Science and Visual Art

Water in Motion: Hydraulic Energy **Third Grade**

Objectives

Students will:

- learn the effect of forces applied to a moving object.
- learn about different types of water wheels.
- construct their own waterwheels to better understand applied forces and motion.

Introduction

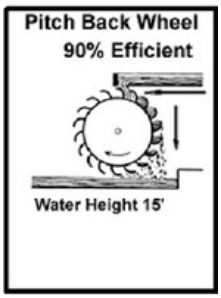
Begin by explaining to students about waterwheels. Waterwheels are machines that convert the energy of flowing or falling water into power that can be used to do other tasks. If you've ever seen waterwheels, you know that they are usually large wheels made of wood or metal that have many blades or buckets along the outside edge to capture the power of moving water.

Ask students if they have ever seen a waterwheel. Where might they usually find them?

Explain to students that there are several different types of water wheels. Depending on the direction, speed or flow of the water, different wheels will function differently, but they all have the same result of converting water to hydraulic energy.

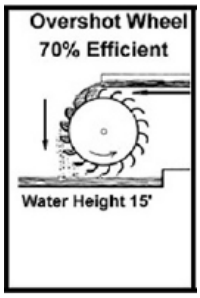
1. Pitch Back Water Wheel

- This wheel has a falling water sources that propels the wheel backwards



2. Overshot water wheel

- This water wheel, receives a flow of water that propels the blades of the wheel in a forward motion



Andrew Smith, *Moon Pool, 2004*

Materials

- Video on Andrew Smith's Moon Pool
- Videos of Waterwheels on Youtube
- Styrofoam Plates
- Plastic Dixie Cups
- Spoons
- Straws
- Other building supplies of your choice
- Storage Bin
- String
- Tape
- Scissors
- Paper and Pencil
- Pitchers or cups for pouring water

Images from the Museum

- Andrew Smith, *Moon Pool*

Utah Core Standards

Science Standard 3

Students will understand the relationship between the force applied to an object and resulting motion of the object.

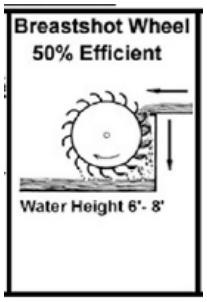
Objective 1
Demonstrate how forces cause changes in speed or direction of objects.
b. Compare the forces of pushing and pulling.
c. Investigate how forces applied through simple machines affect the direction and/or amount of resulting force.

Standard 3 Objective 2
Demonstrate that the greater the force applied to an object, the greater the change in speed or direction of the object.
a. Predict and observe what happens when a force is applied to an object (e.g., wind, flowing water).

Visual Arts
Objective 3
Recognize the connection of visual arts to all learning.
a. Use a visual arts form as a help in expressing an idea in a nonart subject; e.g., a science project, the writing of a poem, a social studies project.

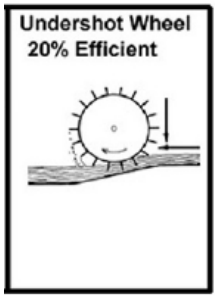
3. Breastshot water wheel

- A vertically mounted water wheel that is rotated by falling water striking buckets near the center of the wheel's edge, or just above it, is said to be breastshot. Breastshot wheels are the most common type in the United States of America. This is similar to the Pitch back wheel, however is less effective due to less of a force of falling water



4. Undershot Wheel water

- This is the least effective of water wheels as it does not deal with falling water. In this case, the water flows underneath the while, propelling the blades forward and causing it to turn.



You may want to show videos on Youtube of the different types of water wheels so they can better visualize the differences.

Explain to students that the spinning motion of the wheel is what converts the motion into energy. (Note: If you are teaching a more advanced secondary class, this can be applied to Newton's 3 Laws of Motion)

Introduction Cont.

Now, show students a copy of Andrew Smith's *Moon Pool* from the Springville Museum of Art's permanent collection. If you can visit the museum, students can see the process, however you may also access a video of the *Moon Pool* online at https://www.youtube.com/watch?v=p3wUCIXAcZs or https://www.youtube.com/watch?v=DEOqjKFBd9w

Have them watch the whole process and determine the flow of water.

