PEEK 2003 First Grade Curriculum

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Lesson 1:
Drop Test/Sturdy Car

Lesson 2:
Introduction to Motors

Lesson 3:
Tractor

Lesson 4:
Zuckerman's Tractor

Lesson 5:
Snowplow

Lesson 1: Drop Test

Lesson Objective: To familiarize students with the components of sturdy structures.

Learning Objective: To learn basic Lego structures.

The Challenge: To build a sturdy car out of Legos that passes the drop test.

Materials:
- Lego Simple Machine kits or other Lego building pieces

Vocabulary:
- 'Drop Test'

Procedure: Discuss the 'Lego Tip' of how to alternate Lego blocks when building a sturdy structure. Point out if your classroom has cement block walls.

Introduce the Lego challenge for the day - to build a sturdy car that will withstand the 'Drop Test'. Explain that the 'Drop Test' involves the teacher dropping the child's car from his/her knees to the floor and having the car remain in one piece. The entire structure must stay intact.

Have children build their cars and when they are ready, bring their structures to the teacher for the 'Drop Test'. As each structure passes the test, have students share with their classmates how it was built. (Take pictures if a camera is available.)

In the last part of the lesson, instruct students on how to properly care for, put away, and store Lego materials.

Extensions: If cars withstand the Drop Test, proceed to the 'Ultimate Drop Test' – seeing if the structure withstands being dropped from the teacher's waist to the floor.

Assessment: Bring the class together to discuss the various designs and what they found worked well. What was the biggest problem you had as you were building? What did you try? Did it help?

Troubleshooting:
- Some students will be very familiar with vocabulary and building while for others this will be a new experience.
- First grade students are on different levels of reading comprehension and math ability.

Resources:
- Lego/Tufts website- www.ceeo.tufts.edu/curriculum
- Lego Dacta "Simple and Motorized Machines" Teacher Guide

Lesson 2: Introduction to Motors

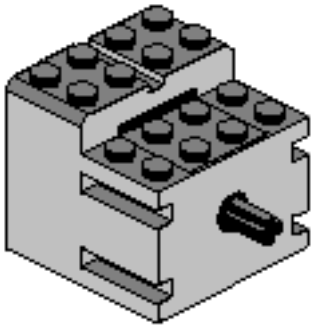
Lesson Objective: To familiarize the students with specific Lego pieces.

Learning Objective: To learn the basic Lego pieces and their functions; to learn about making an electrical connection.

The Challenge: To investigate and experiment with a 9-volt motor.

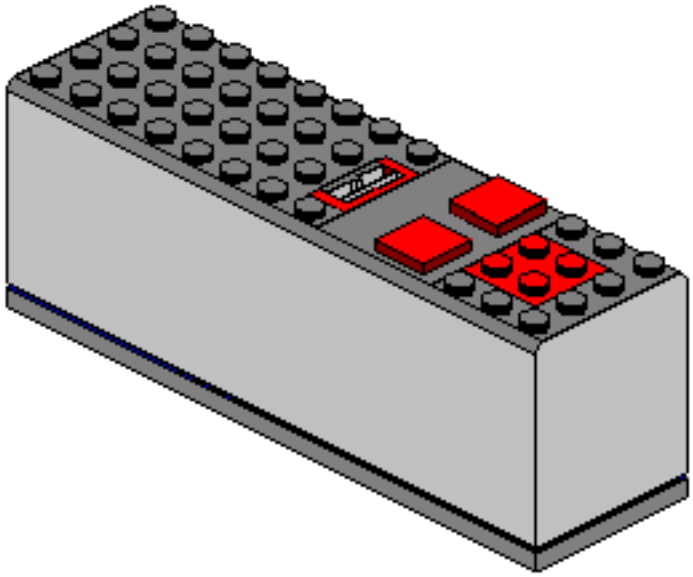
Materials:
- Lego Simple Machine kits or other Lego building pieces
- Engineer's Surprise (the handout)
- Literature - Search your library for various books on simple machines to have pictures of motors available for examples.
- Batteries
- Scissors
- Tape

Vocabulary:
- Motor
- Connecting wire
- Battery pack
- Batteries
- Primary colors



Procedure: Begin this lesson by asking probing questions about motors. Hold up a motor and ask:
- What is this Lego piece called?
- Where have you seen something like this?
- Do all motors look the same?
- Why were they invented?
- What does a motor do?
- What makes a motor run?
- Do all motors run on the same fuel?
- What does our Lego motor need to make it move?

