MOPPING UP THE COMPETITION

Basketball is a game of fast breaks, quick stops, high jumps, swift pivots, attempts to gain the ball, and a lot of sweat. Keeping the court as safe as possible is paramount!

How does the Thunder keep players safe from falls due to sweat and grime on the hardwood? It takes a lot of hustle, attention to detail and the right tools! In this case, those tools are large brooms, smaller mops and towels. During time outs, between quarters, after free throw attempts, and every time a player falls, the court is cleaned by the Thunder ball crew. These people hustle to wipe up sweat and dirt, either across the entire playing surface or just the affected area. The stop in the action is usually extremely brief, so having equipment that works efficiently is important!

HERE'S WHAT YOU'LL NEED:

- **Water**
- **Oil** *(cooking oil, mineral oil, baby oil, etc.)*
- **Corn starch** *(flour, baby powder, or baking soda could be substituted)*
- **Small containers**
- **Soft or absorbent materials** *(cotton balls, rag materials like old t-shirts, paper towels, polyester fiber, etc.)*
- **Scale**
- **Clothespins** *(enough for each student or student group)*
- **Dropper or straw**
- **Waxy paper plates or another nonporous surface**
- **Pencil**
- **Journal**

WARM-UPS

Basketball courts are made of hardwood with a waxy protective coating. This makes for a playing surface that provides plenty of return energy for the players as well as a pleasant viewing experience for the spectator. This surface can also become very slick when it gets wet, oily, or dirty. Because basketball players depend so much on having sure footing when on the court, keeping it dry and free from unwanted moisture is a very important duty!

Watery sweat, loose dirt and dust, or even oil from our skin, can make a basketball court a slipping hazard.

Think about these potential slipping hazards. What kind of material do you think would be most efficient in cleaning them up from a waxy surface?

Select three potential materials for quickly cleaning up these messes. You don't need much of each material. Cut or tear each material into three pieces approximately the same size. Each piece should be about 2 square centimeters, or about 1 inch squared. This will result in nine pieces of material.

Use the scale and weigh each piece of your material. Then make a chart. Include the name or description of each type of material you chose, its weight and space to include three more weights per material. Label these three extra spaces: ***Dirt, Water, Oil.***

Set out three small containers. Label the first container Dirt. Fill this container partway with some sort of dust-like material such as flour, cornmeal, or corn starch. Label the second container Sweat. Fill this container partway with water. Label the last container Oil. Fill this container partway with the oil you chose to use.

Now make a hypothesis. Using what you know of each material that you selected, which material will pick up the most dirt? Which will absorb the most sweat or water? Which will be most effective at picking up the oil? Will one of the materials that you selected be best at picking up all three?

After you have made your hypothesis, you will test it by dipping and rubbing each of the three chosen materials in each of the three slipping hazards. Use a "figure 8" shape to try to repeat this process as similarly as possible each time.

Start with dirt. Using the same "figure 8" technique each time, dip and rub each piece of the chosen materials in the dirt and then weigh them. How much have the weights changed from the addition of dirt? Record your findings in your chart. Be sure to be consistent, you want to measure the efficiency of the material not the effectiveness of your effort.

After you have tested each material in the dirt, use the next clean pieces of the chosen materials to test the water. Use the same process as before, being careful to use the same technique each time. Test, weigh and record your findings for all three materials in water.

Lastly, test the oil. Using the same processes as before, be as consistent as possible. Test, weigh and record your findings.

What did you discover? Was your hypothesis correct? Were you surprised by any of your findings? Was any one material more efficient than the others? Were there positive characteristics to each material?

