Interactive Graphing

Overview

There are plenty of tools available to generate instant graphs of student answers, if the questions are multiple-choice. But what if the questions are student-generated data? And what if your class is online and non-synchronous? How do you collect data and build a graph, letting students see the combined results from the entire class, when the data points are being generated at any hour of the day or night, over the course of several weeks?

For my Plants, Plagues & People class, I had students use an external tool to run simulations of disease spread in a population. It was a great tool, and it let students change variables to see how population density, mixing, and immunity (vaccination) impacted the spread of disease. But I wanted the students to see how their own individual results fit in with a more statistically valid sample: the simulations run by the entire class. I wanted a way to have each student enter his or her own data, and have it instantly incorporated into a graph of all of the data submitted up to that point in time. There wasn't a tool for that!

My "stuff you can use" is a way to build real-time data collection and graphing into a Canvas page. This would be a great tool for any situation in which your class is generating data and you want to compile it quickly, in class or online. The students simply enter their data into a form on the Canvas page, and the embedded graph changes as each new data point is added.
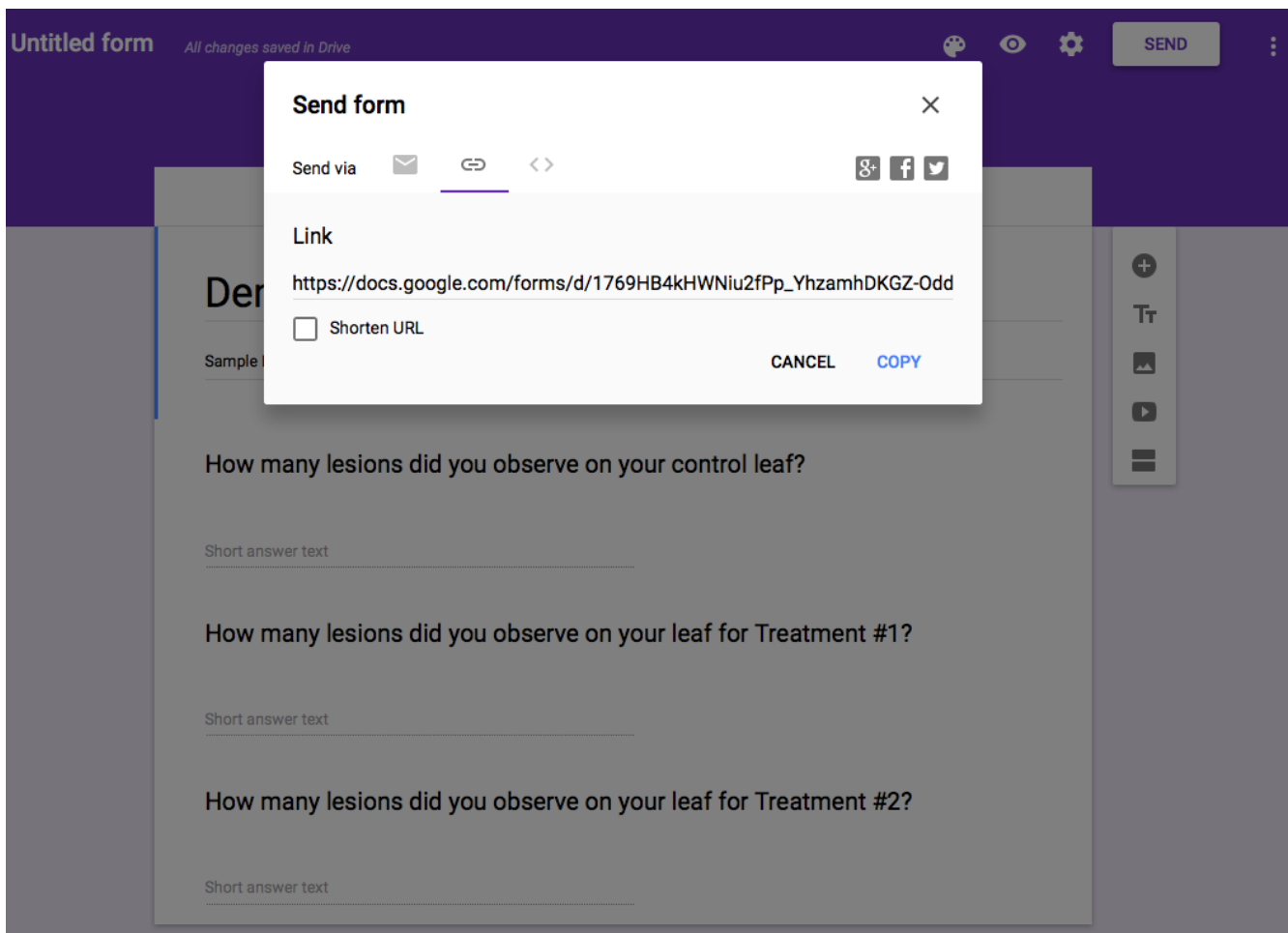
Instant Graph Instructions:

Using Google Docs tools
If you want to use Google Docs tools, you will have to have a Google account, but your students will not. This method should not be used for any sort of private data.