After a discussion, show the children examples of motors in some of the collected literature.



Then introduce the connecting wire and the battery pack. Show the inside of the battery pack and count how many batteries are needed. Explain how the wires need to make a metal connection to send power to the motor. Demonstrate how the wire is connected to the battery pack. Draw attention to the metal on all pieces. Run the motor. Notice the direction in which the motor is spinning and discuss how you can change direction by rotating the connecting wire on the battery pack.

Engineering Challenge:

1. Find the motor, connecting wire and battery pack in your Lego kit. Connect them and observe how the motor works.
2. Cut out the first circle on the Engineers checklist.
3. Choose two primary colors that can be mixed together make a new color. (Ex. Red+blue=purple , red+yellow=orange, yellow+blue=green)
4. Color in the sections of the circle, alternating your two colors.
5. Place the large gear on the end of the motor. Make a small circle of tape and attach your color wheel to the gear on the motor.
6. What happens to the colors when you turn your motor on?
7. Reverse the direction and see if it makes a difference.

Extensions: Design several different patterns for other paper circles, such as spirals, dots, circles or dashes.

Assessment:

- Name learned pieces
- Sort pieces into correct bins
- Teacher observations and interviews
- Completion of Engineering Challenge

Troubleshooting:

- Some students will be very familiar with vocabulary and building while for others this will be a new experience.
- First grade students are on different levels of reading comprehension and math ability.
- Have extra (undivided) circles on hand for further exploration.
- Watch that children do not try to make fans and put the motors close to their faces! Hair can get caught in the motor!

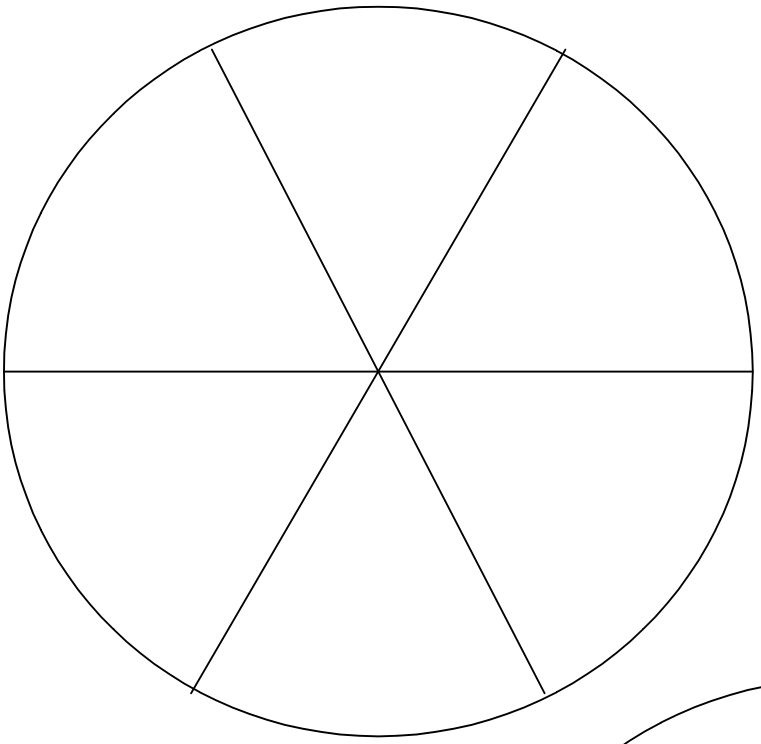
Resources:

