Title: How Many Green M&M’s Should I Have?

Course: Math 8

Grade Level: Eighth Grade

Unit Length: 5 Days

Materials: Bags of M&M’s, colored pencils, graph paper, TI-73 graphing calculator

Laura Samulski
Objectives for the Unit

1. Students will be able to collect and analyze their own data.

2. Students will be able to represent their data in different types of graphs such as bar graphs, circle graphs and scatterplots.

3. Students will be able to analyze graphs and understand what the graphs represent.

4. Students will be able to calculate the mean, median, mode and range and understand what these statistics represent.

5. Students will be able to analyze data and graphs and draw conclusions using the information.

6. Students will be able to enter lists and create graphs on the TI-73 graphing calculator.

7. Students will be able to calculate the mean, median, mode and range using the TI-73 graphing calculator.
NCTM Standards

- Understand patterns, relations, and functions.
  - Students will be able to represent, analyze and generalize a variety of patterns with graphs, tables and words.

- Use mathematical models to represent and understand quantitative relationships.
  - Students will be able to model and solve conceptualized problems using various representations such as graphs, tables and equations.

- Formulate questions that can be addressed with data and collect, organize and display relevant data to answer them.
  - Students will formulate questions, design studies and collect data about a characteristic shared by two populations.
  - Students will select, create and use appropriate graphical representation of data, including histograms, box plots and scatterplots.

- Select and use appropriate statistical methods to analyze data.
  - Students will be able to discuss and understand the correspondence between data sets and their graphical representations, especially histograms, stem and leaf plots, box plots, and scatterplots.

- Develop and evaluate inferences and predictions that are based on data.
  - Students will use observations about differences between two or more samples to make conjectures about the populations from which the samples were taken.
  - Students will make conjectures about possible relationships between two characteristics of a sample on the basis of a scatterplot.

- Make and investigate mathematical conjectures.

- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
• Create and use representations to organize, record, and communicate mathematical ideas.
NYS Standards

• #1B: Make and evaluate conjectures and arguments, using appropriate language.
  - Explain and show solution processes in a variety of ways (words, numbers, symbols, pictures, charts, graphs, tables, diagrams, and models)
  - Clarify problems using discussion with peers.

• #5D: Use statistical methods and measures of central tendencies to display, describe and compare data.
  - Interpret graphs, tables, scales, and charts by making comparisons and calculations.
  - Use appropriate statistical measures to compare data.
  - Organize and display collected data using appropriate tables, charts, or graphs including histograms, broken line, circle graphs, stem and leaf plots, and box and whisker plots.

• #5E: Explore and produce graphic representations of data (calculators/computers may be used.)
  - Use graphing calculators to organize and analyze data.
  - Construct histograms and frequency polygons.
Resources


Materials and Equipment

1. Individual size bags of plain M&M’s.

2. Colored Pencils especially brown, red, blue, yellow, green, and orange.

3. Graph Paper. I prefer to make my own graph paper on the handouts that the students receive using my TI-73 graphing calculator but separate sheets of graph paper of any size may also be used.


5. Overhead projector. Transparencies of the charts that students will be filling out may also be used but are not required.

6. Overhead screen for the graphing calculator so that the students can see the teacher’s calculator screen while they are doing the activities.

7. Graph Link so the calculator can be connected to the overhead.
Overview

I. Day 1
   A. Students will collect data by counting how many of each color M&M they have in their bag and record the data in a chart.
   B. Students will arrange their M&M’s according to color in the form of a bar graph. They will then use their colored pencils to draw the bar graph they created on their handouts.
   C. Students will then arrange their M&M’s in order by color in the form of a circle. They will then use their colored pencils to draw their circle graph on their handout.

II. Day 2
   A. Students will enter the data they collected on day 1 into lists on their calculator. They will create one list named “color” in which they will enter the different colors of M&M’s and another list named “Number” in which they will enter the amount of each color M&M in contained in their bag.
   B. Students will create a bar graph using the information entered in the lists.
   C. Students will create a circle graph using the information entered in the lists.

