Math Modeling Project: Correlating Cups
Monroe Co. Middle School
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**Modeling Activity:**

Summarize your activity demonstrating the authentic experience to draw meaningful connections to mathematics. This activity will make the student's mathematical learning relevant. Share any image, source and other relevant information. Keep it simple; this is not a full unit plan

To draw meaningful connections to mathematics, MCMS will be completing a school wide STEAM activity: Correlating Cups. Each of the grade levels (6th, 7th, and 8th) will set their own objectives with one goal in mind: Which cup keeps liquid hot or cold the longest? The temperature of the liquid will be determined by the season in which we decide to complete the project. If it is hot outside, we will keep the liquid as cold as possible; if it is cold, the liquid will be hot.

Being successful in learning will be determined by each individual teacher and the content they are trying to portray within the project. Standards and objectives are listed below. Overall, each MCMS student will be critiqued on the following items: creating a table, collecting data, and analyzing a graph based on grade level KAS and NGSS.

Our special education team will provide differentiation for students with modifications. Students with learning goals will have supplemental aids and services.

To gain a sense of ownership, all students are asked to bring in a cup of their choice: Ozark, Yeti, Solo, Mug, etc. If students do not have a cup, teachers will provide extras of different materials. Each student will measure the temperature of the contents throughout the day - collecting data each hour. To be considered hot, the temperature of the contents should be greater than room temperature. To be considered cold, the cup must still contain ice. With an ongoing Google Sheet, teachers will input the data collected by the students (to ensure the data is precise and unbothered by other grade levels). At the end of the day, each grade level teacher will compile their data into a scatter plot based on time of day to the temperature of the contents of the cup. Functions from Google Sheets will allow the teachers to complete the task quickly for efficient feedback for the students. Each cup will have its own unique data set. Lastly, based upon the grade level, students will be analyzing the data using proper vocabulary to show their understanding. Our school has an initiative for literacy, therefore students will write (potentially record using Flipgrid) about their observations and learnings of which cup would be the best at keeping drinks hot or cold.

**Engaging Context:**

How does the activity serve as an engaging context for the math concept(s) you teach?

This activity primarily serves as engaging for the students simply because they get to take part in their very own science experiment based off of a cup of their choice. Most students bring a steel walled cup/bottle (YETI, Hydroflask, Ozark Trail, etc.) to school

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| every single day. With that being said, it is such a neat activity for students to be able to take something that they use on an everyday basis and actually be able to test its limits. This also serves as a low-cost project because there will not be any buying of materials as students will be using what they already have, or what can be provided by teachers and/or the school. |

**Objectives:**

Objectives are clearly written and contribute to a unique work; they are measurable and linked to assessments. Objectives are written with Depth of Knowledge

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| **6th** | TBD by Mrs. Kelton (6th Grade Math) and Mrs. Copas (6th Grade Science) |
| **7th** | 1* Students will be able to create their own, unique display based off of their dataset at a 100% accuracy level.<br>2* Students will be able to make an educated hypothesis on which cup is better based off of the data they collect.<br>3* Students will be able to determine the numerical difference in quality between each cup based on visual overlap. |
| **8th** | 1* Students will be able to interpret a scatter plot as positive, negative, or no correlation at a 100% accuracy level.<br>2* Students can predict a line-of-best-fit based upon the scatter plot for their grade level at an 80% accuracy level.<br>3* Students can discuss what would have happened if conditions changed based upon outside factors. |

**Standards:**

Standards (particularly math; write out ALL applicable standards; integration encouraged)

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| **6th** | **KAS:** TBD by Mrs. Kelton (6th Grade Math)<br>**NGSS:** TBD by Mrs. Copas (6th Grade Science) |
| **7th** | **KAS:**<br>7.SP.0 - Create displays, including circle graphs (pie charts), scaled pictographs and bar graphs, to compare and analyze distributions of categorical data from both matching and different-sized samples.<br><br>7.SP.A.1 - Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.<br><br>7.SP.B.3 - Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. |

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| | **NGSS:**<br>ED.3 - Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. |
| **8th** | **KAS:**<br>8.SP.1 - Construct and interpret scatter plots for bivariate numerical data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association and nonlinear association.<br><br>8.SP.2 - Know that lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a line and informally assess the model fit by judging the closeness of the data points to the line.<br><br>**NGSS:**<br>ED.3 - Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. |

**Collaboration:**

How effective did your team work to create a modeling project?

