Hands-On Math Pre-Algebra

by

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Contents

To the Teacher

Since the early 1970's we have been teaching math to learners of all ages, from young children to adults, who represent many different cultures and socioeconomic backgrounds. We believe that all learners can do math by first overcoming any math anxiety and then participating in meaningful cooperative learning activities that foster the four major standards of Communication, Problem Solving, Connections, and Reasoning. These standards are founded in the Curriculum and Evaluation Standards for School Mathematics (1989), grades K–12. The draft of the content framework for *"Equipped for the Future" Standards for Adults* (1998) suggests that for adults to be "equipped for the future," they must be able to problem solve, make decisions, and communicate effectively using math concepts and technology in an ever-changing world.

Our goal is to encourage all learners to "know math by doing math." To this end, we have developed activities called "labs" that enable the learner to discover mathematical concepts through a hands-on approach. Cooperative learning skills are developed through group activities in which each learner participates collaboratively as a team member. Communication skills are fostered through group discussion and written reactions to lab discoveries. Many of the labs are connected to real-life situations. Other labs require learners to form generalizations about mathematical revelations.

As you look through the labs you will notice that many labs cluster around mathematical concepts of fractions, percents, geometry, and number relationships. Many of the labs require each group to report to the whole class. We suggest that teachers document these responses on the board or overhead for the whole class to see. This allows the students to look further at possible number patterns and relationships.

Probably the most important lab in our book is the lab entitled *Math Alphabet Soup*. In order for any of these labs to be successful, students should be made comfortable in the classroom. Many come with high levels of math anxiety and lack skills sufficient to work in groups. Beginning your course with the *Math Alphabet Soup* activity allows the students to vent their anxieties, realize they are not alone in their feelings, and begin to find ways to overcome this anxiety. It has been our experience that addressing math anxiety is very important in creating a classroom environment that will foster success.

Another suggestion we have is to begin journal writing in your math classroom. A journal could consist of some mathematical question the student must answer along with a reflection on their learning process. We have gained much knowledge about each of our students through their journal entries. Journals can be used as an alternative means of assessing whether a student *understands* a concept as well as checking the student's confidence level.

As teachers, we believe learning should be learner centered, not teacher driven. The response from our learners has been favorable. As one student said, "Thank you for turning my math disability into a math ability."

— Pam and Judy

m&m's™ and Math

Teacher Page

Learning Outcome

Students will be able to:

- recognize a ratio (a comparison of two numbers by division).
- express a ratio as a fraction, decimal, and percent.
- understand the statistical terms **mean** and **median**.
- use data from a chart to calculate a mean and a median.

Overview

Students will use m&m's to find ratio, percent, mean, and median of the various colors, and will compare individual data to class data.

Time

Two 45–60-minute periods

Team Size

Three to four students

Materials

Bags of m&m's for each student (1.69 oz. or 47.9 g size or larger); paper towels to put m&m's on; calculators; 9" paper plate

Procedure

Activity One

1. Caution students not to eat the m&m's until they have finished steps 1 and 2 of Activity One.
2. If students have no prior knowledge of percents, don't teach them but use the lab as a starting point to see what they know about percents. Their knowledge will become evident when you ask them to estimate the percent of each color from their ratios and then write their strategies for making these estimations.
3. If you feel students need direct teaching on how to calculate the actual percent, model step 6 of the lab. This lab can reinforce fractions, decimals, and percent equivalents, or it can be an introduction to the concepts.
4. After all groups have calculated their percents of each color, create a class data chart on an overhead or the blackboard, similar to the chart on page 85. Have students record their individual data on the chart, then study all the data.

(continued)

5. Discuss each team's observations. Ask why some students got a total of 100 percent while others computed over or under 100 percent for their totals. On the overhead or blackboard, list their reasons for these discrepancies. The main reason is that rounding each percent can sometimes make the total seem greater or less than 100 percent. If students carried their percents out to two or more decimal places, the margin of error would be minimal.

