



# Robotics Engineering

## DoDEA - Career and Technical Education

### SIMPLE AND COMPOUND MACHINES

#### Practicum - The Better Mousetrap

#### Objective:

You will incorporate three or more simple machines into a compound machine that represents "The Better Mousetrap." Your invention will be made from the components found in the Lego Mindstorms kit and may repeat the use any single simple machine type only once.

#### Discussion:

Mousetraps come in assorted types. Some capture the rodent alive while others are quite lethal. Many considerations are engineered into the animal trap. For instance, glue traps can capture rodents alive (sometimes not), but the glue also captures the rat mites that leave the rodent once it's dead. That's just a little engineering useless bit of information. You're going to build something completely different.

There are six different types of simple machines; pulley, lever, wedge, inclined plane, screw, and the wheel and axle combination. Each of these machines can be used in a variety of ways. A hammer is an example of a lever, a bicycle uses the wheel and axle combination, and a wheelchair ramp is an example of an inclined plane. Combining these simple machines together can create compound machines that are rather complex contraptions that solve complex problems. Catching a mouse can indeed be a complex problem.



#### Research Resources:

##### Web Sites

- <http://strobist.blogspot.com/2009/03/building-better-mousetrap.html>
- [http://www.ehow.com/how\\_6353067\\_build-three-four-simple-machines.html](http://www.ehow.com/how_6353067_build-three-four-simple-machines.html)

##### Description

- Better Mousetrap Concepts
- Better Mousetrap Instructions

#### Scenario:

You're considering entering a Rube Goldberg competition where the contestants are building overly complex machines to trap a toy mouse. Your task is to model your entry using only the parts found in the Lego Mindstorms NXT Robotics kit. Your entry must contain at least three simple machines to qualify. Here are the rules:

1. Only Lego components from the Lego Mindstorms NXT Robotics and Resource Kits (and string) may be used.
2. Each machine must include at least three simple machines and no single type of machine may be used more than twice.
3. The machine must have a trigger mechanism to start its operation. The trigger may count as part of the machine count.
4. The machine may trap the mouse either alive or dead.

#### Procedure:

##### Required Materials and Equipment:

Lego Mindstorms NXT Robotics Trainers      Lego Resource Kit      String

##### Steps:

1. Sketch your design and identify the simple machines contained in your invention.
2. Get the instructor's approval before you start to build.
3. Build your mousetrap, evaluate and improve until it works reliably.
4. Demonstrate how you invention works and identify the simple machines contained in the design.
5. Compare your final design to a standard mousetrap.
6. Complete the Self- Assessment Rubric
7. Photograph and disassemble and properly stow your Lego components.

#### Robotics Engineering – DoDEA Career and Technical Education

#### Simple and Compound Machines - Practicum

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Name:	Period:	Date:
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**Deliverable:**

Standard Mousetrap Advantages	The Advantages of Your Design

**Ideas Regarding Emerging Mousetrap Technologies**

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**How would you improve your design?**

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**Assessment Rubric:**

Item	Criteria	Assessment	
		Student	Instructor
	<b>The Better Mousetrap</b> <i>Has the student</i>		
1	...studied the Research Resources?	Yes/No	
2	...presented a sketch or drawing of their mousetrap design?	Yes/No	
3	...justified their design and described its operation?	Yes/No	
4	...built their model from the specified materials only?	Yes/No	
5	...incorporated at least three simple machines into their design?	Yes/No	
6	...built a machine that does not repeat simple machines more than twice?	Yes/No	
7	...met the contest terms and specifications?	Yes/No	
8	...completed the Advantages table?	Yes/No	
9	...provided ideas regarding the future of mousetrap technology?	Yes/No	
10	...recommended improvements upon their mousetrap design?	Yes/No	
<b>If you want a grade of "A"</b>			
	...constructed a mousetrap that incorporates five or more simple machines without repeated any single type of machine more than twice?	Yes/No	

**Conclusion:** Compound machines are made by combining a series of simple machines. Nearly every modern mechanism, device or appliance is made of hundreds of simple machines working together to accomplish a desired task. In this module you learned to identify and apply the six simple machines that have been realized since the dawn of humanity. Simple and compound machines form the foundation of our world's technology, and through their discovery and use, have brought about the prosperity of modern civilization. This is truly remarkable especially when you consider that everyone works with and relies upon these marvelous inventions hundreds of times each day.