Lesson Plan Title: Materials for Extreme Weather

Subject area: textiles; 90 minutes

Recommended course (s):

Design Application and Analysis

Aligned to NASAFACS Standards:

16.2.2 Evaluate performance characteristics of textile fiber and fabrics.

*add cost analysis of newly engineered fabric to add mathematics objectives

Objectives:

*Explain the importance of materials engineering for survival and comfort in various weather conditions.
*Describe several examples of engineered materials and textiles.
*Model and analyze different materials for the effectiveness to resist wind, water and cold temperatures.

Materials needed:

For each group:
*thermometer
*scissors
*Materials Analysis Worksheet

For entire class:
*a variety of cloth scraps
*a variety of other materials such as
*aluminum foil, plastic wrap, brown paper, shower liner, etc.
*needle & thread (continued in resources)

Resources:

*duct or masking tape
*1 or more fans, as wind source
*1 or more spray bottles with water
*1 or more containers of ice
*water repellent spray (optional)

Resources:
teach engineering website:
https://www.teachengineering.org/activities/view/cub_weather_lesson01_activity1

Lesson Summary/Outline:

Today's textiles do more than provide protection from rain and cold. They resist stains, resist wrinkles, repel water, even play music. Space suits and clothing for extreme sports improve safety for people.

Teacher will develop a "testing station" in the classroom. This station (or stations) will include a fan (wind), spray bottle with water (rain/snow), and a container of ice to demonstrate cold temperatures.

Students will engineer a new layered material to endure harsh conditions of a blizzard, including high winds, wet snow and cold.

Motivator/Opening:

What different types of clothing do you use in different types of weather? What dangers do people face in extremely hot or cold weather and how can they be protected? What factors are important to consider when designing material to protect from weather?

Activities:

Give students the following scenario: You are engineers designing a new layered material to minimize the harsh conditions of a blizzard, including high winds, wet snow and cold temperatures. Work in teams to analyze several different existing materials in order to create a new layered material. Develop a design that combines one or more of the materials you have tested. After you have develope a prototype (model) of this new layered material, conduct analysis at a testing station to determine how well the material holds up during wind, wet snow and cold. Develop a problem statement for your design that includes the type of weather the material is designed for (in this case, a blizzard).

Have students think about how they should test the different materials for resistance to wind, snow and cold temperatures. Have them describe their processes on their worksheets.

Next, have students choose up to five materials to analyze.

Have students complete their materials analyses, following the worksheet. (continued in assignment section)

Assignments:

Next, have students choose which of their tested materials they want to use in their new material designs and explain why they are choosing those materials. (What makes these materials good for blizzard weather conditions?)

Have students draw designs of their new materials and how the individual pieces will be layered. Approve student designs before they begin creating their prototypes. Ask students about their thinking in formulating their designs. Why do you think this will work? Do you think it would be comfortable? Would you want to wear it? Why or why not?

Give students time to assemble and test their new material using the provided materials.

Have students complete their worksheets, analyzing how well their new materials functioned, what changes they would make, and how they could be used during blizzard conditions.

Have teams present their creations to the class and explain their reasoning for their new materials and the processes used to test them. What do you think that blizzard weather would be like? How would you market this material?

Evaluation:

Assessment could come from the group presentation including why they engineered this fabric and how they would market it. Any other factors to consider in the newly engineered fabric? What would this new fabric cost? etc.

Notes:

Students could choose their own type of extreme weather instead of the blizzard conditions used above.

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