# Science Assessment System Through Course Task

## Acorn to Oak Tree

**Grade Level:**
5

**Phenomena:**
Tree Mass from Gas (and Water)

**Science & Engineering Practices:**
Analyzing and Interpreting Data
Constructing Explanations and Designing Solutions

**Crosscutting Concepts:**
Patterns

Designed and revised by Kentucky Department of Education staff
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.

# Acorn to Oak Tree Task Annotation

After **analyzing the data from BOTH experiments** on *matter and plant growth*, identify the patterns in the data **that support the explanation** that *plants get their matter from air or water and not from the soil.*

**Overall Intent**

This task was developed with the intent of evaluating 5th grade students' ability to a) analyze, interpret, and compare data to provide evidence of a phenomenon, b) use data as evidence to support an explanation and c) use a patterns lens to analyze and understand a phenomenon.

**Phenomenon within the task**

Although air is not visible and water comes and goes visibly around a tree, it's a phenomenon that the vast majority of the mass of a growing/grown oak tree comes from air and water, and not the soil.

In this task, the students are interested in the source of the mass in plants, beginning with pondering how an acorn develops into an oak tree. The girls in the task have conflicting ideas about where the mass comes from and decide to set up experiments to gather data to support and/or refute their explanations. This leads them to generate data, compare the findings of the two experiments, and utilize patterns thinking to come to a consensus that the plant mass derives from air and water, not soil.

**Ideas for setting up the task with students**

We recommend that students engage with this task after some experience with planning and carrying out investigations that involve collecting and analyzing data. Students should have experiences in thinking about how to design investigations that help them explain phenomena that they have encountered. Ideally, students would have had completed some investigations surrounding plants. Finally, to be successful at this task, students will need to have had experience using the crosscutting concept of patterns and patterns in data to analyze phenomena. *Multiple experiences with identifying patterns within data sets is recommended prior to engaging with this task.*

**Intent of the Task for Assessment**

As described in the Overall Intent section above, this task was designed to elicit evidence of the student's ability to think and act like a scientist in several overlapping ways. Can students use the idea of patterns to understand the data and how it relates to the phenomena of an acorn becoming an oak tree? Can students look critically at the data to identify the patterns that provide evidence

of an explanation that the plants' mass is from the air and water, and not the soil? Can students synthesize the information gleaned from data as evidence to support an explanation?

**List components of the task / resources used with the task.**

1. Text giving information/rationale about the experiments
2. Completed data charts for each experiment
3. Task directions

**Success Criteria**

Evidence of Learning Desired based on Progression from Appendices

- Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products. Patterns can be used as evidence to support an explanation. (App G - Patterns)
- Students analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.
- (App F - Data)
- Students will compare and contrast data collected by different groups in order to discuss similarities and differences in their findings. (App F - Data)
- Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem. (App F - Constructing Explanations)

Success Criteria

- Students identify that the patterns in the data in Experiment A indicate that, for each of the three bean plants, the plant mass is increasing, while the soil mass is remaining virtually the same.
- Students identify that the patterns in the data of Experiment B indicate that all three spider plants are increasing in mass without the presence of soil.
- By comparing the patterns in the data, students come to the logical conclusion that the plant mass must not be coming from the soil based on Experiment A, but instead must be coming from the air and water.

- Students use the patterns in the data to construct a logical explanation of plant mass being derived from air and water, not soil.

Actual Student Responses

- "The pattern in experiment B is every week they checked the mass of the spider plants and every time each plant got heavier and heavier"
- "They now know that plants get their matter from the air or water and not the soil because in Experiment A, all of the bean plants grew in size (mass), but the soil mass did not really change at all. That means that if the plants were getting bigger, it wouldn't be from the soil since the soil never decreased in mass."
- "In Experiment B, the spider plants all grew in size and in the text, it said they needed to refill the water every week. That means that the spider plant must have grown due to the water."
- "If the spider plants can grow with only water and air and without soil it means that the plant gets its mass from water or air and not soil."
- "The data shows that plants get their matter from air and water because in experiment A bean plant 1 shows that when they planted the plant it had the same amount of soil as it did after 4 weeks. In bean plant 2 it only uses 1/10 of a gram of soil and it grew bigger…."
- "Compared with how much they grew, the plants barely even used the soil to help make their matter."
- "Based on those two experiments, the girls realized that the plants' mass can't come from the soil and must come from somewhere else."

