RAUE CENTER FOR THE ARTS

Garry Krinsky: Toying with Science
Study Guide

For Teacher Classroom Use
School Performance(s):April 25, 2011 at 9:30 a.m. and 12:15 p.m.

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Introduction

It has been said that **GARRY KRINSKY** resembles a living cartoon with his animated movement and non-stop energy. His theater experience is extensive. Garry co-founded the Patchwork Players, and was an original member of both the Boston Buffoons and the Wright Bros., a New England vaudeville troupe. Since 1978, Garry has brought his high energy and experience to thousands of schools, theaters and festivals and has also been seen on the NBC Today Show. *Toying with Science* is a fast-paced, varied and dynamic performance. Commissioned and developed with the Museum of Science in Boston, this performance explores, among other things, the scientific principles of gravity, leverage, simple machines, and the human property of imagination. Combining circus skills, mime, original music, and audience involvement, Garry and his audience investigate basic scientific information and delve into the imaginations of scientists who explore our world.

Within this guide you will find a glossary, information about levers, simple machines, fulcrums, questions to pose to your students regarding leverage and fulcrums, a worksheet on fulcrums, and information to make your students think more about these scientific principles and prepare for Garry's performance. We hope that the guide will also give you ideas to develop follow-up activities after Garry's performance.

Garry would love to know your ideas as well as those of your students on activities that you have developed in conjunction with this program. Occasionally he will selectively add projects to the guide that are sent to us, with credit to the students, teacher and school, to give future teachers innovative ideas to use with their students.

Garry would love to hear from your students. If you have any questions or comments about the performance, or if you would like to mail student packets to Garry, you can address mail to:

GARRY KRINSKY c/o

Baylin Artists Management

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Glossary

CENTER OF GRAVITY: The point in any solid where a single applied force could support it; the point where the mass of the object is equally balanced. The center of gravity is also called the center of mass. (When a man on a ladder leans sideways so far that his center of gravity is no longer over his feet, he begins to fall.)

GRAVITATION (GRAVITY): The force, first described mathematically by Isaac Newton, whereby any two objects in the Universe are attracted toward each other. (Gravitation holds the moon in orbit around the earth, the planets in orbit around the sun, and the sun in the Milky Way. It also accounts for the fall of objects released near the surface of the earth. Objects near the surface of the earth fall at a rate of 32 feet per second.)

FREE FALL: In physics, the motion of a body being acted on only by gravity.

FRICTION: The force of one surface sliding, rubbing, or rolling against another. Friction slows down the motion of objects, and can create heat. Friction can also stabilize motion.

FULCRUM: The fixed point about which the lever moves. The point at which energy is transferred.

INERTIA: The tendency for objects at rest to remain at rest, and objects in uniform motion to continue in motion in a straight line, unless acted on by an outside force.

LEVER: A rigid rod or bar to which a force may be applied to overcome a resistance. A lever (or a combination of levers) is a simple machine used to gain force, gain speed, or change directions.

LEVERAGE: To wield power with levers. Understanding where the fulcrum is located allows us to position ourselves to gain our greatest leverage.

MACHINE: A device (or system of devices) made of moving parts that transmits, send or changes a force. Machines are often modeled on how the human body works.

SCIENCE: An organized body of information or HOW THINGS WORK!

SIMPLE MACHINE: Machines powered by human force (as opposed to batteries, electricity or burning fuel)

Some Famous Names in Science

GALILEO—An Italian scientist of the late 16th Century and early 17th Century. His full name was Galileo Galilei. He proved that objects with different masses fall at the same velocity. Galileo also invented one of the first telescopes. Disputing the popular opinion of the time, Galileo proclaimed that the planets revolved around the sun and not around the earth.

NEWTON, SIR ISAAC—An English scientist and mathematician of the 17th Century. Newton made major contributions to the understanding of motion, gravity and light. He is said to have discovered the principle of gravity when he saw an apple fall to the ground at the same time that the moon was visible in the sky.

