

Designing Assessment+ Tasks: Teacher Instructions

As you learned in the workshop, the steps to designing three dimensional assessment tasks are:

1. Determine what you will assess.
2. Create assessment scenarios.
3. Create associated questions and tasks.
4. Develop a rubric to assess student responses.

We have created a number of resources to help you with this process. Use the instructions below to guide you through using the resources.

Designing Assessment+ Tasks 1: Determining Objectives

Use this resource to identify the specific content (disciplinary core ideas), skills (science and engineering practices), and overarching connections (crosscutting concepts) that you expect students to demonstrate a mastery of through the assessment task. Be as specific as you can. Follow the directions on each step to complete the organizer.

Designing Assessment+ Tasks 2: Science and Engineering Practices

After you have identified your target Science and Engineering Practices, find the appropriate organizer (there is one for each). Follow the steps on the organizer to identify your scenario — choosing between a phenomena, an investigation, or a problem — and any additional information you will provide during the task, which could include data, arguments, explanations, models, etc. Prompts are listed at the bottom of the organizer to help you begin developing the tasks that students will complete. You may use several prompts — from several different SEP organizers — during your assessment task.

For example, you may target Constructing Explanations as your primary SEP. You may provide students with a description of a phenomena and a data table with additional information. Students may use this information to construct their explanation of the phenomenon, which is the primary task. That said, additional prompts that build from the same scenario may incorporate SEPs like asking questions or using a model.

Designing Assessment+ Tasks 3: Constructing The Assessment

Now that you have determined your objectives and considered your scenario and the associated student tasks, you are ready to actually construct your assessment. Use this last organizer to outline the scenario information you will provide, how you will provide it (text, video, pictures, data, etc.), and the primary task you will assign students. Then, build from that primary task to incorporate additional Science and Engineering Practices and emphasize the connection to the Crosscutting Concepts.

IS IT A Three Dimensional Assessment?

Ideally, you should return to the checklist in this resource sheet to determine if your assessment is truly three dimensional.

Examples

Use the examples provided to explore what a three dimensional rubric looks like. Notes have been added to indicate the evaluation of all three dimensions — disciplinary core ideas, science and engineering practices, and the crosscutting concepts. Just as the assessment must incorporate all three dimensions, so too should the rubric you use to evaluate student performance.

Designing Assessment Tasks 1: Determining Objectives

Step 1: Disciplinary Core Ideas

WHAT DISCIPLINARY CORE IDEAS SHOULD STUDENTS KNOW?

List the important content knowledge students should know. Be as specific as possible.

Step 2: Science and Engineering Practices

WHAT SCIENCE/ENGINEERING PRACTICES WILL YOU ASSESS?

1. List the **primary** practices (those identified in the Performance Expectation itself), as well as any **secondary** practices you would like to target.
2. Consider including previously taught/assessed practices as **secondary** practices.
3. Because each of the seven major practices represents a number of specific skills, use the NSTA's Science and Engineering Practices Matrix to identify the exact skills you are assessing.

Step 3: Crosscutting Concepts

Crosscutting Concepts can be used as a "lens" through which to view the phenomena you use in your assessment. Which crosscutting concept(s) will you target? How will it help students understand the disciplinary core ideas?

Designing Assessment Tasks 2: Asking Questions

Step 1: Choose Your Base

PHENOMENA

Describe your phenomena using text, images, videos, and/or data.

INVESTIGATION

Describe an investigation of an observable phenomenon.

PROBLEM

Describe a problem using text, images, videos, and/or data.

Step 2: Optional Add-ins

data

arguments

model

explanation

research question

Step 3: Choose Your Task

- Identify which of the following questions could be investigated. Explain your reasoning.
- Create a question to investigate the [phenomenon/investigation/problem.]
- Create a question to investigate the [phenomenon/investigation/problem] and describe the evidence you would need to answer your question.
- Create a question based on the results of the investigation.
- Create questions that would help you understand the argument presented.
- Create questions that would help you understand the relationships between parts of the model.

Designing Assessment Tasks 2: Defining Problems

Step 1: Choose Your Base

PHENOMENA

Describe your phenomena using text, images, videos, and/or data.

INVESTIGATION

Describe an investigation of an observable phenomenon.

