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Subject: Math

Title: *Forget Aperture, this is MY test chamber* - Data and Statistics Final Project

Author:

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School / Organization, City and State / Province:

Shoreline, WA

Grade Level: 6th

Common Core Standards Met:

Develop understanding of statistical variability.

- 6.SP.1. Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. *For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.*
- 6.SP.2. Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.
- 6.SP.3. Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

Summarize and describe distributions.

- 6.SP.4. Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
- 6.SP.5. Summarize numerical data sets in relation to their context, such as by:
    - Reporting the number of observations.
    - Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
    - Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

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- Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

Time needed for lesson: Several class periods to design, collect and analyze data. These may be clumped together at the end of a data and statistics unit or spread throughout the unit.

Overarching Question and Objectives:

How can we use data and statistics to make sense of information gathered regarding video game play?

Summary of lesson:

This lesson is actually more of an outline for a culminating project in a data and statistics unit. Students will come up with a question based on a test chamber they create in the Puzzle Maker. They will then collect data by having other students play their level. After they have collected what they deem to be sufficient data they will use knowledge from their work with data and statistics to analyze the data, interpret it and present their findings to the class (graphs should be included in their findings). They should also be able to state some sort of implication for future data analysis from their findings. Lesson includes sample student page, final presentation requirements and rubric for assessment.

Vocabulary:

Students should be familiar with the basic vocabulary from sixth grade data and statistics, for example: mean, median, mode, range, quartiles, sample, etc.

Teacher materials needed:

If possible, a computer so that students can give a slideshow presentation of their findings.

Student materials needed:

* The Puzzle Maker

* Possibly access to spreadsheet software, or, data can be analyzed by hand

* PowerPoint type software for student presentations, or, students can create posters

Lesson Plan:

This project/assessment is meant to be a culmination of student knowledge throughout a unit on data and statistics. Some familiarity with the Puzzle Maker is assumed. *If students have not yet had a chance to explore the Puzzle Maker, additional time will be required in order for them to use it successfully.*

Essentially, students will be collecting data and information about a level they create in the Puzzle Maker. Students will need to come up with a question for which they can gather data. They may want to play around with the Puzzle Maker (and/or *Portal 2*) to get ideas. It is best not to give students too many examples of questions they could ask so that they have the opportunity to think creatively. For teaching purposes, here are some sample questions for which students could gather data:

- How long does it take people to make it through my test chamber?
- How many tries will it take other students in order to successfully pass my level?
- If I tell students the level is really hard, do they make more mistakes than if I tell them it easy? (*I had students in one of my classes use this question*)
- If I create a really hard room and offer people hints if they need them, how many people ask for hints? How many hints do they request?
- If I make two rooms, one that I consider easy and one that I consider hard, will people be able to solve the "easier" room faster?
- Do people who have played *Portal 2* move more quickly through my test chamber than people who have not?
- Will people solve the test chamber faster if we just set a stopwatch versus having me just watch them the entire time they play?
- How much faster will people solve my level if they play it twice?

The point for the questions is the students need to have some numbers to work with. If students come up with a very basic question, really encourage them to think more creatively. What kind of information could they gather that would be interesting to share?

Once they have come up with a question, they need to ensure that the room they've designed will indeed help them to answer the question they have asked. They should be able to articulate in writing how this test chamber will indeed allow them to gather the data they need, as well as any other resources that will be necessary to collect the information. Students will also need to explain how they are going to track their data (e.g., a spreadsheet, on paper, etc.).

Depending on the question students' are asking, it may be important that they not tell others what they are doing, so as not to skew their data.

Once they have submitted their plan, it is time for them to gather data. They will need to submit the data to you at the end because they will have to defend their thinking and be able to answer any questions you might have (for instance, if they dropped an outlier from their data they would need to explain why they did so).

After students have had time to collect data from their peers, it is now time for them to analyze their work using data and statistics. Hopefully in class you've had some discussions about the different measures of central tendency and the pros and cons of each. They should run a variety of statistics to analyze their data. For instance, they could do scatter plots to look for correlations. It is very important that their graphs make sense, for instance a line graph would not make sense for many types of questions, so therefore, they should not use one if they are not looking for change that occurs over time.

They will be submitting a final write-up to you on their level. This could be a written paper or something like a PowerPoint presentation. Their presentation should include their question, why their question interested them, a screenshot of their level, their data, their work from their analysis, a summary of their analysis (e.g., the answers), an interpretation of their findings

(were they surprised?), and a final statement (what they would have done differently or what they would do to enhance their study).

Having students present in front of the class and having them answer questions from their peers is also a great way to assess their understanding of their own material.

Below is a sample page of instructions for students and a sample rubric that could be used for assessment!

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Aperture Science is about to meet its match….*you*!

Here is your opportunity to conduct your own experiment on a group of test subjects, also known as your classmates. ☺

You will be designing a test chamber for your classmates to play. When you design your chamber, you should have a question in mind. This question needs to be one that you can collect data for (otherwise, your experiment will not work).

Once you have a question, you will write a proposal to me. Your proposal will have:

*Your question
*A brief description of how your room and experiment will get data to answer the question
*A few sentences about how you will gather/record your data

When you have my approval for your test, it's time to gather data! You will probably want to keep your question confidential. Once you have data, you need to use knowledge from our unit on data and statistics to analyze your data, and hopefully, discover something interesting from your experiment.

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Finally, you will present your experiment to the class. The requirements are on the next page.

Final Presentation

You will create a poster or slideshow that contains the following elements:

- Your question
- Why you picked your question
- A screenshot of your test chamber
- All of your data
- Your work for your analysis (what measures did you use?)
- A summary of your analysis including at least one graph
- An interpretation of your findings (what they mean)
- A final statement (what would you differently or where would you go from here?)

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Rubric for Portal Experiment

	3	2	1
Proposal	All elements are included with testable question and a clear explanation of how data will be gathered.	One element of proposal is not clearly defined, all elements are included and it appears that question and data collection will work.	Proposal is lacking in clarity and it is not evident how data will be gathered to support the question.
Data	Sufficient amount of data is collected for analysis. The data collected matches the question asked and is organized neatly.	Data collected matches the question asked but there is either not a sufficient amount of data to analyze or the organization is lacking in some way.	Data collection did not occur as planned. The data is not sufficient or is organized in such a way that analysis will not work.
Analysis	Student clearly demonstrates an understanding of how to analyze data. At least five different mathematical ways of analyzing data were used.	Student demonstrates an understanding of how to analyze data. Four different mathematical ways of analyzing data were used.	Student does not demonstrate an understanding of how to analyze data. Three or less ways of analyzing data were used.
Accuracy	All computations were computed accurately.	At least 80% of computations were computed accurately.	Less than 80% of computations were computed accurately.
Summary	Two visual interpretations of the data were included and were properly selected. Student description of statistics is correct.	At least one visual interpretation of the data was included that properly represents the data. Student description of statistics is mostly correct.	No visual interpretations of the data were included that properly represent the data. Student description of the statistics is incorrect.
Final Presentation	Includes all of the required elements. Student was well-prepared and able to address questions posed by peers and teacher.	Includes at least 90% of the required elements. Student was able to speak about the project and answer most questions posed by peers and teacher.	Includes less than 90% of the required elements. Student had difficulty speaking about the project and could not answer most questions posed by peers and teacher.

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