Science Assessment System Through Course Task

Which Model is Best?

Grade Level:
1

Phenomena:
Plants Need Water and Light to Grow

Science & Engineering Practices:
Developing and Using Models
Engaging in Argument from Evidence

Crosscutting Concepts:
Patterns

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in collaboration with teachers from Kentucky schools and districts.

Preparing to implement Through Course Tasks in the Classroom

What is a TCT?

- TCTs are 3-dimensional tasks specifically designed to get evidence of student competency in two dimensions, Science and Engineering Processes (SEPs) and Crosscutting Concepts (CCC), untethered from Performance Expectations (PEs)/standards. Tasks are sense-making experiences.
- Tasks are to be used formatively. The goal is for both students and teachers to understand areas of strength and improvement for the SEP(s) and CCC assessed within the task.

How do I facilitate a Through Course Task (TCT)?

- TCT facilitation is a collaborative process in which teacher teams calibrate understanding of the expectations of the task and refine strategies to be used during task facilitation.

Before the task:

1. Complete the TCT as a learner – compare understanding of task through the lens of success criteria (identified in the task) in order to understand expectations.
   Success criteria include:
   - What is this task designed to get evidence of?
   - What is the task asking the students to do?
   - What might a student response look like?
2. Identify the phenomenon within the task. Consult resources to assure teacher teams have a deep understanding of associated science concepts.
3. Collaborate to generate, review and refine feedback questions during facilitation.
4. Identify potential "trouble spots" and plan for possible misconceptions.

During the task:

5. Collect defensible evidence of each student's competencies in 3-dimensional sense-making for the task.
6. Ask appropriate feedback questions to support student access and engagement with the task in order to elicit accurate evidence of student capacities.

After the task:

7. Reflect on the task as a collaborative team.
8. Review student work samples to identify areas of strength and areas of need.
9. Determine/plan next steps to move 3-D sense making forward through the strengthening of the use of SEPs and CCCs.

Using the materials included in this packet:

- **Task Annotation:**
  - The task annotation is a teacher guide for using the task in the classroom. Additionally, the annotation gives insight into the thinking of developers and the task overall.

    - Each task has science and engineering practices, disciplinary core ideas, and crosscutting concepts designated with both color and text style:
        - **Science and Engineering Practices**
        - *Disciplinary Core Ideas*
        - Crosscutting Concepts
- **Student Task:** The materials to be used by students to complete the TCT.

Which Model is Best? Task Annotation

After comparing plant models to identify similarities and differences **in the features, state a claim** as to which model would be most useful when explaining what *plants need to survive* and **support the claim** using patterns identified in the model features **as evidence.**

Phenomenon within the task

The phenomenon is that plants have the common needs of water and light in order to grow. Plant needs are the context for the task, and the assessment focus is on the use of models as a means for communicating information. Students need to begin at an early age using models to represent their thinking or explain something they see in the natural world. It is important that they understand that models can consist of different components, or features, which are used to convey specific scientific thinking/concepts. Some models might have similar features yet they might not communicate the same concept. This task provides students with an experience that requires them to think deeply about various features of models and the usefulness of different features to communicate a concept clearly. The idea that man uses models to represent conceptual understanding of scientific concepts begins at grade K and continues throughout Grade 12.

How the phenomenon relates to DCI

At K, students learn that plants need water and light to grow (LS1.C). This task draws on this knowledge as the context for the models the students will use. This content builds in Grade 1 as students develop an understanding of the parts of a plant that help it survive (LS1.A). As student progress to Grade 2, they will further their understanding about plants as they develop an awareness that plants depend on air, water, minerals and light to grow (LS2.A).

What information/data will students use within this task?

Prerequisite experience/understanding:

- Models (conceptual) represent current understanding of a system or phenomenon.
- Models are tools used to communicate ideas/concepts.
- Models can take a variety of forms besides physical replicas.

- Similarities and differences can be used to help identify patterns.
- Evidence can be used to support a claim.
- Plants have needs, e.g., water and sunlight.

Possible Misconceptions:

- Models are only in magazines and in store windows.
- Models are only miniature physical representations (such as a toy car).
- Models are always accurate.