1. Log in to Google and go to Google Forms (https://docs.google.com/forms/). Use the "Start a new form" link to build your data collection form.

- Edit the question field with your data request question. For example: How many lesions did you observe on your control leaf?
- Using the drop-down menu, change the answer type to "short answer."
- Click on the "show more" icon (three dots) to drop down the additional options menu, and select "data validation."
- In the resulting drop-down options, select "number" and "is number" to restrict your responses to numerical data. You can also use this to further limit input options (e.g., number is greater than or equal to zero). If you like, you can customize the error text that students will see if they try to enter a non-numerical answer.
- Continue adding questions until you have a question for each data point to be collected. When you are finished, click "SEND" to get a link for the survey form. Click the link icon to copy the form link immediately. Paste it into a safe place for your records. Then click the "<>" icon to get the embed link. Copy this link, too; you will use this to embed the form into your Canvas page.

2. Enter some test data.
- Paste your survey link into the browser bar in a new tab, and enter some data. This will allow you to test the function and appearance of your graph.

3. Return to your form and click on "Responses" at the top of the form.

Demonstration Data: Stuff You Can Use

Sample Data

How many lesions did you observe on your control leaf?

Short answer text

How many lesions did you observe on your leaf for Treatment #1?
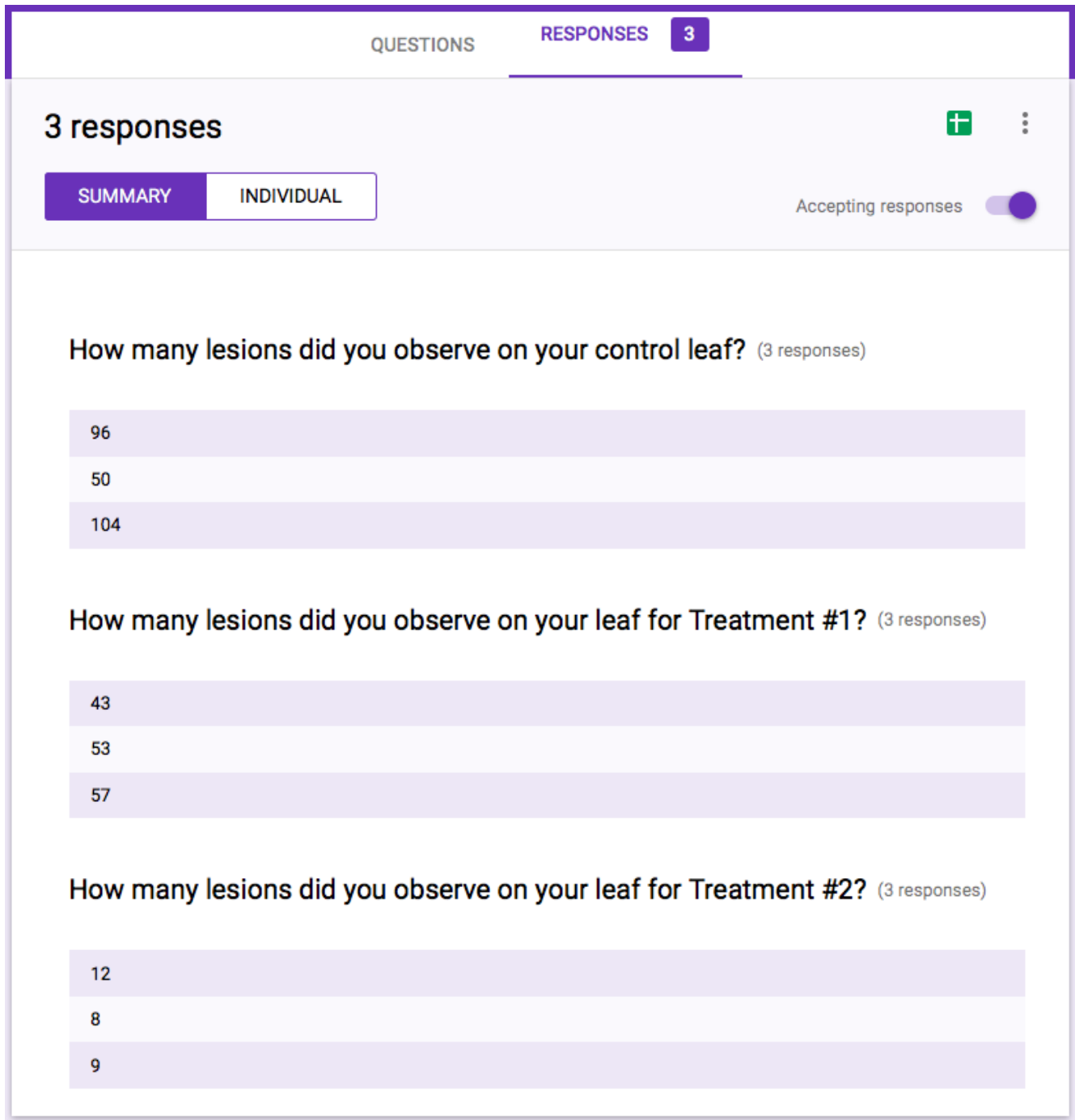
Short answer text

