Science Assessment System Through Course Task

The Big Spill

Grade Levels:
2

Phenomena:
Absorbency of Different Materials

Science & Engineering Practices:
Analyzing and Interpreting Data
Engaging in Argument from Evidence

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.

The Big Spill Task Annotation

Task Template: After **analyzing data from tests** of *properties of various materials*, **make a claim** about the effectiveness of a *material for an intended purpose*, and **support the claim based on** patterns identified **in provided investigation results** *for the materials*.

Phenomenon within the Task

A spill in the cafeteria is certainly an event that most second graders have experience with, as well as the mess in trying to clean it up with school grade napkins or paper towels versus the observed ease in cleaning of the spill using the custodian's mop. This task forces students to question why this disparity between materials exists and to use experimental data to support their claims. The Big Spill was designed to highlight that students can use data from simple tests as evidence to support or refute ideas about the effectiveness of something based on interpreting simple qualitative and quantitative data. Students will use the data to help support or refute the usefulness of various materials for cleaning up a spill. Finally, the students are asked to transfer their evaluation of the data by using the same sets of investigative data with new criteria in mind (waterproofness and strength) for creating an outdoor flag.

Connections to DCI

This task supports development of PS1.A (*Different properties are suited for different purposes*) but does not delve deep into what makes one material more absorbent or stronger than another material. Student focus is on analyzing and using the outcome of investigations that test for these properties, rather than developing an understanding of the characteristics of the materials that result in these properties. It is strongly encouraged that students be provided opportunities to explore these properties in depth after task facilitation.

Information used by students to complete the task

Information provided:

- Story (read aloud to class by teacher)

- Illustrations of material samples and investigation procedures
- Data charts of results from each of two investigations

Prior experience required:

- Familiarity with vocabulary used in task: *material, **properties**, absorb/absorbency, data, investigation*
- Experience with reading information in charts/tables
- Understanding of the need to support scientific arguments with sufficient evidence

Ideas for setting up the task with students

Essential Components needed:

- The Big Spill- Teacher Page
- The Big Spill- Investigative Data
- The Big Spill- Student Response Page

During the Task:

- Read the story aloud to your class.
- Distribute the data sheet for each student and/or show using a document camera.
- Call attention to the illustrations and data as you read about the two investigations.
- Ask questions to check students' comprehension of the data presented in each chart.
- If necessary, confirm that students understand that the numbers in Chart 2 refer to number of rubs before the material tears (and that a greater number of rubs indicates a stronger material).
- Allow students to independently answer the questions using the data sheet. You may encourage students to circle or mark the data that they want to cite in their answers. In addition, we found that reading each question and then allowing time to respond before moving to the second question was most effective for this age group.

Intent of the Task for Assessment

Using this task, teachers should be able to collect evidence of and gain insight into their students' abilities to employ these two scientific practices:

- Analyzing and Interpreting Data
- Engaging in Argument from Evidence

Students combine simple numerical and qualitative data/information from two different investigations based on the relative usefulness of various materials for cleaning up a spill to make an informed choice (a claim). In addition, they make comparative statements based on data in question three (i.e., "This material is stronger than this material because in the data one tore at 66 rubs and the other tore at 25 rubs."). By doing so, students are essentially identify patterns in the data. Often we do not think of making comparisons or identifying similarities and differences as identifying patterns, but these foundational skills are essential as students engage with both macroscopic and microscopic phenomena.

Based on our experience with this task, students may be able to quickly identify which material is "best" or "better" for cleaning up a spill, but may only offer a very basic claim as to why. This task can help illustrate whether students can use data as evidence effectively and fully. We found that many students simply copied the data from the chart, but couldn't explain how the data helped to inform their choices. This task offers an opportunity to access the level of students' abilities to fully support their claims.

The initial portion of the task should be facilitated in a manner that supports students in accessing the data collected from the investigations. Class discourse about the purpose of the investigation and the results is encouraged, being careful not to lead students to an answer for the final question.

The final question in this task asks students to look at the same sets of investigative data with new criteria in mind (waterproofness and strength) for creating an outdoor flag. We found that some students struggled to switch their thinking to what criteria would be necessary for an outdoor flag, and instead, answered that the cotton cloth would still be a good material. Depending on student prior experience it might be necessary to discuss weather elements and/or show pictures of outdoor flags, perhaps walking by a school flag high on a flagpole. This part of the tasks offers insight into the student's ability to think about how the same materials may not be well-suited for a different task. It highlights for teachers whether students are aware of the causal relationship between

the material properties and their functionality for different purposes in addition to using relevant information when making decisions (the data from the investigations).