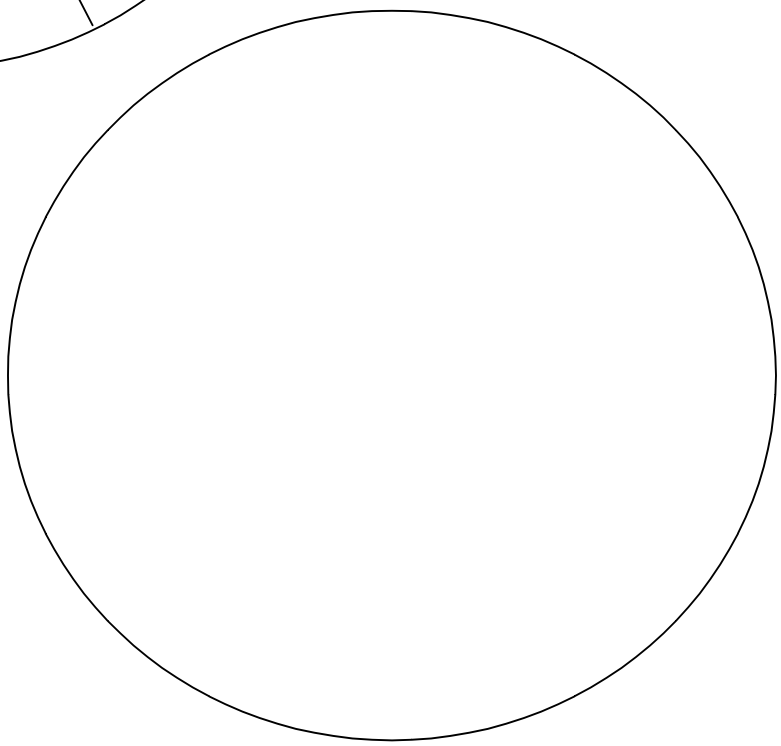
- Lego/Tufts website- www.ceeo.tufts.edu/curriculum
- Lego Dacta “Simple and Motorized Machines” Teacher Guide

Engineer: _____ Date: _____
Partner: _____

Engineer's Surprise

Color your circle with two primary colors that can be mixed together to make a new color. Cut out the circles. Push a large gear on your motor. Tape the circle to the motor and see what happens!





Lesson 3: Wheel & Axle

Lesson Objective: To familiarize students with programming, sturdy structures, and the motors and pulleys.

Learning Objective: To learn how to build a sturdy structure using a motor and pulley.

The Challenge: To build a tractor from Wilbur's barn that holds a miniature farm animal; to successfully program the tractor to move forward and backward.

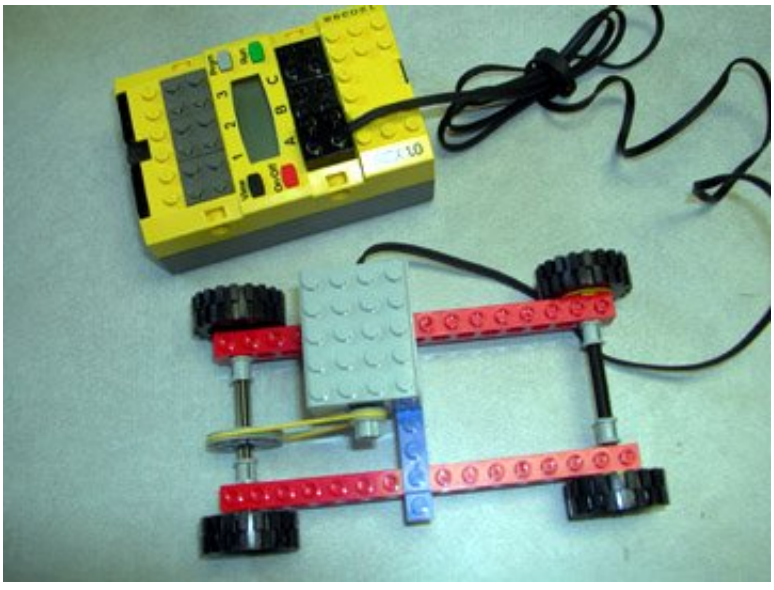
Materials:

- 3 handouts – Building Design sheet, Engineer's Programming sheet, and Programmer's Icon sheet
- Lego building pieces
- Motors
- Pulleys
- Robolab software
- RCX
- Miniature farm animal or stuffy

Vocabulary:

- Pulley
- Icon
- Motor

Procedure: Introduce the challenge- to build a tractor that can hold a miniature farm animal or stuffy. Ask the children if they remember how to build a sturdy car. Review the key components of a sturdy car. Explain that they will be putting a motor and pulley on their tractor to enable it to move. The motor will be connected to the RCX for power. Show the children a model of the pulley system they will be using on their tractor.