How many lesions did you observe on your leaf for Treatment #2?

Short answer text

4. Click on the green "create spreadsheet" icon to create a Google Docs spreadsheet that will be linked from this survey. (You can also select the "more options" icon (three dots) and select "Select response destination" from the menu options.) Unless you have already created a spreadsheet for this data in Google Docs, leave the "new spreadsheet" option selected, and click "create." A new spreadsheet will open with your data.

3 responses

SUMMARY   INDIVIDUAL

Accepting responses 🔘

How many lesions did you observe on your control leaf? (3 responses)

96
50
104

How many lesions did you observe on your leaf for Treatment #1? (3 responses)

43
53
57

How many lesions did you observe on your leaf for Treatment #2? (3 responses)

12
8
9

5. Because you will want to graph the means, not the individual data, select a row below where you expect your data to end, and insert the means formula for each column of data. This is the same formula used in Excel software: =Average(x:y), where x:y is the data range.
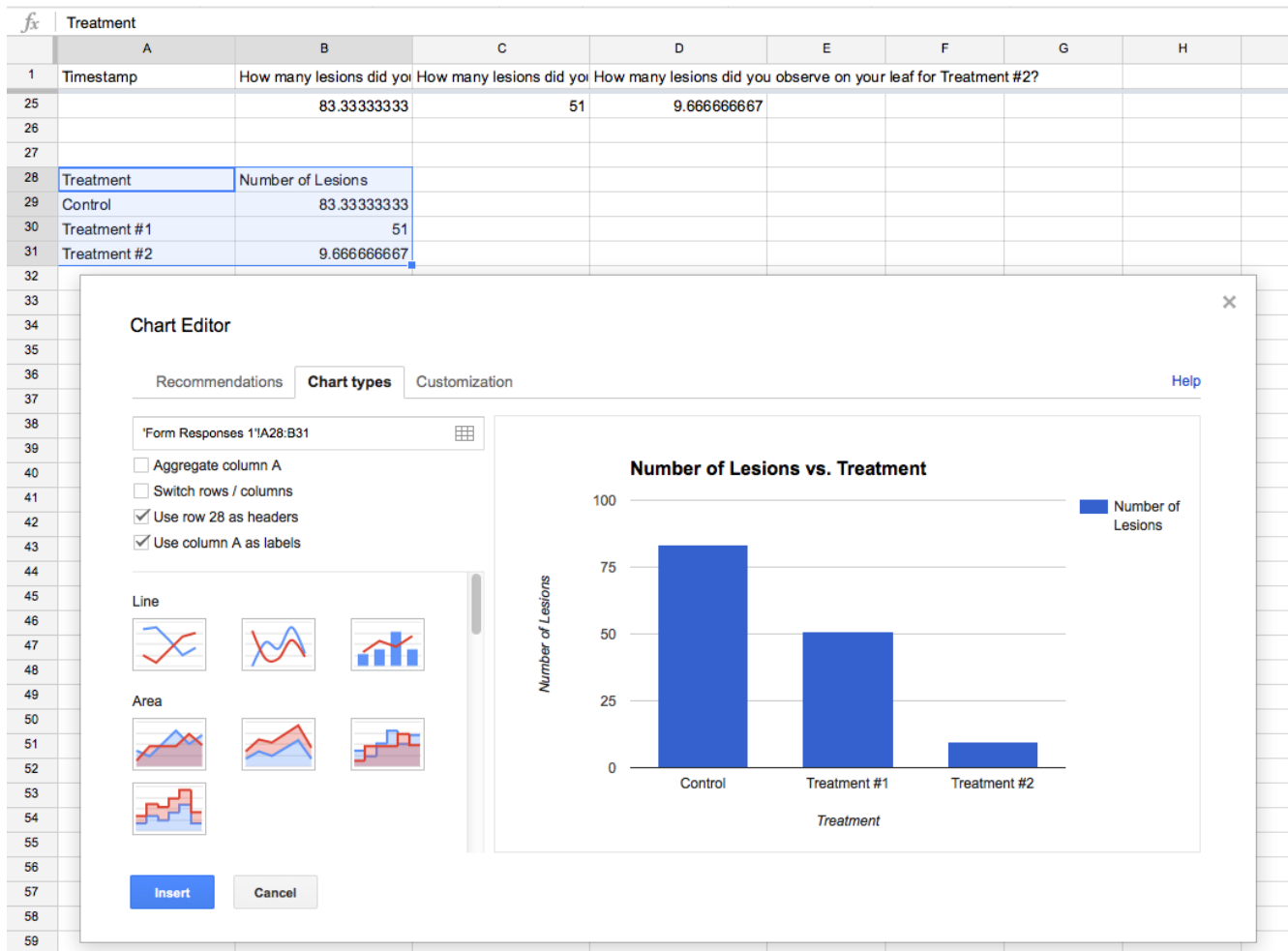
6. Create your data graph. You can use any graph type; this example will use a simple column graph.

