K-2 SCIENCE

PERFORMANCE TASK
TEACHER INSTRUCTIONS

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TASK OVERVIEW

TITLE	GRADE LEVEL	SUBJECT AREA	INSTRUCTIONAL UNIT	TIME FRAME: HOW LONG TO ADMINISTER THE TASK?
Push, Pull, Play	Kindergarten	Science	Force and Motion	Four/Five Days

CONTENT AREA

PROFICIENCIES AND PERFORMANCE INDICATORS

GRADUATION PROFICIENCY	GRADUATION PROFICIENCY DESCRIPTION	PERFORMANCE INDICATOR	PERFORMANCE INDICATOR DESCRIPTION
#1 Physical Sciences - Structure and Properties of Matter / Forces and Interactions	Students will demonstrate an understanding of structure, properties, and interactions of matter (PS1) and explain and predict interactions between objects and within systems of objects (PS2) through the integration of scientific and engineering practices and crosscutting concepts.	A	Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. (K-PS2-1)

CROSS-CURRICULAR

PROFICIENCIES AND PERFORMANCE INDICATORS

GRADUATION PROFICIENCY	GRADUATION PROFICIENCY DESCRIPTION	PERFORMANCE INDICATOR	PERFORMANCE INDICATOR DESCRIPTION
Collaboration	Students will demonstrate collaboration through working effectively and respectfully with others toward a common goal.	2	Contribute to a common goal by exercising flexibility and accountability.
Problem Solving and Critical Thinking	Students will demonstrate problem solving and critical thinking by applying processes to define problems, evaluating possible outcomes, and persevering in solving complex problems.	4	Implement a plan or process of approach using tools and information.

Problem Solving and Critical Thinking	Students will demonstrate problem solving and critical thinking by applying processes to define problems, evaluating possible outcomes, and persevering in solving complex problems.	5	Show flexibility and persist through frustrations; continue to revise a plan or process of approach in order to arrive at a viable solution.

NEXT GENERATION SCIENCE STANDARDS
Disciplinary Core Ideas ● Pushes and pulls can have different strengths and directions. ● Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. ● When objects touch or collide, they push on one another and can change motion. ● A bigger push or pull makes things go faster. ● For Expanding: Because there is always more than one possible solution to a problem, it is useful to compare and test designs. **Cross-Cutting Concepts** ● Cause and effect: simple tests can be designed to gather evidence to support or refute student ideas about causes. **Science and Engineering Practices** ● I can ask questions and make predictions. ● I can collaborate with my peers. ● I can make a plan to answer my questions. ● I can conduct an investigation. ● I can make and record observations. ● I can collect and compare data. ● I can use data to answer my questions. ● I can compare my prediction to my results.

SCORING CRITERIA[1]

PERFORMANCE INDICATOR	BEGINNING	DEVELOPING	PROFICIENT	EXPANDING

#1 Physical Sciences - Structure and Properties of Matter / Forces and Interactions: A Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object. (K-PS2-1)	**Answers** teacher guided questions, recalling direct information the teacher gave about the phenomenon. Works with peers to **implement** the plan. **Identifies and gathers** (records) **data** related to the investigation.	**Asks questions** about the phenomenon. Through answering teacher guided questions, student identifies the phenomenon. Works with peers to **investigate** the phenomenon and **implement** the plan. **Identifies, gathers** (records) **and discusses** data related to the investigation.	**Asks and answers questions** that the teacher poses and is able to explain the phenomenon. Works with peers to **come up with** a way to **investigate** the phenomenon and **implement** the plan. **Identifies and gathers** (records) **data** related to the investigation. **Uses** the collected data to **compare** the effect of different strengths and directions on the motion of an object.	Independently **asks questions and answers guiding questions** that the teacher poses to introduce the phenomenon. **Generates** multiple ways to investigate the phenomenon, as well as **justifies** which way might be a better way to explore than another. Works with peers to **come up with** multiple ways to **investigate** the phenomenon. **Implements** the plan, and makes changes to it as needed. **Identifies and gathers** (records) **data** related to the investigation. **Analyzes** the collected data to **make a generalization** about the effect of different strengths and directions on the motion of an object.
Collaboration: 2 Contribute to a common goal by exercising flexibility and accountability.	**Share** ideas related to a common goal.	**Listen** to others and **exchange** ideas related to a common goal.	**Contribute** to common goal by adjusting opinions or ideas.	**Promote** flexibility and accountability in others in working toward a common goal.