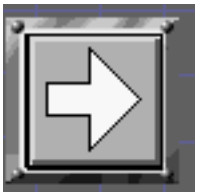


Distribute the student worksheet, “Building Design Sheet: A Tractor”. First, have the children draw their designs. When they are finished, they should write about their designs. Next, the children should find partners and share their design sheets with each other. They should talk about ways to use both of their ideas in the building process. Finally, the partners will begin build their tractors.

Programming: Students will program their tractors in Pilot 1 or Inventor 1 to move forward for a set amount of time. Students should first plan out their program using the “Engineering Programming Sheet” and the “Programmer’s Icon Sheet”.

For Pilot - After planning out their program on paper, the students should:

- Click on the “Programmer” icon after opening up the software.
- Double click on “Pilot One”.
- By holding down the icons with the mouse, students can change the selections on the screen.
- Choose different amounts of time (1,2,4,6,8 or 10 seconds).
- When students finish selecting their programs, they can click on the arrow (see below) under the icons to download their programs onto the RCX. (Be sure the RCX is turned on).



- After downloading, students should test their programs to see if they work.
- Students should repeat these steps two more times, changing the amount of time the tractor moves.

After successful completion of Pilot One programming, students can program in the “Pilot Three” program. Students should try programming their tractor to go forward and backward for selected amounts of time.

Extensions:

- Modify the tractor to tow something behind it.
- Modify the tractor cab to give shade to the miniature farm animal.

Assessment:

- Student journal (design sheet)
- Completion of the challenge with teacher interview and observations
- Successful programming of the tractor to move forward and backward

Troubleshooting:

- Build a car with a motor and pulley to share with the children during the discussion of the challenge.
- Some children will be very familiar with building and other will have limited

experience.
- Pulleys need to be tight enough, but not too tight.
- Some children will need help putting the pulleys together.

RCX Use Reminders:
- Use Program One to have the motor run forward only.
- Attach the wire from the motor to port A (connect black to black).
- If the tractor is going the wrong direction, just turn the wire connected to the RCX half a circle (180°).
- If the children drop the RCX, or you change its batteries, it may loose its firmware (its "brains") and may not work properly.
- If the firmware is missing on the RCX, the four zeros will be missing on the readout of the RCX. It will not run properly. To download the firmware, go into the "administrator" and select "download firmware". (Be sure that the RCX is turned on & pointing at the tower.) Downloading firmware can take 3-4 minutes. When finished, click on "Test RCX Communication" to check the firmware.

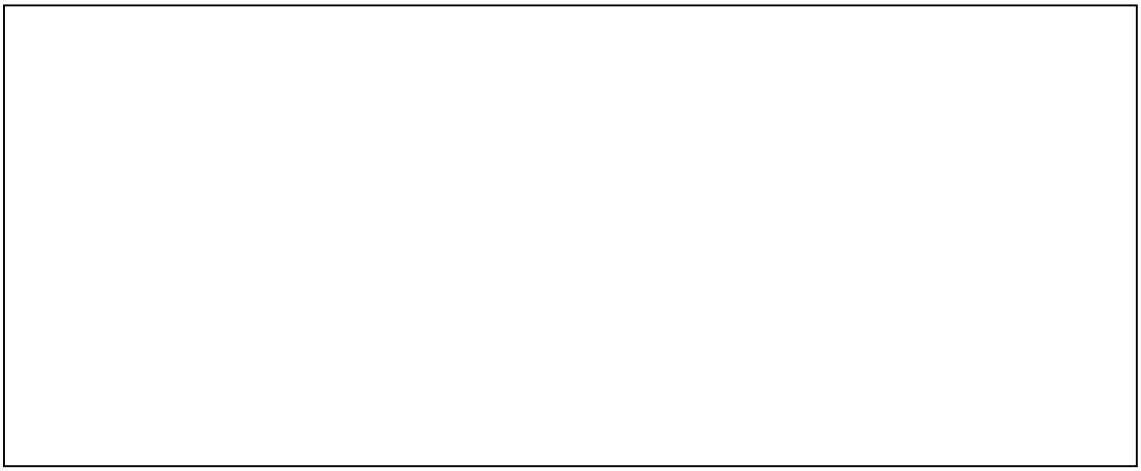
Resources:
- Fictional book- Charlotte's Web by E.B. White
- Lego Dacta "Simple and Motorized Machines" teacher guide
- Tufts Engineering - www.ceeo.tufts.edu/curriculum

Engineer: _____ Date: _____
Partner: _____

Building Design Sheet: A Tractor

Challenge: To build a tractor from Wilbur's barn that can hold a miniature farm animal.