- For the column graph, your data has to be in columns on your spreadsheet. To set up your data correctly, choose a new location below your means and enter your treatment names

in one column and set each corresponding value in the adjacent column by setting the value as equal to your means cell.
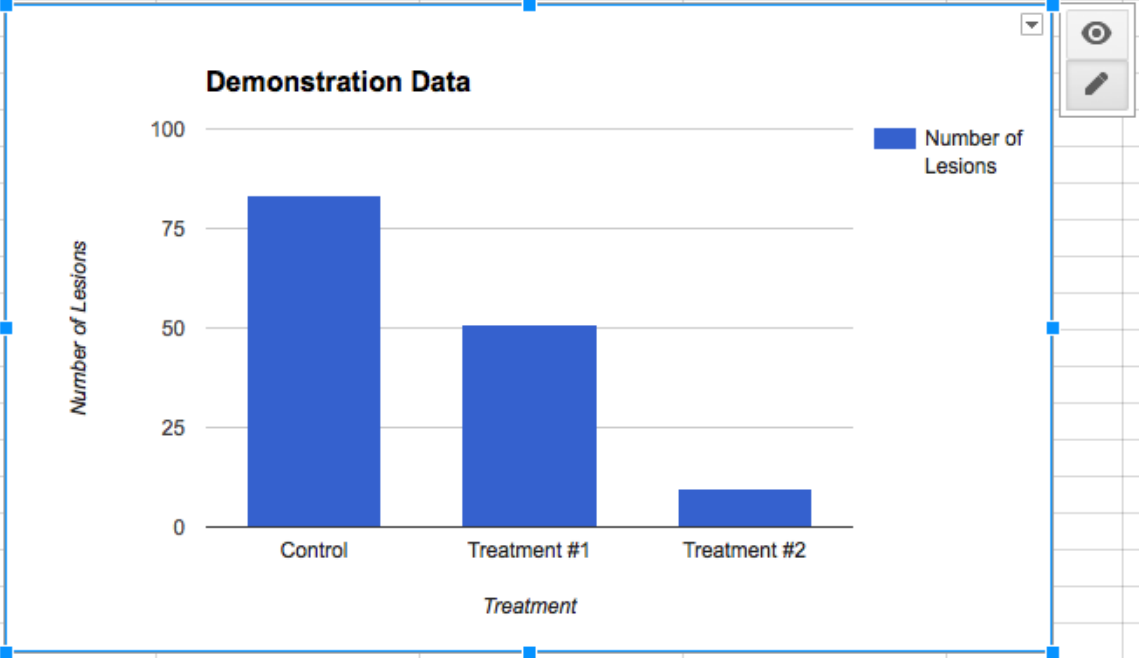
Untitled form (Responses) ☆ ▮

File   Edit   View   Insert   Format   Data   Tools   Form   Add-ons   Help   All changes saved i

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	A	B	C	D
1	Timestamp	How many lesions did yo	How many lesions did yo	How many lesions did yo
21				
22				
23				
24				
25		83.33333333	51	9.666666667
26				
27				
28				
29	Control	83.33333333		
30	Treatment #1	51		
31	Treatment #2	9.666666667		
32				

- Add headers, as desired; these will appear by default as the axis titles.
- Select your newly organized summary data (treatment names and means) and click on the "insert chart" icon in the toolbox at the top of the spreadsheet. 📊
- In the Chart Editor window, select the chart type desired.
- Click the "Chart types" tab to customize how the chart tool uses your data (e.g., use column A as labels).
- Click the Customization tab to add a chart title, select colors, etc.