Problem Solving and Critical Thinking: 4 Implement a plan or process of approach using tools and information.	**Identify** tools to solve a problem.	**Identify** a range of appropriate tools to help solve a problem and begin to implement a plan or process of approach.	**Utilize** information, appropriate tools, and/or technology strategically to implement a plan or process of approach to provide a potential solution or product.	**Demonstrate** creativity and innovation in selection and use of tools and **anticipate** and **address** possible implementation challenges.
Problem Solving and Critical Thinking: 5 Show flexibility and persist through frustrations; continue to revise a plan or process of approach in order to arrive at a viable solution.	**Identify** a strategy that could be used to overcome an obstacle in problem solving.	**Make an attempt** to reach a viable solution by applying a strategy.	**Make multiple attempts**, persisting as needed, to reach a viable solution by **applying and adjusting** varied strategies and approaches.	Make multiple **attempts**, if needed, until an effective solution is reached by **applying, evaluating** and **adjusting** strategies and approaches.

[1] Modifications were made to the Content Scoring Criteria after the task was administered. These modifications were based on a more thoughtful interpretation of the relevant NGSS standards. The modified versions are shown below.

PERFORMANCE INDICATOR	BEGINNING	DEVELOPING	PROFICIENT	EXPANDING
A. Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an	Participate in an investigation to make observations about the motion of objects.	Participate in an investigation to identify the effects of various pushes or pulls on the motion of objects.	Plan and conduct an investigation to compare the effects of different strengths or different directions	Plan and conduct an investigation to explain why different strengths or directions of pushes and pulls

object. **(K-PS2-1)**			of pushes and pulls on the motion of an object.	affect the motion of objects.

CONNECTIONS TO INSTRUCTIONAL UNIT

UNIT SUMMARY May include big ideas, authentic context, enduring understandings, essential questions.
The unit begins with direct instruction of force and the two types: push and pull. Students are engaged in observation and inquiry to differentiate between the two types of forces. They will explore how these forces impact an object's movement and changes its location. Additionally, students will determine that the amount of strength needed to push or pull an object is an effect of the object's weight. Through inquiry based instruction, students will discover that the speed and direction of an object's movement is determined by the amount and type of force applied to it. They will also explore how a pushing force applied to multiple objects affects the direction those objects move. Throughout the unit, students will be engaged in a combination of partner and small group PBL tasks, direct vocabulary instruction, integrated literacy comprehension tasks and informational claim, evidence discussion and writing components. **Anchoring Phenomenon:** Where do we see pushes and pulls on the playground?

What will students know as a result of instruction in this unit in order to complete the task?	**What will students be able to do as a result of instruction in this unit in order to complete the task?**
• Objects move as a result of a push or pull. • The strength of the push or pull has a result on the speed and direction of the object.	• Develop and implement a plan. • Identify and gathers data around motion of an object. • Compare data. • Ask questions about the phenomena. • Answer questions about the phenomena.