NEWTON'S LAWS OF MOTION—The three laws that govern the motion of material objects. They were first written down by Isaac newton and gave rise to a general view of nature known as the CLOCKWORK UNIVERSE. The laws are: 1. Every object moves in a straight line unless acted on by a force. 2. The acceleration of an object is directly proportional to the net force exerted and inversely proportional to the object's mass. 3. For every action, there is an equal and opposite reaction.

Levers

Here are examples of levers. Long levers = power; short levers = speed and mobility

LONG	vs	SHORT
	These are Levers	
shovel		trowel/toy shovel
ladle		spoon
ax		hatchet
pitchfork		fork
sledge hammer		hammer
tennis racquet		ping pong paddle
	These are Simple Machines	
bow		sling shot
clothing shears		paper scissors
wire cutters		cuticle (fingernail) cutters
deep sea fishing rod (for big fish)		lake fishing rod (for small fish)

Can you name other levers?

Simple Machines

Most of the items below are simple machines. Identify those that ARE NOT simple machines.

scissors	hedge cutters	can opener	calculator	window shade	reclining chair
umbrella	wind-up clock	toilet	hot shower	hour glass	car jack
door	toaster	mouse trap	bicycle	chop sticks	telephone

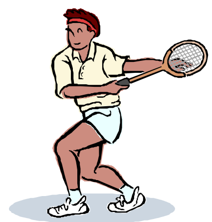
Can you name other simple machines?

(ANSWERS: these are NOT simple machines: hot shower, toaster, telephone, calculator - fueled by electricity, fuel, or battery)

Fulcrums

The fulcrums pictured on the next page are examples of *fixed* fulcrums, but we often use *non-fixed* or moving fulcrums. For example, in a rowboat the oars are placed into oar locks which are fixed fulcrums, but when paddling a canoe, our lower hand acts as the fulcrum but it is moving. Fixing the fulcrum (keeping its movement to a minimum) can often give us more power. We can apply more of our force in a rowboat than we can in a canoe. (However, canoes can often move faster because they have less surface in the water, and do not have as much speed-robbing friction to slow them down. Friction is also the main reason why fat-wheeled mountain bikes cannot travel as quickly as thin wheeled racing bikes.)

As with a canoe paddle, we encounter many non-fixed fulcrums in sports. Can you name some other sports levers where we transmit our power through non-fixed fulcrums?


(ANSWERS (just a list to get everyone started): baseball bats, hockey sticks, pole vaults, pool cues, tennis racquets, golf clubs, and Lacrosse sticks.)

We do not need levers to use leverage. We often use our arms and legs as levers. Can you name activities where you or other people use your arms and legs as levers?

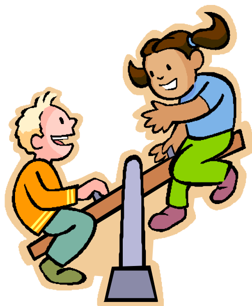


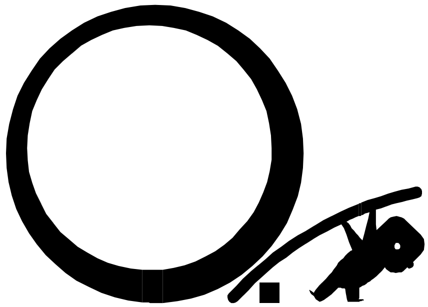
(ANSWERS (just a list to get everyone started): dancing, doing martial arts, directing traffic, performing mime, pitching a baseball, wrestling, bowling, playing Frisbee, throwing a football, swimming, diving.)