Being from a small rural school, each of our team members are comfortable with collaborating together. We have been in each other's classrooms, almost daily, and know each other's teaching styles. With only 3 math teachers in the school, John and Emily have collaborated numerous times and have no trouble in being realistic in what "works" and what does not. Dallas and Chelsea are two of four in the special education department. They gave great insight on what changes could be made in each grade level for all students to be successful. Overall, each member feels this project could be a great opportunity for MCMS to become unified in learning. Furthermore, it allows students to see the connections that can be made between core content classes.

**Evidence:** Address the following in 1-2 pages:

How did you collect evidence? (Create a brief survey, or interview a few students about the activity).

To collect evidence from the students concerning their learning, each individual grade level will be requiring students to discuss their findings. With our literacy initiative, each class will be looking for content and grade level specific vocabulary. (It was suggested from the discussion board to possibly allow students to record their learning through Flipgrid, thus giving students choice within the activity.)

Sixth grade learning will be established by the 6th grade math teacher, Mrs. Kelton, and 6th grade science teacher, Mrs. Copas.

Seventh grade learning will be facilitated and implemented by the math teacher, Mr. Jackson, and STEAM teacher, Mrs. Shirley. They will specifically focus on students being able to construct their own visual that provides the correct representation of their data as well as gaining information based on their classmate's data. Students will also be looking for any "overlaps" in data that would represent commonalities between the cups.

Eight grade teachers, Mrs. Emmert and Mrs. Carter, will build upon the students' understanding of scatter plots and line-of-best-fit. Specifically, students will be assessed on their interpretations of the chosen line-of-best-fit (if one occurs) and through details given in their personal responses. Lastly, the eighth grade team will ponder and discuss the outcomes of the results if variables were changed. For example, the location of the cup in the room, insulated vs non-insulated cups, etc.

As mentioned, our special education team (Mr. Carnahan, Mrs. Hammer, Ms. Tooley, and Ms. Buchanan) will provide differentiation for students with modifications. Students with learning goals will have supplemental aids and services.

*Since this assignment is in the planning stages and it is currently summer, students have not been interviewed.

Did it enhance the understanding of the concept? (Note: this is not a formal evaluation but may include diagnostic, formative and summative assessment).

*This is solely a prediction of what we anticipate after completing this activity.

This activity is school wide, thus providing opportunity for chatter and curiosity amongst the students. Each grade level is completing the same activity with grade level concepts in mind. Teachers are to be facilitators, while students are the ones collecting, compiling, and analyzing the data gathered. It is the goal for students to have an authentic learning experience, but to also learn new concepts and review previous learning while having fun. With an activity like this one, there are so many concepts learned that curiosity will no doubt be a prominent occurrence throughout the whole project. However, at the end of the day, it is our hope that students' understand how data and graphs are so closely connected, how to correctly represent data in a visual, and experience experiments with their peers. With an experiment like this one, students are exposed to so many different outlets that make up a data set. A lot of the time, students are only collecting data or analyzing a graph, but this experiment allows for students to take ownership in their own product by providing the experimental object, collecting their own data, graphing their own data, and then analyzing the different parts that make up said data. A truly phenomena based activity for all.

Decisions concerning the assessments for 6th grade will be determined by the 6th grade teachers.

Students will be formatively assessed in 7th grade on the concepts of accurately collecting data as well as making inferences based on their data that they collected.

They will then be assessed on the quality, accuracy, and validity of their visual that they create.

Eighth grade students will be introduced to the mentioned concepts of scatter plots and line-of-best-fit through this activity. Formative assessments will be given after these introductory lessons and the students have had time to process their new learning.