Best Practices of Technology Integration

Title: *Ins and Outs of Simple Machines*

Subject: Science, Language Arts, and Computer Technology

Intended Grade Level: 6

Description:
Students will be actively involved in finding out about the "ins and outs" of simple machines. They'll discover who uses them, what they do, where they can be found, when are they used, and how do they actually work.

Students will first use content area reading strategies by partner reading, note taking, and mapping to provide an understanding of basic scientific concepts of simple machines.

Students will be provided many opportunities to discover and manipulate simple machines as they work through stations, which include the six simple machines, friction, and a computer station.

Students will apply their knowledge learned by creating a compound machine that uses a minimum of three different simple machines.

Students will design, write about, demonstrate, and display their compound machine.

Students will create a multimedia presentation using computer software to create a simple machine presentation.

Narrative:
Students find this unit a lot of fun, because of the diverse activities involved in finding out how simple machines work and if, in fact, they do make work easier for us. Of course, knowing that each student comes to us with varying backgrounds, I use the text to ensure each student is familiar with terms and concepts used in the investigations, such as input and output force, work, benefits and drawbacks of friction, mechanical advantage, etc. Even though students don't find reading informational text or note taking "fun", they do however, prefer partner reading and note taking. This enables them to share the reading, discuss, and record important facts with each other.

After acquiring background knowledge and familiarizing themselves with new concepts through text, students will be able to actively investigate, explore, discover, examine, observe, calculate, compare, predict, discuss, record, identify, and construct (whew) the properties of simple machines. Students work in cooperative groups of four and rotate to

a different station each day, using simple machine experiments to experience how simple machines work to make work easier. At each station, students will find the procedures to follow and materials needed to complete their investigation. Teachers may have their own activities or may use suggested activities that will follow later.

Each student, alone or with a partner, is to design and build a contraption that performs a task. This project is to be completed outside of school, but they will have the opportunity to present their contraption in class. Students have built a wide variety of machines. I had one machine that turned off a student's alarm clock, another cooled the student with a fan, one threw a ball for his dog to fetch, and yet another poured the student's morning cereal. Children are full of wild and wacky ideas.

My teaching partner in language arts had them write an informational piece explaining their contraption; materials used, how it was built, the simple machines used, and how it works. They also had to include a labeled drawing.. She had them use a word processing program for their final copy and many used drawing tools for their illustration.

Students really enjoyed using computer software, like HyperStudio® or PowerPoint®, to create a multimedia presentation. Students are able to put together all the information they've learned and seen together for an interactive computer gala. They can include graphics, illustrations using drawing tools, add sound, animation, videos, pictures taken from a digital camera, scan pictures, and of course, text.

Curriculum Benchmarks:

MI.SCI.I.1.MS.2
Design and conduct simple investigations.

MI.SCI.I.1.MS.5
Use measurement devices to provide consistency in an investigation.

MI.SCI.I.1.MS.7
Write and follow procedures in the form of step-by-step instructions, recipes, formulas, flow diagrams, and sketches.

MI.SCI.IV.3.MS.2
Relate changes in speed or direction to unbalanced forces in two dimensions.

MI.SCI.IV.3.MS.4
Design strategies for moving objects by application of forces, including the use of simple machines.

Detailed Timeline:

The first part of the unit will take approximately 14 days, one science period per day. The instructional writing will take approximately 5-7 days, one language arts class per

day. I recommend reserving the computer lab for two (2) weeks in the event that technical problems may occur.

Material/Hardware/Software:

- Science textbook or resource book
- Simple machine activities from textbook, resource books, such as *step-by-step Science Series: Simple Machines* by the Carson-Dellosa Publishing Company, Inc.; and/or the Internet - Simple Resources (for teachers and students): http://www.indirect.com/www/dhixson/machines.html.
- The Internet and magazines may be used to collect information and pictures for the multimedia project
- Multimedia presentation software, such as HyperStudio® or PowerPoint®
- Digital camera and video (optional)
- Station materials depend on the activity being used – see **Materials Needed** under each activity
- *The Way Things Work* by David Macaulay CD-ROM
- *The Incredible Machine* by Sierra CD-ROM

Teacher Preparation:

- Teacher should be familiar with the method of note taking students will be using (I use the Cornell Method) and have your own set of notes
- Mapping/webbing strategy
- Each student needs a pencil, a journal to record lab results, a highlighter, a red pen, and magazine pictures
- Multimedia presentation software
- Type activity procedures, if necessary and make copies for each student
- Gather materials needed for each station's activities and magazines
- Reserve computer lab, if available, well in advance.