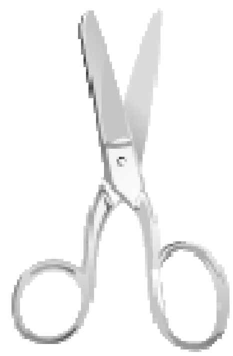
When compared to a long canoe oar, in swimming, our hands act as small, barely efficient levers. The canoe oar increases our power. Most of the machines and tools that we build use the human body as a model, and by adding the scientific principal of leverage, it increases our own power to make the human race move stronger, faster and more efficient.

TEACHER NOTE: On the next page are examples of fixed fulcrums. You may make copies of this page to use as worksheets for your students.

Find the Fulcrums







Garry Krinsky's Simple Machine Collected Rhymes (Copyright 2007)

Fulcrum Man

(By Garry Krinsky)

Fulcrum's a funny word. Simply what it is
Is the place where energy's transformed. Relax, They'll be no quiz.
See the seesaw painted red, divided equally.
The fulcrum's here, upon my head. It transfers energy. (He's Fulcrum Man)

Move the fulcrum over here and see this arm get long.
The fulcrum now's in this hole, wow, it makes me feel so strong.
With it, I can lift a car. Let's hit the road, "Jack",
'cause with the long arm of the lever, you get power. That's a fact.

(We use leverage) with my shovel, dig?
(Leverage) with my hockey stick,
(Leverage) paddling with my oar,
(Leverage) fishing from the shore.
(Leverage) I've got to cut the line.
(Leverage) It's scissors time.
(Two levers) with one fulcrum.
(Levers) They share the fun.

Fulcrums, they're everywhere. Look; There's one.
In the middle of my devil stick, you'll see the red fulcrum.
When I move the stick right there, and make a move just right,
My devil stick takes to the air as if it were in flight.

(Leverage) makes a wheel go 'round.
(Leverage) It's where up meets down.
(Leverage) See my circular stroke,
(Leverage) here in the middle of the spoke.
(Leverage) That's the fulcrum ya' know.
(Leverage) It make a helicopter go.
(Leverage) It's so uplifting.
(Leverage) It's in everything.

It's in toys, tools and machines. It's everywhere,
But other living creatures use leverage, Oh yeah',
Like beavers, who build dams with their tails.
Clams will crawl and a butterfly sails.

(Leverage) How 'bout an eagles wings?
(Leverage) A grasshopper springs.
(Leverage) You've got your elephant trunk.
(Leverage) How 'bout your smelly skunk?
(Leverage) A puppy wags it's tail.
(Leverage) A squid leaves an ink trail.
(Leverage) You've got your spider's web.
(Leverage) Hey, Can you see the thread?
It's leverage!

When he pulled the sword out, King Arthur did shout, "Leverage!"

Garry Krinsky's Simple Machine Collected Rhymes (Copyright 2007)

Seesaw Rhyme

(By Garry Krinsky)

In a playground, what would this be?
Ends with saw, starts with see.
Seesaw, a simple machine,
Powered by a human being,
And where the energy
Changes, that's the fulcrum, see?
This side up sends that side down.
Fulcrums make the world go 'round.

When the fulcrum's in the middle, you get speed,
But if power is what you need,
Move the fulcrum to the end.
Oh, what a force you'll send!

"Don't Slip on the two Ws"

(A Rhyme to Remember the 6 Types of Simple Machines)

(By Garry Krinsky)

Simple machines, there's six different kinds.
To remember them, here's a few clues,
A silly phrase that helps to remind;
"Don't SLIP on the two Ws!"

"S" is for screw, "L" is for lever,
and "I"s for the inclined plane.
"P" is for pulley. The first "W"s wedge.
Wheel and axle is all that remains.

Don't slip; Don't slip;
Don't slip, slip, slip;
Don't slip on the two Ws.
It's a silly phrase
That helps to remind,
Don't SLIP on the 2 Ws!

Feather Balancing

TIPS FOR SAFETY

Remove “breakables.” You will need to move around, so prepare the room for your feet. Feathers break easily, so be gentle with them. Feathers have points, so be careful with your eyes.