III. Day 3
   A. Students will come up to the overhead and enter their individual data in a chart. They will each be given a bag number, and they have to enter their bag number and the number of green M&M’s they had in their bag.
   B. Students will then enter the class data in to lists on their calculator. They will enter the bag numbers in to list 1 and the number of green M&M’s in to list 2.
   C. Students will create a scatterplot using list 1 and list 2 and answer questions on the graph.
IV. Day 4
   A. Students will use list 1 and list 2 to create a bar graph of all the green M&M’s contained in each bag.
   B. Students will then calculate the mean, median, mode and range of the green M&M’s using the TI-73 calculator.

V. Day 5
   A. Students will work with a partner to analyze the data and graphs they created during the week and make conjectures about what the data and graphs represent.
Day 1

Objectives: Students will be able to create a bar graph and a circle graph using data they collected.

Outline:

1. Each student should receive a project instruction sheet which explains what they will have to do in this week’s activity.

2. Each student should receive a bag of plain M&M’s, a handout and a box of colored pencils. Have students open their bag and count how many of each color M&M’s are in the bag. They should enter their data in to the chart provided.

3. When students are finished recording their data, have them arrange the M&M’s in order by color to create a bar graph. They must then use their colored pencils to draw their bar graph on their handout.

4. When students have completed the bar graph, they should then arrange their M&M’s by color in the form of a circle on their handout. They should then connect the edges of the color sections to the center of the circle to create a circle graph. They should use their colored pencils to fill the chart in.

5. Hand out homework sheet.
**Project Description**

We have received a letter from Mr. Peanut, CEO of the company that makes M&M’s. He needs your help with a problem. Here is the copy of the letter.

Dear Sir or Madam;

Our corporation is looking for a few good statisticians to help us out with a problem. The M&M corporation has received complaints that there are not enough green M&M’s in each bag. One of our main goals is to keep our customers happy so we have decided to look into this problem. Although we do not guarantee how many of each color M&M will be in each bag, we would like to know the statistics on what the bags actually contain. We would like you to come up with these statistics for us and complete the report that we have sent to you. We truly appreciate your help in this matter.

Sincerely,

MR. Peanut

CEO

Throughout the week you will gather different forms of data and statistics and represent them in different types of graphs. At the end of the week, you will use the information you gathered to fill out the report for Mr. Peanut.
Open your bag of M&M’s and count how many of each color is contained. Record your data in the chart below.

<table>
<thead>
<tr>
<th>Color</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td></td>
</tr>
</tbody>
</table>
Now arrange your M&M’s in the form of a bar graph. Sketch your bar graph below.

Arrange your M&M’s in the form of a circle with all of the colors grouped together. Sketch your circle graph below.

Homework Questions:

1. Does the bar graph accurately represent your data? Why or why not?_____________________________________________________
   _________________________________________________________
   _________________________________________________________
   _________________________________________________________
2. Does your circle graph accurately represent your data? Why or why not?_____________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

3. Which graph do you think better represents your data? Explain your answer.___________________________________________
   __________________________________________________________
   __________________________________________________________

Name:_____answer key (sample)___________________________________
Day 1 Handout

Open your bag of M&M’s and count how many of each color is contained. Record your data in the chart below.

<table>
<thead>
<tr>
<th>Color</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>8</td>
</tr>
<tr>
<td>Red</td>
<td>14</td>
</tr>
<tr>
<td>Blue</td>
<td>7</td>
</tr>
</tbody>
</table>
Green
12
Yellow
6
Orange
7

Now arrange your M&M’s in the form of a bar graph. Sketch your bar graph below.

Arrange your M&M’s in the form of a circle with all of the colors grouped together. Sketch your circle graph below.
Homework Questions:

4. Does the bar graph accurately represent your data? Why or why not? __students_should_say_yes_and_give_a_valid_reason.__

5. Does your circle graph accurately represent your data? Why or why not? __students_should_say_yes_and_give_a_valid_reason.__

6. Which graph do you think better represents your data? Explain your answer.  Answers will vary.
Day 2

Objectives:

- Review of bar graphs and circle graphs
- Use technology (TI-73 graphing calculator) to create bar graphs and circle graphs.

Outline:

1. Each student should take out the data they collected on day 1. They also should have their TI-73 graphing calculator and should be given the day 2 handout.

2. Students should enter their data from day 1 in to lists on the calculator following the teacher, who will be doing it on the overhead, and the steps on the handout.