PROBLEM

Describe a problem using text, images, videos, and/or data.

data

arguments

Step 2: Optional Add-ins

model

explanation

research question

Step 3: Choose Your Task

- Define the problem you learned about in your own words.
- What is the criteria for success -- or the requirements -- that a solution must meet in order to solve the problem?
- Use the data provided to describe the consequences of the problem if it is not solved.
- How does the [text/research/video] provide relevant information that helps define the problem?
- What are the constraints (scientific, economic, social) to developing a solution for this problem?
- All of life operates within systems. Describe the parts of the system in which the problem is embedded. What things are a part of the system, and what exists outside of the system?
- What evidence would you need to determine whether or not the solution was successful?

Designing Assessment Tasks 2: Developing and Using Models

Step 1: Choose Your Base

PHENOMENA

Describe your phenomena using text, images, videos, and/or data.

INVESTIGATION

Describe an investigation of an observable phenomenon.

PROBLEM

Describe a problem using text, images, videos, and/or data.

data

arguments

Step 2: Optional Add-ins

model

explanation

research question

Step 3: Choose Your Task

- Create a model that represents the [amounts of/relationships between/scales/patterns in] _____ that you observed in the phenomenon.
- Compare the two models to identify similarities and differences.
- Revise the model and justify your changes using the [scientific knowledge/disciplinary core ideas] you have learned.
- Create a model to explain the phenomenon you have observed. Use your model to provide evidence for your explanation.
- Examine the drawing provided and label the components, interactions, and mechanisms in the model.
- Develop a model that generates data, and explain the phenomenon using the data generated from your model.
- Use evidence from more than one type of model to support an explanation of the phenomenon.
- How could you test the model to determine its reliability?
- How could you revise this model to improve its reliability?

Designing Assessment Tasks 2: Planning & Carrying Out Investigations

Step 1: Choose Your Base

PHENOMENA

Describe your phenomena using text, images, videos, and/or data.

INVESTIGATION

Describe an investigation of an observable phenomenon.

PROBLEM

Describe a problem using text, images, videos, and/or data.

Step 2: Optional Add-ins

data

arguments

model

explanation

research question

Step 3: Choose Your Task

- Generate a research question.
- Evaluate the possible ways to observe or measure the phenomenon to decide which will best answer your research question.
- How much data is needed to be considered reliable?
- Conduct the investigation you have designed and collect evidence to [answer your question/evaluate your model].
- What are the environmental, social, and personal impacts of the investigation?
- Write an explanation supported by the data you have collected during your investigation.
- Revise the investigation to [better answer the research question/generate more accurate and precise data.]

Designing Assessment Tasks 2: Analyzing and Interpreting Data

Step 1: Choose Your Base

PHENOMENA

Describe your phenomena using text, images, videos, and/or data.

INVESTIGATION

Describe an investigation of an observable phenomenon.

PROBLEM

Describe a problem using text, images, videos, and/or data.

data

arguments

Step 2: Optional Add-ins

model

explanation

research question

Step 3: Choose Your Task

- Which design solution best addresses the problem? Explain your reasoning.
- Describe the patterns you observe.
- How do the patterns in the data help to explain the phenomenon?
- Which data are most relevant to explaining the phenomenon you are investigating?
- Organize, represent, and analyze the data in more than one way. Which representation best reveals patterns in the data? Explain your reasoning.
- Analyze your data by finding the [mean/median/mode/variability]. What conclusions can you draw about the phenomenon based on your mathematical analysis?
- How do the patterns in the data support the [hypothesis/explanation/argument]?
- Record a valid and reliable scientific claim based on your data analysis. Describe the limits of your data analysis.
- Use the data provided to explain the phenomenon. Evaluate whether the interpretation provided is consistent with the data. Explain your reasoning.
- Revise the [explanation/model] provided after examining the new data.

Designing Assessment Tasks 2: Using Mathematics & Computational Thinking

Step 1: Choose Your Base

PHENOMENA

Describe your phenomena using text, images, videos, and/or data.

INVESTIGATION

Describe an investigation of an observable phenomenon.

PROBLEM

Describe a problem using text, images, videos, and/or data.

Step 2: Optional Add-ins

data

arguments

model

explanation

research question

Step 3: Choose Your Task

- Construct a [graph/visual display] of the data collected and describe the patterns and relationships you observe.
- Develop an equation or algorithm to represent the phenomenon described.
- Use the results of the computational model to support an explanation of the phenomenon.
- Describe the patterns and relationships in the simulation.
- Explain the rules in the simulation using your scientific knowledge as supporting evidence.
- Compare the results of the simulation with real-world data. Does the simulation make sense?
- Compare the results of two simulations with real-world data. Use your comparison as evidence to construct an argument for which simulation makes the most sense.

Designing Assessment Tasks 2: Constructing Explanations

Step 1: Choose Your Base

PHENOMENA

Describe your phenomena using text, images, videos, and/or data.