TIPS FOR SUCCESS

Look at the **top** of the feather. Balance in a non-windy space (indoor spaces work best). The more you practice, the better you will get, so don’t get frustrated if success doesn’t come right away.

PLACES TO BALANCE ON TRICKS TO TRY

Palm of hand	- from a hand balance, throw it up and catch it
Back of hand	- keep it balanced
Shoulder	- throw it from one hand to the other
Elbow	- throw it in the air, clap and catch it (see if you can add more claps)
One finger	- carefully switch the feather from one finger to another
Top of your foot	- balance it on your foot, kick it up to your hand
Chin	- let a “balanced” feather lean, walk in that direction
Nose	- as above

EXPLORE NEW PLACES TO BALANCE ON

- Hold the feather like a dart or javelin (point up) and throw it straight up. It will turn over and return to earth facing down. Catch it in the palm of your hand. It helps to bend low to catch the feather so that it has time to straighten.

- While balancing, sit, lie down, then stand up again.

- Lying on your back, balance the feather on the bottom of your foot.

- EXPLORE NEW TRICKS!

TIPS FOR THROWING

- Throwing it high and catching it low gives you more time to see the feather.

- Higher throws allow the feather to straighten out.

- Straight throws are the easiest to catch.

- When throwing more than one feather with more than one person, one person should call out a loud and clear “cue” so that all partners throw at the same time.

MORE THAN ONE PERSON PASSING

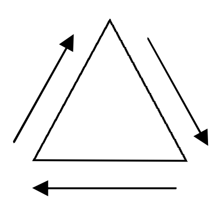
- With a high, straight throw, pass a balanced feather from one partner to the other.

- With each partner balancing a feather, one partner gives a clear CUE (“1, 2, 3!” or “Ready…Go!”) and partners switch feathers with a high, straight throw, AND, of course they balance it when they catch it.

- One partners give a “javelin” toss to the other.

- Two partners “javelin” toss at the same time (on a clear CUE) switching their feathers with a high and accurate throw.

- Three partners stand in a triangle formation, each holding a feather with the “javelin” hold. On a clear CUE, they toss their feather to one partner, then IMMEDIATELY turn to catch it from the other partner.



- Two partners stand one behind the other, both facing the same directions. The front partner balances a feather (on their hand), then throws it straight up moving forward underneath it, while the back partner steps up and catches it. This can also work with a whole line of people, with the front person moving to the back of the line each throw. A clear CUE is IMPORTANT!

HAPPY BALANCING!!!

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JUGGLING & OBJECT MANIPULATION

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For more information on Garry Krinsky, please refer to his website:

www.garrykrinsky.com

Garry Krinsky: Toying with Science
Teacher Guide

For Toying With Science Workshop
By Garry Krinsky

The following information is provided as an aid for teachers who have participated in Garry Krinsky's "Toying with Science" workshop. This guide should help reinforce the scientific principles and exercises that the teachers experienced during the workshop, as well as help them apply and adapt the information to their respective classrooms. It is designed to be used in conjunction with the "performance study guide", which can be accessed at the bottom of the "Toying With Science" page at www.garrykrinsky.com.

Teacher workshops encourage participants to experience the information in three ways: 1) as learners (students), 2) as appliers (teachers), and 3) as adapters. In other words, teachers will first experience and digest this new information for themselves, as their students will. After each activity they then explore how they would apply this experience to their classrooms, adapting it to their individual needs and themes. Classroom space, class size and age, and curriculum integration factor into each teacher's adaptation.

GRAVITY AND AIR RESISTANCE

The principles of gravity, its opposing force, and air resistance can be seen and understood through two activities: object balancing and juggling.

OBJECT BALANCING

In the first workshop activity, teachers explore air resistance (and how to find the center of gravity) by balancing peacock feathers on their hands. Teachers experience, firsthand, how the feather resists the pull of gravity (by trapping air) and thus allows them ample time to move the bottom stem to keep the feather balanced (as gravity pulls down the length of the feather through their hands). Doing the feather balancing as a group allows the teachers to share the workshop space in a harmonious way.