Ask your student the following questions:

- What type of water wheel does Andrew Smith use in *Moon Pool*?
- What makes Smith's *Moon Pool* art instead of just engineering?
- If the speed and direction of the water where to change, what would happen to the wheel?

Learning Activity

Explain to students that they will be creating their own water wheels. Break the students into small groups and challenge them to work together to create their own waterwheel. Students may decided which materials they will use (Not all materials must be used).

Before the groups begin constructing their wheels, have them sketch and design their wheel. They should identify which type of wheel they will be creating.

After groups have built their wheels, test them out! An easy way to do this is bring a large plastic storage bin. Using pitchers or cups, students can pour water onto their wheels to see how they function.

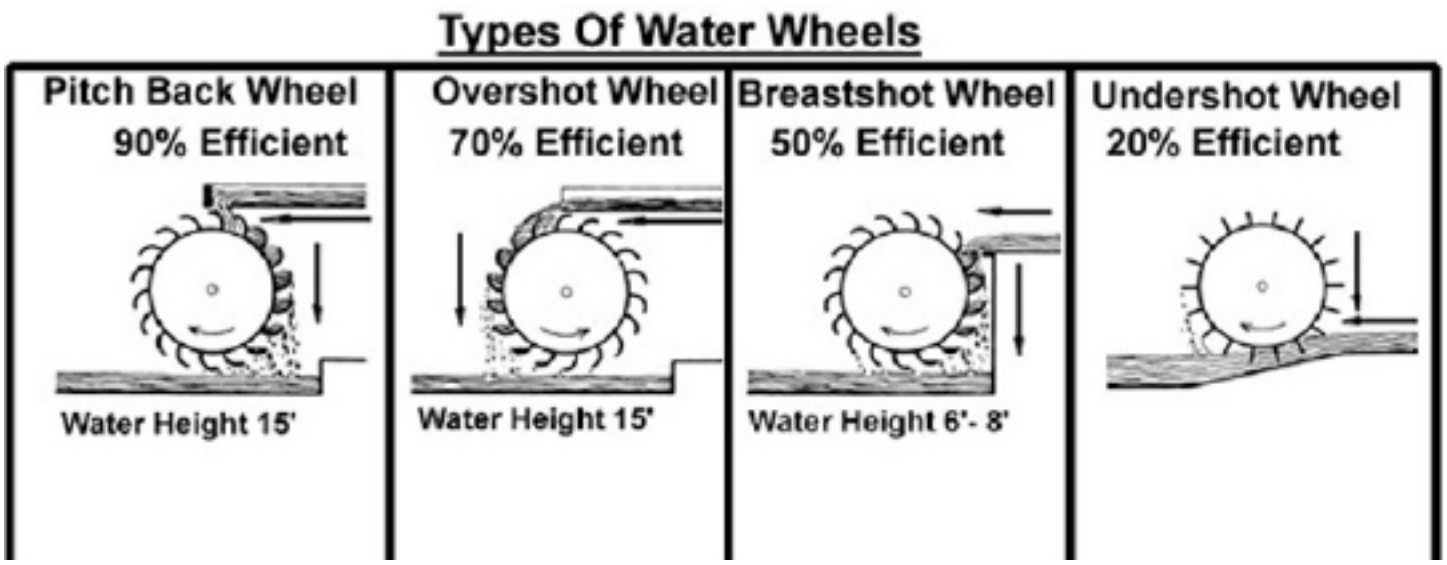
Extensions

After your students have built their wheels, have them experiment with the different types of waterwheels (Pitch Back, Overshot, Breastshot, Undershot). This can be done by changing the direction of the flow of water. Have your students record the differences. (i.e . which appears to be the most efficient/ least efficient etc.)

Assessment

Each group should answer the following questions about their water wheels.

- What was the most difficult part to figure out?
- Were there things you forgot about in your first design plan?
- Did anything surprise you?
- What was your favorite part about this activity?



Andrew Smith, *Moon Pool, 2004*