Ideas for setting up the task with students

Included in this task is a document ***Pre-task Resource*** that is suggested for use prior to engagement in the actual task. Using the pre-TCT resource students will be given the opportunity to distinguish between a model and an actual object. They will explore the difference between the representation of an object, like a diagram of a plant, or a photograph of an apple, and the actual object that they can experience in real time.

After a number of presentations of types of models that can be used to represent objects, students will begin to look at the different models to identify common features and differences. They will chart ways that models are similar and different. Then, they will then use patterns found in the similarities and differences to make a claim about how each model can be used to communicate an idea or help to answer a question.

Prior to using the Pre-task Resource, consider engaging students in a discussion about models. Ask, "*What do you think a model is?*" If students suggest that a model is a person in a magazine or store window guide their thinking to other possible types of models. Ask, "*Have you ever seen or made a model of a real object-like a model airplane, or a design of a house or car?"* Explain that scientists use and construct models as a helpful tool for representing ideas or to explain things.

- Allow students to bring in a favorite toy and look at the toy from the perspective of a model.
- Take a walk around the school grounds and look for things that are models and how they could be used to help understand a scientific idea.
- Bring in a variety of pictures and look at how the pictures represent an actual object.
- Bring in the plans for a house and share how the model is a design for how a house will be built. Look at other designs, like for a garden, a new swing set, or plans to create a new type of car.

- Help students to construct an understanding of the difference between a model and the real life objects. What are the advantages of the real object? What are the advantages of the model?

Note to teachers:

Based on the needs and abilities of your students, you can scaffold the components of this task to ensure that students are able to access the information needed to complete the task. For instance, you can show the models on a whiteboard or print out large copies of the models to add to chart paper. The chart paper can be used to capture student thinking about the features of each model. When comparing the models, you can create an organizer to capture student thinking as well as highlighting or circling features that they models have in common. All of these modifications do not affect the intent of the task, but you should be very conscious about the questions you ask as to not lead the students to the "best" model. Let them do the thinking! You do not need to print out the entire set of papers for each child. This task can be completed in small groups or one on one. It will be up to you and your partner to determine how you will collect data on each child and to plan for common prompts to use as the students share their model choice and their reasoning.

There are a few resources that will be helpful as you seek to better understand modeling in the primary grades. You may wish to do a general search for information about modeling as used in the primary grades.

Other resources for modeling in primary are:

Benchmarks for Science Literacy (AAS 1993 and 2008) K-2 Models:

- Many of the toys children play with are like real things only in some ways. They are not the same size, are missing many details, or are not able to do all of the same things.
- A model of something is different from the real thing but can be used to learn something about the real thing.
- One way to describe something is to say how it is like something else

National Science Education Standards (NRC 1996) K-12 Unifying Concepts and Processes-Evidence, Models and Explanation:

- Models are tentative schemes or structures that correspond to real objects, events or classes of events that have explanatory power.
- Models help scientist and engineers understand how things work.
- Models take many forms, including physical objects, plans, mental constructs, mathematical equations and computer simulations.

Intent of the Task for Assessment

The intent of the task is to elicit evidence of student ability to analyze features of models, then identify which model would be most useful to explain the needs of plants. Evidence gathered will include student ability to analyze and compare the features of the given models, as well as their ability to make a claim that is supported with evidence.

Success Criteria

Evidence of Learning Desired based on Progression from Appendices

Developing and Using Models

- Compare models to identify common features and differences.

Engaging in Argumentation from Evidence

- Construct an argument with evidence to support a claim.

Patterns

- Patterns in the natural and human world can be observed and used as evidence.

Success Criteria

Students make a **claim** about which of three models is best to use when conveying an intended science concept (needs of plants) based on:

- close observation (analysis of) the features of each model.
- comparison of the features in all models (patterns thinking – alike/different, has/doesn't have).
- understanding of the relationship between the model features and the science concept conveyed by the model.

Possible Student Responses

- Model A, B and C all relate to plants. They all have words. They are all in color.
- Two of the models have labels and one does not.
- Two models are diagrams and one is a picture.
- One model has what plants need, one has parts of a plant and one has words.
- One model has a title, one has words and one only has labels.
- Students circle Model B

"I pick Model B because it is a diagram and it shows you all the parts, which means it shows everything the plant needs to grow."
"I pick Model B because it has words, pictures, color and all of the right things, soil, water, sunlight, air and roots. Also, because the other diagram is missing water."
Extended student response: "I pick Model B because it is a diagram that explains what plants need to grow. Model A is a picture with words that don't explain what a plant needs, and Model C is a diagram of plant parts, but it doesn't explain what a plant needs to grow."