Garry will model ways to make this activity safe, and then lead them through a series of feather balancing exercises (see "Tips for Balancing Feathers" in the performance study guide), which challenge and hone the teachers' balancing abilities, providing them with a unique learning experience.

Following this, the teachers discuss the various scientific principles that they have explored with these exercises, and how they will share the experience with their students. Their adaptations will be governed somewhat by how much mastery each individual teacher feels they have gained, but also how teachers can adapt the activity to their respective curriculum, classroom layout, student size, and interest. The workshop is not designed to create circus artists and/or mimes, but rather to allow the teachers a unique experience that they feel capable (and excited) to share with their students.

Some **key phrases** to remember with feather balancing are:
-"Be soft with your bodies. If you make contact with someone, do not move them out of your way, but rather slide on through following and eventually controlling your feather."
-"Let the feather fall, not you, or your classmates."
-"Share the space!"
-"Be gentle with the feathers. They break easily."
-"Keep your eye on the top of the feather. Don't begin to balance until you've focused on the top."
-"Give each other positive feedback, so that if a feather toss to a partner isn't high enough, ask for it to be higher, as opposed to saying that it was too low. Work together!"

Cautions

Students often want to test their balancing abilities after working with the feathers by trying to balance other objects. This can be dangerous as a group activity, and is better suited to be an individual activity or done in small groups. Still, a few safety checks are an important starting point:

- Stress how vital it is to catch the object before it falls. Aside from students possibly getting hurt, accidents can also adversely affect the student's ability.
- Nothing should ever be balanced that can't easily (and safely) be caught (if it falls), as well as be safely lifted and put down afterwards.
- The balancing space should always be inspected for safety before balancing. When the student's eye is focused on the top of the balanced object, they can't see below them, so be sure to remove anything on which they might trip.
- Students should be careful as they move on from feather balancing to other objects. Longer objects tend to be easier to balance (up to a point), such as yard- sticks, broom handles, rakes, baseball bats, tennis rackets, etc. It took Garry almost a full year before he was able to balance a ladder on his chin, and he made sure that he had (adult) "spotters" surrounding him to catch it if it fell. The ladder did not fall, mainly because he worked his way up to it step by step, gradually balancing more challenging objects, but also because he could relax and do his best, knowing that he had "spotters" there for safety. Feeling safe is an important element in learning anything new.

JUGGLING

Teachers also explore the concept of juggling during the workshop and working with scarves and/or plastic bags, both of which have great air trapping abilities. It becomes immediately clear how air resistance slows down the force of gravity, making it much easier to see and understand the juggling pattern.

The basic juggling pattern is in the shape of a "figure 8", with the "8" standing on its side. The figure 8 is a single twisted, but continuous line, similar to the symbol for infinity. In this pattern, there is basically only one object in the air at all times, which is why the basic juggling pattern normally involves three objects (one in each hand, plus one in the air).

Suggestions

- It is also helpful (and fun) to juggle two objects in one hand. Naturally, the pattern changes to become either circular or to parallel lines. Juggling is a fun way to recognize and illustrate a variety of geometric patterns.

- It can also be enlightening to hold the plastic bags with two hands by the open end and swing it so that it fills with air, then move it in different patterns (circles, figure 8s, lateral motions), eventually letting it go and watching it languidly float down to Earth. Wouldn't it be nice if we could slow down all kinds of physical motion to better understand how things work? What other activities can we think of where humans juggle multiple activities? What other ways can we see gravity and air resistance at work?

Other Challenges

- With younger children (or older children who are having trouble mastering the figure 8 pattern), it can be quite helpful to simply throw the scarves/bags (even one at a time) straight up, do a body motion (a spin, a leap, touching the ground, slapping someone "five") and then catch the scarf/bag before it hits the ground.

