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2014-2015

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idea packet

LEGO: Plane and Simple

LEGO: Plane and Simple

(Originally a Teacher Mini-Grant sponsored by the P.L. Dodge Foundation)

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Goals and Objectives

Big Idea 1: The Practice of Science

SC.1.N.1.1 Raise questions about the natural world, investigate them in teams through free exploration, and generate appropriate explanations based on those explorations.

SC.1.N.1.2 Using the five senses as tools, make careful observations, describe objects in terms of number, shape, texture, size, weight, color, and motion, and compare their observations with others.

SC.1.N.1.3 Keep records as appropriate - such as pictorial and written records - of investigations conducted.

SC.1.N.1.4 Ask "how do you know?" in appropriate situations.

Big Idea 12: Motion of Objects

SC.1.P.12.1 Demonstrate and describe the various ways that objects can move, such as in a straight line, zigzag, back-and-forth, round-and-round, fast, and slow.

Big Idea 13: Forces and Changes in Motion

SC.1.P.13.1 Demonstrate that the way to change the motion of an object is by applying a push or a pull.

Introduction

Many early childhood specialists believe it is imperative that science be purposely included in early childhood programs. According to Eshach and Fried (2005), early science experiences are essential for children, as these experiences help them understand their environment, create and test ideas, learn how to collect and organize information, and nurture positive attitudes toward science. Early childhood educators have the ability to ignite a passion and desire for learning in the field of physical science which might not be present when students are in middle and high school. Physical science subject areas must be presented in a hands-on manner to students in primary grades if they are to succeed later on within their scientific academic life (Eshach and Fried, 2005).

Course Outline and Overview

With so much emphasis being placed on reading and math in early childhood education, teachers end up spending less time on science education. Coupled with the lack of educational content knowledge, and materials, early childhood teachers may find that they are not well equipped to teach science (Pianta, 2012). These underlining problems pose a major obstacle for students later on in life. Therefore, empowering early childhood teachers with meaningful educational development opportunities will help teachers feel confident in teaching science to early childhood students.

The LEGO Education Simple Machines Set has made it easy for early childhood teachers to educate students with step by step instructions on using hands-on STEM (science, technology, engineering, mathematics) activities that align with both National Science Teachers Association (NSTA) science standards and National Council of Teachers of Mathematics (NCTM) math standards. The LEGO Simple Machines Set introduces elementary students to key simple machines concepts while building teamwork and communication skills. This teamwork and communication opportunity with the LEGO set is also an excellent means to reach the ELL (English Language Learner). No matter what type of student population a teacher may have, using LEGO's in the classroom equals hands-on learning and academic success for any early childhood student.

This set and activity pack provides students with the basic physical science concepts such as gears, pulleys, levers, and wheels and axles through observation, reasoning, prediction, and critical thinking. Using hands-on manipulatives maximizes the time students learn and provides meaningful lessons in physical science areas (Trundle, 2009). As a result of utilizing the LEGO Education Simple Machines and Activity Pack my students were able to understand, explain, and demonstrate the physical science concepts of axles and wheels, gears, pulleys, and levers.

The LEGO Simple Machines Set with the Simple Machines Activity Pack provided all the necessary resources to teach students the

basic physical science concepts necessary to understand and visualize such things as gears, pulleys, levers, and wheels and axles through observation, reasoning, prediction, and critical thinking. My project idea was to integrate physical science activities through the use of LEGO Education Simple Machines and Activity Pack within my science teaching block. The LEGO Simple Machines Set was used in conjunction with the Activity Pack which has 16 principle activities, four main activities, and four problem-solving, hands-on activities that covered the physical science concepts of gears, pulleys, levers, and wheels and axles.

Gears Lesson Plans using LEGO®

Introduction:

I began by explaining that a simple machine is a tool that uses force to make work easier. Then, I had students watch a video from BrainPop Jr. on Simple Machines. The video introduces the concept of force and explains that force is a push or pull that can change the way something moves.