Other information teacher teams might find useful when preparing to use this task in the TCT process
Before starting, have students recall what senses we use when making observations. Having a science word bank on an anchor chart is a scaffolding strategy for students with less experience with the written sign system. Listening and speaking are key standards this time of year, so ask students to read the word bank word before starting with the observation, and then again have students read the science vocabulary and sight words before making their claim in written form.

When presenting the task to first graders, it may be necessary to guide them through reading the scenario with Cam and his teacher. As each of the three models is presented to students, teachers are encouraged to support students using prepared questions that will elicit student thinking (rather than telling them what to think) and to record student comments on a chart that can be used by students when making their claim.

*Young students are not aware of how the CCC & SEPs are used in sense making, therefore it is important to engage them in discussions that foster this understanding. For instance, as students engage in this task they are actually obtaining information. They observe and analyze the models to identify features that are helpful when explaining what plants need to survive. The information they gather is used to support their claim. Encourage students to share their thinking and provide opportunities to talk about what sense making skills they are using as they engage in any task. This will help build a foundation that can be built on over time.

Extensions and/or other uses after the task is implemented
Students should be encouraged to make comparisons (in all content areas) and to identify patterns on a regular basis. Provide students with opportunities to create models that show their current understanding of science concepts as well as opportunities to

revise their models as after learning experiences to show growth. This is a powerful tool to use when conferencing with students and when communicating with parents about their child's learning.

Through Course Task – Which Model is Best?

Pre-Task Resource

1. Comparing Models (*Use this sequence of lessons prior to facilitating the TCT)*

Show students an actual car (outside of classroom on street or in parking lot) and a photograph of a car.

Which of the following items is a real car? How do you know? *(Students should be able to differentiate between the features of an actual car and a photograph; the actual car can be driven, they can use their senses to touch it, it can hold people.)*

How is the real car like the photograph of a car? *(Students should note that both have wheels, tires, hood, their shape is the same.)*

How is it different? *(Students should note that the real car has actual tires, hood, windows, you can touch the actual car and feel the texture, whereas the photograph is a picture, or model of what a car looks like and when you touch it, you are touching a picture and not the actual car. You can get inside and drive an actual car, but you can only look at a picture of a car.)*

Next show students a photograph of a car and a diagram of a car. Engage in discussion about how the photograph and the diagram are both models of a car. Scientists make models as a helpful tool to represent ideas and explanations.

Have students discuss the features of the photograph model and the features of the diagram model.

Model for students how to chart ways that the features of the two models are alike.

<table>
<tr><th colspan="2">Box and T Chart</th></tr>
<tr><td colspan="2">How are the features of the two models alike?
Possible student responses:
They both provide information about a car
They both show parts of a car like the wheels, windows, doors.
They both show the shape of the car</td></tr>
<tr><td>Photograph
Possible student responses:
The photograph is a picture.
The photograph does not have words.
The photograph shows colors.</td><td>Diagram
Possible student responses:
The diagram is a drawing.
The diagram uses words to explain the parts.
The diagram shows the car in black and white.</td></tr>
</table>

Discuss the following situations with students:

Situation 1:

Cara's family just bought a new car and her classmates asked, "Cara what does your new car look like?"

What features of the model shown above would best help her to answer their question?

Why do you think so?

Situation 2:

Juan had to walk to school because his family's car had a problem that needed to be fixed.

What features of the model would provide useful information about fixing the car's problem?

Why would the features of the other model not be as helpful to the family?

2. Comparing Models of Sunflower

Show students an actual flower (outside of classroom or one that you can bring into the classroom) and a photograph of a flower.

Which of the following items is a real flower? How do you know? *(Students should be able to differentiate between the features of an actual flower and a photograph; the actual flower can be felt using their senses, it can grow and is a useful part of the plant for helping the plant make seeds. The can use their senses to touch, smell, and/or feel it.)*

How is the real flower like the photograph of a flower? *(Students should note that both have the same parts and the same shape.)*

How is it different? *(Students should note that the real flower grows and is part of a plant. They can use their senses to gather information about the real flower, whereas the photograph is a picture, or model of what a flower looks like, and when you touch it, you are touching a picture and not the actual flower.).*

The photograph and the diagram are both models of a sunflower. We thought about how scientists make models, like the car model as a helpful tool to represent ideas and explanations.