- It can also help to count how long it takes from the time it leaves the hand to just before it hits the ground to see how much time air resistance truly gives us. One nice thing about working with plastic bags is that they are cheap (free) and easily available.

- If a juggler has trouble maintaining a figure 8 pattern, because he or she keeps handing off (rather than tossing up) the object to their stronger hand (reverting to a circular pattern), it helps to start juggling with the weather hand, because one is less likely to "stick" the object into their weaker hand.

- It can also help for the teacher to stand facing the student juggler and catch each scarf/bag at its peak and slow its descent (holding it) even more than the air would. This can help allow the student to truly see the figure 8 pattern, without the pressure of gravity (even gravity slowed by air resistance) rushing them. In other words, the teacher can slow things down to match the learner's comprehension. Remember, if the objects travel in a true figure 8 pattern, then the object should be right there for the catching.

- Learning to juggle, especially with balls, requires thousands of drops, so it's best not to practice when a class is taking a test or doing concentrated work on the floor below. Juggling over a couch or a low table or even a bed, at home, not only protects your neighbors, but saves the juggler the strain of constantly picking balls up after they fall to the ground.

Partner Juggling

A helpful variation is to have two students stand, side by side, and have each student use only their outside arm, as they juggle three objects, together, in a figure 8 pattern, each using only one arm. There are a number of more advanced patterns for jugglers to explore once the preceding challenges are met.

Juggling is basically learning to do one thing well enough that you can add something else to your pattern. In other words, walking while talking on the phone is a form of juggling, as is playing the guitar and simultaneously singing, taking notes while listening to a lecture or dribbling a basketball while searching for an open teammate to pass to. Humans juggle in a variety of motions all of the time, and so learning to juggle 3 inanimate objects (please, no cat juggling allowed) simply exercises our multi-tasking abilities.

MACHINES

Machines are often designed with the human body as a model or built to enhance certain human motions. Some machines such as bicycles and automobiles increase our abilities (in this case our ability to travel), while others are designed to make our lives easier and/or more organized. When we reach for a glass of water, there are a multitude of simultaneous motions that are near impossible to duplicate with a machine. The human body has such incredible mechanics that scientists have rarely been able to create robots that move as smoothly and gracefully as we humans do.

Suggestion

A fun and educational experiment that highlights this is to conduct an everyday task as a robot might, and then compare how many moves a human would need to accomplish the same action. Try a series of tasks such as pouring liquid into a glass and then drinking from it, sharpening a pencil, tying a shoe, hanging up a coat, or taking a book out of desk and opening it. It can also be fun (also easier to organize and clean up afterwards) to "mime" these tasks (first as a robot and then as a human, or vice versa). There are mechanics involved in all of our actions. When we lift or move heavy objects, we use our legs and arms as levers and create our own fulcrums. Understanding how our bodies move can provide great insight into how machines work, and understanding how machines work can sharpen our awareness of our own physical motion.

SIMPLE MACHINES

Simple machines are powered by humans (as opposed to being powered by electricity or burning fuel). Scientists have organized these machines into six different categories:

1. **Screw** – an inclined plane (slanted surface) wrapped around a cylinder to form a spiral. {bottle cap, piano stool}
2. **Lever** – a rigid rod or bar to which a force may be applied to overcome resistance. {crowbar, seesaw}
3. **Inclined plane** – a slanted surface used to raise or lower an object. {ramp}
4. **Pulley** – a chain, belt, rope or string wrapped around a wheel. {window shade, curtain}
5. **Wedge** – an inclined plane that moves. Most wedges (but not all) are combinations of two inclined planes (often two slanted surfaces). Wedges generally split things apart. {ax, knife}
6. **Wheel and axle** – a lever that rotates in a circle around a center point (or fulcrum). The larger wheel (outside) rotates around the smaller wheel (axle). {wagon, skateboard}

In an effort to remember the various types of simple machines, Garry has composed a simple phrase and accompanying rhyme:

"Don't SLIP on the two Ws"

(A Rhyme to Remember the 6 Types of Simple Machines)

(By Garry Krinsky)

Simple machines, there's six different kinds.
To remember them, here's a few clues,
A silly phrase that helps to remind;
"Don't SLIP on the two Ws!"

