Overview:
After studying probability and normal distributions, we will now look at sampling distributions. In this activity we will be introduced to the sampling distributions of proportions. We will see how drawing conclusions from sample data requires an understanding of randomness. Samples will vary from sample to sample not in a haphazard way but in a predictable manner allowing us to draw meaningful conclusions about the underlying population.

Part 1
Task 1 (group work)
Consider the population of the M&M candies manufactured by Mars Candies. The colors produced for a traditional bag of M&M's are red, brown, yellow, blue, green and orange. Let's take a guess at what the distribution of these colors is.

Red:       Brown:   Yellow:       Blue:       Green:       Orange:

Now suppose that you want to learn about the distribution of these colors of candies but can only afford to take a sample of 50. In our experiment, we will consider one bag of M&M's as our sample of 50. (Exact counts will vary from bag to bag, but that's another chapter!)
a) Open your bag of M&M’s (DO NOT EAT YET!) and using the sheet of paper provided, group them by color. Record the results of your “sample” in the table below. (Once you have recorded your results, you may enjoy your M&M’s.)

<table>
<thead>
<tr>
<th>M&amp;M Color</th>
<th>Red</th>
<th>Brown</th>
<th>Yellow</th>
<th>Blue</th>
<th>Green</th>
<th>Orange</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative Frequency</td>
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<tr>
<td>Proportion</td>
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</tbody>
</table>

b) What is the proportion of red M&M’s in your sample?

c) Is this a statistic or a parameter?

d) What is the symbol used to represent this?

e) Do you know the proportion of red M&M’s manufactured by Mars Candies?

f) Would this be a statistic or parameter?

g) What is the symbol used to represent this?
Task 2 (class participation)

a) Create a dotplot of individual sample results:

b) Did everyone obtain the same proportion of red M&M's?

c) Calculate the mean proportion from the individual samples.

d) Comment on the shape, center and distribution of these sample proportions.

e) What would be a better guess of the true proportion of Red M&M's, an individual sample proportion or the mean of the sample proportions?

This simple, perhaps obvious, experiment illustrates a very important statistical property known as sampling variability. Values of sample statistics will vary from sample to sample.
f) In what way would the dotplot have looked different if each student took a sample of only 10 candies?

g) In what way would the dotplot have looked different if each student took a sample of 100 candies?