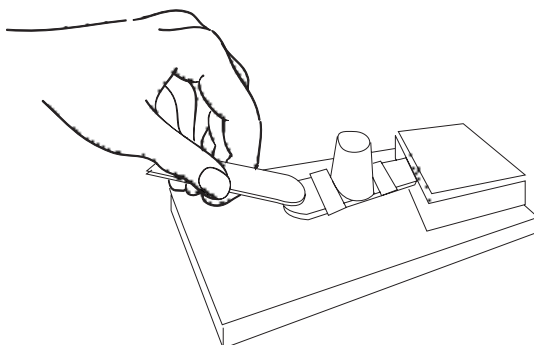


OVERVIEW

VARIABLES



GOALS

Some of the most important scientific concepts students learn are the result of their ability to see relationships between objects and events. Relationships always involve interactions, dependencies, and cause and effect. The **Variables Module** has four investigations that help students discover relationships through controlled experimentation. Students will fling, float, fly, and flip objects as they discover relationships in each investigation.

FOSS EXPECTS STUDENTS TO

- Gain experience with the concept of variable.
- Gain experience with the concept of system.
- Design and conduct controlled experiments.
- Construct materials that will be used in the investigations.
- Acquire some understanding of the behavior of pendulums.
- Gain experience with buoyancy.
- Use data to make predictions.
- Apply mathematics in the context of science.
- Record and graph data concretely, pictorially, and symbolically to discover relationships.
- Acquire the vocabulary associated with controlled experimentation.
- Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, organizing, and relating.

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VARIABLES MODULE MATRIX

SYNOPSIS

SCIENCE CONTENT

THINKING PROCESSES

1. SWINGERS

Students experiment with variables that do and do not affect the behavior of pendulums. They graph their results and use their graphs to predict the behavior of additional pendulums.

- A variable is anything that you can change in an experiment that might affect the outcome.
- In a controlled experiment only one variable is changed, and the results are compared to a standard.
- The length of a pendulum determines the number of swings in a unit of time.

- Observe and compare the behavior of pendulums.
- Experiment to find out what variables affect the number of cycles a pendulum makes in a unit of time.
- Relate pendulum length to the number of cycles it makes in a unit of time.
- Predict the behavior of new pendulums, using a graph.

2. LIFEBOATS

Students construct a fleet of paper-cup boats and discover how many passengers (pennies) each will hold before sinking. The variables of boat depth and arrangement of passengers are explored.

- A variable is anything that you can change in an experiment that might affect the outcome.
- In a controlled experiment, only one variable is changed, and the results are compared to a standard.
- Capacity is the maximum volume of fluid a container can hold.

- Observe and compare the buoyancy of different boats.
- Organize information on a graph.
- Relate the capacity of boats to the mass they can hold before sinking.
- Predict the behavior of new boats, using a graph.

3. PLANE SENSE

Students construct rubber-band-powered airplanes and fly them on a line. They experiment with a number of variables to see how each affects the distance the plane travels.

- A variable is anything that you can change in an experiment that might affect the outcome.
- In a controlled experiment, the experimental variable is changed incrementally to see how it affects the outcome.
- A system is a set of related objects that can be studied in isolation.

- Observe and compare the behavior of a standard plane system to modified plane systems.
- Conduct controlled experiments.
- Organize data in a flight log.
- Relate the effect of variables to the distance the plane travels.
- Predict outcomes of plane flights.

4. FLIPPERS

Students manipulate small catapults called flippers to investigate the variables that contribute to the highest and longest flips of objects. They conduct controlled experiments and graph their results.

- A variable is anything that you can change in an experiment that might affect the outcome.
- In a controlled experiment, the experimental variable is changed incrementally to see how it affects the outcome.
- A system is a set of related objects that can be studied in isolation.

- Observe and compare the behavior of objects flipped from a catapult.
- Conduct controlled experiments.
- Organize and communicate the results of investigations.
- Relate the effect of variables to the trajectory of objects.
- Predict the behavior of new objects on the catapult.

Language Extensions

- Teach peers.
- Make a swinging bulletin board.
- Research pendulum history.

Math Extensions

- Problem of the week.
- Play an ordered-pairs game—Hurkle.

Music Extension

- Investigate metronomes and rhythms.

Science Extensions

- Investigate linked pendulums.
- Investigate a double-decker pendulum.
- Investigate stringless pendulums.

See the Science Stories folio.

- *What Scientists Do*
- *Swinging through History*

www.fossweb.com

Check the FOSS website for interactive simulations, to write questions to a scientist, for teaching tips, and to talk with other classes using FOSS.

Home/School Connection: Students look for pendulums at home and make a few pendulum timers with family and friends.

Language Extensions

- Tell a sailor's tale.
- Make a list of boats.
- Research boats and ships.

Math Extensions

- Problem of the week.
- Weigh the passengers in the lifeboat.
- Measure displacement volume.

Science Extensions

- Float boats in other seas.
- Make a Cartesian diver.

See the Science Stories folio.

- *Sink or Swim?*
- *Science in the Bathtub*

Home/School Connection: Students build cork rafts and aluminum-foil boats to investigate the variables of boat design.

Language Extensions

- Teach peers.
- Research aviation news.
- Write a flight plan.

Math Extensions

- Problem of the week.
- Determine speed.

Science Extensions

- Investigate variables with toys.
- Launch balloon rockets.

See the Science Stories folio.

- *Airplane Basics*
- *Experimental Designs*
- *Great Names in Aviation History*
- *Build Your Own Paper Airplane*

Home/School Connection: Students make a paper airplane and work with the variables to change the way it flies.

Language Extensions

- Discuss variables.
- Research catapults.
- Write directions for a flipper game.
- Prepare oral presentations.
- Describe the group experience.

Art Extension

- Design effective presentation posters.

Math Extensions

- Problem of the week.
- Investigate trajectory.
- Find the angle.

Science Extensions

- Investigate compensating variables.
- Make a coin sorter.
- Conduct a flipper field day.
- Test consumer products.

See the Science Stories folio.

- *Flingers*
- *Prove It!*

Home/School Connection: Students work on their chosen projects at home.