Now, think about the photograph of the flower and the diagram. In the top box list ways that the models are alike. In the bottom two boxes list parallel differences.

How are the models alike? How are they different?

<table>
<tr><th colspan="2">Box and T Chart</th></tr>
<tr><td colspan="2">How are the models alike?</td></tr>
<tr><td>Photograph</td><td>Diagram</td></tr>
</table>

Discuss the following situations with students:

Situation 1:

Sam's class decided to plant a garden at school. One plant that grew in the garden was the sunflower. At home one day, Sam was telling his sister about a pretty sunflower growing in the garden. His sister asked, "What does a sunflower look like?"

Back at school, you asked your teacher if you could pick the sunflower from the garden and take it home to show your sister. Your teacher suggested that you share a model of the sunflower with your sister instead.

- Why do you think that your teacher would not let you take the real flower to show your sister? *(The actual sunflower is an actual part of a plant and it would not be able to grow and do its job for the plant if you picked it to take it home.)*
- What features of the model shown above would best help to answer their question?
- Why do you think so?

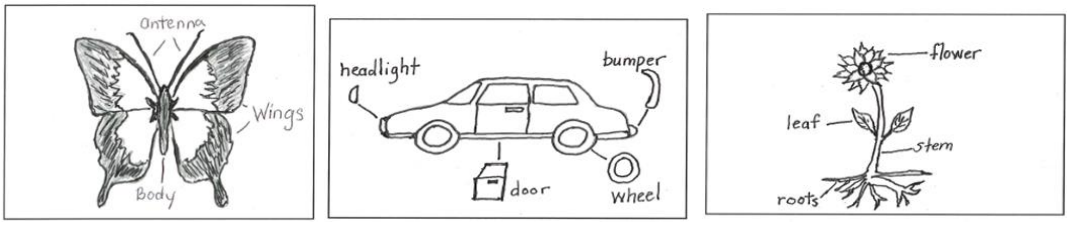
Situation 2:

One day you noticed that the sunflower had fallen over on the ground. Everyone in the class was worried.

- Which model has features that will help the class learn more about the parts of the sunflower and what they do to support the plant?
- Why would this model be the best to use to answer this question?

1. Comparing Model Features

Present the following three models to students.



Discuss with students:

1. What are the common features found in the models?
2. How are they different?
3. How would the features of this type of model be useful in solving a problem?

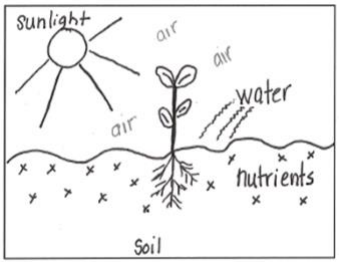
Through Course Task – Which Model is Best?

As Cam was walking to school he saw a plant growing along the path. It made him wonder, "**What does this plant need to grow?"**

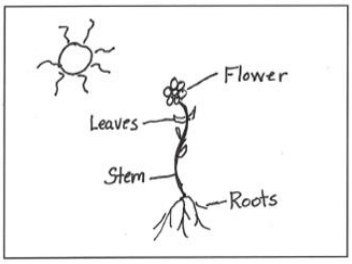
At school, he asked his teacher, Miss Pat, to help him answer the question. Miss Pat showed Cam some models, and told him that models are useful to understand and explain things. She showed Cam three different models and explained that models usually have parts, or features, that help tell about an idea or something that is understood. She also told him that different models are used for different reasons.

Model A

Model B



Model C



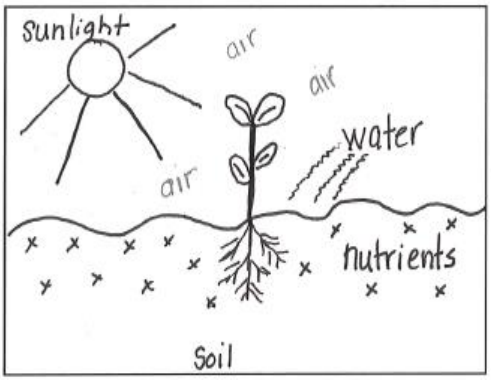
Miss Pat suggested that Cam compare the features in the models to find out how what they have that is alike and what is different.

