Science Assessment System Through Course Task

Levi and Friend

Grade Level:
K

Phenomena:
Heavier Objects Require More Force to Move
(All Other Things Being Equal)

Science & Engineering Practices:
Developing and Using Models
Constructing Explanations and Designing Solutions

Crosscutting Concepts:
Cause and Effect

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.

Levi and Friend Task Annotation

After using a model to determine patterns in the **strength of pulls needed to start an object in motion, construct an explanation** *as to when more force is needed to push or pull an object* using patterns of cause and effect in the models provided.

Overall intent of the task

This task was created to gather evidence of student ability to use information they gather from two pictures (models) to support a claim about the effects of different strength of pulls on the motion of a wagon carrying the same load of vegetables. Students will make a claim about why a young boy was not able to move the wagon without help from his friends, using evidence from the models to support their claim. Students are encouraged to use cause and effect relationships as they synthesize the provided information.

Students should claim that Levi cannot move the wagon by himself because the amount of pull he uses to move the wagon is not "big" enough (his strength alone is not "big enough" to move the full wagon from the garden to the barn). The evidence is found in the provided pictures. One picture shows Levi trying to move the wagon and the wagon does not change position (it did not move). The second picture shows Levi and a friend pulling the wagon and it has changed position. The evidence in the picture of Levi and his friends pulling the wagon is in the number of people pulling the wagon AND the fact that the wagon has changed position. Therefore, a "bigger/greater" pull results in the movement of the wagon.

Phenomenon within the task

Students are encouraged to make sense of the science concepts that pushes and pulls can have different strengths and direction. *Levi, a young boy, is asked to help his grandfather in the garden by moving vegetables from the garden to the house. Levi needs to use a bigger/stronger pull to move the wagon load of vegetables to the house in one trip (without making multiple trips). When Levi realizes he cannot pull the wagon by himself, he asks his friend to help him by having them both grab hold of the wagon handle and pull the wagon of vegetables from the garden to the house. With both of them pulling together (which equals a bigger pull), they are able to move the wagon from the garden to the house.*

Students look at the picture card of Levi trying to pull a wagon full of vegetables from the garden to Grandpa's house (but not able to because Levi does not have enough force to move the wagon). Then students look at the second picture of Levi and his friend (adding force) pulling the wagon of vegetables from the garden to Grandpa's house. Students determine a pattern for the amount of force needed to move the object (wagon) and then construct an explanation as to why more force was needed to pull the object (wagon) based on the pattern. The pattern is that Levi alone did not have enough force to move the wagon. When multiple people pulled the wagon, thus adding force, the wagon was able to be moved.

Content within the task

Teacher Note: The physical science disciplinary core ideas at kindergarten do not specifically use the word "force." **This term is introduced in the standards at grade 3.** Rather, the emphasis is on different strengths of pushes and pulls. It will be important to help students conceptualize force yet use language that depicts various amounts of strength (push/pull) needed to move (change the motion of/start/stop) an object.

Students should be encouraged to use grade appropriate words that quantify the varying strength of pushes and pulls like bigger/smaller, more/less and harder/softer.

<table>
<tr><td>PS2.A
Forces and motion</td><td rowspan="2">Pushes and pulls can have different strengths and directions, and can change the speed or direction of its motion or start or stop it.</td><td rowspan="2">The effect of unbalanced forces on an object results in a change of motion. Patterns of motion can be used to predict future motion. Some forces act through contact, some forces act even when the objects are not in contact. The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.</td><td>The role of the mass of an object must be qualitatively accounted for in any change of motion due to the application of a force.</td><td>Newton's 2nd law (F=ma) and the conservation of momentum can be used to predict changes in the motion of macroscopic objects.</td></tr>
<tr><td>PS2.B
Types of interactions</td><td>Forces that act at a distance involve fields that can be mapped by their relative strength and effect on an object.</td><td>Forces at a distance are explained by fields that can transfer energy and can be described in terms of the arrangement and properties of the interacting objects and the distance between them. These forces can be used to describe the relationship between electrical and magnetic fields.</td></tr>
</table>

Ideas for setting up the task with students

It is highly recommended that students have multiple opportunities to explore differences in the amounts of strength needed to move different objects. This concept can be introduced/supported through investigations such as bowling in physical education time or demonstrate pushing toy cars to observe the amount of motion that results from the push or pull. Students should make numerous observations of everyday use of pushes and pulls required to do certain tasks (empty shopping cart vs full shopping cart,

amount of pull needed to get a puppy to follow on a leash compared to a full grown dog, pushing an empty box compared to one that is filled with objects, etc.). Encourage the use of appropriate terms for kindergarten to quantify varying amounts of push and pull.

Consider having students "read" the provided pictures. Ask guiding questions so that all students are aware of the change in the position of the wagon between the two pictures, the load in the wagon, the background features (garden and barn), etc. It will be essential that kids are able to make thorough observations of the detail in the pictures.

Note: An example data collection sheet is provided. This sheet can be modified (possibly add more prompts, look fors, etc.) to better assist you when you gathering evidence of student learning related to the intent of the task. It is not for students to write on but is designed to support you as you gather evidence.

Intent of the Task for Assessment

Students gather information from the models (pictures) coupled with their prior experiences of pushes and pulls to use as evidence to support a claim about the differences in the amount of pull needed to cause an object to move. Heavier objects require more push or pull to cause them to move them while lighter objects require less push or pull to move them.

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

- *2 picture cards*
- *student task page*
- *data collection page*

Success Criteria

Evidence of Learning Desired based on Progression from Appendices

Analyzing and Interpreting Data (Appendix F)

- *Use observations to describe patterns or relationships in the natural or design world in order to answer scientific questions and solve problems.*

Constructing Explanations and Designing Solutions

- *Use information from observations (firsthand and media) to construct an evidence based account for natural phenomena.*

Cause and Effect (Appendix G)

- *Events have causes that generate observable patterns.*

Success Criteria

- Students use prior first hand experiences and information as they gather **data** from provided pictures to support an explanation about varying amounts of force on an object (wagon) and the resulting motion of the object.

