Landslides
2024 NHERI Summer Institute
Brian Welch

Subject: Physical Science

Associated Unit: Natural Disasters

Lesson Title: Landslides!

Grade level: 6

Time required: 5 days (250 mins)

Summary:

Students are researching an area where landslides occur in the United States. They are describing the topography of the area and indicating previous substantial landslides that occurred in that area. Students are tasked with creating a prototype to protect homes and properties from the effects of landslides, with particular emphasis on low monetary commitments and abundant resource availability from the people in the area.

Engineering Connection:

Students use scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems. Students also develop and use models to represent phenomena, systems, processes, or solutions to engineering problems. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to identify advantages and limitations of models such as their size, scale, properties, and materials.

Engineering Category:

Relating science and/or math concepts to engineering

Keywords:

landslides, natural disasters, gravity, downslope movement, gravity, debris flow, slope failure, falls, topples, flows

Educational Standards:
SCIENCE.6.5.D examine and model the parts of a system and their interdependence in the function of the system

SCIENCE.6.5.E analyze and explain how energy flows and matter cycles through systems and how energy and matter are conserved through a variety of systems

SCIENCE.6.5.F analyze and explain the complementary relationship between the structure and function of objects, organisms, and systems

Learning Objectives:

- Students will be able to describe and evaluate an area prone to landslides in detail using topography
- Students will conduct cost-benefit analysis on material usage for prototype
- Students will create, test, evaluate, and improve a prototype for protection from landslides
- Students will present findings and prototype in front of audience including peers and instructors

Lesson Background

[Background for teacher]

[Landslides, often described as the downward movement of soil, rock, and debris, represent one of nature's powerful and often destructive forces. These geological phenomena can occur suddenly or gradually, triggered by various factors such as heavy rainfall, earthquakes, volcanic activity, or human intervention like deforestation and construction activities. Their impact ranges from minor disruptions to catastrophic events, posing significant threats to lives, infrastructure, and the environment.

Understanding landslides involves delving into their causes, classifications, and mitigation strategies. They come in various forms, including rockfalls, debris flows, and slope failures, each with its distinct characteristics and triggers. Geological factors such as slope steepness, soil composition, and weathering play crucial roles in determining the susceptibility of an area to landslides.

The study of landslides encompasses multidisciplinary approaches, involving geologists, engineers, meteorologists, and urban planners. Through advanced technologies like satellite imagery, remote sensing, and geographic information systems (GIS), researchers can assess landslide hazards, monitor vulnerable areas, and develop early warning systems to mitigate risks.

Moreover, human activities significantly contribute to landslide occurrences. Deforestation, urbanization, and improper land use practices can increase slope instability, increasing the likelihood of landslides. Sustainable land management practices and infrastructure planning are essential for reducing the vulnerability of communities to these hazards.

In summary, landslides represent complex natural phenomena with far-reaching implications for human safety and infrastructure. Understanding their dynamics and implementing effective protection measures are crucial steps toward building resilient communities in landslide-prone regions.]

Introduction

Utilizing your prior knowledge of landslides, your team has been tasked with creating a prototype of a barrier that will protect homes and businesses in landslide prone areas. The prototype must be cost effective, incorporate scale and utilize natural resources where available. In addition, you team will present your findings to the group, along with a model of the prototype.

Vocabulary/Definitions:

Landslide	the sliding down of a mass of earth or rock from a mountain or cliff
Debris Flow	Debris flows are fast-moving landslides that are particularly dangerous to life and property because they move quickly, destroy objects in their paths, and often strike without warning
Slope Failure	Slope failure, also known as landslides or mass wasting, refers to the sudden and often catastrophic downslope movement of soil, rock, and debris.

Topples	overbalance or become unsteady and fall slowly
Gravity	the force that attracts a body toward the center of the earth, or toward any other physical body having mass

Associated Activities

Natural Disasters: Earthquakes, Volcanoes, Tornadoes & More- students will investigate natural disasters, including cause/effect relationships.

Materials needed per group:

- cardboard tubes or pieces
- chenille stems
- cotton balls
- craft sticks
- foam cups, plates, or trays
- liquid glue
- modeling clay or dough
- packing peanuts
- paper and/or newspaper
- paper cups, plates, or trays
- paper or foam egg cartons
- plastic containers and/or bottles
- plastic cups, plates, or trays
- rubber bands
- straws
- string or yarn
- tape

Assessment:

- Students will be assessed on presentation content and delivery.
- Students will be assessed on the engineering process steps each day.
- Students will be assessed on the final prototype cost and feasibility.