

Kindergarten: Engineering, Technology, and Applications of Science

WINTER CLOTHING CHALLENGE: Engineering

Background Information

Students in kindergarten develop the understandings of basic needs, weather patterns, the concepts of push and pull, engineering, and the applications of science. Through identification of patterns, determination of cause and effect, investigation of structure and function, as well as systems and system models students begin to make sense of the natural world. Developmentally appropriate use of science and engineering practices prepares students for more complex phenomenon.

December through February comprise the winter season in the Northern hemisphere. Changes in temperatures, forms of precipitation, types of storms, and preparedness plans occur during winter. Average daily temperatures in the Chicago area range from a high of 36°F to 18°F as a low, while precipitation ranges from 1.93 inches to 2.56 inches. These are average conditions for the winter season.

Freezing rain may accumulate making walking and driving difficult. Trees and power lines may fall due to the weight of the ice. Snow, caused by water vapor freezing in the air, may have similar consequences as freezing rain. When visibility is extremely limited due to blowing snow the event is classified as a blizzard. Health concerns during the winter season include dry skin due to evaporation of water from the skin. Due to the amount of time indoors, immune systems may be compromised. Frostbite may happen within a few minutes of skin exposure to extreme cold. Due to slippery conditions, such as ice, injuries from falls may increase. Those susceptible to respiratory conditions may experience difficulties due to the temperatures. Weather forecasting, storm advisories, snow/ice removal, and dressing appropriately for the weather aid in preparedness for the effects of winter.

Suggested Winter Read Alouds

- *When It Starts to Snow* by Phillis Gushator
- *Over and Under the Snow* by Kate Messner
- *Animals in Winter* by Henrietta Bancroft and Richard G. VanGelden
- *Owl Moon* by Jane Yolen
- *Waiting for Winter* by Sebastian Meschenmoser
- *Snowy Day* by Ezra Jack Keats
- *The Mitten* by Jan Brett

Performance Expectation

K-2ETS1-1 Design Challenge: Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

<https://www.nextgenscience.org/pe/k-2-ets1-1-engineering-design>

Disciplinary Core Ideas

ETS1.A: Defining and Delimiting Engineering Problems:

A situation that people want to change or create can be approached as a problem to be solved through engineering. Asking questions, making observations, and gathering information are helpful in thinking about problems. Before beginning to design a solutions it is important to clearly understand the problem.

Science and Engineering Practices

Developing and using models: Develop and/or use models to describe and/or predict phenomena.

Engaging in arguments from evidence: Support an argument with evidence, data, or a model.

Asking questions and defining problems: Asking questions and defining problems in K-2 builds on prior experiences and progresses to simple descriptive questions.

Crosscutting Concepts

Patterns: In grades K-2, children recognize that patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

Materials

- Winter Fun Power Point
- *Winter Clothing Challenge* Student Pages
- Fabric Sample Cards
- 3 Fabric Samples for Each Group (Such as Cotton, Polyester, Quilt Batting, Fleece)
- Cups
- Water
- Droppers
- Coloring Supplies
- Containers for Snow
- Chart Paper (optional)
- Towels for Cleanup
- Mitten and Glove (optional)
- Snow, Ice Cubes, Crushed Ice

Advanced Preparation

- Prepare a set of fabric sample cards.
- Determine how materials will be arranged and distributed for testing.
- Determine how testing will proceed. Will all groups complete the same test simultaneously?
- Determine what will be accomplished each day.
- Water will be needed.
- Paper or cloth towels may be needed for cleaning up spills.
- Bring in a mitten and glove if you will be using one for discussion. (Check the Lost and Found box for these items.)

Suggested Implementation

Begin by showing the *Winter Fun* power point. As the class progresses through the slides, encourage comments on the activities, how the people are dressed, and why they are dressed in that fashion.

Students will work in groups of four. *Note: You may wish to have a mitten and a glove for display during the lesson. You may also wish to have “snow” available for exploration and testing.* Share that they will decide what material(s) they would use to make mittens (or gloves). This involves determining the desirable traits for mittens (or gloves), exploring the materials, and making a decision (claim) of what to use based on evidence.

Begin by identifying the problem: Which material(s) would you use to make mittens (or gloves)? Next, move to identifying what qualities a mitten (or glove) needs to have. Distribute one Mitten handout to each group and have the group talk about what a mitten (or glove) needs to have. After they’ve had time to discuss their ideas within their group, elicit ideas from the class. Record the ideas on chart paper.

Introduce the fabric samples to the students. You may wish to label a sample and display it for the students. Another idea is to make sample cards for each fabric type. Attach a small sample of one material to an index card and label that card with the fabric’s name. Provide each group with one set of sample cards.

Follow with examination and testing of the materials available. Tests may include, but are not limited to the following:

- Observations of material samples with hand lenses
- Flexibility of material samples
- Water repelling
- Water absorption
- Warmth
- Order of layers
- Comfort of material samples

Distribute student pages one at a time. Assist students in recording their observations and data. Once groups have had time to finish all of the testing, they need to decide what material(s) they would use to make a mitten (or glove) and why. You may wish to have your students record the data and their choices on the student pages if appropriate.

Follow up the investigation with a tally of choices for each material, as well as a pro and con list for each type of material. Here are some questions for discussion: (Go back to the original traits as needed for discussion and prompting thinking.)

- If someone asked you what type of mitten to buy, what would you tell them?
- Why would you tell them this?

Assessment

The following single point rubric can be used to assess student understanding. For each of the criteria listed below, either circle the proficient description or add notes to a box indicating why the student’s performance was either lacking or exceptional.

Areas that need improvement. Developing Performance	Criteria for Proficient Performance	Evidence of exceeding standards. Advanced Performance
	Explain how materials were tested.	
	When asked “Why did you choose the material(s)?” students reference observations from the testing of the materials.	