Science Assessment System Through Course Task

Pots and Pans

Grade Level:
4

Phenomena:
Engineering Design

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

Crosscutting Concepts:
N/A

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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.

Pots and Pans Task Annotation

After **organizing data to support evaluation against criteria and constraints** *for a set of pots and pans*, **state a claim supported by evidence** as to which of four *proposed sets of pots and pans best meets the identified criteria and constraints*.

Note: Typically, any PE that relates to an ETS DCI doesn't have a CCC connected to it. See the Engineering Design page for Grade 3-5 in the standards. You will see that there are 3 PEs, none of which have a CCC connected in the foundation boxes (the green area). There is only a reference to the influence of Science, Engineering and Technology on Society and the Natural World. Therefore, students are asked to process the information through the lens of the needs and wants of people. However, it can be argued that causal thinking is present in tasks where students are evaluating design solutions, such as this task. What causes one design solution to be a better choice over others? *While this is not the intended use cause and effect as a CCC in scientific sense-making as to the intent of the standards (what causes a phenomenon?), being intentional about causal thinking in any classroom experience is beneficial to building understanding for cause and effect.*

Phenomenon within the task

This is an engineering design task. The context for the task is a hypothetical scenario where a grandma wants to purchase a set of pots and pans. The grandma has a "wish list" of features that she would like the pots and pans to have (criteria) to use with her new gas range (constraint). Students evaluate several sets of pots and pans to determine which set best meets the desired criteria set by Grandma.

How the phenomenon relates to DCI

ETS1A: Defining and Delimiting Engineering Problems: Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared based on how well each one meets the specified criteria for success or how well each takes the constraints into account.

> ***3-5 ETS1-1:*** *Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time and cost.*

What information/data will students use within this task?

- Experience identifying problems to be solved, related criteria and constraints
- Experience establishing criteria for a successful design solution
- Opportunities to learn about how constraints impact design solutions
- Use of criteria to evaluate design solutions
- Prior experience locating relevant information in text (cookware descriptions)

Content:

- Familiarity with cookware
- Basic understanding of types of oven/stove appliance
- Non-stick surfaces
- Basic understanding of conductors and insulators (plastic and metals)
- Familiarity with term “transparent”

Ideas for setting up the task with students

Provide students opportunity to observe various ovens and discuss the difference between an oven and a stovetop. Students do not need to know specifics about how ovens/stovetops work but they do need to understand that various types are available. The same is true for cookware. Expose students to an array of cookware and encourage discussion as to why certain features of the cookware are desirable. Be sure to discuss differences in handles. Students should have some basic understanding about materials that serve as insulators. Some of the cookware in the task have metal handles. It will be important to ensure that students understand that even though the handles are made of metal, the design of these metal handles minimizes heat conduction. Often metal handles are split in to 2 or more narrow cross sections near the handle of the pan. This design allows heat to pass through these openings therefore passing less heat. The heat conducted is dissipated into a much larger area resulting in the handle having a lower temperature. Students might also observe that the handles are thinner, not in direct heat, placement of handle is near rim which is not directly in contact with the heat source and the area of the handle in contact with the pan/pot is small.

Provide students with opportunities to observe cookware lids. Promote discussion as to the benefits/limitation of various lids: transparent versus opaque. The handles on lids can also be discussed as they too relate to conduction. This is not imperative for completion of the task but serves as a talking point to reinforce features of cookware that are desirable (based on needs and wants).

It would be helpful if the students have had experiences related to establishing criteria for a successful design solution as well as opportunities to learn about how constraints affect design solutions.

Task: The task begins with a somewhat realistic scenario where a person is preparing to purchase a new set of cookware. A wish list of the features desired in the cookware is shared as is a constraint that needs to be considered (gas stove).

Part A: Students begin the task by identifying the problem within the task, the criteria for success and a limitation, the identified constraint. If these terms are relatively new to students, or if they have had limited experience in identifying criteria and constraints, it is recommended that this part be facilitated in a way that promotes student thinking about the problem, the wants and desires that need to be taken into consideration and the limitation the need to be taken into account.

This component of the task should be facilitated in a way that best meets the needs of your students. Because the information for question in Part A is accessed by reading the text, it might be necessary to share the scenario aloud or have students buddy read. It is suggested that the class share out the information they found in the text so that all students have access to the same information. Without an understanding of this portion of the task, students will not be successful in solving the problem.

