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# Math Modeling: S'**more Energy**

We created a visual display of our math modeling project on the S'more Energy Google Slides so if we continue to teach digitally or would like to share the lessons with colleagues, it would be easier for others to apply the project as well.
**Public Link to slides if hyperlink is not working:**
https://docs.google.com/presentation/d/14o16OpYkpnIYleDcC9aZ7MUd7B0qvAVui4jFKtjiR-M/edit?usp=sharing

***Modeling Activity***
Our mini unit is rooted in an engineering project about energy and math is used to collect information and measure effectiveness of collection of solar energy. The mini unit is developed as an investigation that is built upon across grades PreK to second grade. There is more detail within the slides.

- *Preschool:* Students practice counting and comparing materials used to create the best oven.
- *Kindergarten:* Students practice counting materials and comparing how energy is used when there are more or less marshmallows to cook.
- *First Grade:* Students continue to count out s'more items but the focus is more on charting and specifics on length of time to cook and comparing data on how fast an oven can cook based on how many s'mores are in the oven. Do more s'mores take longer? How does the energy effect cook time?
- *Second Grade:* Students begin to do the same activity, but now they tie in temperature. Students use thermometers and track temperatures of ovens. Where does the marshmallow or chocolate begin to melt? Will a sunny or cloudy day affect its ability to melt better? Students use real world math with cooking and temperature.

***Engaging Context***
The sun is a part of every student's environment, even if they live somewhere where there is a lack of sunlight, the sun is universal. The sun is something all our students have had some sort of experience with. The sun provides heat and warms the planet. Some students may even know about solar panels and solar energy, but how does it work? Why should students care about solar energy. On the S'more Energy Google Slides students can learn about fossil fuels, why we are working on harnessing the sun's energy, and how what they will make has real life applications. There is also a book that one can get or use the youtube link to play for students: "Energy: Heat, Light, and Fuel"by Darlene Stille. There is a real life focus on other energies other than fossil fuels so this investigation is not an isolated activity, and gives students a reason to track information. Also, eating the best smore would add to motivation to track the best design/system to heat it with the sun.

***Measurable Objectives***
*Preschool:* Students will create solar ovens together and test out different materials. Students will track which material cooks the smores the best. Students will practice one to one correspondence as the count materials.

- This applies to the math standard as they are comparing their ovens to see which materials are more hot/effective to cook their smore.

*Kindergarten:* Compare how a solar oven cooks three different types of s'mores. Smores with more or less chocolate and marshmallows.

- This applies to a math standard of not only counting objectects but also comparing objects as most or least.

*First Grade:* Compare the length of time it takes to cook. One, two, three s'mores in the same oven. Which takes the longest/shortest amount of time. Explain why.

- This applies to a math standard of shortest to longest in terms of time more than length. It also applies to charting on a bar graph length of time.

*Second Grade:* Students will create bar graphs showing temperature before the oven cooked their smore and another showing how long it took the s'more to cook on different days. An extension might be to have students compare the data on a line graph to show how the temperature increased over time depending on the day. Which day would be more effective to cook the smores on?

- This applies to a math standard of comparing numbers within 100. If the smore melts at 80 degrees, is this hotter or colder than 50 degrees. Students can create a bar graph **or** the teacher can deviate from the standards a bit and have students transfer their points onto a line graph marking the melting point.

***Standards***

*Preschool Standards*

- **DRDP** for preschool is a great resource of standards to track student learning, we focused on COG 8,9,10 which focus on cognition in the realms of math and science. https://www.desiredresults.us/sites/default/files/docs/forms/DRDP2015PSC_090116.pdf

*NGSS: K-2 Engineering standards*

- **K-2-ETS1-1.** Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- **K-2-ETS1-2.** Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- **K-2-ETS1-3.** Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

*CCSS-M: Cross Grade Levels*

- Kindergarten: **K.MD.A.2** Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference.
- First Grade: **1.MD.C.4** Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.
- Second Grade: **2.MD.D.10** Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph. **2.NBT.A.4** Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons.

***Evidence***
Although the school year is over for the both of us, here are some ways we would like to collect evidence across grade levels. Some will look similar as it is an activity that should feel familiar so students can continuously build connections each year. Students universally should have a science notebook (optional for preschool). *In all investigations it is highly recommended for teachers to take anecdotal notes and pictures so the teacher can informally assess students ability to complete the investigation in a collaborative setting and ask and answer relevant questions.*

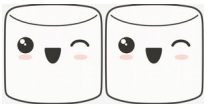
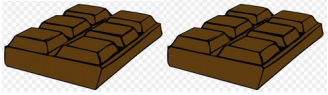
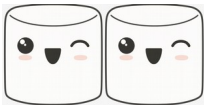
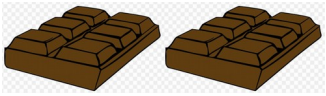
*Preschool:* The teacher could use stickers made into the shape of each ingredient and to have the student post the correct sticker under each column. Once students finish posting stickers, they will count the total number of each ingredient and inquire the same quantity of ingredient from the teacher accordingly.
Table for measurement: See below

| **Group Names** | **Cracker** | **Marshmallow** | **Chocolate** |
|---|---|---|---|
| Aiden |  |  |  |
| Sarah |  |  |  |
| Benjamin |  |  |  |
| Justin |  |  |  |
| Total for everyone | **8**  | **4**  | **4**  |

- *Science Notebook:* Students draw out what the oven looks like, and attach/tape a strip of tinfoil, construction paper, and cardboard to their books. They can save these for later to understand vocabulary and remember materials features. They will circle the best material after the investigation.
- *Guiding Questions:* What kind of energy can we find in the room? Where does the energy come from? How do we use energy in our daily life?