1. Draw your idea:



2. Write about your idea:

_____

_____

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3. Share your plans with a partner.

Engineer: _____ Date: _____
Partner: _____

Engineer's Programming Sheet

Your programming challenge is to move your tractor forward for 1, 2, 4, 6, 8, or 10 seconds. Use the icons on the Programmer's Icon Sheet to plan out your program.

Program 1: Our tractor will go forward for _____ seconds.

Program 2: Our tractor will go forward for _____ seconds.

Program 3: Our tractor will go forward for _____ seconds.

Now, use *Pilot 3* to program your tractor to move **forward and backward.**

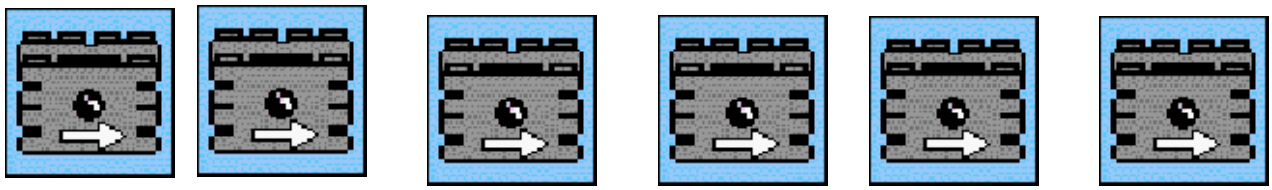
Program 4: Our tractor will go forward for _____ seconds. Our tractor will go backwards for _____ seconds.

Programmer's Icon Sheet

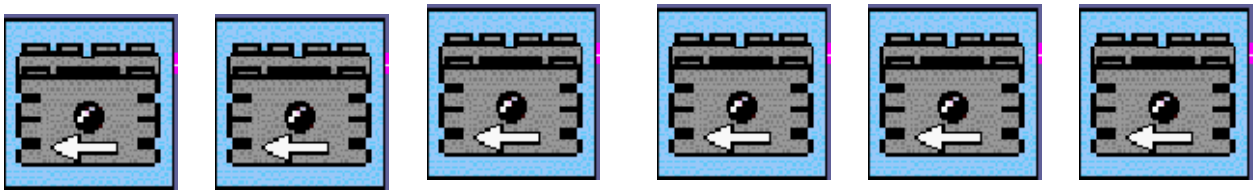
Cut and paste the desired icon on your "Engineering Programming Sheet."

