TE Learning Task: Candy Populations
Adapted from Birdville County, Texas Probability and Statistics Unit

In this task, students will draw inferences about a population of M&Ms based upon random samples of M&Ms using proportional reasoning developed in unit three.

STANDARDS ADDRESSED IN THIS TASK

MCC7.SP.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.

MCC7.SP.2: Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples of the same size to gauge the variation in estimates or predictions.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
3. Construct viable arguments and critique the reasoning of others.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

In order for students to be successful, the following skills and concepts need to be maintained:

- Understand how to construct a proportional relationship and identify how parts of proportions are related
- Solve a proportion for an unknown variable
- Use multiplication and division or rational numbers to solve real-world problems

*It is very important that students already know how to set up a proportion in order to solve this task. This is not a learning task, but a performance task that helps to further develop student reasoning about samples and populations not proportions.
COMMON MISCONCEPTIONS

- Students may believe that one random sample is not representative of the entire population. Many samples must be taken in order to make an inference that is valid. By comparing the results of one random sample with the results of multiple random samples, students can correct this misconception.

ESSENTIAL QUESTIONS

- What is a random sample?
- How can random samples be used to make predictions about populations?
- Does a sample have to be random to make accurate predictions about populations?
- How are proportions used to estimate information about populations?

MATERIALS

- M&Ms *Trial Sized may be easier
- Small plastic bags
- Paper plates or paper towels
- Task Sheet

GROUPING

Small Groups

TASK DESCRIPTION

To begin this task:
1. Give each student a small bag of M&Ms with approximately 10-15 M&Ms in each.
   *Note: Each bag needs to represent a random sample- teachers need to make sure that M&Ms are not assorted by color. Each group should have a total of 50-60 M&Ms. Trial sized M&Ms may be the best sample because they are already pre-packaged.
2. Pass out additional materials and task sheets

TE Performance Task: M&M Populations

*NOTE: The following solutions are based upon a group of five sets of 10 M&Ms. Numbers will vary depending on sample sizes that teachers create for their students.

1. Count the number of EACH color of M&Ms and record your answers in a frequency table. Make sure to label your frequency table clearly.

   Solution:
   Students may choose a variety of different frequency tables, including a tally chart or line plot.
2. Using the results from your group, fill in the following chart and find the number of M&Ms for each person in your group and the total number of M&Ms. Find the percentage of each color of M&Ms for your sample.

Suppose that a group of students received the following samples:

<table>
<thead>
<tr>
<th>M&amp;M Color</th>
<th>Number of M&amp;Ms in Sample # 1</th>
<th>Number of M&amp;Ms in Sample # 2</th>
<th>Number of M&amp;Ms in Sample # 3</th>
<th>Number of M&amp;Ms in Sample # 4</th>
<th>Number of M&amp;Ms in Sample # 5</th>
<th>Number of M&amp;Ms in ALL Samples</th>
<th>% of Each Color of M&amp;Ms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>11</td>
<td>( \frac{11}{50} = 22% )</td>
</tr>
<tr>
<td>Orange</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>( \frac{6}{50} = 12% )</td>
</tr>
<tr>
<td>Yellow</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td>( \frac{6}{50} = 12% )</td>
</tr>
<tr>
<td>Green</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>7</td>
<td>( \frac{7}{50} = 14% )</td>
</tr>
<tr>
<td>Blue</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>( \frac{8}{50} = 16% )</td>
</tr>
<tr>
<td>Brown</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>12</td>
<td>( \frac{12}{50} = 24% )</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>50</td>
<td>100%</td>
</tr>
</tbody>
</table>

Answer the following questions about your sample:

3. Is your sample random? Explain your answer.

Yes, our teacher gave us the M&Ms in a random assortment.
4. Do you think your sample could predict the number of M&Ms in a larger bag? Why or why not?
   \textit{Yes, because we have a small, random sample that we can use to make predictions for a larger bag of M&Ms, as long as they are the same kind of M&Ms.}
   \textit{Teachers should point out that samples need to be representative. For example, it does not make sense to use Mini-M&Ms to estimate for a large bag of Peanut M&Ms.}