3. When students have entered their data in to lists, they should follow instructions on how to create a bar graph on the calculator. Again the teacher should go through the steps on a calculator linked to the overhead. Students will be asked to sketch their graph.

4. Students should the create a circle graph on their calculator following the steps on the handout. The teacher should also follow the steps on the overhead. Students should sketch their graph on the handout.
To do this activity you need your data from Day 1 and your TI-73 graphing calculator.

1. Press the “LIST” button on your calculator. You should see the following screen.

2. Scroll through your lists until you come to a blank list. We are going to name this list “Colors”. To name this list be sure that your curser is where you want the name to be. To enter the text press 2nd MATH. You should see the following screen.

3. We want to name our list “COLORS”. We need to type the name in and be sure that it has quotation marks around it. When you are finished typing press DONE.
4. When you have pressed DONE you will return to your lists. Press ENTER and the name COLORS will appear at the top of your list.

5. Now you should enter the color names in to the list by following the same steps you took on #4 and #5.

6. Press the right arrow button to scroll over to the next list. Name this list number and enter the number of each color M&M you had in your bag.

7. We are now ready to create a bar graph. Go to 2\textsuperscript{nd} PLOT. Make sure your curser is on plot 1 and press ENTER. First be sure to turn the plot on. Then choose the bar graph. For categorical list we need to type in COLORS. To do this make sure you have your cursor on the
list and press 2nd Text. Then type in colors. For Data List 1 we need to type in NUMBERS. When you are done your screen should look like the one below.

8. When your plot screen is ready press graph and you should see your bar graph. Sketch it in the box below.

9. Now we are going to create a circle graph. Go back to 2nd PLOT. Again, chose PLOT 1. This time choose the circle graph. Make sure that your categorical list is COLORS and your data list is NUMBERS. Then make sure the word number is highlighted. Then press graph. Sketch your circle graph below.
Day 2 Handout

To do this activity you need your data from Day 1 and your TI-73 graphing calculator.

1. Press the “LIST” button on your calculator. You should see the following screen.

2. Scroll through your lists until you come to a blank list. We are going to name this list “Colors”. To name this list be sure that your curser is where you want the name to be. To enter the text press 2nd MATH. You should see the following screen.

3. We want to name our list “COLORS”. We need to type the name in and be sure that it has quotation marks around it. When you are finished typing press DONE.
4. When you have pressed DONE you will return to your lists. Press ENTER and the name COLORS will appear at the top of your list.

```
<table>
<thead>
<tr>
<th>L5</th>
<th>L6</th>
<th>COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COLOR(1) =</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

5. Now you should enter the color names in to the list by following the same steps you took on #4 and #5.

```
<table>
<thead>
<tr>
<th>L5</th>
<th>L6</th>
<th>COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>BROWN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RED</td>
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<tr>
<td></td>
<td></td>
<td>BLUE</td>
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<td></td>
<td>GREEN</td>
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<td>YELLOW</td>
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<td>ORANGE</td>
</tr>
<tr>
<td>COLOR(7) =</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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6. Press the right arrow button to scroll over to the next list. Name this list number and enter the number of each color M&M you had in your bag.

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<table>
<thead>
<tr>
<th>L6</th>
<th>COLOR</th>
<th>NUMBE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BROWN</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>RED</td>
<td>14</td>
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<td></td>
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<td>YELLOW</td>
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<td>ORANGE</td>
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Day 2 Homework.

1. In the space provided, compare the bar graph you drew to the one you created on the TI-73.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

2. In the space provided, compare the circle graph you drew to the circle graph you created on the TI-73.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

3. Using the following data, create a bar graph on your TI-73.

A survey was taken of 100 students to find out what their favorite food was. The following are the results.

<table>
<thead>
<tr>
<th>Food</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pizza</td>
<td>40</td>
</tr>
<tr>
<td>Tacos</td>
<td>15</td>
</tr>
<tr>
<td>Hamburgers</td>
<td>15</td>
</tr>
<tr>
<td>Hot Dogs</td>
<td>20</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
</tr>
</tbody>
</table>

Sketch your bar graph below.
Now create a circle graph using the same data. Sketch your graph below.
Day 2 Homework.