To begin teaching with the concept of gears, I used the merry-go-round LEGO® activity as many students are familiar with this type of ride. I introduced gears and explained decreasing speed of rotation, increasing speed of rotation and gearing at an angle. Next, I divided the students into pairs allowing for each group to have their own LEGO simple machines set to replicate two types of merry-go-rounds: one with an eight teeth spur gear and a 24 teeth crown gear, and the other merry-go-round type with four gears (two small spur gears, a crown gear, and a large spur gear with 40 teeth). Students then test to see which type of merry-go-round went faster with the same amount of turns. Students were encouraged to explore the gearings illustrated on the Student Worksheet (see page 10) and to record their observations.

Learning Objectives:

Students will build and test models that use the following techniques associated with gears:

- Decreasing speed of rotation
- Increasing speed of rotation
- Gearing at an angle

Students should already be familiar with following vocabulary before performing this activity:

- Drive gear

- Driven gear
- To mesh

  Guidance is provided by the LEGO Activity Teacher's guide.

Materials needed:

LEGO® Education Simple Machines Set

Activity:

1. Have students build Merry-Go-Round Model A6 and make it turn.

2. Remind students that the drive gear is the gear turned by an outside effort, in this case your hand which is cranking the yellow handle.

3. Ask students to count the teeth on the two types of gears (a spur gear with 8 teeth and a crown gear with 24 teeth).

4. Have students compare Merry-Go-Round Model A6 and A7 (students should observe the difference in both size and number of gears used on both models) and make a prediction as to which model they believe will turn faster A6 or A7.

5. Ask students to follow the step by step instructions to build Merry-Go-Round Model A6.

6. Have students test the Merry-Go-Round Model A6 and see how many times they have to crank the handle in order for the minifigure to make a full turn. Students will have to crank the handle three times for the Merry-Go-Round Model A6 to make one full turn. Therefore the gear ratio is 3:1.

7. Now students will build Model A7 and make it turn. Here there are four gears used: two small (8 teeth), a crown gear (24 teeth), and a large spur gear (40 teeth).

8. Have students test Model A7 by cranking the handle three times, and see how many times the minifigures make a full turn. Students will soon

see that three turns of the 49-tooth gear produces five turns of the merry-go-round. Therefore, the gear ratio is 3:5 and so the Model A7 turns at a much faster pace than Model A6.

9. Finally, students record their observations by drawing their conclusions and checking their predictions for accuracy on the Student Worksheet.

education

Student Worksheet

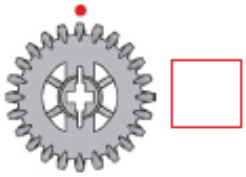
Name(s):

Date and subject:

Main Activity: Merry-Go-Round

1. **First, build Merry-Go-Round Model A6 and make it turn.**
   Follow Building Instructions A, pages 34 to 42, steps 1 to 11.

2. **Count the teeth on the gears. Start counting from the dot.**



3. **Then look carefully at the pictures of the models and compare Merry-Go-Round Model A6 to Merry-Go-Round Model A7.**

   • Circle what is different:

A6

A7

   • What do you notice? Explain how the models are different.

4. **Next, look carefully at the pictures of the models and make a prediction.**

   If I compare model A6 to model A7, then I think Merry-Go-Round Model (A6 / A7) will turn faster.

A6 ☐

A7 ☐

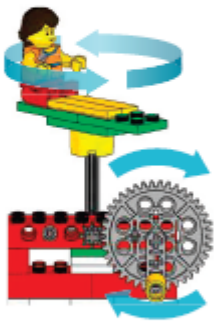
5. **Test Merry-Go-Round model A6.**

   - **If you want Sam or Sally to make a full turn, how many times must you crank the handle?**

   Write down your answer.
   Remember to try at least three times for a fair test. It is important to keep an eye on
   a) where your handle start position is and
   b) where Sam or Sally's start position is on the Merry-Go-Round.