Possible Student Responses

- *By himself, Levi could not pull the wagon. With the help of his friend, Levi was able to move the wagon. More people pulling makes a bigger pull and the bigger pull caused the wagon move.*
- *In the first picture, Levi could not move the wagon because he did not have a big enough pull. In the second picture, Levi was able to pull the wagon because he had his friend to help. His friend helped him have more pull to move the wagon.*
- *By himself, Levi could not pull the wagon. In the second picture, with his friend helping, the effect was that Levi and his friend were able to pull the wagon. Together they had a stronger/bigger/more pull which caused the wagon to start moving and they pulled together all the way to the barn.*
- *Levi could not pull the wagon by himself because he alone did not have a big enough pull to move the wagon with the vegetables to the barn. In the second picture Levi, along with his friend, provided a bigger (greater)pull that let them move the wagon together.*

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

I actually had students move buckets of items by pushing and pulling them to help them conceptualize the task and to foster the use of terms like bigger/ larger/greater when explaining their observations. I did not use a wagon because I wanted to see if my students could transfer their understanding to a new situation.

Extensions and/or other uses after the task is implemented

Continue to capitalize on gathering more evidence about student ability to identify cause and effect relationship associated with pushes and pull while on the playground or while students engage with everyday materials. Develop open ended questions that promote conversations between students so that you can glean more information about your students.

Through Course Task – Levi and Friend

After using a model to determine patterns in the **strength of pulls needed to start an object in motion, construct an explanation** *as to when more force is needed to push or pull an object* using patterns of cause and effect in the models provided.

A. Analyze the Models

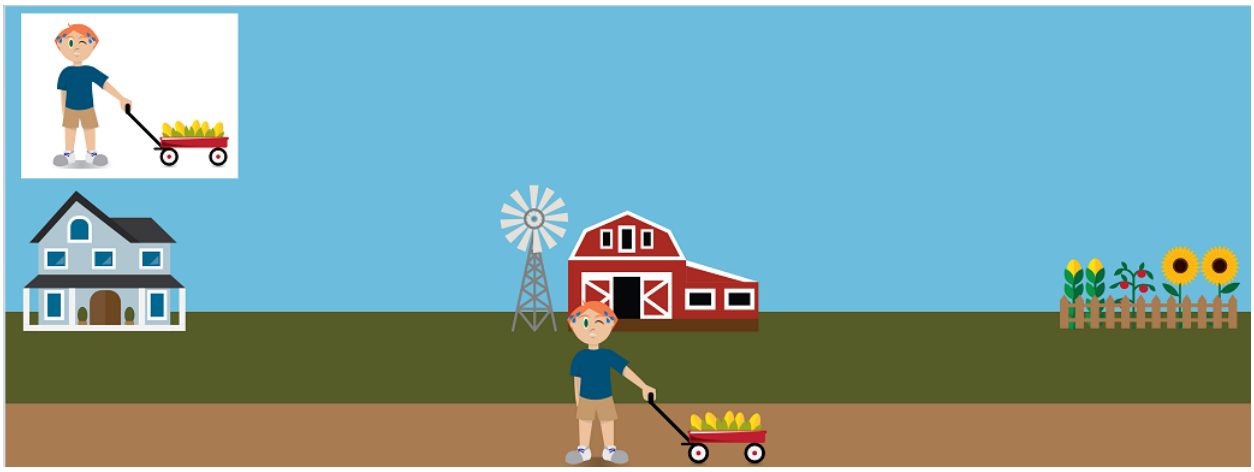
Levi loves helping his grandpa in the garden. He helps pick the vegetables and then use his wagon to haul them to Grandpa's house. He helped pick the corn and put it in his wagon. He started for the house. Levi quickly realized that the wagon was hard to move. Levi pulled and pulled but he couldn't get the wagon to budge. He even got behind and pushed the wagon. It moved a little but not much. Finally, Levi was able to get the wagon moving. Based on your prior experiences and the information from the pictures, explain how and why the wagon began to move.

You have the following resources:

- picture cards
- story teacher read

B. Construct an Explanation

Using the patterns in the pictures, explain why Levi can't move the wagon in the beginning and what caused it to move in the end. Use evidence from the models and provide reasoning to support your claim.



Levi and Friend/Grade K

Data Collection Sheet

Student Name_____ Date_____

Student closely observes the pictures to identify the describe patterns (similarities and differences).	Yes /No	Student response/Teacher notes/Prompts used *Possible prompts: Have you ever had a similar experience? I know this because…. This reminds me of ... Like when…*
Possible look fors: ● Levi is alone in the first picture. ● Levi with friend in the second. ● The wagon has same load in both pictures. ● There is a difference in the position of the wagon in the picture (one is farther than the other). ● Levi, alone, moves wagon a specific distance. ● Levi, with friend, moves the wagon farther.		
Students explains why Levi, alone, cannot pull the wagon all the way to the house.		
Possible look fors: ● Stronger pulls are needed to move heavier objects. ● Sometimes objects are too heavy to move by yourself. ● Students share a personal experience or an event they observed that supports their explanation.		
Students identify that Levi, along with a friend, was able to pull the wagon farther than when he pulled the wagon by himself.		
Possible look fors: ● A bigger pull is needed to move the wagon farther because Levi's pull is not strong enough. ● Together the two boys have a stronger pull so they can move the wagon to the house. ● Use prior experience to support an explanation for Levi being able to move the wagon farther with the help of a friend.		