"S" is for screw, "L" is for lever,
and "I"s for the inclined plane.
"P" is for pulley. The first "W"s wedge.
Wheel and axle is all that remains.

Don't slip; Don't slip;
Don't slip, slip, slip;
Don't slip on the two Ws.
It's a silly phrase
That helps to remind,
Don't SLIP on the 2 Ws!

Screw, **L**ever, **I**nclined Plane, **P**ulley, **W**edge, **W**heel and axle

THREE CLASSES OF LEVERS

*Levers can be further categorized into three different classes, according to where the fulcrum is in relation to the effort used to overcome the resistance. For example, in a seesaw, the fulcrum is in the middle of the lever, between the effort on one end and the resistance on the other. This is a **first class lever**, as is a catapult or an automobile jack.*

*In a **second class lever**, the resistance is located between the fulcrum and the effort. Picture a wheel barrel (a second class lever), where the effort to raise it becomes more difficult when it is heavier (loaded up with more mass), and the fulcrum is the wheel and axle on the end. A door is another example of a second class lever, because the effort (mass of the door) is between the knob (where we exert the effort to open and close it) and the hinges (the fulcrum.)*

*To understand a **third class lever**, observe a set of tweezers and you will see that the fulcrum is on the attached end, while the effort is located in the middle, where we squeeze them to overcome the resistance of what we are gripping on the other end. So, a simple way to remember the different classes of levers is to identify where the (F) fulcrum is located relative to the (E) effort and the (R) re sistance.*

First class: E – F – R

Second class: E – R – F

Third class: R – E – F

COMPOUND MACHINES

Many simple machines are actually **"**compound machine**s,"** which are machines comprised of two or more types of simple machines. For example: A scissors is made of two levers (attached at the fulcrum), while the sharp (inside) edge of each of these levers are wedges (two slanted surfaces). Within a can opener, you'll find two levers, a circular wedge and a wheel and axle.

Suggestions

A great exercise is to picture (or enter) a room and list all of the simple machines you can find, and then break them down into their various categories. You might start with your classroom for there you will find a treasure trove of human powered machines, everything from window shades (pulleys), to books (two attached levers with the binding acting as the fulcrum), to tape dispensers (wheel and axle, wedge), to pencil sharpeners (lever, wheel and axle, wedge…Remember, a wedge usually separates, in this case, separating the old wood from the new, revealing more lead to write with).

- Move outside to the playground and note the varying types of simple machines.

- Try the gymnasium. Think about kitchens. How about bathrooms? (warning: the latter can lead to toilet humor.)

- Ask your students to think of rooms (garages, basements, artist studios, dance or gymnastic studios), places and activities (carnivals, the beach, sporting events, boat trips, outdoor adventures) that contain lots of simple machines and continue identifying and categorizing them. Of course, whenever possible, locate the respective fulcrums of these machines.

- Powered machines often have simple machines parts. For example, a gas-powered lawn mower, has a handle which acts as a lever, and some have a pulley chord to start them up. Refrigerators have doors on hinges (levers), and buttons (levers) that when released light up the inside when opened. Cars have wheel and axels, steering wheels, levers that recline seats and of course, door with hinges (levers with fulcrums).

- It is also a worthwhile exercise to identify the "ancestors" of our modern machines. Before there were cars, there were horse and buggies, as before there were modern plows, we plowed our fields with large simple machines pulled by horses and other animals. Predating the computer was the typewriter. Before touch tone phones, there were rotary phones, and before that, phones that had to be cranked up. Explore the mechanics that went into bringing these "ancient" machines into the modern age.