Success Criteria Development

Evidence of Learning Desired based on Progression from Appendices

Analyzing and Interpreting Data

- Use observations to describe patterns and/or relationships in the natural and designed world in order to answer scientific questions and solve problems.
- Analyze data from tests of an object or tool to determine if it works as intended.

Engaging in Argument from Evidence

- Construct an argument with evidence to support a claim.

Patterns

- Patterns in the natural and human design world can be observed, used to describe phenomenon and use as evidence.

Success Criteria

- Student identifies the cotton towel as the best material for cleaning up the spill and identifies the properties of absorbency and strength to support their claim.
- Student uses specific data from BOTH charts to support that the cotton towel is better than other materials for cleaning up the spill. Student clearly demonstrates an awareness that the evidence supports a relationship between the data and the material's effectiveness.
- Student identifies nylon as the best material for an outdoor flag and supports this choice with specific evidence from the TWO investigative data charts.

Possible Student Responses (taken from actual student work)

- "The material needs to be strong and soak up all of the water."

- "Both the cotton towel and sponge soaked up all of the water but the cotton towel was stronger with 66 rubs than the sponge with 25 rubs"
- "I choose nylon cloth. An outdoor flag would need to not soak up water and in the chart is said that nylon soaks up none and it also needs to be strong. The nylon and the nylon is pretty strong. It did not rip for 50 rubs."

Other information teacher teams might find useful when preparing to use this task in the TCT process

- Though not necessary to task completion as we want the students using the data and not relying on their own knowledge/experience with the materials, it may be helpful to have samples of the materials available. Many students during the pilot were curious about the materials used in the task.
- Be sure to assist the students and call their attention back to the data in the charts. You may want to encourage them to circle or highlight the data that is useful as evidence.
- Have students think of uses for the identified materials other than those in the task. Promote thinking as to what makes certain materials good for specific tasks or products.
- Consider engaging students in opportunities where they are given scenarios that require them to determine which material is best for certain situations based on the same data.

Through Course Task – The Big Spill

Teacher Page

Teacher reads all of the following:

"Gus and Kate are eating lunch in the cafeteria, when Gus accidentally knocks Kate's juice carton off the table. It spills onto the cafeteria floor. Gus and Kate first try to clean up the spill using the **paper napkins** they have on their trays. They are able to get some of the juice off the floor, but soon the napkins are just smearing the juice around and starting to fall apart.

A teacher sees the kids trying to clean up the spill and offers them some **paper towels** to help. They are able to get more juice up off the floor with the paper towels, but not all of it. Soon, the custodian comes over with the **sponge mop** and cleans up the rest of the spill. The kids thank the custodian for his help, but it gets them wondering: *How did the mop clean up the spill so much easier than the paper towels and napkins?*

They decide to ask their teacher when they return to their classroom. The teacher says that they can set up some investigations to help find out why the different materials worked better or worse for cleaning up the spill. The teacher also suggests that maybe they should try out a few more materials in their investigation. They decided to test six materials: **paper** napkins, **paper** towels, a **sponge**, **cotton** cloth from an old towel, **nylon** cloth from an old raincoat and **fleece** from a pull-over jacket. With the help of their teacher, Gus and Kate did the following investigations.

Distribute/project and direct student's attention to visual of materials to be tested on student page one.

INVESTIGATION 1: Absorbency Test

First, Gus and Kate wanted to figure out which material soaked up, or *absorbed*, the most water. With the help of the teacher, Gus and Kate cut out small, same-sized squares of each of the materials they were testing. They measured one tablespoon of water into each of eight paper cups. Then, they placed each of the materials into a cup of water for one minute and watched how much water each material soaked up. They recorded the data in **Chart ONE**.

Direct student's attention to visual of testing method and data chart one.

INVESTIGATION 2: Strength Test

Next, Gus and Kate wanted to figure out how strong each material was. With the help of the teacher, they cut out larger same-sized squares of each of the materials. They took each piece of material and rubbed it hard on the carpet, counting every back and forth rub. When the material started to tear, they stopped and wrote down the number of rubs. They recorded this data in **Chart TWO**.

Direct student's attention to visual of testing method and the first column of data in chart two.

Finally, they tested to see which materials were still strong even when wet. They wet new samples of each of the materials with one tablespoon of water. Then they repeated the strength test with these wet pieces and added this data to the chart.

