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From TeeterTotters to Ferris Wheels: Simple Machines = Simple LEARNING and Simple FUN!

National Engineers week was February 21 – 25 and the new movie **ROBOTS** opened nationwide on March 11, 2005 to rave reviews from both kids and big kids (aka adults). In Corvallis, OR the theme for this year's Ashbrook Independent School Science Fair was **inventions**. What better way is there to get kids of all ages thinking about **engineering**. We took this opportunity to introduce Ms. Rountree's 2nd grade Ashbrook class to **Simple Machines**.....and in the process develop a great classroom or home activity that anyone of any age will enjoy. So slide down that *incline plane*, grab the *pulley*, *wheel* your way up to the top and drop down onto that *teeter-totter* to launch yourself into the **simple machines adventure!**

Simple Machines = Simple LEARNING and Simple FUN Alicia-Lyman Holt and Dr. Skip Rochefort

INTRODUCTION

This project was developed with Ms. Rountree's 2nd grade class at Ashbrook Independent School in Corvallis, OR. The idea came from the Oregon Science Olympiad Tournament *Mission Possible* event for middle school students, put on in our region by Covie Quick at Calapooia Middle School in Albany, OR. We think it can be done with all ages and for whatever amount of time you are willing to dedicate to the activity. With the 2nd grade class we did the project for one hour per week over 8 weeks, culminating in four simple machine designs and a poster for the Science Fair. It was fun and the kids learned a lot. Now, we'll go off on a class trip to see **ROBOTS** with a new appreciation for **SIMPLE MACHINES**.

BACKGROUND

Simple Machines are machines with no or few moving parts that help make work easier (or play more fun). Simple Machines are tools that change either the amount of force acting on an object, or the direction of the force. Force is the energy you put into something – like pushing off on a teeter-totter. You use these in your every day with out even thinking about them.

Below are some example of simple machines and their uses.

Incline Plane (ramp, tube, etc.) Incline planes make change vertical distance easier – driving up your driveway would be hard without an incline plane.

Pulley: The pulley is a simple machine made of a wheel with a rope or belt wrapped around it. It is used to lift things up. When you pull down on one end of the rope, the other end moves upward. A pulley can help move an object to a place that is hard to reach. Pulleys reverse the action of force – for example when you want to lower a flag you push the rope up.

Wheel: A wheel which is connected to an axle takes the force applied to the axle and makes it go farther – One rotation of the small axle = one rotation of the wheel. A door knob is a good example, so is a bicycle wheel.

Lever and Fulcrum: A lever is a straight rod or board that pivots around a fixed point, the fulcrum. These are used to lift heavy objects with less force. A teeter-totter is a common lever and fulcrum.

There are other types of simple machines such as screws, gears and wedges, but they do not lend themselves to gumball machines.

Still confused about simple machines or just want to learn more? Check out the list of web links in the resources section below.

These are both resources used to develop this lesson and useful resources for those teaching simple machines.

Simple Machines

<http://www.edheads.org/activities/simple-machines/> -- Fun and very interactive

<http://home.earthlink.net/~kandyhig/sm/toolbox.htm>

<http://www.mos.org/sln/Leonardo/InventorsToolbox.html>

<http://www.cosi.org/onlineExhibits/simpMach/sm1.html>

<http://edtech.kennesaw.edu/web/simmach.html> -- This is a list of links

<http://www.rube-goldberg.com/>

OVERVIEW: INVENTIONS

Age group 2nd – 12th grades

When given a choice of something to “invent”, Ms. Rountree’s 2nd grade Ashbrook class decided they would like to design a “gumball machine”. Since this is nothing more than a glorified Rube-Goldberg device, the simple machines concept was a natural. Everyone needs guidelines, so the following rules were given for each of the groups to design their gumball machine.

Challenge: To students were asked to *invent* a new design for a **Gumball Machine** using at least *three (3) simple machine* concepts.

Objective: The *goal* is to take the *longest time possible* to deliver the gumball after the customer has deposited their money (marble) into the gumball machine.

The following contains general information about leading a class through 6-8 lessons on simple machines. This is a project based lesson; the end result is that in teams the students will build a machine that delivers a gumball. The machine will use a marble to run a course which in the end will provide a gumball. This idea is similar to the game “Mousetrap” or a Rube Goldberg machine. These lessons we developed using small group work and mentors – each group of four students had one adult mentor.

Materials

For this activity you will need three types of materials: matter to construct the machines; adhesives to adhere the machines together; and a container to hold the entire machine.

You will also need a marble for each group....and, of course, gumballs to deliver to customers!

Machine Building	Adhesive	Container
Toilet paper rolls	Duct tape	Old clean pizza box
Pipe (pvc)	Mounting tape	Large moving box
Chenille sticks (pipe cleaners)	Masking tape	Other container of suitable size
Paint stirrers	Clear tape	
Molding clay		
Pencils		
String		
Spools		
Coffee Stir Sticks		
Anything that could be used to build something		

LESSONS (45 min class periods)

Lesson I. Introduce simple machines – sketch and give a demonstration of each simple machine.

Optional fun exercise: Play the game *Mousetrap* with the kids. Tthis game is a series of simple machines...the 2nd graders all know about it.

Lesson II. Build one simple machine in small (3-4) groups. A incline plane or lever with fulcrum are pretty easy. Give them the marble to use.

Lesson III. Introduce the idea of building a machine that will take the longest time possible to deliver a gumball. Have the students sketch ideas in their science notebooks. Once everyone has something down, bring the groups together to do some quality “sharing”. This is the concept of “brainstorming” used in most engineering design. Let the students spend a few minutes trying to “combine” a series of simple machine.

Lesson IV. Introduce the “container” in which the students are to build their Gumball Machine. We used a “dishpack” carton from the local moving company. Let students begin to implement (build) their design within the container. Let them experiment....and back away!

See *Gumball Machine Photos* for examples of the variety of designs that are possible.

Lesson V, VI, VII This depends on how much time you have. We found that 3 weeks was about the right amount of time for 2nd graders. It gave the kids a week to “experiment” without too much guidance, a week to get more focused on the “challenge” and using three simple machines, and a week for testing and to get it working (or at least somewhat!).

Lesson VIII. Last minute tune-ups and “game day” roll-offs! Make this fun, have everyone watch each others machines, and let them be “successful”.

There are no winners, because everyone is a winner!

The scope of the project and the timeframe can be adjusted to meet your needs. The main thing is to introduce simple machines and let the kids do *engineering design*...and make sure you tell them that’s what they’re doing!

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