<table>
<thead>
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<th>Curriculum Design Template</th>
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<tr>
<td><strong>Content Area:</strong> Math, Science, Technology</td>
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<td><strong>Course Title:</strong> STEM</td>
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<td><strong>Unit Plan:</strong> Robotics</td>
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<tr>
<td><strong>Date Created:</strong> August 2014</td>
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<td><strong>Board Approved on:</strong> August 25, 2014</td>
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## Unit Overview

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<th>Content Area: Math, Science, Technology</th>
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<td><strong>Unit Title:</strong> Robotics</td>
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<td><strong>Target Course/Grade Level:</strong> 6</td>
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### Unit Summary

Students will study robotics, more specifically science, technology, engineering and mathematics (STEM) skills as they relate to robotics. Students will increase their understanding of how this field improves the quality of our lives. They will research how STEM shapes careers in this field and will be able to employ these skills to solve real world problems by analyzing and evaluating design options with hands-on projects.

### Primary interdisciplinary connections:

#### Language Arts: speaking, reading, writing
- Engage in discussions to facilitate problem solving and to express their design ideas (in groups and teacher-led)
- Interpret directions to complete hands on, inquiry-based projects
- Create journal entries to respond to specific questions and formulate conjectures and be able to defend hypothesis

#### Science
- Arrange materials to perform a predicted outcome
- Experiment with weight distribution
- Use concepts of energy
- Explore friction
- Test a hypothesis
- Experiment with motion
- Develop conjectures based on mathematical properties

#### Math
- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

#### Technology:
- Use Ipads every day.
- View presentations on SmartBoard.
- Explore situations from videos on YouTube etc.

### 21st century themes:
- Global Awareness; Financial, Economic, Business, and Entrepreneurial Literacy; Civic Literacy; Health Literacy

**21st Century Skills - Videos, Articles, Resources, Experts**

ASCD supports changes in teaching, learning, and leadership that adequately prepare students for the 21st century who:
• Acquire and apply core knowledge and critical-thinking skill sets that are essential in an information age.
• Demonstrate creativity, innovation, and flexibility when partnering with business and community members to advance common goals.
• Make decisions and solve problems ethically and collaboratively.
• Use technology to gather, analyze, and synthesize information for application in a global economy.
• Exhibit positive interpersonal relationships that value multiple languages, cultures, and all persons.
• Display leadership skills that inspire others to achieve, serve, and work together.

Unit Rationale
In order to meet the needs of our society in the future, we need to inspire students to participate in STEM-related experiences. Lessons need to allow room for the student to rely on creativity and teamwork. They need to allow students to develop critical thinking skills and to become true problem solvers by experimenting, evaluating a result, and making a decision about how to improve the process.

This course is designed to engage all types of learners in an inquiry-based, problem-solving process that will encourage further exploration. We will apply math and science skills that students already possess and build upon that knowledge, but we will mainly concentrate on allowing students to discover the excitement that is inherent in STEM-related careers later in life.

Learning Targets

| Standards: Math |
|-----------------|----------------|
| CPI #          | Cumulative Progress Indicator (CPI)                                      |
| CCSS.MP1       | Make sense of problems and persevere in solving them.                   |
| CCSS.MP2       | Reason abstractly and quantitatively                                     |
| CCSS.MP3       | Construct viable arguments and critique the reasoning of others.         |
| CCSS.MP4       | Model with mathematics.                                                  |
| CCSS.MP5       | Use appropriate tools strategically.                                     |
| CCSS.MP6       | Attend to precision.                                                     |
| CCSS.MP7       | Look for and make use of structure.                                      |
| CCSS.MP8       | Look for and express regularity in repeated reasoning.                   |

Unit Essential Questions
• What is STEM and why is it important?
• What is robotics?
• What is a robot?
• What are simple and complex machines?
• What are Newton’s Laws of Motion?
• How is the study of robotics used in different careers?
• What opportunities are available that students can participate in High School and beyond?

Unit Enduring Understandings
• Robotics is the branch of technology that deals with the design, construction, operation, and application of robots.
• Robots are machines capable of carrying out a complex series of actions automatically, especially one programmable by a computer.
• The importance of robotics can be seen in careers relating to Medicine (robots can perform more precise operations than humans), Law Enforcement and National Security (bomb disabling robots), Space and Oceanic Exploration (extreme temperatures that cannot be tolerated by humans).
STEM careers can be rewarding in many ways: financially, creatively, and socially. Most careers have some aspect of STEM required in being successful. There are many opportunities to develop STEM skills that are fun, exciting, and challenging.

### Unit Learning Targets

Students will ...
- Gain an appreciation for STEM related concepts.
- Understand the importance of STEM in our world.
- List some of the major contributions to society that STEM careers have developed.
- Understand the importance of keeping a STEM journal and set up their own journal.
- Identify and explain the steps of a design process: recognize the need or problem, research the problem, develop possible solutions, select the best solution and design, construct a prototype, test and evaluate, communicate the solution, and redesign as needed.
- Design, build and test various structures.
- Work in cooperative groups to brainstorm, make conjectures and solve problems.