How will teachers know what students know and can do prior to the task? Which relevant concepts and skills have students struggled with, had misconceptions about or missed entirely?	**What background knowledge do students need (cultural, language, etc)? Have both content goals and language demands for ELL students been considered? Have the needs of diverse learners been considered?**
• Forces such as gravity continue to act on	• Force, motion, push, pull, gravity, directions, speed

objects, even if they are not moving. ● Forces are applied to objects (a relation between objects), not a property of an object. ● Identify pushes and pulls through prior investigations and observations. ● Knowledge based on students ability to ask and answer questions. ● Classify pictures as either a push or a pull and place those pictures into a T-chart.	● Model how to make scientific observations. ● Asking questions (wondering) ● Playground expectations. ● Define a claim

CULMINATING TASK

TASK SUMMARY
Students will gather around the slide to hold a "brainstorming session" and discussion Discuss how to plan an investigation: I wonder questions and I think statements (hypothesis); plan, carry out a plan, record data and form a conclusion Help guide students to investigate bigger pushes. **Anchoring Phenomenon:** Where do we see pushes and pulls on the playground?

STUDENT ACTIVITY

DAY ONE:

1. Students spread out on the playground and use different equipment, exploring the phenomenon: Where do we see pushes and pulls on the playground? Share out examples of pushes and pulls.

2. Students will listen to directions of the pushing investigation on the slide. Share their wonderings and hypothesis.

3. Each person will take turns sliding three ways:
    a. **No Push –** When they are sitting at the top of the slide not moving, they are "at rest." Sit at the top of the slide just above the tape mark. Hold your position until the timer (the other adult and perhaps a student volunteer after modeling) says, "Go!" Let go, cross your arms forward until gravity starts to pull you down, and slide. The timer stops the watch when the tape crosses the tape line at the bottom of the slide.[2]
    b. **Self Push –** Get into the same starting position as above, but this time, when the timer says, "Go!"

push yourself off with your hands and arms. Timing happens the same way.

c. **Partner Push –** Once again, start in the same position. This time have a friend push you down the slide when the timer says, “Go!” Timing happens the same way.

4. Students turn and talk to discuss what they can claim about force (push) as a result of their investigation. What did they learn about pushes as a result of the slide investigation? (The harder the force (push) the faster you go (speed)).

DAY TWO:

1. Students come to the rug with their name tags on with their data from the exploration of the previous day.
2. Students will make observations about what they notice is similar between their own individual times (data) and the times on the sample chart.
3. Students discuss and answer questions about anchoring phenomenon.

DAY THREE:

1. Demonstrate pushes and pulls with the class by playing a quick game of tug-of-war (you can use a big rope and include everyone all at once or use a smaller rope (jump rope) and have a few students participating. Students discuss/answer teacher generated questions and explain the difference between pushes and pulls.
2. Give students sufficient time to conduct simple investigations into the motion of objects down the ramps.
3. At this stage in their learning, students ask and answer “What would happen if…” questions as they change their angle of their ramps and find other objects to roll down the ramp.
4. Students answer teacher generated questions about the phenomenon and/or discuss the phenomenon with their peers.
5. Students work collaboratively in their groups to draw a plan for how they will investigate an answer to one wondering question provided by their teacher.

DAY FOUR AND/OR DAY FIVE:

1. Students revisit collaborative work in their groups to draw a plan for how they will investigate an answer to one wondering question provided by their teacher.
2. Students generate what they think will happen (hypothesis) and discuss/share out.
3. Students listen on the rug

4. Students engage with their group to implement their plan. Building their ramp and engaging in their trials with different objects, marking the end point with masking tape for each shape object.

5. Students share out what they notice for teacher to record on the data anchor chart. Have students come up from each group and place a mark on the class observational data anchor chart next to the object that was the farthest, shortest and whether each object's direction was straight or curvy.

6. Students listen and access prior knowledge.

7. Students turn and talk to discuss possible claims as a result of their investigation.

8. Students demonstrate what they know by drawing and dictating their claim on their evidence ticket.

[2] Directions for step 3a. for Day One were modified slightly based on administration of the task. Task administrators found there was no need to mark the children or the slide with masking tape. Here are the resulting directions:

Each person will take turns sliding three ways:

a. **No Push** – When they are sitting at the top of the slide not moving, they are "at rest." Sit at the top of the slide. Hold your position until the timer (the other adult and perhaps a student volunteer after modeling) says, "Go!" Let go, cross your arms forward until gravity starts to pull you down, and slide. The timer stops the watch when the student crosses the bottom of the slide.