***Kindergarten:*** Students intentionally use the same chart in a different way from preschool so there is some familiarity. This time they use different amounts and choose who they compare to.

*The teacher could use stickers made into the shape of each ingredient and to have the student post the correct sticker under each column.
Table for measurement: See below

| **Group Names** | **Cracker** | **Marshmallow** | **Chocolate** |
|---|---|---|---|
| Aiden |  |  |  |
| Sarah |  |  |  |
| Benjamin |  |  |  |
| Justin |  |  |  |
| Total for everyone | 8 crackers | 8 marshmallows | 6 chocolates |

***No more than 3 per category.**

- *Science Notebook:* Students draw out the materials in their s'more and mark how long it took to melt. Students compare their results with their friends and group mates.
- *Guiding Questions:* What kind of energy can we find in the room? Where does the energy come from? How do we use energy in our daily life? What type of smore cooked the fastest? What cooked the slowest? Why do you think?

***First Grade:***
Compare the length of time it takes to cook. One, two, three s'mores in the same oven. Which takes the longest/shortest amount of time. Explain why. Students will explain this by creating a bar graph where they measure the time it takes to cook each smore. The teacher can use individual times for groups or one big timer for the whole class.

- Science Notebook: Students draw out what the oven looks like or draw the amount of smores in the oven. Students can draw in their bar graph to mark time and when it melts.
- *Guiding Questions:* What kind of energy can we find in the room? Where does the energy come from? How do we use energy in our daily life? Which set s'mores took longer? Which sets took the least amount of time? Why do you think? How was energy used?
- *Consider:* How do we know something is melted or ready? Will different groups have different criteria for it?
- Table for measurement: See below

| Time minutes | S'mores Cooking Tracker | | |
|---|---|---|---|
| **60** | | | |
| **55** | | | |
| **50** | | | |
| **45** | | | |
| **40** | | | |
| **35** | | | |
| **30** | | | |
| **25** | | | |
| **20** | | | |
| **15** | | | |
| **10** | | | |
| **5** | | | |
| | *One s'more oven* | *Two s'mores oven* | *Three s'mores oven* |

**How many s'mores in the oven?**

*Above are sample results. The oven with more s'mores should take longer as they require more energy. Results will vary.

***Second Grade:***

Students will create bar graphs showing temperature before the oven cooked their smore and another showing how long it took the s'more to cook on different days. An extension might be to have students compare the data on a line graph to show how the temperature increased over time depending on the day. Which day would be more effective to cook the smores on?

- Science Notebook: Students draw what their ovens look like in its position to the sun. They do this for various styles of day. Students can draw their bar graphs for each day in their book and add the line graph as the culminating project.
- *Guiding Questions:* What kind of energy can we find in the room? Where does the energy come from? How do we use energy in our daily life? Which set s'mores took longer? Which sets took the least amount of time? Why do you think? How was energy used?
- *Consider:* How do we know something is melted or ready? Will different groups have different criteria for it? How does the time of year impact results (A standard is why does it feel hotter in the summer than winter?) Will a hot, cloudy (overcast) day cook as fast as

a sunny day? Does the sun's position impact cooking? Do s'mores still cook well in the shade?

Below is a sample bar graph:

| Time minute | **S'mores Cooking Trackers** | | | |
|---|---|---|---|---|
| **60** | | | | |
| **55** | | | | |
| **50** | | | | |
| **45** | | | | |
| **40** | | | | |
| **35** | | | | |
| **30** | | | | |
| **25** | | | | |
| **20** | | | | |
| **15** | | | | |
| **10** | | | | |
| **5** | | | | |
| | *Cold, Cloudy Morning* | *Cold, Cloudy Afternoon* | *Hot, Sunny Morning* | *Hot, Sunny Afternoon* |

**Environmental factors when cooking**

*Above are sample results. The oven with more s'mores should take longer as they require more energy. Results will vary.

| Heat (F) | **S'mores Cooking Trackers** | | | |
|---|---|---|---|---|
| ***120*** | | | | |

| | | | | |
|---|---|---|---|---|
| ***110*** | | | | |
| ***100*** | | | | |
| ***90*** | | | | |
| ***80*** | | | | |
| ***70*** | | | | |
| ***60*** | | | | |
| ***50*** | | | | |
| ***40*** | | | | |
| ***30*** | | | | |
| ***20*** | | | | |
| 10 | | | | |
| | *Cold, Cloudy Morning* | *Cold, Cloudy Afternoon* | *Hot, Sunny Morning* | *Hot, Sunny Afternoon* |

Bottom row is the cooking environment and temperature side shows what temperature before the s'more melted.

*Above are sample  results. The oven with more s'mores should take longer as they require more energy. Results will vary. Usually it takes about 85-90 degrees to start to cook.

***Collaboration***

We really worked as a team on this assignment. Chloe found the initial data webpage and then we brainstormed ideas on what aspects of the site we like best, how can we apply the information practically to both our grades, and then narrowed down a focus. Molly applied the standards more to the ideas as California uses NGSS, CCSS-M, and DRDP and Vancouver, Canada does not. Then we worked together on the write up and google slide editing and adding to the descriptions and activities.