### Evidence of Learning

### Instructional Strategies
- Group discussion and questioning
- Research
- Experimentation
- Writing/Journal

### Customizing Learning/Differentiation
- Students will be engaged in small group work, where students of differing abilities and learning styles should be grouped together.
- Students act as peer coaches to support each other.

### Suggested Lesson Plans

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Timeframe</th>
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<tr>
<td>1- Simple Machines</td>
<td>1-2 class periods</td>
</tr>
<tr>
<td>2 – I Want to Hold Your Hand</td>
<td>1-2 class periods</td>
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**Teacher Notes:**
Lessons should be presented in whatever order makes sense within context of the class. For example, Ipads will need to be scheduled for use, materials will need to be available, students will need to make progress within a lesson in order to move on, and community visitors will be scheduled as to their availability.

### Curriculum Development Resources

Click the links below to view resources, and to access additional information.

*Office of Science and Technology Policy* | *The White House*

*Science, Technology, Engineering and Math: Education for Global Leadership* | *U.S. Department of*
Education

Improving STEM Curriculum and Instruction: Engaging Students and Raising Standards | Successful STEM Education

Resources | STEMFirst

NEA - The 10 Best STEM Resources

NASA

STEM-Works

STEM Activities for Middle Grades, Special Focus on Girls

IVCC NSF Grant

National Science Foundation

Connect a Million Minds
**Lesson Plan 1**

**Content Area:** Math, Science, Technology  
**Lesson Title:** Simple Machines  
**Timeframe:** 1-2 class periods

**Lesson Components**

<table>
<thead>
<tr>
<th>21st Century Themes</th>
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<tbody>
<tr>
<td>Global Awareness</td>
<td>Financial, Economic, Business, and Entrepreneurial Literacy</td>
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<table>
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<tr>
<th>21st Century Skills</th>
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<tbody>
<tr>
<td>Creativity and Innovation</td>
<td>Critical Thinking and Problem Solving</td>
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<table>
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<tr>
<th>Interdisciplinary Connections:</th>
<th>Math, Science, Technology</th>
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**Integration of Technology:** Smartboard, internet videos

**Equipment needed: (per group):** rulers, pencil sharpeners, wedges, and other items to use as examples of simple machines, Activity Sheets from “Hands on Engineering,” Beth L. Andrews, p. 88-91

Bookmark and preview urls given of videos.

### Goals/Objectives

- Explore the difference between simple and complex machines
- Discuss the six types of simple machines
- Understand how simple machines work
- Calculate work using Newtons and Joules
- Give examples of simple machines in the world

### Learning Activities/Instructional Strategies

**Lesson Sequence**

1. Discuss objective. As a class, use Internet to find definition of simple and complex machines, using teacher computer and Smartboard
2. Show examples, discuss.
3. Distribute Activity Sheets, read out loud.
4. Show videos listed on p. 86
5. Write definitions for work, force, and distance in journal.
6. Introduce the terms Newtons and Joules by watching BrainPop video. Add to journal.
7. Show video on ramps.
8. Discuss friction, add to journal.
9. Show video on pulleys.
10. Complete worksheets, and review in class.

### Differentiation:

- various ability / sizes of groups
- groups can be assisted or challenged accordingly during the discovery phase

### Resources Provided

- BrainPOP
- Simple Machines on Vimeo
- MIKIDS for YOUR KIDS!
- Brainpop Video on Work
- Inclined Planes on Vimeo
- Simple Machines: Pulleys on Vimeo
- Self Assessment Quiz
# Lesson Plan 2

## Content Area: Math, Science, Technology

### Lesson Title: I Want to Hold Your Hand

| Timeframe: 1-2 class periods |

## Lesson Components

### 21st Century Themes

| Global Awareness | Financial, Economic, Business, and Entrepreneurial Literacy | Civic Literacy | Health Literacy |

### 21st Century Skills

| Creativity and Innovation | Critical Thinking and Problem Solving | Communication and Collaboration | Information Literacy |
| Media Literacy | ICT Literacy | Life and Career Skills |

## Interdisciplinary Connections:
Math, Science, Technology

## Integration of Technology:
Smartboard, internet videos

## Equipment needed: (per group):
narrow rubber bands, drinking straws, cardboard, tape, scissors, nylon cord, centimeter ruler, pen, printed instructions from [http://www.carnegiesciencecenter.org/roboworld/lessons/LP_7to9/Hold_Your_Hand_NASA.pdf](http://www.carnegiesciencecenter.org/roboworld/lessons/LP_7to9/Hold_Your_Hand_NASA.pdf)

Bookmark and preview urls given of videos.

## Goals/Objectives

### Learning Activities/Instructional Strategies

#### Lesson Sequence
1. Discuss objective.
2. Distribute one set of instructions per group, and materials.
3. Allow students to create hand, help with directions as needed.
4. Reflection - Answer questions in journal, and share group achievements and entries.

### Students will:
- construct a robotic-like hand
- demonstrate how data are collected when using robotic technology

## Differentiation:

- various ability / sizes of groups
- groups can be assisted or challenged accordingly during the creation and reflection phase

### Resources Provided

- BrainPOP
- Instructions - I Want to Hold Your Hand