1. In the space provided, compare the bar graph you drew to the one you created on the TI-73.
   ______They_are_the_same______________________________
   ____________________________________________________
   ____________________________________________________
   ____________________________________________________

2. In the space provided, compare the circle graph you drew to the circle graph you created on the TI-73.
   ________They_are_the_same______________________________
   ____________________________________________________
   ____________________________________________________
   ____________________________________________________

3. Using the following data, create a bar graph on your TI-73.

   A survey was taken of 100 students to find out what their favorite food was. The following are the results.

<table>
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<td>Hot Dogs</td>
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<tr>
<td>Other</td>
<td>10</td>
</tr>
</tbody>
</table>
Sketch your bar graph below.

Now create a circle graph using the same data. Sketch your graph below.
Day 3

Objectives:
- Students will be able to create and understand information provided in a scatterplot.
- Students will be able to use their TI-73 graphing calculators to create their scatterplot.

Outline:
1. Each student should take out the data that they collected on day 1 and should be given a day 3 handout. The teacher should ask each person to come to the overhead and put their information in the chart. The class should also record the information on their handout.

2. Students should put the information in to lists on their calculator following the steps in the handout and the teacher.

3. The students should then create a scatterplot for the color brown to see if the information is consistent.
Day 3 – transparency

<table>
<thead>
<tr>
<th>Bag #</th>
<th>Brown</th>
<th>Red</th>
<th>Blue</th>
<th>Green</th>
<th>Yellow</th>
<th>Orange</th>
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</tr>
</tbody>
</table>
1. We are going to create a scatterplot to try to determine if the brown M&M’s are consistent in each bag. Go to LIST and enter the bag numbers from your chart in to List1. Then enter the number of brown M&M’s in each bag in to List2.

2. We are now going to create our scatterplot. Press 2$^{\text{nd}}$ PLOT. Chose the scatterplot. Then make sure your Xlist is L1 and your Ylist is L2. You should then have the following screen.

3. Now press ZOOM. We want to select ZoomStat. Your scatterplot should come up automatically. Sketch it in the box below.
<table>
<thead>
<tr>
<th>Bag #</th>
<th>Brown</th>
<th>Red</th>
<th>Blue</th>
<th>Green</th>
<th>Yellow</th>
<th>Orange</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>14</td>
<td>7</td>
<td>12</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>9</td>
<td>4</td>
<td>9</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
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1. We are going to create a scatterplot to try to determine if the brown M&M’s are consistent in each bag. Go to LIST and enter the bag numbers from your chart in to List1. Then enter the number of brown M&M’s in each bag in to List2.

2. We are now going to create our scatterplot. Press 2\textsuperscript{nd} PLOT. Chose the scatterplot. Then make sure your Xlist is L1 and your Ylist is L2. You should then have the following screen.

3. Now press ZOOM. We want to select ZoomStat. Your scatterplot should come up automatically. Sketch it in the box below.
1. What does the scatterplot that you created in class tell you about the consistency of brown M&M’s in each bag?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

2. Use your TI-73 to create a bar graph displaying the brown M&M information.

3. Use the data collected in class to create a scatterplot of the number of red M&M’s in each bag. Sketch your graph below.
1. What does the scatterplot that you created in class tell you about the consistency of brown M&M’s in each bag?
   The number of brown M&M’s is not consistent.

2. Use your TI-73 to create a bar graph displaying the brown M&M information.

3. Use the data collected in class to create a scatterplot of the number of red M&M’s in each bag. Sketch your graph below.
Day 4

Objectives:
- Students will be able to calculate the mean, median, mode and range of a set of data.
- Students will be able to use their TI-73 calculator to calculate the mean, median, mode and range.

Outline:

1. Students will need the information collected in class on day 3, their TI-73 calculator and a handout. Students should enter the number of brown M&M’s each bag contained in to their calculator. They should then calculate the mean, median, mode and range using their TI-73 calculator.
1. Using the classes data, enter the number of brown M&M’s contained in each bag into lists in your calculator.

2. Now we must return to our home screen. If you are not there, press 2\textsuperscript{nd} QUIT. We want to calculate the mean of our data. Press 2\textsuperscript{nd} STAT. You should see the following screen.