Part B: Next, four sets of cookware are provided along with a brief description of the features of each. This portion of the task provides an opportunity for students to choose how they will organize and present the given data in order to make a fair and accurate decision as to which cookware set Grandma should purchase. There are multiple ways to approach the task. Students might create a checklist based on the defined success criteria (Grandma's wish list) and the identified constraint (gas stove). Others students might highlight relevant information in the cookware descriptions or rank the cookware based on the number of criteria it meets. Whichever way students choose to organize the data, provide an opportunity for students to look closely at all the presentations. Consider having students engage in a gallery walk to make observations on each display. Taking into account the various ways students organize the data, promote rich discourse related to the similarities and differences in the way the data was organized as well as key patterns that arise from analysis of data. Students can discuss which way is most helpful in "seeing" the best

choice for Grandma. By encouraging this type of discourse you will gain insight as to how your students process and reason with information. Be mindful that students should focus on the display of the information and not the data in the display. This portion of facilitation is not about which set of cookware Grandma should buy, but rather how student gathered and organized the data. Steer clear of conversation that focuses the solution to the problem. After creating and sharing the tools used to gather information, each student evaluates the sets of cookware in light of the given criteria and constraints provided in the scenario.

A resource for this type of experience is **5 Practices for Orchestrating Productive Task- based Discussions in Science** (National Council of Teachers of Mathematics, 2013). Here you will find support on how to facilitate productive talks that aligns with the science and engineering practices.

Part C: Students work independently to apply the results of the data analysis to two questions related to Grandma's new cookware. First, students determine if the set Grandma selected is the best choice based on her wish list and the constraint of the gas stove. They use evidence from their analysis of all the displayed data to support their answer. Next, students state a claim as to which of the cookware sets they would recommend to Grandma. Again, students support their selection using data from the evaluation of the cookware as evidence.

Intent of the Task for Assessment

The intent of this task is to get evidence of a student's ability to develop a reasoned argument for competing designs. In order to do this, students must access the provided data. Components of this task are completed collaboratively in order to facilitate engagement with the topic of cookware (types of cookware, development of criteria and identification of constraints). Through collaboration, the experience is more equitable, thus allowing for better evidence of the intended student learning. Teachers will need to be very intentional in how they gather evidence of student ability when organizing and analyzing the data as these skills are essential for successful engagement in the task, but are also valuable, transferable skills for many applications and disciplines that all students need to develop. Preplanning for gathering anecdotal information as students work collaboratively is necessary. Consider developing check sheets with specific "look fors" identified to use as you listen in on conversations and ask probing questions to elicit student thinking.

Success Criteria

Evidence of Learning Desired based on Progression from Appendices

Note: Because of the structure of this task, evidence of student learning related to the SEP that is bolded is gathered as students engage collaboratively. Therefore, these components of the task are not included in the success criteria but are essential to engagement in the task. It is suggested that teachers plan effectively for gathering formative information on all students.

Analyzing and Interpreting Data

- **Represent data in tables and/or various graphical displays to reveal patterns that indicate relationships**
- Use data to evaluate design solutions

Engaging in Argument from Evidence:

- Respectfully provide and receive critiques from peers about a proposed procedure, explanation, or model by citing relevant evidence and posing specific questions. (Part C - students critique the set of cookware proposed by Gramma.) **Evidence of student ability related to this SEP is gathered as students engage in task part B-students provide feedback on the effectiveness of presentation of relevant information to be analyzed.*
- Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem

Success Criteria

Part A – Students identify the problem as well as the criteria and constraints associated with the problem.
Part B – Student work collaboratively to identify relevant information and organize that information in a way that makes it clear as to which of the cookware sets is best for Grandma.
Part B – Students provide feedback on the effectiveness of presentation of relevant information to be analyzed.
Part C- Student provides reasoning consistent with the data analysis to support or refute the argument that SS is the best cookware for Grandma Rose.
Students state a claim as to which one of the proposed design solutions they feel best solves the identified problem based on:

- Criteria and constraints are accurately applied when evaluating design solutions
- Use of reasoning consistent with information provided in the task (set of cookware, problem to be solved).

Possible Student Responses

- Relation of constraints and criteria of success to solution chosen
- Supported claim with evidence found in the provided data (shared information displays)

- Reasoning as to why the solution they choose is the best choice

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

Consider asking colleagues to allow you to borrow a piece or two of their cookware. This would provide students with an array of pots and pans to observe since most kids are only familiar with those they have at home.

Extensions and/or other uses after the task is implemented

- Students consider other criteria that should be taken into consideration when purchasing a new set of cookware. Should cost be considered? Does the cookware come with a warranty? Does color matter? Etc.
- Students could do research on which cookware set is rated the best by other consumers?
- A deeper look into the materials that make up the cookware might be of interest to students.

