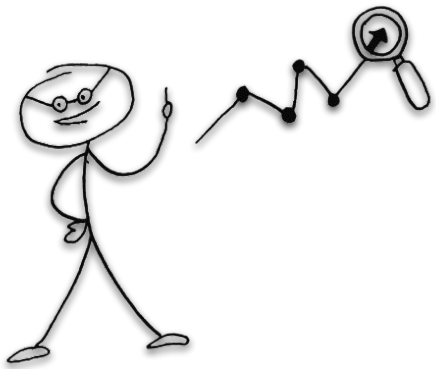
- ❏ draw pictures or write my…
  observations?
  thoughts?
  ideas?
- ❏ find patterns with data?
- ❏ compare what I thought would happen to what did happen?
- ❏ use information to decide if something works as it should?



Practice 4b

Can I…? Did I…?

- ❏ show data in…
  tables?
  bar graphs, pictographs, pie charts?
- ❏ look for patterns in data?
- ❏ compare and contrast different data?
- ❏ use data to improve a problem or a design?



Practice 4c

Can I…? Did I…?

- ❏ create, look closely at, and use data in maps, charts, graphs, and tables to find relationships?
- ❏ compare and contrast data?
- ❏ describe data by calculating, mean, median, mode and variability?
- ❏ consider limitations of data, tools, and accuracy?
- ❏ find the range in which the data tools, and process works best?

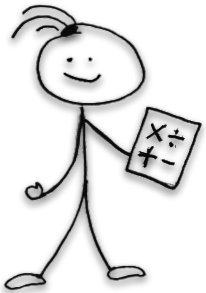
Source: Tara Koehler & John Sammon, via Edutopia

Practice 5: Using Mathematics & Computational Thinking

Practice 5a

Can I…? Did I…?

- ❑ choose when to use qualitative vs. quantitative data.
- ❑ use counting and numbers to share patterns?
  talk about measures?
  compare amounts?
  show the data with simple graphs?
- ❑ use numbers to compare two solutions to a problem.



Practice 5b

Can I…? Did I…?

- ❑ choose if qualitative or quantitative data are best to tell if an object or tool is successful?
- ❑ put together simple data sets to show patterns and relationships?
- ❑ tell about, measure, estimate, or graph amounts such as area, volume, weight, and time to address questions and problems?
- ❑ create or use graphs, charts, simple computations and compare solutions?

Practice 5c

Can I…? Did I…?

- ❑ use digital tools to look closely at large data sets for patterns and trends?
- ❑ use math models to describe or support scientific conclusions?
- ❑ create a series of ordered steps (algorithms) to solve a problem?
- ❑ use calculations from math class such as ratio, rate, percent, basic operations, and simple algebra to questions and problems?
- ❑ use digital tools or math to test and compare solutions to engineering solutions?

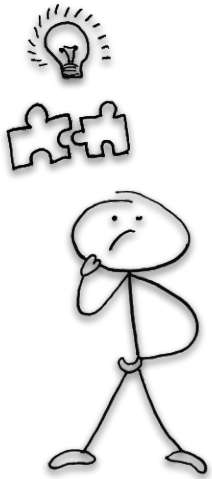
Source: Tara Koehler & John Sammon, via Edutopia

Practice 6: Constructing Explanations & Design Solutions

Practice 6a

Can I…? Did I…?

- ❑ use observations to tell about evidence?
- ❑ tell how to build something that solves a problem?
- ❑ compare different ways to fix a problem?



Practice 6b

Can I…? Did I…?

- ❑ explain relationships you observe?
- ❑ use measurements, observations, and patterns to create an explanation?
- ❑ use evidence and reasoning to support explanations?
- ❑ use science ideas to solve problems?
- ❑ compare different solutions to a problem and tell how well they meet the criteria and constraints?

Practice 6c

Can I…? Did I…?

- ❑ construct an explanations…
  using qualitative or quantitative relationships between variables?
  using models or representations?
  based on valid and reliable evidence obtained from sources?
- ❑ use valid scientific ideas, principles and reasoning in explanations?
- ❑ use scientific ideas or principles to design /construct, an object or tool?
- ❑ use the design cycle, create solutions that meet criteria and constraints?
- ❑ optimize performance of a design, making tradeoffs, testing, revising, and re-testing?

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Practice 7: Engaging in Argument from Evidence

Practice 7a

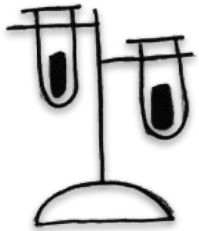
Can I…? Did I…?

- ❏ make a claim and support it with evidence?
- ❏ tell the difference between opinions and evidence?
- ❏ retell the main points of an argument?
- ❏ make a claim about if a solutions works or not?

Practice 7b

Can I…? Did I…?

- ❏ make a claim and support it with evidence and reasoning?
- ❏ tell the difference between facts, and judgments in an explanation?
- ❏ respectfully provide and receive feedback from peers on explanations and evidence?
- ❏ use data to evaluate claims about cause and effect.
- ❏ make a claim about the merit of a solution and about how it meets the criteria and constraints of the problem.



Practice 7c

Can I…? Did I…?

- ❏ compare and critique two arguments on the same topic?
- ❏ respectfully provide and receive critiques about one's explanations, procedures, models and questions?
- ❏ create, use, and present an oral and written argument supported by empirical evidence and scientific reasoning?
- ❏ make an oral or written argument that supports or refutes the advertised performance of a device, concerning whether or not the technology meets the criteria and constraints?
- ❏ evaluate competing design solutions based on jointly developed and agreed-upon design criteria.

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Practice 8: Obtaining, Evaluating, & Communicating Information

Practice 8a

Can I…? Did I…?

- ❏ find patterns from reading or media about science topics?
- ❏ tell how images support a scientific or engineering idea?
- ❏ use text features and media to support claims and answer science questions?
- ❏ share science ideas by talking, drawing, writing?

Practice 8b

Can I…? Did I…?

- ❏ combine information from books and other media to explain science ideas and design problems?
- ❏ use evidence to summarize complex texts or media about scientific and technical ideas?
- ❏ use complex texts or other media to support science and engineering practices?
- ❏ share information in written text and tables, diagrams, or charts to support the science and engineering practices?

Practice 8c

Can I…? Did I…?

- ❏ gather, read, synthesize information to determine the central ideas and assess the credibility, accuracy, and possible bias of the information?
- ❏ use qualitative and/or quantitative scientific/technical information from text, media and visual displays to clarify claims and findings.
- ❏ evaluate competing information such data, hypotheses, and conclusions in scientific and technical texts?
- ❏ communicate about a proposed object, tool, or process in writing and/or through oral presentations?

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