3. Chose MATH and then Chose mean(.

4. After you have chosen mean(, press 2\textsuperscript{nd} STAT and chose the list your data is in from the list. Then press ENTER. Your mean should be calculated automatically.

   Mean = __________

5. Follow the same steps to calculate the median.

   Median = __________
6. Follow the same steps to calculate the mode.

   Mode = ____________

7. Now calculate the range. This can be done right on your home screen.

   Range = ______________

**Questions:**

1. What is the mean? What does the number you found to be the mean tell you about the data?

2. What is the median? What does the number you found to be the median tell you about the data?

3. What is the mode? What does the number you found to be the mode tell you about the data?

4. What is the range? What does the number you found to be the range tell you about the data?
1. Using the classes data, enter the number of brown M&M’s contained in each bag in to lists in your calculator.

2. Now we must return to our home screen. If you are not there, press 2nd QUIT. We want to calculate the mean of our data. Press 2nd STAT. You should see the following screen.

3. Chose MATH and then Chose mean(. 

4. After you have chosen mean(, press 2nd STAT and chose the list your data is in from the list. Then press ENTER. Your mean should be calculated automatically.

   Mean = _____10.5_____

5. Follow the same steps to calculate the median.

   Median = ___10_______
6. Follow the same steps to calculate the mode.

   Mode = _____8,9______

7. Now calculate the range. This can be done right on your home screen.

   Range = ______12_______

**Questions:**

8. What is the mean? What does the number you found to be the mean tell you about the data?

   The mean is the average. The mean of my data tells me the average number of brown M&M’s in a bag.

9. What is the median? What does the number you found to be the median tell you about the data?

   The median is the middle number. This tells me what number is in the middle when the numbers are lined up in order from least to greatest.

10. What is the mode? What does the number you found to be the mode tell you about the data?

    The mode is the number that appears most often. This tells me what number of brown M&M’s is most common.

11. What is the range? What does the number you found to be the range tell you about the data?
Day 5

Objectives:

- Students will be able to analyze their data to make conjectures about what it means.

Outline:

1. Students will analyze data and fill out a report to show what all of the data means when put together. The report will be done on the handout provided. The teacher should be available for questions and problems.
Report on Green M&M’s

1. Using a TI-73 graphing calculator, create a bar graph showing how many green M&M’s were contained in each bag the team of statisticians analyzed. Sketch your graph below.

2. Using your calculator, create a circle graph showing how many green M&M’s were contained in each bag. Sketch your graph below.

3. Using your calculator, create a scatterplot showing how many green M&M’s were contained in each bag. Sketch your graph below.
4. Use your calculator to calculate the mean, median, mode and range of the number of green M&M’s contained in each bag.

   Mean = __________

   Median = __________

   Mode = __________

   Range = __________

5. In the space below, write a paragraph explaining to Mr. Peanut what the information you collected in #1-4 above tells you about the number of green M&M’s in each bag of M&M’s. Be sure to explain how you came to these conclusions based on each graph and the statistics.
Report on Green M&M’s

1. Using a TI-73 graphing calculator, create a bar graph showing how many green M&M’s were contained in each bag the team of statisticians analyzed. Sketch your graph below.

2. Using your calculator, create a circle graph showing how many green M&M’s were contained in each bag. Sketch your graph below.

3. Using your calculator, create a scatterplot showing how many green M&M’s were contained in each bag. Sketch your graph below.
4. Use your calculator to calculate the mean, median, mode and range of the number of green M&M’s contained in each bag.

Mean = ____11.35_____
Median = ____11_____
Mode = _____13_____ 
Range = _____6_____

5. In the space below, write a paragraph explaining to Mr. Peanut what the information you collected in #1-4 above tells you about the number of green M&M’s in each bag of M&M’s. Be sure to explain how you came to these conclusions based on each graph and the statistics.

Students should explain that the graphs show that the number of green M&M’s in a bag are not consistent. If they were the bars on the bar graph should be close to even, the sections of the circle graph should be the same and the scatterplot should form a horizontal line.

The students should also suggest that if Mr. Peanut wants to have the bags be even he should put about 11 green M&M’s in each since the mean and median were both near 11. They should have an explanation of what this suggests.