Shark Tank: Is Your Machine Shark Bait?

Problem

Throughout history machines have been invented that positively impacted society. Create a machine to simplify a process that enhances today's society.

Lesson Summary

In this unit, the students will assume the roles of employees working for an Advanced Technology Institute. As engineers, they will be presented with the problem of creating a machine that will enhance today's society by reducing the time spent to complete various daily tasks. The employees of the institute will come together to present their machine (prototype) to investors in order to convince them to assist with production and marketing. To complete this unit, students will need to have background knowledge on the scientific principles of work, force, and motion (6.2 a, d, e) previous to this unit.

Major Topic and SOL

Science SOL (2010)	6.2 a, d, e
US History I SOL (2008)	8 c
Language Arts SOL (2010)	6.1a-d, 6.2 a,c,e

Length of Time

5 - 90 minute class periods

Student Objectives

- Predict and observe if the machines they made were actually simplifying a process.
- Explain how machines function to help make our lives easier.
- Design and use examples of machines found in the school, home, and work environments.

21st Century Skills

- Critical-Thinking and Problem Solving
- Communication
- Creativity and Innovation
- Collaboration
- Information and Media Literacy
- Contextual Learning

Assessment Evidence

- Machine checklist
- Presentation Criteria Rubric

Lesson Contributed by: Tracy Elliott, Judy Faulkner, and Sherri Hudson
Funded through a 2014 State Council of Higher Education for Virginia (SCHEV) grant, PI STEM

Supplies/Materials/Technology

Lesson 1

- Hummingbird Robotics kit (1 per group)
- Computers with the Visual Programmer Software (1 per group)
- Internet Access
- **Six Simple Machines Project Video
- **Simple Machine Robot Video
- **Visual Programmer Video Tutorials
- Crafting materials for groups to choose from: empty boxes and containers (cardboard and plastic), tape, scissors, hot glue sticks, popsicle sticks, construction paper, pipe cleaners, pompoms, google eyes, felt, yarn, string, various plastic or paper cups and plates
- Hot glue gun (1 per group)
- Power cords and extension cords (needed to plug in computers, glue guns, and robots for each group)
- Presentation Criteria Rubric
- Self-Assessment - Teamwork Rubric (1 per student)

Lesson 2

- **NASA's Lightweight Surface Manipulation System (LSMS) Video
- **Just Plain Simple Resource (for teacher)
- **Levers That Lift Resource (for teacher)
- **Not So Simple (for teacher)

Lesson 3

- Crafting materials for groups to choose from: empty boxes and containers (cardboard and plastic), tape, scissors, hot glue sticks, popsicle sticks, construction paper, pipe cleaners, pompoms, google eyes, felt, yarn, string, various plastic or paper cups and plates
- Hot glue gun (1 per group)
- Power cords and extension cords (needed to plug in computers, glue guns, and robots for each group)
- Hummingbird Robotics kit (1 per group)
- Computers with the Visual Programmer Software (1 per group)
- Internet Access

Lesson 4

- Crafting materials for groups to choose from: empty boxes and containers (cardboard and plastic), tape, scissors, hot glue sticks, popsicle sticks, construction paper, pipe cleaners, pomp oms, google eyes, felt, yarn, string, various plastic or paper cups and plates
- Hot glue gun (1 per group)
- Power cords and extension cords (needed to plug in computers, glue guns, and robots for each group)
- Hummingbird Robotics kit (1 per group)
- Computers with the Visual Programmer Software (1 per group)

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- Internet Access

Lesson 5

- Crafting materials for groups to choose from: empty boxes and containers (cardboard and plastic), tape, scissors, hot glue sticks, popsicle sticks, construction paper, pipe cleaners, pompoms, google eyes, felt, yarn, string, various plastic or paper cups and plates
- Hot glue gun (1 per group)
- Power cords and extension cords (needed to plug in computers, glue guns, and robots for each group)
- Hummingbird Robotics kit (1 per group)
- Computers with the Visual Programmer Software (1 per group)
- Internet Access

Lesson 1: (1- 90 minute class)

- Ask students to identify the 6 simple machines (lever, pulley, wheel and axle, screw, wedge, inclined plane). Be sure to record the simple machines on the board or projection system.
- Review this short video on a project integrating all six simple machines. Add real life examples to your list of simple machines (i.e. scissors, handicap ramp, flag pole)
- Show the students the video, Simple Machine Robot (stop video at 40 seconds). Ask students to identify simple machines that they observed on the robot. Play the rest of the video to see if they could identify the simple machines correctly.
- Inform the students that they are going to assume roles of employees in an engineering institute to complete some time saving tasks.
- Put the students in groups of 3-4 students and ask them to decide on their group roles:
  Project Manager: This person's role will be to keep the group on task with individual roles and responsibilities. They will also be in charge of collecting materials used for the project task(s) and will monitor the time to complete the project(s).
  Publicist: This person's role will be to collect digital artifacts to present the group's learning progress through images, videos, and notes and will be in charge of putting together a presentation for the group's completed task(s).
  Design Engineer: This person's role will be to be the lead programmer and prototype tester of the group's design(s).
- Have the groups establish a business name for their company.
- Explain to the students that they are going to use what they learned/reviewed about **simple machines** by creating a prototype of an machine using the Hummingbird Robotics kit. They will first have to learn about what is in the Hummingbird Robotics kit, and how to use the programming tool, Visual Programmer (~12 minutes of videos for learning), researching and watching a few tutorials with their teammates.

Lesson 2: (1- 90 minute class)

- Make an announcement to the class: Shark Tank is looking for a new invention. Check out this video on NASA's Lightweight Surface Manipulation System (LSMS). The problem is, it

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has to be a time-saving invention. They are looking for a new invention that will both save time and simplify a process that society will not want to live without.

- Instruct students to get into their company "groups" and discuss possible design solutions.
- The class will regroup and discuss if their designs had any simple machines on them to be able to have multiple functions (without giving away their company design to the *competitors*).
- The teacher will begin talking about mechanical advantage, and how it is calculated, based on the type of simple machine they are using to help do *the work*.
- The teacher will pass out the mechanical advantage chart (not included) for different simple machines. The teacher may use (or reference) the following materials for teaching formulas for mechanical advantage:
  **Just Plain Simple Resource – 20m on mechanical advantage for inclined plane, wedge, & screw and calculating mechanical advantage
  **Levers That Lift Resource (for teacher) – 20m on lever, pulley, wheel & axle and calculating mechanical advantage
- The teacher will also discuss compound machines.
  Not So Simple (for teacher) – 20m on compound machines.

Lesson 3: (1- 90 minute classes)

- Begin class by putting your students into their company groups and giving them time to discuss their original designs.
- Inform the companies that there is a scarcity of their institute's materials. There has been a freeze on purchasing materials, other than the materials in their warehouse. The teacher will then show students the materials they are left with to create and build their prototype to the *Sharks* (this will be the crafting materials you provide).
- The students will now be able to begin working on their prototype and presentation for the *Sharks*.

Lesson 4: (1 – 90 minute class)

- Give students the time to work on **creating and improving their model** and time to complete putting their presentations together to present to the *Sharks* at the next class period.

Lesson 5: (1– 90 minute classes)

- Start the class by asking them, if they think their company's machine prototype will be bait and be financed or become food for the bottom feeders and be canned?
- Students will present their company's machine prototype design to the class by showing how it works, explain how it was put together, and discuss the challenges and successes for their group.

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