

2.B.3 Pulleys and “The Amazing Mine” :

The Engineering Design Process in the classroom

Grade Level	2
Sessions	1 – 30 minutes 2 – 30 minutes
Seasonality	None
Instructional Mode(s)	Whole class, groups of 4–5 students, individual
Team Size	None
WPS Benchmarks	02.SC.IS.01; 02.SC.IS.02; 02.SC.IS.03; 02.SC.IS.06; 02.SC.TE.02; 02.SC.TE.04;
MA Frameworks	K-2.TE.1.2; K-2.TE.2.1
Key Words	Simple Machine, Pulley, Wheel, Rope

Summary

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This lesson works in conjunction with the Balance and Motion, and Simple Machines lessons. In this activity, each student will be given an opportunity to experiment with a simple pulley. Each student should discover that pulleys do make lifting easier. The students should then discuss with the teacher places where people use pulleys for lifting. The teacher should then read “The Amazing Mine” story, which illustrates the uses of pulleys, levers and ramps to make work easier. The students should predict how the miner will use the simple machines.

Session 1: Balance

Summary of Session

This session will introduce the students to the concept of a pulley.

Learning Objectives

—
2002 Worcester Public Schools (WPS) Benchmarks for Grade 2

Students will...

02.SC.IS.01 Ask questions about objects, organisms, and events in the environment.

02.SC.IS.02 Tell about why and what would happen if?

02.SC.IS.03 Make predictions based on observed patterns.

02.SC.IS.06 Discuss observations with others.

02.SC.TE.04 Identify tools and simple machines used for a specific purpose.

Additional Learning Objectives

—
Students will apply their knowledge of simple machines to real-world examples.

Required Background Knowledge

—
For the students...

None

For the teacher...

Pulleys function by reducing the total work done, to increase the power of the work. For example: in a 2x pulley (the pulley system provided in the kit), each 1 ft pull of the rope, only moves the pulley $\frac{1}{2}$ ft.

Pulleys are used for many activities. Sailors use pulleys to pull in the boom and sail. The Egyptians used pulleys to pull the large stone blocks up the sides of the pyramids. Cranes use pulleys to lift heavy loads up into the air.

Essential Questions

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1. Does a pulley make work easier or harder?
 2. How do people use pulleys to make work easier?

Introduction / Motivation

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The students' motivation for this exercise is that they will have time to experiment hands-on how to discover that a pulley makes work easier.

Procedure

1. Set up pulley assembly by securing the loop to the ceiling, or other high place, such as a doorframe.
2. Fill the bucket with nuts and bolts for weight.
3. Allow the students to attempt to lift the bucket by grabbing all of the ropes and lifting up (without using the pulley). Then the students should try to lift the weight by pulling on the free end of the rope.
4. Ask the students, which was easier. If they think it was easier without the pulley ask them to try again
5. After each student has attempted the experiment, discuss how pulleys are used.

Materials

Materials per class	Amount	Location
Pulley Kit	One	

Vocabulary with Definitions

1. Pulley – A simple machine, which uses wheels and rope to make work easier

Assessment / Evaluation of Students

1. Do the students recognize that a pulley makes work easier?
2. Can the students identify practical uses for pulleys?

Lesson Extensions

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None

Attachments

—
None

Troubleshooting Tips

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1. Ask the students to talk about their findings. Their shared experience with simple machines will help cement the idea that simple machines make work easier.

Safety Issues

—
None

Additional Resources

Session 2: “The Amazing Mine” Story

Summary of Session

In this Session, the students will listen to story about practical uses for simple machines

Learning Objectives

—
2002 Worcester Public Schools (WPS) Benchmarks for Grade 2

Students will...

02.SC.IS.01 Ask questions about objects, organisms, and events in the environment.

02.SC.IS.02 Tell about why and what would happen if?

02.SC.IS.03 Make predictions based on observed patterns.

02.SC.IS.06 Discuss observations with others.

02.SC.TE.02 Identify and explain some possible uses of natural materials and human materials.

02.SC.TE.04 Identify tools and simple machines used for a specific purpose.

Additional Learning Objectives

—
Students will begin to use their imaginations to consider additional scenarios where they might use levers, ramps, and pulleys.

Required Background Knowledge

—
None

Essential Questions

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1. How can the Miner move his gold over a ledge?
 2. How can the Miner move his gold up a mine shaft?
 3. How can the Miner move the heavy boulder?

Introduction / Motivation

—
This is a simple story, and the students should be encouraged to make predictions.

Procedure

1. Read “The Amazing Mine” story, stopping periodically to ask the students to predict how the miner might solve the latest problem.

Materials

Materials per class	Amount	Location
“The Amazing Mine” Story	One	

Vocabulary with Definitions

–
None

Assessment / Evaluation of Students

1. Can the students make reasonable predictions how the miner might solve the problems?
2. Are the students active listeners during the story?

Lesson Extensions

–
The students may choose to write/illustrate their own stories, in which the main character uses simple machines.

Attachments

–
None

Troubleshooting Tips

1. Students may enjoy reading the story more than once.
2. Depending on the students comfort with the concept of simple machines, ask the students to think about why each modification to the simple machines used in the store makes the work even easier.

Safety Issues

—
None

Additional Resources

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None