Prerequisite Student Skills:

Paragraph writing and research skills and locating and gathering information
Basic computer skills, such as word processing, and using toolbars
Previous multimedia presentation software experience, but not necessary.

Student Activities/Procedures:

3 Days:

1. First, preview the lesson orally with the students. Read and discuss information such as the lesson title, objectives, dark print words, pictures, charts, diagrams, captions, summary, and review questions.
2. Next, students read the lesson silently.
3. Then, students partner read and take notes. Each student has a partner. They may either choose a partner or the teacher may assign a partner. One partner reads the first paragraph aloud as the other listens and follows along in the book. Next, they discuss and then record the facts using a note taking strategy. The partners alternate reading

the paragraphs. After reading each paragraph, they discuss and record the notes. I use the Cornell Method of note taking:

- Using lined paper, on the left-hand side of the margin, write the main topic or main idea.
- On the right-hand side of the margin list the facts related to the topic in phrases, not sentences.
- Partners do not have to agree on the facts, but write what they perceive is important.
- I also have them skip a line between facts. I tell the students that most of us will read facts separately, small sections at a time, but our eyes tend to skim when reading in paragraph form.
- This is a great self-study tool, too. They can fold their notes at the margin, hiding the facts, and quiz themselves by turning the main topic into a question. For example, if the topic is levers, they can ask themselves "What are the properties of levers?" Also, parents, siblings, or friends can quiz them, and the facts are right in front of them. I usually allow two days for reading and note taking, depending on the length of the lesson.

1-2 Days (depending on how much discussion takes place):
To correct their notes, students need a highlighter and a red checking pen. I place notes I've taken on transparencies on the overhead. If they need to add any notes, they may write any missed note(s) on their copy using their red pen. They highlight correct notes. This enables each student to have a complete set of notes to study from and, at the same time, model note taking skills. This also lends itself to large group discussions.

1 Day:

1. I assign the lesson review questions found at the end of the lesson, or give them a worksheet with questions I want them to focus on. They must restate the question in the answer and answer in complete sentences.
2. Using 3x5 cards, students are to write the vocabulary term on the blank-side, and the definition on the lined-side. This is a great study tool, too. They may self-test; have someone else test them, using them as flash cards; or play a matching game with another student, using two sets of cards.

1 Day:

1. I have the students draw a mapping for the six simple machines: screw, wedge, pulley, lever, inclined plane, and wheel and axle.
2. They are to fill in the details for each simple machine and include: its definition or description, an example, its purpose, and an illustration. They'll use this mapping for much of the information needed for their multimedia presentation, and it's another great study tool.

8-10 Days:
Students will be working at stations. A few days before, I gather all the materials needed for each station. Materials may be found in your science supplies, from the shop teacher,

your kitchen, a lumber store, etc. It's much easier if the materials are purchased and kept in the science lab to use each year. Since some materials are consumables and must be purchased each year, make a list and place a sticky in your folder. Then, you'll know for next year what needs to be purchased. I place as much of the materials as I can, including the lab sheets, into seven (7) trays. This makes it easy to keep track of all the materials and for clean up purposes. Each station consists of two (2) lab tables pushed together, to enable four (4) students to work together and have a large working surface.

A great resource for lab activities is the *Step-by-Step Science Series: Simple Machines* by the Carson-Dellosa Publishing Company, Inc., which I list below. The eighth station is the computer station. I use *The Way Things Work* by David Macaulay CD-ROM and *The Incredible Machine* by Sierra CD-ROM.

Students are to record their activity results and answer questions in their journal each day. I also have them write a brief 2-3 sentence statement summarizing what they did each day. If there were any problems associated with the activity, including uncooperative students, they may write about it in their journal for that day.

The stations are:

Station 1: Screws and wedges (I combine screws and wedges together, because there is less involved in these two activities and can be completed in one science period.)