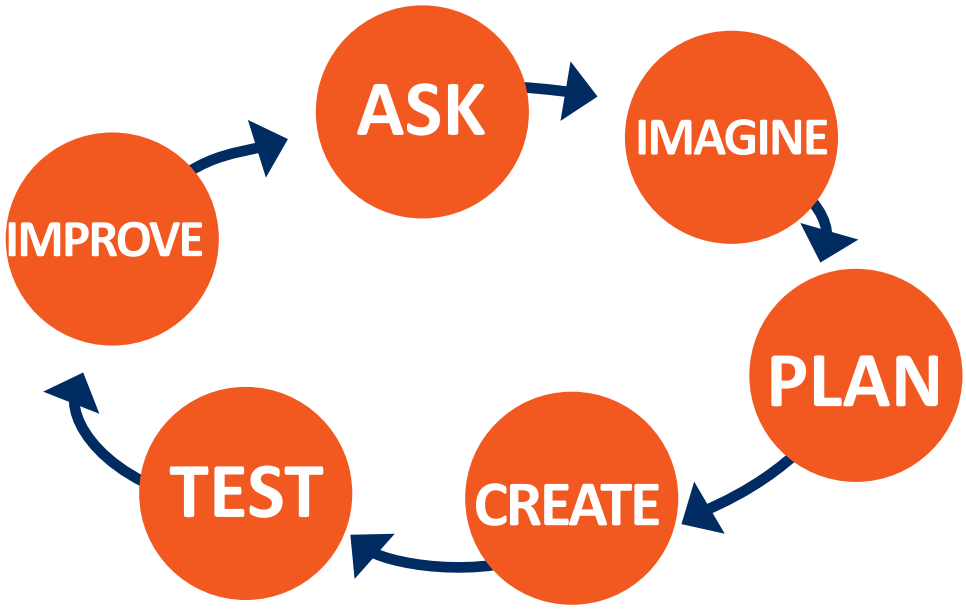
You just used a simple version of the scientific process. This includes making a hypothesis, or proposing an explanation that can be tested, performing that test and observing if the proposed explanation is correct or if another hypothesis needs to be created and tested.

GAME TIME

Now that you have experimented with a few different types of material, it is time to engineer a "mop" that can efficiently address all of these needs.

A big broom is used between quarters and during timeouts to clean the entire court. Soft large towels are used to wipe up sweat after a fall. After a free throw attempt, special mops are used to quickly clean up the area along the lane and under the bucket.

For this activity you will design, build and test a mop. To do this you will follow the engineering design process.



Engineers develop new tools to help us accomplish all sorts of necessary tasks safely, efficiently, and if possible, inexpensively. You may normally think of an engineer as someone who designs aircraft or cars or even buildings. There is a huge variety of different types of engineers, though! There are toy engineers, video game engineers, and yes—even mop engineers that search for the most efficient way to keep the Thunder players and their opponents safe.

The engineering design process provides steps to improve products and processes. It never really ends. Just as a basketball player will keep practicing and learning new skills to get better, the engineering design process shows us that there is always a path to improve.

Before you get further into the engineering design process, create a slick basketball court for the challenge. You will also have to be able to measure the efficiency of the tool that you designed. Place a waxy paper plate on a scale and record its weight. Place a small amount of cornstarch or other dirt in the center of the waxy plate. Next add two drops of water, or sweat, to the plate near the center. Lastly, place one drop of oil near the center of the plate. Now weigh the plate again and record its new weight. Subtract the weight of the plate alone with the weight of the plate with the added grime. This difference in weight represents the sweat, oil and dirt on the plate.

Pro-Tip: If you do not have a dropper, you can use a straw by placing the straw into the liquid and then placing your finger over the top of the straw. When you move the straw the liquid will remain inside until you remove your finger. ***You are using atmospheric pressure to do work!***

Starting at **Ask** you can identify the challenge and the requirements that it presents. In this case, it is creating a device that can wipe up dirt, oil and sweat off the basketball court that you prepared earlier. There are also constraints. How much time will you have?

For this Game Time activity, the challenge is to create a solution that can effectively and efficiently wipe up a mix of dirt, sweat and oil from the plate in one small figure-eight motion. The device that you create must be able to quickly attach to the end of a clothespin.

Next, you will **Imagine** solutions. This includes not only brainstorming but also research. In Warm-Ups, you collected a little data through your research. You may also discuss with classmates what they discovered in the Warm-Ups. Gathering data from the research of others is generally beneficial. Now draw up some possible designs based upon this research.

The **Plan** step comes next. Look at your possible designs and select one, or more, that you think would be most advantageous to build and test.

Then, it is time to **Create**. In this step, you will build a working model of the design that best addresses the challenge and can be created within the constraints of the project. This first working model to test the effectiveness of the design is called the prototype.