EXPLORING MECHANICS THROUGH MIME

An interesting activity is to have the students play the different parts of some of these machines.

A good starting point would be to try a "statue" game. Pair them in groups of two and have them take turns manipulating each other into various poses (one is the sculptor, while the other is the clay), mindful of how our bodies move at the various joints (elbows, wrists, fingers, shoulders, waist, neck, hips, knees, ankles and toes.)

It is important to set some boundaries before beginning about being respectful to each other, as well as stressing that the sculptor must maintain the clay-person's balance. At various intervals, the teacher could call out, "freeze!" They could then examine each others' statues, before the teacher again shouts, "switch!" at which points the sculptor becomes the clay, etc… They should be encouraged to bend at a wide variety of joints, as opposed to just moving each others hands and arms. How does bending at the knee affect the body's balance and shape? …bending at the waist? …gently twisting the hips?

You could also expand the groups and have one sculptor create a "work of art" out of two or three people. A variation on this game is to match the statue(s) to a photo, but it is important to keep exploring how the "clay people" are molded into the finished product, as opposed to just posing without being "sculpted". Ideally, these exercises should warm them up and give them a better sense of body mechanics.

Before they undertake portraying different machines, make a list (with them) of some machines that might have animated parts, such as an automobile, a vending machine, computer game or carnival ride. Then, have them separate into groups and decide upon a machine (or related machines) to create. Remind the students that machines transfer, send or change energy, and how this energy gets moved should help them work together. Also, help their classmates figure out the paticular type of machine.

Often having a human(s) manipulate the machine can illuminate the kind of machine it is. Have them work out who plays which parts, and then ask the class to try to figure out the type of machine(s) that they are miming. Sounds are perfectly acceptable and can be quite helpful. After identifying each machine(s), discuss how the energy got transferred through the machine, where fulcrums appeared, and which types of the six simple machines were employed (levers, pulleys, etc…). If a student portrayed a door as part of the machine, where was the hinge (fulcrum)? What type of simple machine was the knob? Was it wheel and axle attached to a lever (door latch)? Humor should be encouraged, so long as it does not digress into outright silliness. Sometimes a few props can spark the imagination (a yardstick, a hoop, a ball, etc…), but less can often be more with these activities. The imagination makes up for a lot.

A simple variation on miming machines is to have individuals create a mime using an object. Generally, levers, such as a yardstick, work well, but a bat or a tennis racket can also serve the purpose. The audience guesses what was just mimed, but also where the fulcrum(s) were located. In the general study guide, you'll find a number of fulcrum exercises including "Find the Fulcrum!" Fulcrums are not always fixed as they are, for example, in a rowboat's oar bracket.

The fulcrum moves when we swing a golf club or a baseball bat. The same is true when we cast with a fishing rod, or swing an ax. The energy still transfers or changes at the fulcrum, except, in these examples, the fulcrum is no longer fixed. Attention should be paid to what type of simple machine (if it is a machine) that the mime creates. This can also work as a warm-up activity. Ideas often spark other ideas, and a next step could be to let audience members add to (or join in with) each mime, so that you would have group of mimes.

All of these various activities should result in students becoming more aware of the various machines that surround us, and how these machines come from and reflect who we are. As Garry says, "May the fulcrum be with you!"

WEB LINKS

The following web sites relate to the material covered in Garry's Teacher Workshops, and may be helpful to further understanding these concepts, as well as applying them and adapting them to your classrooms:

www.garrykrinsky.com/Study%20Guide.pdf

www.kidskonnect.com/content/view/99/27/

http://www.usoe.k12.ut.us/curr/science/sciber00/8th/machines/sciber/intro.htm

To purchase peacock feathers (Garry thinks the 40" length is best, but the shorter lengths also work well):

http://www.ostrich.com/shop/cat?cmd=stdsearch:feather,peacock,eye-nat&