Activities: *The Wedge* pg. 27-28

Purpose: To help students understand that a wedge is a simple machine that is really a small inclined plane used as a tool

Materials needed: a door wedge, a large wooden block, clay, and a plastic serrated knife and bar of soap for each student

Which Is A Wedge? pg. 29

Purpose: To give students practice in identifying which common objects are forms of the wedge.

Materials needed: a nail, saw, chisel, push pin, scissors, and door wedge

The Screw pg. 30-31

Purpose: To help students understand that a screw is a simple machine that is really an inclined plane that curves around a shaft or pole.

Materials needed: a large screw for each student, pencils, paper, ruler, scissors, and tape

Experiment With Screws pg. 32

Purpose: To give students an opportunity to see how screws work in wood. To have students find out how much a screw or bolt increases force.

Materials needed: wood screws, screwdrivers, scraps of soft wood such as pine, screws and bolts of different sizes

Station 2: Levers

Activities: The Lever pg. 33-34

Purpose: To help students understand that a lever is a simple machine that can help lift a weight with less effort.
Materials needed: a 2" x 6" x 6' framing board, and a small triangular piece of wood about 6" on each side and 8" long
There Is A Trick To Levers pg. 35-36
Purpose: To enable students to discover how moving the fulcrum of a lever can change the effort needed to lift a load."
Materials needed: the long board and triangular wood piece from previous activity, about ten (10) books the same size, black marker, and tape measure
You Must Pay the Piper pg. 37
Purpose: To help students observe more about how a lever works.
Materials needed: the long board and triangular wood piece from previous activity, books from previous activity, and tape measure or yardstick
Using Levers pg. 38-40
Purpose: To give students an opportunity to experiment with levers. To help students identify and understand first-, second-, and third class levers
Materials needed: a claw hammer, a container that has a lid that must be pried open such as a cocoa container, screwdriver, nails, scraps of wood, nutcracker, unshelled nuts such as peanuts, and old newspapers

Station 3: Inclined planes

Activities: The Inclined Plane pg. 23-24
Purpose: To help students discover that an inclined plane is a simple machine that makes lifting easier. To help students think of common ways that the inclined plane is used.
Materials needed: a heavy block, brick, or wood; large paper clip; large, strong rubber band; smooth board or plank about three (3) feet long; ruler; string; chair; drawing paper; crayons or markers; and pencils
Learning More About Inclined Planes pg. 25-26
Purpose: To help students understand more about how the inclined plane works.
Materials needed: a heavy block from previous activity, string, spring scale, three (3) boards of different lengths (2 feet, 3 feet, and 4 feet), and tape measure

Station 4: Pulleys

Activities: The Pulley pg. 46-47
Purpose: To help students understand that a pulley is a simple machine that is used for lifting heavy objects."
Materials needed: a pulley with a hook; heavy cord, one short and one long; plastic container, such as a bleach bottle, which has a handle and a screw-on lid; water; and spring scale
Using A Movable Pulley pg. 48

Purpose: To enable students to discover that using a movable pulley reduces the effort needed to lift a heavy object.
Materials needed: same as previous activity

Station 5: Wheel and Axle

Activities: The Wheel And Axle pg. 41-42

Purpose: To help students understand that a wheel and axle is a simple machine that helps us apply more force or lift a heavy load with less effort.
Materials needed: a piece of ½"-thick plywood, 18" x 24"; and two (2) skateboards

Some Surprising Wheels and Axles pg. 43-45

Purpose: To help students recognize the wheel and axle in some common tools. Materials needed: scraps of wood, screws, screwdriver, brace and bit with a ¼" diameter woodworking bit, 5/16" hex-head lag screws about 2" long, box end ½" wrench, and red and blue crayons or markers

Station 6: Friction

Activities: Friction Between Different Surfaces pg. 8-11

Purpose: To help students understand that friction is a force that resists motion between two surfaces that touch. To demonstrate that there is less friction between smooth surfaces than between rough surfaces.
Materials needed: a block of wood, chalkboard eraser, pencil eraser, ice cube, string, spring scale, 36" length of waxed paper, 36" length of aluminum foil, 36" strip of very coarse sandpaper, and 36" strip of carpet

Reducing Friction pg. 12

Purpose: To help students understand that since friction opposes motion, friction must be reduced as much as possible in some machines to make them efficient
Materials needed: a disposable plastic tablecloth or heavy paper, several blocks of wood, vegetable oil, bar of soap, dish detergent, cake of paraffin wax, and short lengths of wooden dowels

Station 7: Force and Work

Activities: What Is Force? Pg. 6

Purpose: To help students understand that force is a push or pull that changes the motion or shape of an object.
Materials needed: Play "Forceful Charades" using 3x5 cards that involve some kind of force, either a push or pull action, such as a hockey player hitting a puck. Each student acts out the action described on a card without speaking. The other students must guess what action is being performed and state whether the force is a push or pull.