Images of Pots and Pans

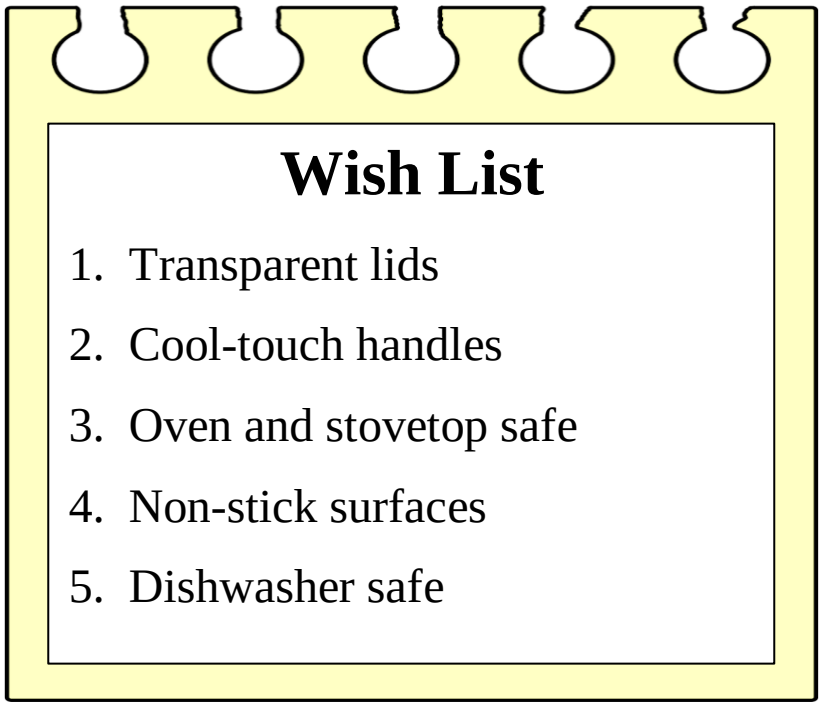
- Stainless Steel Cookware: "Familiar pots and pans" by Ole Jensen licensed under CC BY-SA 2.0
- Simply Balaton: "Red pots and pans on white table" by https://www.yourbestdigs.com/ licensed under CC BY 2.0
- T-Fabulo: "T-fal pots and pans" by https://www.yourbestdigs.com/ licensed under CC BY 2.0
- Copper Infused Ceramic Cookware: "Copper and black pots and pans" by https://www.yourbestdigs.com/ licensed under CC BY 2.0

Through Course Task – Pots and Pans

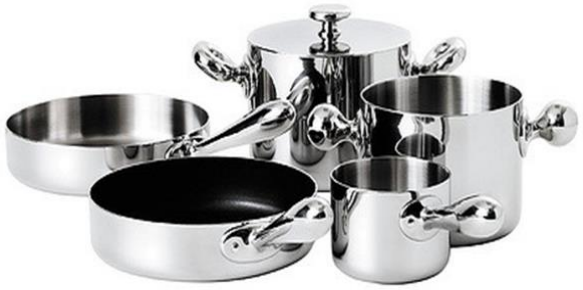
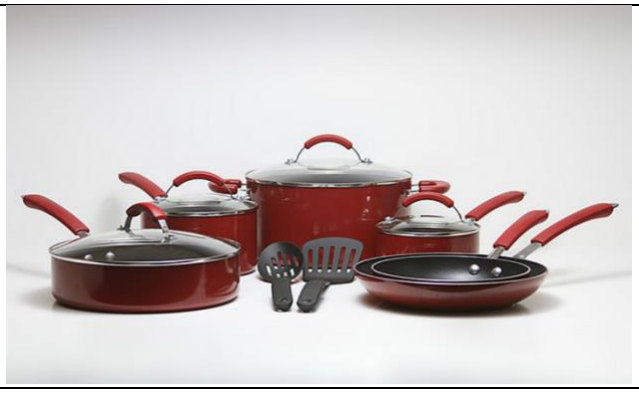
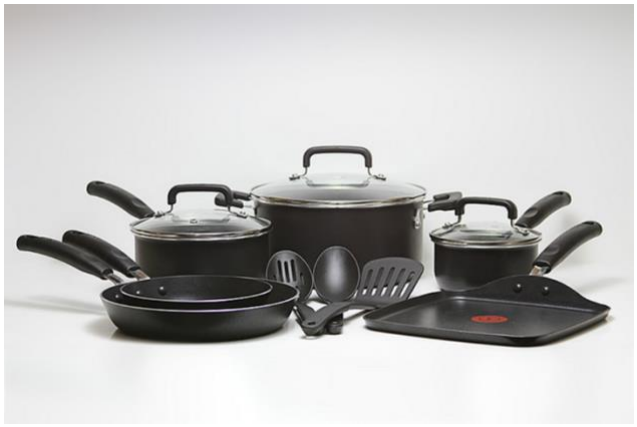
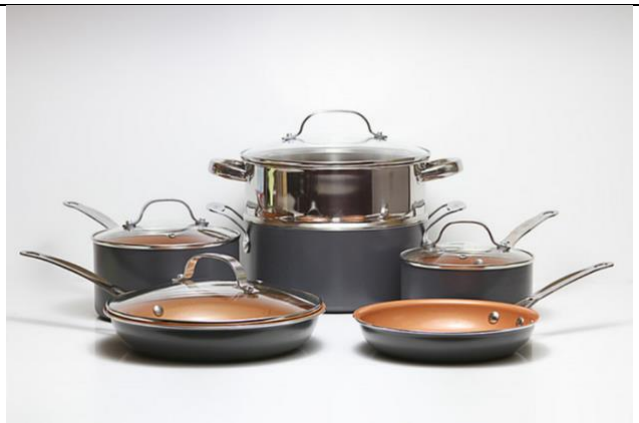
Name_____ **Date**_____

