Thaumatrope

Materials

- 1 black marker
- hole punch
- blank index cards (one per student)
- rubber bands (two per student)
- pencils or crayons for students to draw with (no markers)

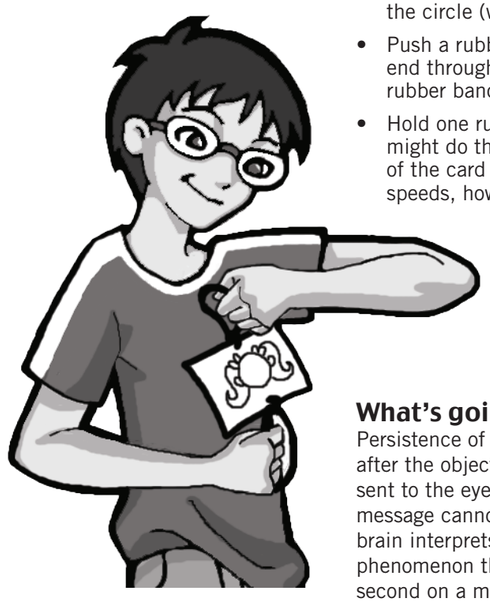
Explore how your brain and eyes work together with this classic toy that preceded modern day animation.

1.2.1 Understand that things are made of parts that go together.

2.1.3 Understand how to construct a reasonable explanation using evidence.

Procedure

- Prepare index cards by punching holes (as shown in the illustration), and outlining a circle with black marker on one side. It works best if the circle is somewhat visible on the back side as well.
- Pass one card to each student.
- Have students start on the side with the black circle and draw some hair, clothing and accessories. Make sure they draw on the outside of the circle only.
- Next have them flip the card over and draw two eyes, a nose and a mouth inside the circle (which should be barely visible from the other side).
- Push a rubber band through one of the holes. Open one end and pass the other end through it to form a loop. Pull it until it is tight. Repeat with the other rubber band so that the card is suspended between the two rubber bands.
- Hold one rubber band in each hand and twist the card many times. (Students might do this with a partner.) When the rubber bands are tightly twisted, let go of the card and observe the magic. Try experimenting with different spinning speeds, how does this affect the illusion?



Challenge

Try this activity again having students draw a bird on one side and a cage on the other, or a fish and a fishbowl. What happens if you punch the holes on the sides of the index card instead of the top and the bottom?

What's going on?

Persistence of vision is the eye's ability to retain an image for a fraction of a second after the object is gone. Every time the thaumatrope changes sides, a new image is sent to the eye. If it is spinning fast enough, the first image hits the retina and the message cannot get to the brain before the second image is observed, therefore the brain interprets the two quick flashes as one continuous image. This is the same phenomenon that allows the brain to see a series of 24 individual frames each second on a movie screen as a moving picture.

Resources

Blood and Guts: A Working Guide to Your Own Insides, by Linda Allison, 1999

Eyewitness: Skeleton, by Steve Parker, 2000

The First Human Body Encyclopedia, DK First Reference Series, 2005

Reader's Digest: How the Body Works, by Steve Parker, 1999

The Usborne Internet Linked Complete Book of the Human Body, by Anna Claybourne, 2003

www.kidshealth.org

www.yucky.com

www.iknowthat.com/com/L3?Area=Science%20Lab

Science On Wheels website: www.pacificsciencecenter.org/education/sow

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SCIENCE On WHEELS

BLOOD and GUTS

Dear Teacher,

Thank you for having the *Blood and Guts* van visit your school. We hope you enjoyed investigating the human body with your students during this Science On Wheels experience. This flier is intended to help continue the enthusiasm generated by our visit and extend your students' learning.

The following activities have been selected because they are straight-forward, require few materials, and support state adopted learning objectives. We have identified and listed two corresponding Grade Level Expectations (GLEs) for each activity. The one page insert is written for your students, with activities you may choose to do as a class, or copy for home use.

Thank you again for having the *Blood and Guts* van visit your classroom and remember, have fun!

~Science On Wheels Teachers

Detective In The Dark

Materials

- a darkened room
- objects or pieces of cloth in different colors and shapes (it is important that some of the objects are unfamiliar to the students)

How does our sense of sight change when the lights go down? Discover why detecting color is more difficult in the dark.

1.1.1 Understand simple properties of common natural and manufactured materials and objects.

2.1.3 Understand how to construct a reasonable explanation using evidence.

Procedure

- Darken the room. You may want to test the room before trying this activity with students.
- Hold up objects one at a time, using objects students are familiar with as well as ones they have never seen before. Ask the students to identify the shape and color of each object.
- Turn the lights on. Compare the student responses to the actual objects. How accurate were they? Were the students more likely to correctly identify the shape or color of an object? Did it matter if the object was familiar to them?

Challenge

When you go to bed tonight, test yourself at home. Turn out the lights and look around your room. Can you correctly identify all the objects? How about all the colors? Try looking in a drawer or closet. Can you easily distinguish between different solid-colored shirts? Next time you are in an unfamiliar place, try this test again.

What's going on?

Humans have two types of light detecting cells in our retinas – rods and cones. Rods allow us to see shapes, they record in black and white, and can detect even in very low levels of light. Cones detect color and unlike rods, need much more light before they will "fire" or send a message to the brain. For this reason, we only see in black & white in low light conditions. When we do identify color in the dark it is usually for items we are familiar with. Based on past experiences, our brains can "add" the color in for objects we recognize.

All Thumbs

How important are opposable thumbs? Try this simple activity and see what you discover.