- Close the Chart Editor to view your chart on your spreadsheet. Click the small down arrow in the upper right-hand corner of the chart to get the chart options menu. Select "publish chart."
- Make sure that the publish option is set to "Interactive," not "Image."
- Click the drop-down arrow at "Published content & settings" and make sure that the "Automatically republish when changes are made" box is checked.
- Click "Publish."
- Copy the link and paste it in the same safe place where you put the link to your data form. Then click the "Embed" tab and copy and paste that link, too.

	Treatment	Number of Lesions
26		
27		
28	Treatment	Number of Lesions
29	Control	83.33333333
30	Treatment #1	51
31	Treatment #2	9.666666667
32		

Demonstration Data

Number of Lesions

Treatment	Number of Lesions
Control	83
Treatment #1	50
Treatment #2	9

Y-axis: Number of Lesions (0, 25, 50, 75, 100)
X-axis: Treatment (Control, Treatment #1, Treatment #2)

	Treatment	Number of Lesions
28	Treatment	Number of Lesions
29	Control	83.33333333
30	Treatment #1	51
31	Treatment #2	9.666666667

Demon (chart: Number of Lesions, axis 0, 25, 50, 75, 100)

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Link   Embed

[Demonstration Data ⇕]   [Interactive ⇕]

Publish

▾ Published content & settings

[Entire Document ▾]

[Start publishing]

☑ Automatically republish when changes are made

7. Embed your data entry survey and graph into a Canvas page.
- Go to "Pages" in your canvas course shell. If a front page has already been created, click "view all" and then "add a page."
- Give your page a title, and add your desired text to introduce your data form.
- Click on the HTML Editor link to switch views.
- In the HTML view move to the next line beyond your introductory text, and paste the embed link for your survey.

Results for Class Demonstration

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Last week, we set up an experiment at our field site. We had a control plot and two treatment plots: Treatment #1 and Treatment #2. This week, each student was asked to return to the plots, collect a leaf from each plot using the sampling protocol given, and count the lesions. Please enter your lesion counts into the following form:

p

Options | Only teachers ▾ | can edit this page

☐ Notify users that this content has changed   Cancel   Save & Publish   Save

Results for Class Demonstration

i Rich Content Editor

```
<p>Last week, we set up an experiment at our field site. We had a control plot and two treatment
plots: Treatment #1 and Treatment #2. This week, each student was asked to return to the plots,
collect a leaf from each plot using the sampling protocol given, and count the lesions. Please enter
your lesion counts into the following form:</p>
<p> </p>

<iframe src="https://docs.google.com/forms/d/
OddTpK5aWeCAQ9Y/viewform?embedded=true" width="760" height="500" frameborder="0"
marginheight="0" marginwidth="0">Loading...</iframe>
```

- Click the "Rich Content Editor" link to return to rich content view. You should see a gray, sizable box. Drag the corners to size the box as you like.
- Click "Save" to view the results. You should now have your data survey embedded into your Canvas page.

8. Embed your results graph into the Canvas page.
   - Using the steps above, you can set up your results graph in the same page as the data survey, or you can create a separate page for the graph, depending upon how and when you wish to present the graph to your students. If you place the graph below the survey, they can see the graph, add their data, and see how the graph changes. If you don't want students to see the graph before entering their data, you can place the graph on its own page and control access to the results page.

Results for Class Demonstration

Last week, we set up an experiment at our field site. We had a control plot and two treatment plots: Treatment #1 and Treatment #2. This week, each student was asked to return to the plots, collect a leaf from each plot using the sampling protocol given, and count the lesions. Please enter your lesion counts into the following form:

How many lesions did you observe on your control leaf?

Your answer

How many lesions did you observe on your leaf for Treatment #1?

Your answer

How many lesions did you

Below, you can view the results from the entire class. This graph will update itself as each student adds his or her data.

Demonstration Data

Bar chart titled "Demonstration Data" with y-axis "Number of Lesions" (0 to 100) and x-axis "Treatment" showing Control (~84), Treatment #1 (~51), and Treatment #2 (~9). Legend: Number Lesions.