Shopping for New Pots and Pans

Grandma Rose is shopping for a new set of pots and pans. She has not shopped for new pots and pans for over 25 years. She thought a set of new pots and pans would go nicely with the gas stove she just purchased. There have been a lot of new pots and pans designed since the last time she bought pots and pans. Grandma noticed that now there are many different sized pans, even a flat pan for making pancakes! Some lids are made of glass so that you can see what is cooking and the some cookware has handles that are covered with material to prevent your hands from being burned. So many choices! Grandma decided to write a wish list of things she would like to see in her new pots and pans.



Grandma Rose decided to research different sets of pots and pans on the internet before making her decision. Grandma found the following information on four bestselling cookware sets. Help Grandma determine which set of cookware is best for her!

Picture of Cookware	Cookware description
	Stainless Steel Cookware **Price:** $235 **Description:** Ideal for all stove tops (gas, ceramic, electric, induction). Lids of pots and pans made of stainless steel. Dishwasher safe. Handles made of metal. Can be used in oven or on stovetop.
	Simply Balaton **Price:** $197.00 **Description:** Non-stick coating. Can be used on only gas, electric and ceramic stovetops. Not suitable for oven use. Non-stick coating is unsafe for dishwasher and broiler use. Handles coated with plastic.
	T-Fabulo **Price:** $89.00 **Description:** Non-stick coating, oven safe, temperature indicator built into base of pans and pots, glass lids have a steam release vent, pieces are only rated up to 350 degrees, so they can be used in the oven but only up to that temperature. Handles coated with plastic.
	Copper Infused Ceramic Cookware **Price:** $99.99 **Description:** Tough copper grade, glass lids, non-stick coating, oven-safe up to 500 degrees, will work on all stove tops including gas, electric and ceramic. Must be hand washed and seasoned after washing. Metal handles.

Part A: Define the problem:
We engage in problem solving every day, often without realizing it. Everything from determining what to purchase for lunch or choosing what coat to wear in the morning to deciding what type of bike to buy or where to go on vacation, requires us to think about needs and wants as well as any constraints that will affect our decisions.

Based on the task scenario, identify the problem to be solved.

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What are the needs or wants that should be taken into consideration when solving this problem?

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What constraint(s), or things that limit possible solutions to the problem, are identified in the scenario?

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Part B: Evaluating possible solutions to the problem:
Grandma identified four of the bestselling cookware sets she likes from all of those she found researching online.
Work collaboratively to evaluate all four sets of cookware. Consider the following questions:

- What are the criteria you will use to evaluate the cookware sets?
- What information do you have to work with?
- How will you organize the information so that you can evaluate each set of cookware fairly and accurately in order to determine which of the cookware sets best meets the needs and wants of Grandma?

Be prepared to share your organizational tool and your findings with others.

Part C: Determine best solution based on evaluation or cookware sets:

1. Grandma Rose decides she is going to purchase the stainless steel cookware. Based on your evaluation of the cookware sets, is Grandma making the best choice? Support your thinking with evidence from the data you collected.

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2. Which set of pots and pans would you recommend that Grandma Rose purchase? Use data from your evaluation of the four sets of cookware to as evidence to support your choice.

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