After the prototype is created comes the **Test** step. This is the step in which everything comes together. You will test your prototype. You will gather data as well as look for strengths and weaknesses in your design.

To keep the data you collect as accurate as possible, it is beneficial to have a consistent procedure. Sketch out your completed prototype with the "mop end" device attached to the end of a clothespin. Place your "mop" on a scale and record its weight.

Next with the same "figure 8" movement used in the Warm-Ups rub the device over a wet and dirty plate making sure you only complete the "8" shape once. Place your device on the scale again. Record the weight again.

Subtract the first weight of the device from the weight of the device after you use it. The remainder is how much grime your device picked up. The difference between the weight of the grime that you picked up and the amount of known grime on the plate is how much remains on the plate. The more water, oil and dirt that is picked up, the safer the court will be.

The next step is to **Improve** the design of your creation. In this last step before returning to the beginning of the process, examine your results. What changes would you make and why? If time allows, make those improvements. Be sure to reset the challenge by adding the grime to the plate and recording weights as needed. Test your device again using the same process as before. How effective was it? Did you improve the design?

ANALYZE THE REPLAY
What happened?

The engineering design process is used to continually improve technology and can be applied to nearly any problem. Though the engineering design process is a loop in which Improve leads back to Ask, the time between these two steps is ideal to report what progress you made.

Share with friends or classmates the results of using the engineering design process. How effective was your mop? Were there strengths to your design? Were there weaknesses? For example, did the mop prototype pick up the grime but have difficulty staying attached to the clothespin?

Listen to what other solutions your friends and classmates found. What surprising solutions were shared? Did they discover any weaknesses in design that you did not?

OVERTIME
Let's take it further

Using all the research and resources that as a class you can provide, work in larger groups to prototype and test an even more effective mop. Use the engineering design process to go through each step. Focus on improving the design. Can you make it more efficient? Can you make it lighter? Can you make it easier to hold? Can you make it look super neat?

These are all parts of creating using the engineer design process. When it comes to technology, new discoveries and engineering breakthroughs are constantly giving us new tools and devices to make routine tasks easier. Even after new inventions are created, they go through continual changes using the engineering design processes. Companies research, develop, test, manufacture and market new products every year. New shoes and even new training equipment are introduced often!

As a class, can you scale up the most effective mop design that you created into the size of a usable model? You might want to think about the price for which you would have to sell such a device if it were available for basketball teams and sports fans to purchase. Did you know that a pair of perspiration mops used during professional basketball games can cost several hundred dollars or more? Even replacing the pads that absorb the sweat and mess can cost more than $100! Why do you think these mops might have such a price? Keeping in mind the monetary investment customers will make in the device, why would they want to purchase the mop you designed instead of others? If time allows, there are many questions to explore. Your tests and findings may lead to discoveries that will one day keep basketball players safer!

COACH'S CORNER
Additional information and explanations for parents and educators

Students may be familiar with the scientific method and may see similarities with the engineering design process. It may be helpful to compare and contrast the two different tools.

Students used the engineering design process in Game Time and a simplified version of the scientific method in the Warm-Ups. Both of these tools involve asking questions. In the scientific method, these questions are generally inquiring "what will occur" or "why does something occur?" In the engineering design process, the question is "what is the everyday problem that is trying to be overcome and what is needed to achieve it?" In the scientific method, a hypothesis is made to predict why something occurs and experiments are developed to test if the hypothesis is correct or incorrect. The scientific method helps us acquire knowledge through observation and experience rather than through theories or our own logic. The engineering design process is a creativity-based technique to solve problems of everyday life. The scientific method is used to find a testable explanation. The engineering design process provides an organized system to find usable solutions and continue to improve those solutions.

DO YOU WANT TO LEARN MORE?
Research: Engineering Design Process, Hypothesis, Prototype, Scientific Method

OKLAHOMA ACADEMIC STANDARDS

SCIENCE	4th Grade	5th Grade	6th Grade
5.PS1.1: Matter and Its Interactions		●	
5.PS1.2: Matter and Its Interactions		●	
Math			
4.D.1.2 Data and Probability	●		