Motors*:*

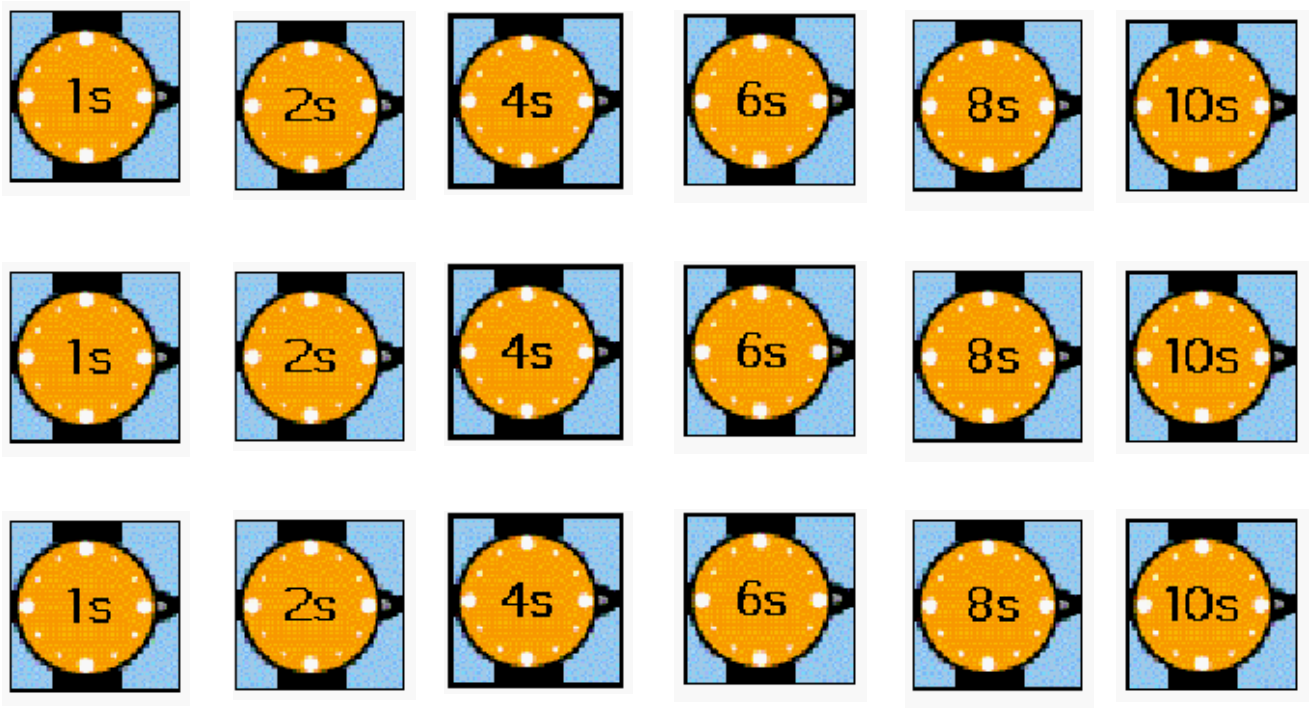
Forward



Reverse



Time:



Lesson 4: Zuckerman's Tractor

Lesson Objective: To familiarize students with sturdy building techniques, as well as the concept of force.

Learning Objective: To learn about force, pull, the parts of a tractor, farms and communities.

The Challenge: To build a tractor that is strong enough to pull heavy weights.

Materials:
- Charlotte's Web
- Picture of tractor and tractor parts
- Drawing and prediction sheet
- Cutouts of steps to be used before computer programming
- Blank paper for student drawings and predictions of weights to be pulled
- organized Lego pieces (motors, beams, axles, wheels, etc.)

Vocabulary:

Procedure:
1. Within a small group, show students pictures of tractors.
2. Discuss the parts of a tractor and why tractors are used.
3. Students can use blank paper to draw their tractors before beginning to build. They should also make predictions of the various weights it will be able to pull.
4. Students will build tractors, cutout steps to plan programming, and then program into the computer.
5. Test each tractor's ability to pull heavy weights and have students share their building strategies with classmates

Programming: Tractors can be programmed to move forward indefinitely or within a set amount of time (forward, forward to backwards).

Resources:
- Lego Dacta "Simple and Motorized Machines" teacher guide
- Tufts Engineering - www.ceeo.tufts.edu/curriculum

Lesson 5: Build a Snowplow

Lesson Objective: To familiarize the students with essential building strategies.

Learning Objective: To learn essential Lego building strategies utilizing the motor and moveable parts.

The Challenge: To build a sturdy snowplow that can withstand the Drop Test.

Materials:
- Lego Simple Machine kits or other Lego building pieces
- Batteries
- Engineer's Journal (worksheet)
- How to build a sturdy car for teacher reference (Lesson 8)
- Literature: Katy and the Big Snow or other snowplow books
- Lego lights
- Lego people

Vocabulary:
- Plow
- Motor
- Connecting wire
- Battery pack
- Batteries
- Friction
- Sturdy

Procedure: Read Katy and the Big Snow or another snowplow-related story. Discuss the positioning of the blade on Katy and offer pictures of different types of snowplows. Begin asking the students questions:
- What does a snowplow do?
- What shape is the blade on the snowplow?
- What direction does the plow face?
- Are the blades on every snowplow facing the same way?
- What other machines have a blade?
- Are the blades always the same?

Engineering Challenge: Instruct students to use their imaginations and build a snowplow. They need to think about the direction of their blade and where they want the snow to go. When the students are ready, have a pile of Styrofoam packing peanuts available. Use masking tape to make the outline of a road on the tile floor. The Engineering Challenge is to push the peanuts out of the roadway.

Note: First graders have a tendency to build their snowplows with every piece in the kit. Consequently, the machines become so heavy that they won't move. This is a good time to discuss weight and friction.

Finally, in the last part of the lesson, instruct students on how to properly care for, put away, and store Lego materials.