5. Do you think that the percentages of each color of M&Ms are the same as other groups? Why or why not?
   \textit{No. Other groups received different samples of M&Ms. Percents may be close to one another but they will not be the exact same.}

6. Using your data values, estimate the number of M&Ms for EACH color for a bag of 1000 candies. (Hint: Use a proportion)

   \textit{Students will use proportional reasoning to estimate the different percentages of each M&M color in a given population.}
   \textit{It is important to help students recognize that this type of reasoning is ONLY truly valid when using valid, random samples.}

   \textbf{NOTE: The following solutions are taken from the above samples. Answers will vary as students use varying sample sizes and amounts}

<table>
<thead>
<tr>
<th>Color</th>
<th>Estimate for Number of M&amp;Ms in a Population of 1000 M&amp;Ms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>$\frac{11}{50} = \frac{x}{1000}$ $50x = 11(1000)$ $50x = 11000$ $x = \frac{11000}{50} = 220 M&amp;Ms$</td>
</tr>
<tr>
<td>Orange</td>
<td>$\frac{6}{50} = \frac{x}{1000}$ $50x = 6(1000)$ $50x = 6000$ $x = \frac{6000}{50} = 120 M&amp;Ms$</td>
</tr>
<tr>
<td>Yellow</td>
<td>$\frac{6}{50} = \frac{x}{1000}$ $50x = 6(1000)$ $50x = 6000$ $x = \frac{6000}{50} = 120 M&amp;Ms$</td>
</tr>
</tbody>
</table>
Green

\[
\frac{7}{50} = \frac{x}{1000}
\]

\[
50x = 7(1000)
\]

\[
50x = 7000
\]

\[
x = \frac{7000}{50} = 140 \text{ M&Ms}
\]

Blue

\[
\frac{8}{50} = \frac{x}{1000}
\]

\[
50x = 8(1000)
\]

\[
50x = 8000
\]

\[
x = \frac{8000}{50} = 160 \text{ M&Ms}
\]

Brown

\[
\frac{12}{50} = \frac{x}{1000}
\]

\[
50x = 12(1000)
\]

\[
50x = 12000
\]

\[
x = \frac{12000}{50} = 240 \text{ M&Ms}
\]

DIFFERENTIATION

Extension

- Have students create an accurate circle (pie) graph to represent the percentages of each sample and compare them between each sample group to discuss random sampling
- Students can create a circle graph in Excel using data entries found in this task, and also use the same method to create circle graphs for the entire population of M&Ms to make comparisons

Intervention

- Small groups can be given examples to help guide them through this performance task
- Sample sizes and population sizes can be adjusted to help guide students through this task
SE Performance Task: Candy Populations

1. Count the number of EACH color of candies and record your answers in a frequency table. Make sure to label your frequency table clearly.

2. Using the results from your group, fill in the following chart and find the number of M&Ms for each person in your group and the total number of M&Ms. Find the percentage of each color of M&Ms for your sample.

<table>
<thead>
<tr>
<th>Candy Color</th>
<th>Number of candies in Sample # 1</th>
<th>Number of candies in Sample # 2</th>
<th>Number of candies in Sample # 3</th>
<th>Number of candies in Sample # 4</th>
<th>Number of candies in Sample # 5</th>
<th>Number of candies in Sample # 6</th>
<th>Total Number of candies in ALL Samples</th>
<th>% of Each Color of candies</th>
</tr>
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<tbody>
<tr>
<td>Red</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Green</td>
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<td></td>
</tr>
<tr>
<td>Blue</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Number of M&amp;Ms in Sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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3. Is your sample random? Explain your answer.

4. Do you think your sample could predict the number of M&Ms in a larger bag? Why or why not?

5. Do you think that the percentages of each color of M&Ms are the same as other groups? Why or why not?

6. Using your data values, estimate the number of M&Ms for EACH color for a bag of 1000 candies. Record your data in the table below.

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<tr>
<td>Green</td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td></td>
</tr>
<tr>
<td>Brown</td>
<td></td>
</tr>
</tbody>
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