



Drexel-SDP GK-12 ACTIVITY

M&M Statistics

Subject Area(s): Math, Statistics

Associated Unit: None

Grade Level 6 (6-10)

Activity Dependency: Knowledge of addition, subtraction, multiplication and division

Time Required: 75 minutes

Group Size: 1

Expendable Cost per Group: \$1

Summary: The goal of this activity is to introduce the idea of statistics and why they are important to engineers. Additionally this activity serves to reinforce important math concepts and ideas like percentages, decimals, fractions and how to convert between the three. Additionally the students are reintroduced to graphing for added reinforcement.

Engineering Connection: Statistics is the science of collecting and analyzing numerical data in large quantities especially for the purpose of finding relationships between proportions in the sample which can be used to infer relationships in a larger dataset. Essentially this means studying numbers in a small set of data in order to figure out how things are proportioned in a large data sample. Engineers use statistics to assess everything. They allow us to evaluate our designs and assess demand for our products and services. Additionally, statistics provide us with a tool to determine the effectiveness of our work.

Keywords: Statistics, math, hypothesis.

Educational Standards

- Math: Pennsylvania Standards 2.1.6.D, 2.1.6.C, 2.1.6.E, 2.2.6.B, 2.2.6.C, 2.8.6.D, 2.4.6.A, 2.4.6.F

Pre-Requisite Knowledge

- Ability to add, subtract, multiply and divide.
- An idea of how to calculate percentages, decimals and fractions

Learning Objectives

After this lesson, students should be able to:

- Discuss why statistics are important and what engineers use them for.
- Calculate percentages from raw data
- Convert between percentages, fractions and decimals
- Make bar graphs and pie charts from a data table

Materials List

Each group needs:

- 1 bag of M&Ms candies. The variety of M&Ms can either be kept the same for the whole class or can be divided evenly amongst multiple kinds of M&Ms.

To share with the entire class:

- 1 data table

Introduction / Motivation:

Statistics is an interesting branch of math. It turns out that all the fractions and decimals and percentages that you practice using all the time are used in statistics! Statistics is a kind of math that is concerned with collecting data and analyzing it. For instance news stations use exit polls to study presidential elections. A certain number of people are asked about how they voted and then that information is used to guess how everyone voted before the results are in. In addition statistics are used to show what percentage of Americans own a particular car or how many of each color of M&M are in each bag. Engineers in particular use statistics a great deal. They use them to study how often a car air bag will fail or what the chance is that a certain bridge will collapse.

There are a few important things to know about statistics. The small group of things that is looked at to make estimates about the whole is called a sample. The group of every single thing of one item is called a population. In our example a sample would be a few bags of M&Ms while a population would be all the bags of M&Ms ever made. As the size of our sample increase so does the chance that we are accurately representing the entire population. For example the more people surveyed after an election the better idea we have about exactly how the population voted.

We will use statistics to look at M&Ms and make guesses about why Mars Corporation makes their bags the way they do.

Vocabulary / Definitions

Word	Definition
Statistics	A branch of math concerned with collecting and analyzing data
Percentage	A proportion multiplied by 100
Hypothesis	An educated guess about what the outcome of an experiment will be.
Average	Summation of all data divided by the number of data points
Error	Difference between what is expected and what is found

Procedure

Background

- Statistics is the science of studying a small sample of a certain thing in order to infer data about the whole sample of all of those like things. For instance it is expensive and difficult for a scientist to look at all the person in the world who have naturally blonde hair in order to determine their eye color. It is much more feasible to collect a sample of people with blonde hair and record the different colors of their eyes. We then have information about what proportion of the sample has blue eyes for instances and if our sample is sufficient we will be able to infer that a certain proportion of blonde haired people also have blue eyes.

Statistics essentially gives us a way to study smaller groups instead of the daunting task of studying every single person or item in a particular set. Engineers in particular use a great deal of statistics. We use them to assess how well a certain part works or to figure out under an impact speed of 35 mph how much of a car will be smashed and what chance the driver has of being injured. Obviously we cannot test all cars by smashing them at 35mph so instead we smash a sample of them to make sure they are within our safety standards. The materials we use to build bridges are tested to see how much load they can hold and other manufactured goods are tested for safety or quality by simply taking a sample instead of every item (the entire population) of a particular type.

Try to drive home to the students the point that everyone uses statistics (not even just engineers). Very good examples are exit polls used during presidential campaigns and statistics you read in the news paper about the percentage of Americans that watch a particular TV show.

In terms of mathematics focus on having your students calculate the proportions of M&M colors and drive home the idea of converting between fractions, decimals and percentages. You can also strongly reinforce their graphing skills with this activity. Finally, remember to reintroduce the concept of a hypothesis (an educated guess about the outcome of an experiment) and explain that engineers and scientists use hypothesis as a way of writing down their thoughts about how an experiment will work out.

With the Students

1. Each student is asked to make a hypothesis about whether or not there are different percentages of each color of M&M in each bag. Have them write their hypothesis on their worksheet.
2. Each student is then given 1 individual size bag of M&Ms.
3. Students are asked to pour the contents of their M&M bag onto a clean sheet of paper.
4. Students are to count the number of each color of M&M in the bag and record it in the data table
5. To follow up the students are asked to give the percentage of the candies that are each color and the decimal and fraction associated with those percentages
6. Students are finally asked to make bar graphs and pie charts for the data in their tables
7. The teacher then collects all the data using a final class table.
8. Students should use calculators to find the average percentage of each color per bag of M&Ms.
9. Present students with the Mars corporation official statistics for M&Ms colors.
10. Have the students compute the error between their statistics and the Mars Corporation statistics.

Attachments

1. Handout for each student with introductory questions and data table.
2. Bar graph handout for each student.

Safety Issues

- Only if there are issues with student allergies to chocolate

Investigating Questions

1. Was your original hypothesis correct?
2. What does the data tell you about the percentages of M&M colors in each bag?
3. Why would Mars Corporation have bags that contain different percentages of different colors of candies?
4. What could we do to improve our statistics?

Assessment

Pre-Activity Assessment

Students should write a small paragraph in their engineering journal giving an example of another case in which engineers would use statistics.

Activity Embedded Assessment

Student graphs and their calculations of percentages, fractions and decimals and the error between Mars Corp stats and class stats.

Post-Activity Assessment

Students should answer the investigation questions..

Activity Scaling

- For lower grades, only perform the activity as stated in this lesson.
- For upper grades, this lesson can be extended to discuss more advanced statistical methods like chi-square tests and other calculations.

References

Mars corporation statistics can be found at, <http://us.mms.com/us/>.

Owner

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