How are the models alike?	How are the models different?

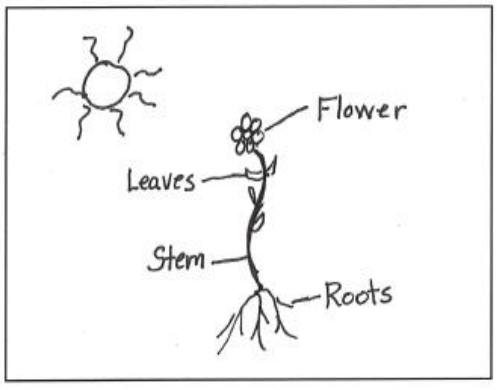
Next, Miss Pat asked Cam to think about each of the models and their features.

Model A: What features do you observe in Model A? What do the features help you understand?

Model B: What features do you observe in Model B? What do the features help you understand**?**

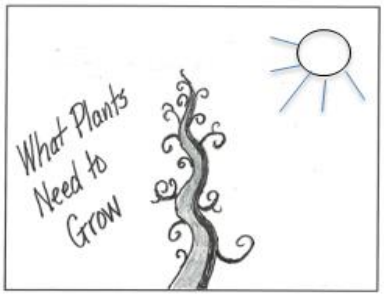


Model C: What features do you observe in Model C? What do the features help you understand?

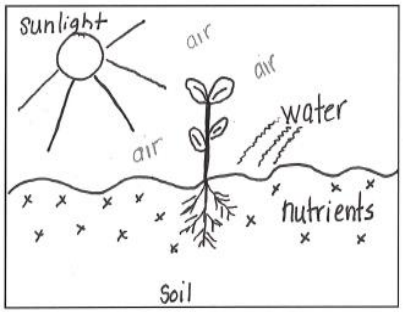


Cam looked at all three models again. He said to his teacher, “I can see that all of the models are alike in some ways, but they are also different.” His teacher said, “All are useful but you need to decide which one will be most helpful when answering your question. Look at each model again and think about how each of the models help you understand about the needs of plants.

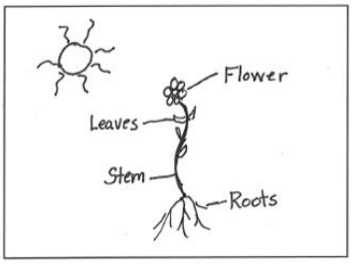
Model A



Model B



Model C



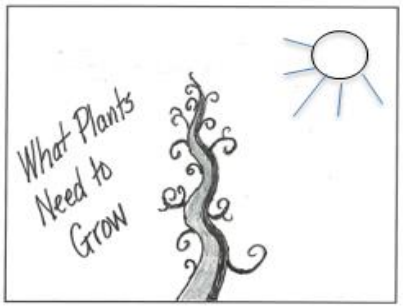
Based on the features of each model, which model do you think gives Cam information that will help him answer his question?

"What does a plant need to grow?"

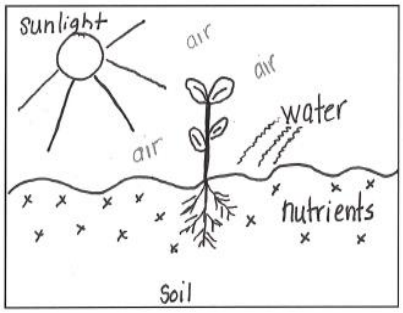
Student Name_____ Date_____

CIRCLE the model you choose.

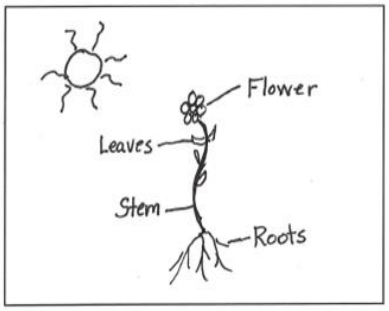
Model A



Model B



Model C



I claim that model **A** **B** **C** would be most helpful to explain what plants need to grow.

I chose this model because

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