Extensions:

- Challenge students to make their snowplows go in reverse without picking them up.
- Students who quickly complete the challenge and are ready for the next step can be given lights and other advanced Lego pieces.
- If the students used a pulley in their design, encourage them to change to gears.
- Encourage advanced students to be 'Lego Teachers' and share their skills with other classmates.

Assessment:

- Name learned pieces
- Sort pieces into correct bins
- Teacher observations and interviews
- Completion of Engineering Challenge

Troubleshooting:

- Some students will be very familiar with vocabulary and building while for others this will be a new experience.
- First grade students are on different levels of reading comprehension and math ability.
- This can be a frustrating experience for first graders until they learn the basic techniques for making a sturdy car. Be prepared to offer many varied suggestions.
- Have a sturdy car built for students to refer to.

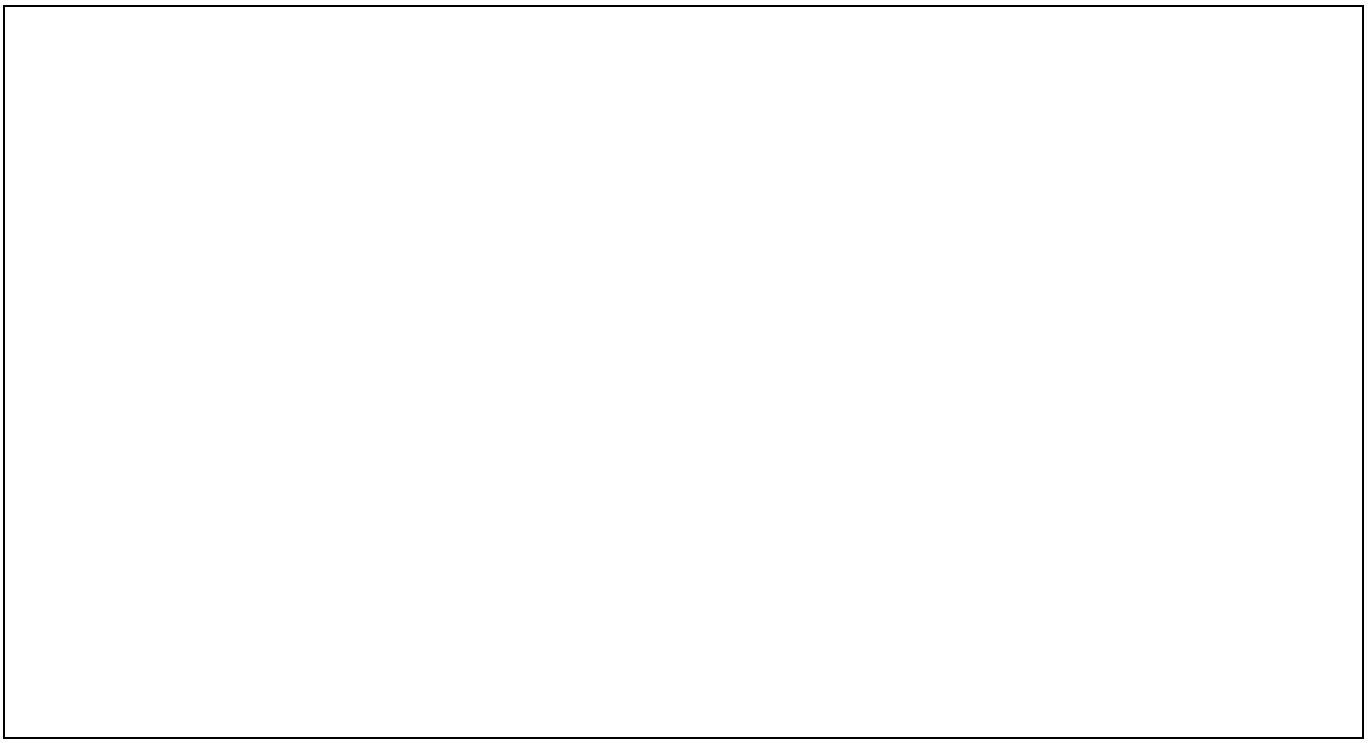
Resources:

- Lego/Tufts website- www.ceeo.tufts.edu/curriculum
- Lego Dacta "Simple and Motorized Machines" Teacher Guide

Engineer: _____ Date: _____
Partner: _____

Engineer's Journal

Draw your snowplow. What part of your design was easy? What was hard?



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