CONSIDERATIONS FOR DIFFERENTIATION AND ACCESSIBILITY

DAY ONE:

- Be sure to model appropriate playground expectations and "pushing"
- If students need more time around expectations consider having an adult volunteer be the "pusher"
- Instead of sliding, consider having some students be the data recorder and/or in charge of announcing the start.
- Consider using a smaller group of students as a sampling of data if time/resources don't permit having all students collect all three trials of data.
- Consider having one small group at a time do the trial and the remainder of students explore the playground to discover pushes and pulls that occur on other playground equipment.

DAY TWO:

- Provide individual copies of class data chart with students data added to it for students that may need visual supports.
- Provide sentence stems for observations.

I notice_____________is the same as _______.
______is different from ______.

DAY THREE:

- Possible materials for the investigation are listed below. Students should be in groups of 4.
- *To make it more challenging add a different shaped item to the students' objects, such as a block or cube, and ask students to describe the motion of the block down the ramp.

DAY FOUR AND/OR DAY FIVE:

- Consider providing students with roles within their group such as three students each being in charge of sending one object from each shape category down the ramp and the fourth student being in charge of marking the end point of the object with masking tape.
- Provide students sentence stems for their claims such as:

The higher/lower the ramp the __________ the object moved.
The more __________(force, push, pull) the _________the ______ moved.
The _________ moved ________ than the _________.
The __________ (object) moved __________.

- Students may write the claim independently on the evidence ticket.

ADMINISTRATION NOTES AND DIRECTIONS

DAY ONE:
Before students go outside, put a piece of masking tape on their pants, across their sides, level with their hip bones. This is a visual aid for the timing of the sliding in the exploration.[3]

1. Teacher takes students out on the playground and presents anchoring phenomenon: Where do we see pushes and pulls on the playground? Challenge students to spread out and use as much of the playground equipment as possible and discuss examples of pushes and pulls.

2. Tell students we will be exploring a pushing force on the slide. Each student will take turns sliding three ways: No Push, Self Push and Partner Push. Model filling out a Scientific Method Sheet (attached). Model writing some I wonder questions and explain that this is where they will write anything they are wondering about (specifically having to do with pushes and pull, but not limited to). Have students share hypothesis of what they think will happen.

3. The teacher or adult volunteer will record the times for each slider on a student name tags. This data will be used in a chart on day 2. **This does not have to happen in a whole group. If you have access to other slides and adult volunteers, kids can slide in small groups.

4. Revisit the scientific method anchor chart and direct students attention to the claim section. Remind students what a claim is. (A scientific statement about what they've learned) Ask students to help you state a claim about what they learned about pushes.

DAY TWO:

1. Remind kids of their playground investigation they did yesterday.

2. Present the Push, Pull, Play Data Chart with a sample of purposefully selected student names on it and their times recorded on the chart. Ask students to look at their own times (data) on their nametags.

3. When the chart is complete, ask the class, "Which kind of push was the fastest…no push, self push, or partner push?" Which push was the strongest?" (*Answer: same as above.) "Do you think the size and weight (or mass) of the person doing the pushing makes a difference in how fast someone goes down the slide? Why?" (*Answer: Yes, a bigger person can usually push harder.) You can introduce the term "mass" in the correct context here. Explain to kids that a big push = a big distance and faster time and a little push = a shorter distance or slower time. They are directly related. You can also explain to the class that they were being pushed in the direction they were sliding. A push down = sliding down…

DAY THREE:

Use T-Chart and picture cards from instruction where students classified objects being pushed or pulled.