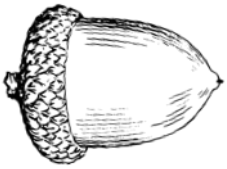
**Other information teacher teams might find useful when preparing to use this task in the TCT process.**
Students could become confused about the different variables (different plants, different time spans, etc.) for the two experiments. Encouraging students to analyze each experiment separately before synthesizing their findings, should keep them from getting the data analysis confused.

Students should be exposed to common language and vocabulary within our science standards.

**Extensions and/or other uses after the task is implemented.**
Teachers may wish for students to more fully explore, allowing the student to design and conduct similar experiences with bean, spider or other plants to add validity to their explanations. The students could compare and contrast their own findings to the ones presented in the prompt. Allowing similar experiments to be conducted with other plants may add more insight into

understanding and crafting an explanation of the phenomena. Students may be asked to more directly compare data of the sorts provided in this task, noting the similarities and differences in findings as interpretive and/or predictive tools for understanding the phenomena or patterns in the phenomena. To reach more logical conclusions about plant growth, students could research plant growth (photosynthesis).

# Through Course Task – Acorn to Oak Tree



Maria and Pretha are walking around the school grounds. On their walk, Maria picks up an acorn.

Maria asks, “Can you believe that this tiny acorn could one day become one of these big oak trees by our playground?”

“I know!” Pretha replies, “Remember how those tiny carrot seeds we planted became great big carrots that we ate? I still don’t get how that works. How do plants grow from tiny seeds into adult plants like oak trees and carrots? I get that the plants get energy from the sun, but what do plants make their body out of?”

“Yeah, where does the matter come from?” wonders Maria. “I guess it comes from the soil the plants are growing in, right? I mean plants are solid matter. Soil is a solid. So plants must build themselves out of the particles they take in from the soil.”

“I don’t know about that,” says Pretha. “At home, my mom has some plants in pots in the windows. They get bigger and bigger each year, but she never adds any soil to the pots. I think plants must get their matter from air or water.”

“How could we get evidence to find out where the matter comes from when plants grow? Maybe we could do an experiment!” The two girls head in from the playground. Their teacher helps them to design two experiments to test their ideas and to collect data about where plants get their matter.

> **Experiment A:** Maria and Pretha plant 1 bean seed in each of three cups of soil. Before planting, they measure the weight of the seed and the weight of the dry soil in each cup. They put the cups on a sunny windowsill and water every day. After 4 weeks of growth, they pull out the plants and weigh each plant. Then they let the soil dry out, and measure the weight of the soil in each cup again.

**Spider Plant 2 – 9/1/16**

**Experiment B**

Maria and Pretha take three clippings from a Spider Plant, a houseplant. They plant each clipping in a cup of water, with no soil, and put the cups on a sunny windowsill. They measure the mass of each plant before it is put in the water and then measure weekly for six weeks. Every week, they add water to keep the cups full.

**Spider Plant 2 – 10/31/16**

After their experiments are completed, Maria and Pretha organize their data into charts.

**Experiment A**: Bean Seeds in Soil

| | **BEAN PLANT 1** | |
|---|---|---|
| | **Plant mass** | **Soil mass** |
| 9/1/16 | 0.5 grams (seed) | 51.3 grams |
| 9/29/16 | 17.7 g | 51.3 g |

| | **BEAN PLANT 2** | |
|---|---|---|
| | **Plant mass** | **Soil mass** |
| 9/1/16 | 0.4 g (seed) | 53.0 g |
| 9/29/16 | 13.0 g | 52.9 g |

| | **BEAN PLANT 3** | |
|---|---|---|
| | **Plant mass** | **Soil mass** |
| 9/1/16 | 0.5 g (seed) | 50.7 g |
| 9/29/16 | 21.2 g | 50.5 g |

**Experiment B:** Spider Plants in Water

| Date | Spider Plant 1 Mass | Spider Plant 2 Mass | Spider Plant 3 Mass |
|---|---|---|---|
| September 1 | 3.1 grams | 2.8 grams | 3.3 grams |
| September 8 | 3.5 | 3.3 | 3.4 |
| September 15 | 5.2 | 5.1 | 4.7 |
| September 22 | 8.4 | 7.5 | 6.6 |
| September 29 | 12.3 | 9.2 | 9.1 |
| October 6 | 15.1 | 10.9 | 11.7 |
| October 13 | 16.7 | 12.8 | 14.1 |

After looking closely at their data, the students thought about their explanations. *They realized that, as plants grow, their mass doesn't come from the soil. It must come from the air and water.* How did they come to this conclusion based on the data they collected?

**Task: After analyzing the data from BOTH experiments on matter and plant growth, identify the patterns in the data that support the explanation that plants get their matter from air or water and not from the soil.**