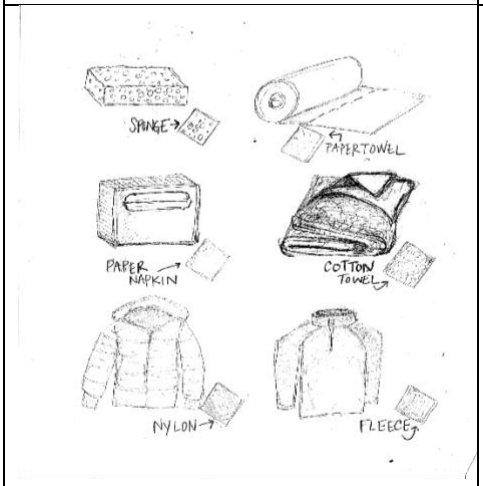
Direct student's attention to the second column of data in chart two.

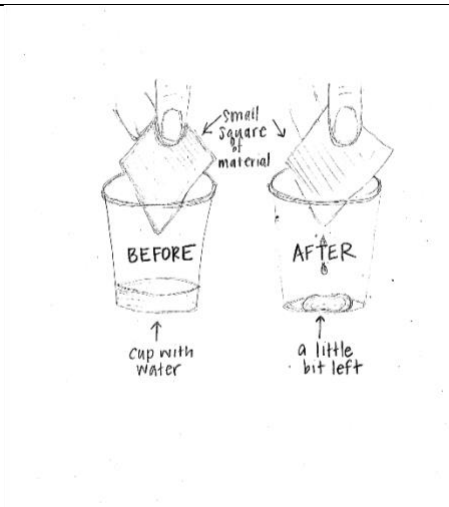
Data Page

INVESTIGATION 1

Absorbency Test (How much water will each material soak up?)

Materials for Testing	Procedure	CHART ONE: Data from Investigation 1





Material	Amount of Water Absorbed (soaked up)
paper napkin	a little bit
paper towel	about half
cotton towel	all
sponge	all
nylon cloth	none
fleece cloth	very little

INVESTIGATION 2

Strength Test (How much can a material rub on the carpet before tearing?)

Procedure

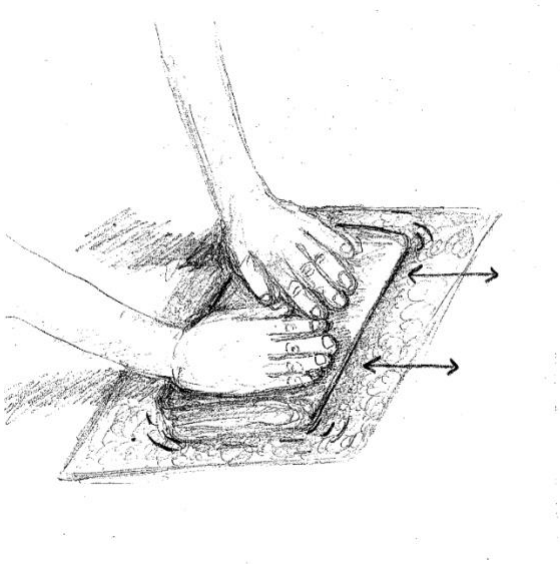


CHART TWO: Data from Investigation 2

Material	Number of rubs on carpet before material tore	
	Dry Material	**Wet Material**
paper napkin	2	1
paper towel	3	1
cotton towel	66	60
sponge	25	12
nylon cloth	50	48
fleece cloth	30	24

Name_____

The Big Spill - Student Response Page

Why do you think Gus and Kate conducted the tests they did? What do you think they wanted to learn about the materials?

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Based on the investigations that Gus and Kate did, what material would be best for cleaning up a water spill?

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What information from the investigations causes you to think this material is better than the other materials that Gus and Kate tested? Use the data in **Charts One and Two** to support your answer.

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Later, Gus and Kate decide that they want to make a school flag to hang outside their school on the flagpole. They thought about what is important to know about a material that would be outside every day.

List some properties that would make a material a good choice for an **outdoor** flag.

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Review the data Gus and Kate collected during the investigations. Think about what Gus and Kate learned about each of the materials from the results of the investigations.

Would the material you chose for cleaning up a water spill be good choice to use for an outdoor flag? Why or why not?

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Which of the six materials tested would be the best choice for an outdoor flag? Use data from the two investigations to support your answer.