1. Present different scenarios using more students on one side, have one side push and one side pull, both pulling, both pushing, etc. (you can pose these as questions, "What would happen if…" and "What happened when…") Model questioning and hypothesis stages of scientific model.

2. Remind students about the scientific method chart format. Display scientific method chart with objective at the top and materials already written in: Sample Scientific Method Anchor Chart. Tell students they will be using provided materials to explore force (push/pull) and an object's motion and direction. Connect back to the Push, Pull, Play Data Recording Sheet and revisit the data to guide connections of force on the slide to how it will help them to develop their plans. Show students the materials they will have available and how to make a ramp. You can prop the ramps up on chairs, desks, walls, books, or any stationary objects.

3. Ask students to share their questions and record on the Scientific Method Anchor Chart under "Questioning."

4. Add to student questions by asking your own questions. Provide students time to discuss possible answers (hypotheses). Teacher assigns and scribes one wondering question to each group on the student

planning sheet. To ensure that students are investigating the performance indicator questions should include:

- I wonder if an object on a higher ramp will go farther?
- I wonder if a cube will go father than a sphere/cylinder?
- I wonder if I push on my object if it will travel farther?
- I wonder if I let go of my object if it will not go as far?
- I wonder how the _________(object) will go down the ramp?

5. Allow students time to break out into their groups of 4 and draw a plan for how they will use ramps to plan an investigation that will answer one of their wondering questions selected by the teacher. Teacher should circulate around the room with an observational checklist to capture evidence for the collaboration performance indicator. Using the descriptors on the following template: Original Observational Data Collection Collaboration Sheet.[4]

DAY FOUR AND/OR DAY FIVE:
*Ensure the cardboard pieces for ramps have a colored dot marked at the top center as a starting point for reference.

1. Have students work in groups to revisit/finish their plan from yesterday. Teacher should circulate around the room with an observational checklist to capture evidence for the collaboration performance indicator. Using the descriptors on the following template: Original Observational Data Collection Collaboration Sheet.[5]
2. Ask students to generate what they think will happen (hypothesis) and record samples on the Scientific Method Anchor Chart.
3. Review materials again on Scientific Method Anchor Chart.
4. Have students work in groups of 4 to implement their plan (investigation). Facilitate the student activity by circulating among the groups and listening to their ideas and observing their simple investigations.
5. Record student data on class observational data anchor chart.
6. Remind students what a claim is (a statement (sentence) about what they learned).
7. Have students discuss possible claims based on their investigation.
8. Have students draw and dictate their claim while teacher scribes it on their evidence ticket.

[3] As previously mentioned, the task administrators found there was no need to use masking tape to mark the children or the slide. This step can be eliminated.

[4 and 5] The task design team modified this document after administering the task. The new version is called the Observational Data Collection Collaboration PI2.

MATERIALS AND RESOURCES[6]

- Name Tags for each student
- Timer
- Pushes and Pulls T-Chart (reference)
- Picture Cards for T-Chart (reference)
- Masking Tape
- Rope or Jump Rope
- Ramps (cardboard with colored dot at top center for a starting point for students to reference)
- Round objects (golf balls, ping pong balls, cotton balls, Styrofoam balls, marbles, wooden spheres)
- Cylinder objects (wooden cylinders, toilet paper rolls, soup cans, water bottles, pop cans)
- Cubes
- Sample Data Recording Chart for Pushes: Slide
- Scientific Method Anchor Chart
- Student Planning Sheet
- Evidence Ticket
- Class Observational Data Anchor Chart Template
- Original Observational Data Collection Collaboration Sheet

[6] As previously indicated, masking tape was deemed unnecessary.

The Observational Data Collection Collaboration Sheet was redesigned and renamed as Observational Data Collection Collaboration PI2.

The design team added an additional resource, Sally the Scientist Character Guiding Tool to move through the steps of the scientific method, to facilitate the teaching of the scientific method.

Supporting Resources:
Forces and Interactions