1.2.8 Know the external parts of the body.

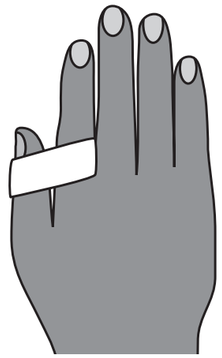
2.1.2 Understand how to plan and conduct simple investigations following all safety rules.

Materials

- masking tape
- stopwatch (optional)

Procedure

- Wrap masking tape around the students thumbs and index fingers as shown in the diagram.
- Try simple daily activities like writing their name with a pencil, tying their shoelaces, picking up a coin, zipping a zipper or fastening a button.
- Discuss which activities were more difficult, which were about the same, and which were impossible to do without the use of opposable thumbs.



Challenge

Have the students try to think of other activities that would be difficult or impossible to do without opposable thumbs. Use a stopwatch to time the students performing an activity with and without the use of their thumbs. Have the students write about how life would be different if humans didn't have thumbs.

What's going on?

Opposable thumbs are one of the distinguishing features of primates. The human thumb is fully opposable, meaning it can touch the fingertips of each of the other four fingers and grasp things against the palm of the hand. Most human technological development can be attributed to the thumb and the fine motor skills dependant upon it.

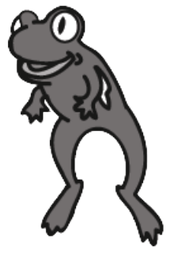
Jump For Joy

Compare your jumping distance with those of other animals. You might be surprised who comes out ahead!

Animal	Jumping Distance (ft.)
Elephants	0
Flea	3
Cricket	4
Grasshopper	5
Frog	6
Dog	7
Bobcat	8
Rabbit	9
Lemur	25
Kangaroo	30

1.1.6 Understand characteristics of living organisms.

2.2.2 Understand that observations and measurements are used by scientists to describe the world.



Materials

- 2 long pieces of rope
- measuring tape
- large open space (best done outside)

Procedure

- Place the ropes 3 feet apart and parallel to one another on the ground.
- Have students stand on one side and try to jump this distance. It's okay to have a running start. If students are successful you can tell them that they have just jumped as far as a flea.
- Continue to increase the distance between the 2 ropes referring to the chart.

Challenge

Discuss how our physical makeup determines what we are capable of doing. What things are we physically capable of doing that kangaroos are not? Why is it valuable for kangaroos to be able to jump 30 feet? Why is it not as necessary for humans to have this ability?

What's going on?

Many things determine the distance that an animal or human is capable of jumping. Some of these things include running speed, take-off velocity, muscle strength, and the weight to be lifted. Notable features of animals specialized for jumping generally include a high muscle mass to weight ratio and the ability to reach high running speeds prior to take off. While an elephant has a lot of muscle, it also weighs 10,000 pounds, so its muscle mass to weight ratio is not large enough for jumping. A flea has much less muscle than an elephant but it only has to lift approximately 1 milligram. Therefore, fleas can jump quite far, relative to their body size.

Tricky Temperature

Materials

- 3 buckets or large containers (additional containers will allow more students to participate in this activity simultaneously)
- ice water
- hot water (no more than 100°F)
- room temperature water

Can you tell if something is hot or cold by touching it? Discover how you can trick your temperature receptors.

2.1.2 Understand how to plan and conduct simple investigations following all safety rules.

2.1.3 Understand how to construct a reasonable explanation using evidence.

Procedure

- Fill one container half full with ice water, one with room temperature water, and one with hot water and place them in a row.
- Have students hold one hand in the hot water and the other hand in the cold water.
- After one minute, have students place both hands in the room temperature water. What do they feel? Do both hands experience the same sensation?

Challenge

What happens if students leave one hand in the cold water and move the other hand directly from the hot water to the cold water after one minute? Do both hands feel equally cold? What if students hold both hands in the hot water for one minute and then place one hand in the room temperature water and the other in the cold water?

What's going on?

The receptors in our skin rapidly become desensitized to repetitive sensory inputs. When we leave our hands in an uncomfortable (but not dangerous) warm or cold bath, the brain quickly begins to ignore that message and eventually begins to "reset" what is normal. When we switch baths, this "resetting" makes the new extreme feel that much colder or hotter than it would if our hands had been kept at room temperature.

Bendable Bones

The human body needs calcium for healthy bones and teeth. Use this activity to discover why!

1.1.1 Understand simple properties of common natural and manufactured materials and objects.

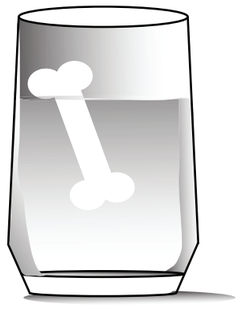
2.1.5 Understand how to record and report investigations, results, and explanations.

Procedure

- Fill one beaker with water and the other with vinegar.
- Give students an opportunity to see and feel the clean chicken bones. Discuss and record observations and predictions.
- Place a bone in each of the beakers and let them sit for 3-4 days.
- Remove bones from beakers and allow students to see and feel them once again. Discuss and record similarities and differences.

What's going on?

Calcium is the primary substance that gives our bones their strength and stiffness. Vinegar contains an acid that dissolves calcium. The bone left to sit in the beaker with the vinegar has lost most of its calcium and will appear rubbery and soft. While human bones are not often exposed to such acids, they do lose stored calcium over time, resulting in osteoporosis in later life.



Materials (per group)

- 2 clean chicken bones (thicker ones like a leg bone are preferable)
- 2 large beakers or wide-mouth glass jars
- vinegar
- water