Activity Two

1. If students have never been introduced to the statistical terms of **mean** and **median**, teach a mini-lesson before students engage in the activity.
2. Students' ages, temperatures, and basketball scores are good examples to show mean and median. Regardless of the data you choose to use for modeling, place the data on the board randomly. Discuss **mean** first, as many students probably have been introduced to the concept of the average or heard of the average temperature for a particular time span or the average score or grade, etc. Ask students to discuss with their teams examples of where they have heard the word **average** used. Then have them write their thoughts on their lab sheet and discuss them with the whole class.
3. Take one of their most frequent ideas and have students help you make up sample data to demonstrate how you calculate the mean, which is nothing more than the average. Tell them they must find the total of their data and then divide by the number of data entries represented. Allow use of the calculator.

   Example: Average high temperature for the week of July 4 in Florida is calculated by taking the week's daily highs (89, 93, 95, 88, 94, 96, 92), finding the total, and dividing by 7 (days).
4. After you model two or three examples, have students return to their teams to see if they can determine the generalization or formula for calculating any mean problem. The following is the algebraic formula, but many responses will be given, depending on the math skills of the students.

$$\frac{x_1+x_2+x_3+\ldots+x_n}{n} = m$$

5. Next, use the temperature data used to model the mean to introduce the median. See first if any student knows or has heard the word **median**. Tell students the data must be listed in a special way, from smallest to largest numerical value, to calculate the median. While modeling, tell students that in a list containing an odd number of data, the median is always the middle number, but for an even number of numbers, the median is the average of the two middle numbers.
6. Using the sample data generated from the class for the mean, have students calculate the median and compare the two. Have them discuss with their teams what they notice about the mean and the median.

(continued)

7. Now students have a foundation for calculating the mean and the median in activity 2 using their m&m's data.
8. Have students work in their teams to calculate the mean and median.
9. After students read the statistic on the percentages of each color that should be in their bags, have them answer the questions.

Extensions

- In a 16 oz. bag of m&m's, there are approximately 500 candies. About how many of each color would be in the bag? (brown—150; yellow—100; red—100; green—100; orange—50)
- Calculate the weight of each m&m in a 16 ounce bag with approximately 500 candies in it.

$$\left(\frac{16}{500} = .032 \text{ ounces}\right)$$

- According to the information on the bag, one serving is about 1.5 oz. How many servings would be in a pound package?

$$\left(\frac{16}{1.5} = 10.6\bar{6} \text{ servings}\right)$$

How many pieces in each serving?

$$\left(\frac{.032}{1 \text{ m\&m's}} = \frac{1.5}{? \text{ m\&m's}} \text{ or } \frac{1.5}{.032} = 46.875 = 47 \text{ m\&m's}\right)$$

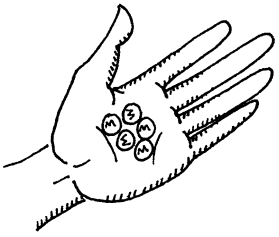
- If there are 240 calories in one serving of m&m's, about how many calories does each m&m contain?

$$\left(\frac{240}{46.875} = \frac{?}{1} = 5.12 \text{ calories in each m\&m}\right)$$

Name _____ Date _____

m&m's™ and Math

Activity One



1. Open your bag of m&m's and organize them in some way. Please **do not eat any** until you have finished the lab. Share with your partners how you organized your m&m's. Write what you observe about the contents of your bag.

_____

_____

2. Count the m&m's in your bag. Total m&m's: _____
   How many of each color are represented in your bag? Record the totals below.

   Green _____ **Orange** _____ **Red** _____

   Blue _____ **Yellow** _____ **Brown** _____

3. What ratio does each color represent? A ratio is a comparison of two numbers to show a relationship. The ratio of each color would be

$$\frac{\textbf{number of each color}}{\textbf{total in bag}}$$

   Write the ratio for each color below.