Measuring Force with Scales pg. 7

Purpose: To give students an opportunity to measure force in an informal way. To give students an opportunity to measure force in newtons with a spring scale. To let students experiment to find out how much force is needed to lift and pull an object.

Materials needed: a bathroom scale, spring scale, heavy book, and string

What Is Work? Pg. 14

Purpose: To help students understand that work is the result of a force moving an object.

Materials needed: copy of "Background" section, and have students complete "Activity" section in their journal

Measuring Work pg. 16-17

Purpose: To let students experiment with the relationship between force and distance when work id done. To give students an opportunity to work with the equation **Work = Force x Distance**.

Materials needed: a wooden block or heavy block, string, spring scale, chair, board to use as an inclined plane, and metric tape measure.

Station 8: Computer

Activities: Students interact with all aspects of simple machines using the CD-ROM, *The Way Things Work* and/or *The Incredible Machine*.

I allow a couple of extra days, because some students may need some extra time to complete an activity or missed an activity due to an absence. Other students may work on their contraption ideas and design described below.

At Home Activity:

Students are to design and build a compound machine using three or more simple machines. Their machine or contraption must perform a task, such as pouring cereal into a bowl. They make work on this assignment individually or with one other student. They must turn in a rough draft of their design for prior approval. They will write about their contraption in their language arts class and then, demonstrate how it works.

5-7 Days:

Language Arts and Word Processing Skills:

Students will write an informational piece using the guidelines described below. Students will use a word processing program for their final copy. They are to include a neatly drawn and clearly labeled diagram of their contraption. Students may use the drawing tools on the computer, a digital picture, or hand drawn diagram.

1. Introduction
   Name the contraption
   List the materials used

State you're ready to begin

2. Three Body Paragraphs
   In the first paragraph explain how you build it
   In the second paragraph describe all three simple machines used
   In the third paragraph describe how the contraption works
3. Conclusion
   State the final function your contraption performs

7-10 Days:

Multimedia Presentation:

Students will need to bring with them their mapping completed earlier in the unit. Also, examples of simple and compound machines from magazines and pictures taken from a digital camera, which can then be scanned. I use *HyperStudio* and have the students include the following items in their stack:

1. The title page must have buttons that link to the other cards in the stack
   A minimum of one card for each simple machine
   About the Author card
2. Each simple machine card(s) must include
   a definition or description
   examples, such as a seesaw and crowbar
   its purpose
   an illustration
   pictures showing the use of the machine in society
   interesting facts or trivia
   go to and go back buttons
3. Extra points:
   adding sound
   adding animation
   a video clip demonstrating your contraption

Assessment/Evaluation:

Rubrics may be used for each project: science stations, compound machine project, informational writing, and the multimedia presentation.

Follow-up Activities:

Present your contraptions and/or multimedia presentations at a school science fair or at parent/teacher conferences. Have student bring in a blank videotape and tape their multimedia presentations and contraption demonstrations for parents to view at home.

Web Sites to Visit:

1. Exploring Leonardo [da Vinci]
   http://www.mos.org/sln/Leonardo/LeoHomePage.html
2. hands-on Technology Program
   http://www.galaxy.net/~k12/

3. Simple Machines – AskEric
   http://www.askeric.org/
   Lesson #: AELP – PHY0044
4. Mega Math
   http://www.cs.uidaho.edu/~casey931/mega-math/menu.html
5. Spotlight on Simple Machines
   http://www.fi.edu/qa97/spotlight3/spotlight3.html
6. J and J Simple Machines (Webquest)
   http://www.plainfield.k12.in.us/hschool/webq/webq8/jjquest.html
7. Simple Machines Resources
   http://www.indirect.com/www/dhixson/machines.html
   *Suggested Student Links and Teacher Resources

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