INVESTIGATION

Describe an investigation of an observable phenomenon.

PROBLEM

Describe a problem using text, images, videos, and/or data.

Step 2: Optional Add-ins

data

arguments

model

explanation

research question

Step 3: Choose Your Task

- Use the data to support an explanation of the cause of the phenomenon.
- Examine the explanation and the evidence provided. Which pieces of evidence [support/contradict] the explanation of the phenomenon?
- Use the model to explain the phenomenon.
- Examine the explanation of the phenomenon. What are some problems/weaknesses of the explanation?
- Examine the data provided. How do the independent variables relate to the dependent variables?
- Examine the evidence provided. Explain what causes the phenomenon and describe how the evidence relates to their explanation.
- Revise the explanation provided based on the new [data/model] you have been given. Describe how the changes you have made relate to the new [data/model].

Designing Assessment Tasks 2: Designing Solutions

Step 1: Choose Your Base

PHENOMENA

Describe your phenomena using text, images, videos, and/or data.

INVESTIGATION

Describe an investigation of an observable phenomenon.

PROBLEM

Describe a problem using text, images, videos, and/or data.

Step 2: Optional Add-ins

data

arguments

model

explanation

research question

Step 3: Choose Your Task

- [Sketch/prototype/describe] a design that solves the problem.
- Analyze the data to determine the scientific causes of the design's failure. How could you improve the design?
- Which design best meets the [needs/criteria and constraints] identified? Justify your response using evidence.
- Discuss the tradeoff considerations for your design approach.

Designing Assessment Tasks 2: Engaging In Argument From Evidence

Step 1: Choose Your Base

PHENOMENA

Describe your phenomena using text, images, videos, and/or data.

INVESTIGATION

Describe an investigation of an observable phenomenon.

PROBLEM

Describe a problem using text, images, videos, and/or data.

data

arguments

Step 2: Optional Add-ins

model

explanation

research question

Step 3: Choose Your Task

- Examine the arguments provided. Which are more scientific? Explain your answer.
- Identify evidence that supports the claim. Explain how each piece of evidence connects to the claim.
- Construct a claim about the phenomenon, identify the evidence that supports the claim, and explain how each piece of evidence connects to the claim using scientific principles you have learned.
- Examine the explanations for the claim. Describe the differences in reasoning. What evidence [supports/contradicts] each explanation?
- Use evidence to support a claim about how well a solution addresses an engineering problem.
- Considering the data sources provided, what pattern of evidence would [support/contradict] the claim?
- Is the evidence provided consistent with the reasoning?
- Is the evidence provided consistent with [the scientific theory/model you have studied]?
- What are the strengths of the arguments provided? What are the weaknesses? Which argument is better supported by currently accepted scientific explanations? Which argument best connects the evidence to the claim through sound reasoning?

Designing Assessment Tasks 2: Obtaining, Evaluating, & Communicating Information

Step 1: Choose Your Base

PHENOMENA

Describe your phenomena using text, images, videos, and/or data.

INVESTIGATION

Describe an investigation of an observable phenomenon.

PROBLEM

Describe a problem using text, images, videos, and/or data.

Step 2: Optional Add-ins

data

arguments

model

explanation

research question

Step 3: Choose Your Task

- Synthesize the resources provided to describe the phenomenon.
- Determine which resources are most helpful in understanding the phenomenon.
- Integrate information from several sources to [answer a scientific question/solve a problem].
- Communicate information from the resources in [oral/written] form using [models/drawings/writing/numbers].
- Obtain information from multiple forms of scientific texts to [answer a scientific question/solve a problem].
- Communicate [an answer to a scientific question/a solution to a problem] in multiple ways (orally, in writing, graphically, mathematically, etc.) to a given audience.

Designing Assessment Tasks 3: Constructing The Assessment

Step 1: Describe Your Scenario

How will you present
students with the
scenario?

What information will
YOU provide?

Things to Consider

1. Minimize background reading.
2. Provide visuals, if possible.
3. Be as specific as you can. (Provide a word bank for targeted terms, for example.)
4. Incorporate the relevant Crosscutting Concept(s).

Step 2: Present the Primary Task

Step 3: Use Additional Questioning to Dive Deeper

Oftentimes, students must be explicitly asked or prompted to demonstrate their understanding.

While you may expect them to address certain concepts through the primary task, it can be helpful to provide follow up questions that either break down the primary task OR elaborate on it.

This is also a great opportunity to emphasize Crosscutting Concepts or review previously assessed Science and Engineering Practices.