   Green _____ **Orange** _____ **Red** _____

   Blue _____ **Yellow** _____ **Brown** _____

4. Place a paper plate upside down on your table or desk. Arrange your m&m's by color around the circumference of the plate. Make a complete circle. The complete circle represents one whole, or 100%, so:

   half the circle represents _____%

   one quarter of the circle represents _____%

(continued)

Name _____ Date _____

m&m's™ and Math *(continued)*

5. Using your circle of m&m's as a visual aid, estimate the percent of each color.

   Green _____ **Orange** _____ **Red** _____

   Blue _____ **Yellow** _____ **Brown** _____

6. Please explain how you estimated the percent each color of m&m represented in your bag. Discuss your strategies with your partners. Write your explanation for the most reasonable strategy.

   _____

   _____

   _____

   _____

   _____

7. Do you know how to calculate the actual percent of each color found in your bag? _____ If so, calculate the actual percents and record them. If not, here's how: Use your calculator to divide the number of each color by the total number in the bag. Multiply your answer by 100 to get the percent.

$$\frac{\text{total of one color m\&m}}{\text{total m\&m's}} \times 100 = \_\_\_\_\_\%$$

   Green _____ **Orange** _____ **Red** _____

   Blue _____ **Yellow** _____ **Brown** _____

   Add together the percents for all the colors to get the total percent. Write it here.

   _____

(continued)

Name _____ Date _____

m&m's™ and Math *(continued)*

8. Post your results on the class data chart. Log all the data on the chart below, and total the results.

m & m Class Data Chart

Name	Percent Green	Percent Orange	Percent Red	Percent Blue	Percent Yellow	Percent Brown

(continued)

Name _____ Date _____

m&m's™ and Math *(continued)*

9. After examining the class data, what observations can you make?

_____

_____

_____

_____

Activity Two

1. Discuss with your partners real-life situations in which you have heard the word **average** used. List them below. Be ready to discuss your thoughts with the entire class.

_____

_____

_____

2. After you and your class have discussed real-life situations, make up sample data to fit the situations mentioned. Record the data below, then compute the average for each.

Situation #1	Situation #2	Situation #3
_____ Average	_____ Average	_____ Average

(continued)

Name _____ Date _____

m&m's™ and Math *(continued)*

3. Write a generalization or way to determine the average (also called the **mean**) for any given situation. Discuss it with your partners and be ready to share with the class.

_____

_____

_____

4. Now discuss the word **median**. Have you or anyone in your group heard this word used? What do you think it means?

_____

_____

_____

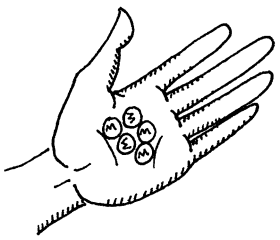
5. After your teacher explains and models the median for you, use the data from step 2 to determine the median for each set of data. Calculate below.

6. Can you and your team draw any conclusions about the mean and median based on your calculations? If so, what are they?

_____

_____

_____



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Name _____ Date _____

m&m's™ and Math *(continued)*

7. Using the data from the m&m's chart, calculate the mean and median percent for each color.

Mean %

Green _____ **Orange** _____ **Red** _____

Blue _____ **Yellow** _____ **Brown** _____

Median %

Green _____ **Orange** _____ **Red** _____

Blue _____ **Yellow** _____ **Brown** _____

8. According to statistics, if you examine many bags of m&m's, you will find that about **30** percent of the candies are brown, **20** percent yellow, **20** percent red, **10** percent green, **10** percent blue, and **10** percent orange.

   a. Which figure—the mean or the median—do you think was used to calculate the above statistics? Please explain.

   _____

   _____

   b. How did your bag of m&m's compare with these data?

   _____

   _____

   c. What conclusions can you draw from this activity?

   _____

   _____