

## Using scientific method to determine the best T.P.

<b>Grade Level</b>	Middle School
<b>Subject Areas</b>	Engineering, Experimental Design, Scientific Method
<b>Skills</b>	observation, comparison, communication, data analysis, scientific method, critical thinking, math skills
<b>Duration</b>	3 or 4 fifty minute days
<b>Setting</b>	classroom
<b>Vocabulary</b>	Scientific method, mean/average, replicates
<b>Standards Addressed</b>	MT Content Standard 1 All Benchmarks but #6: Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate results and reasonable conclusions of scientific investigations.
<b>Objectives</b>	<b>Students will:</b> <ul style="list-style-type: none"><li>● <b>Consider characteristics that make a quality toilet paper</b></li><li>● <b>Design experiment to test these characters</b></li><li>● <b>Carry out experiment</b></li><li>● <b>Create graphic representations of results</b></li><li>● <b>Draw conclusions</b></li></ul>
<b>Materials</b>	<ul style="list-style-type: none"><li>● <b>pennies (20 per group)</b></li><li>● <b>rubberbands</b></li><li>● <b>eyedroppers</b></li><li>● <b>dixi cups</b></li><li>● <b>at least 3 brands of toilet paper of different types (2 ply vs 1 or varying costs) including the school's brand</b></li><li>● <b>other materials students may need to tests</b></li></ul>
<b>Background</b>	People often ignore scientific claims because they go against an individuals personal beliefs, opinions, or would hurt their livelihood (i.e. global climate change, evolution, smoking/caner link, age of the earth) and there are misunderstandings about how these scientific conclusions are brought about. Scientific theories and laws when developed using the scientific method are not based merely on opinion and personal bias but evidence. Allowing other scientists to review how conclusions were drawn also helps control outside influences (i.e. funding from cigarette manufactures, personal bias). The scientific method is a tool used by all scientists to ensure that data is collected and results drawn in an honest reliable way. The steps of the scientific method vary slightly but usually include 1) making observations (looking art a

rainbow) 2) asking a question based on these observations (how do rainbows form?) 3) making a testable (can be found incorrect) hypothesis based on questions (Sunlight reflecting through water is what causes rainbows) 4) Testing the hypothesis (developing an experiment where light is shined through water particles to see if it makes a rainbow) 5) drawing a conclusion (did your experiment provide evidence for or against your hypothesis?) 6) Sharing your results with others in the world.

This experiment will allow us to get beyond the hype of marketing and decide what the “best” brand of toilet paper is by using the scientific method.

## Procedure

Day 1:

Begin the experiment with a class discussion of commercials for different brands of toilet paper (note that this is the making observations step of the scientific method). Begin by discussing a commercial you like or dislike to get the kids comfortable with sharing (I particularly hate the one with the baby bear getting toilet paper stuck to it’s butt). After the students have talked about the commercials that they like or not ask them to describe what the commercial is saying makes their brand superior to others. Make a list of these qualities on the board (strength, softness, absorbance, smell, pretty). Next ask the students which of these qualities they think makes for the “best” type of toilet paper (this is the question “what is the best brand of TP?). Have them vote and put checks next to the most popular.

Next, ask the students if there is a way to measure these qualities in which you get a numerical result as an answer (often times students get stuck on what they have seen in the commercials such as putting a weight on the T.P. and dragging them, make sure to steer them in a direction of quantifiable tests). Write these tests on the board also (this is the experimental design). My students tested strength (rubber banding a piece of TP on top of dixi cup, adding three drops of water, and determining how many pennies it could hold before breaking), softness (having students feel different brands and decide which was the softest and which was the roughest), absorbance (place drops of water on the TP until it is totally saturated and count the drops it takes). Explain the concept of replicates to the students so that they can incorporate it into their designs. Replicates are doing the multiple samples and then finding the average. This is done so that one weird result (outlier) will not throw off their results and conclusion. All of these ideas were the students’ design except the first one.

Have the students make a hypothesis as to what they think will happen. There is a broad range of hypotheses that they can make from a specific brand having the greatest absorbance to the most expensive being the strongest. Make sure that they are specific

hypotheses, “best” is subjective, make them use the quantifiable characteristics that were previously determined.

#### Day 2

Have the students carry out their experiments and record their results. It is a good idea to take away the brand names of the TP and replace them with letters or numbers. This is a good chance to explain to the students about bias and how good scientists try to eliminate the chances of their own bias influencing results.

#### Day 3

Have the students find the averages of their results and make simple graphs that demonstrate what they have found. The students can hand draw their graphs or if there is access to computers and experience with excel they can generate them. These graphs should help them draw a conclusion based on their hypothesis. Have the students write down their conclusion based on their hypothesis ( i.e. The results provide evidence for my hypothesis that the most expensive TP would be the strongest).

#### Optional Day 4

Have the students present their results to the class and have the other students ask them questions.

#### **Assessment**

Students could be assessed on a science notebook if one was kept and the quality of their presentation. Short quizzes could be given on the steps of the scientific method and the differences between question and a hypothesis.

#### **Extension**

This activity should be carried out at the beginning of the year so that students can use the skill gained to develop their own questions and hypotheses for later experiments.

#### **Resources**

<http://www.scribd.com/doc/5809490/What-is-the-best-brand-of-toilet-paper>