1

6. **Build Merry-Go-Round Model A7 and make it turn.**
   Follow Building Instructions A, pages 44 to 52, steps 1 to 11.



7. **Test Merry-Go-Round Model A7.**

   - **If you crank the handle three times, how many times do Sam or Sally take a full turn?**

   Write down your answer.
   Remember to try at least three times for a fair test. It is important to keep an eye on
   a) where your handle start position is and
   b) where Sam or Sally's start position is on the Merry-Go-Round.

3

8. **Finally draw a conclusion and check your prediction.**
   My tests show that Merry-Go-Round (A6 / A7) turns faster.

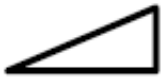
A6 A7

   My prediction was (right / wrong).

Simple Machines Post-Test

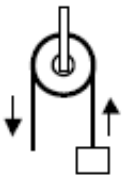
Your Name _____ Teacher's name _____

Write the letter of the picture below next to the name of the simple machine it matches.

A. 

B. 

C. 

D. 

E. 

F. 

G. 

_____ Pulley

_____ Gear

_____ Wheel and axle

_____ Wedge

_____ Inclined plane

_____ Lever

_____ Screw

Write the name of the simple machine that is described in the sentences below:

Word Bank:
Wedge | Gear | Wheel and Axle | Screw | Pulley | Inclined Plane | Lever

These two parts act as one simple machine. They roll and are found on cars, bikes and wheelbarrows. _____

A rope, a wheel with a groove in it and a weight make up this simple machine. You can pull down on the rope to lift the weight. _____

This simple machine can be used to lift a weight. It has a fulcrum, or pivot point, which can be located in the center, near the end or at the end of this simple machine.
_____

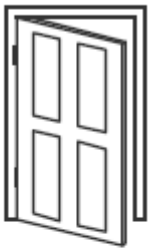
These simple machines are wheels with teeth on them that fit together when the simple machines are turned. These simple machines are used to increase or decrease turning power by changing their size. _____

This simple machine can be used to split things apart or hold a door open.
_____

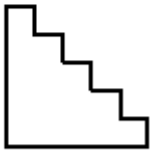
Examples of this simple machine are used to hold things together. It is made up of an inclined plane wrapped around a cylinder. _____

A heavy object could be rolled up this simple machine, instead of lifting it straight up. Using this simple machine can save effort, although the object must usually cover more distance if this simple machine is used. _____

Draw a line from the object below to the name of simple machine it represents:

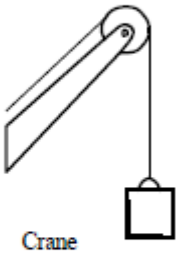


Door on Hinges

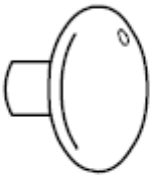


Stairs

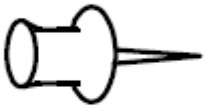
Light Bulb



Crane



Door Knob



Push Pin

Inclined Plane

Wheel and axle

Wedge

Pulley

Screw

Lever

Internet Resource List

www.legoeducation.us

http://www.learninggamesforkids.com/simple-machines-games/label-it.html

http://www.brainpopjr.com/science/forces/simplemachines/

http://www.neok12.com/Simple-Machines.htm

http://www.mikids.com/Smachines.htm

http://www.msichicago.org/online-science/simple-machines/

http://www.edheads.org/activities/simple-machines/pdf/simple-machines-pre-test.pdf

http://siemensscienceday.com/activities/just_for_kicks.cfm

Bibliography

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LEGO® Group (2012). *Activity for Workshop Kit Simple Machines.* Retrieved July 22, 2014, from http://education.lego.com/en-us/downloads/

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Trundle, K. C. (2009). *Teaching science during the early childhood years.* National Geographic.

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