

# **Achieving STEM Fair Success Presenting your Findings- Basic**

Presented by the SLB Outreach Committee

# SLB Introductions!

## Some PSAs:

- Safety screening deadline is Dec 31st!
- Fair updates are on the website
- Follow us on instagram @gsdsef for updates, new workshops, etc
- Follow our youtube channel for workshop replays and safety/screening/applying tutorials

# Agenda

Please hold your questions until the end or ask them in the chat!

- Organizing Results
  - Analyzing Data
  - Labeling Tables and Graphs
  - Examples: Graphing from Tables
  - Examples: Calculating averages and percentages
  - Breakout rooms: 1. Calculating Rates and Percentage Difference. 2. Using Excel to create tables and graphs. 3. Using Googlesheets to create tables and graphs
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# Putting Together Your Project Report: Components

Today's Focus

Table of contents

Abstract

Introduction and Literature Review

Hypothesis and Purpose

Materials and Methods

Results & Data

Data Analysis & Discussion

Conclusion

Acknowledgements and Bibliography

Appendix (raw data) (varies in size)

# Findings: Organize the Results



- Raw numerical data goes in tables
- Graphs are made from Tables
- Qualitative data should also be organized (e.g. photos, description)
  
- All data goes into the appendix
- Don't leave anything out or skip any information. Some of the best science discoveries come from our "mistakes."

# Findings: Analyzing the Data

1. **After organizing** the data/results in charts, tables, and graphs--
2. **Review and Interpret** the Data/Results – Do the Math!
3. **Summarize/Discuss** the Data/Results



**What makes a good  
figure or graph?**



Temperature (Celsius)	Item 1	Item 2	Item 3
11.9°	\$185	\$511	\$441
14.2°	\$215	\$558	\$488
15.2°	\$332	\$447	\$377
16.4°	\$325	\$567	\$497
17.2°	\$408	\$399	\$329
18.1°	\$421	\$561	\$491
18.5°	\$406	\$478	\$408
19.4°	\$412	\$302	\$232
22.1°	\$522	\$288	\$218
22.6°	\$445	\$410	\$340
23.4°	\$544	\$264	\$194
25.1°	\$614	\$339	\$269

Favorite Subject	# of students
European History	14
American History	48
World History	22
Calculus	41
Algebra	11
Geometry	32
Biology	45
Chemistry	13
Physics	48
English Language	40
English Literature	22
Spanish	14

Time (hours)	Species 1	Species 2
0	0	0
2	2	4
4	7	18
6	12	50
8	27	60
10	47	65
12	98	68

Ranking	Percent of people
0	36
1	3
2	12
3	24
4	18
5	7

What’s the correlation in these numbers?

# Labeling A Table

11.9	185.00	232.00	162.00
14.2	215.00	537.00	467.00
15.2	332.00	320.00	250.00
16.4	325.00	218.00	148.00
17.2	408.00	364.00	294.00
18.1	421.00	413.00	343.00
18.5	406.00	462.00	392.00
19.4	412.00	433.00	363.00
22.1	522.00	544.00	474.00
22.6	445.00	593.00	523.00
23.4	544.00	539.00	469.00
25.1	614.00	503.00	433.00

# Labeling a Table

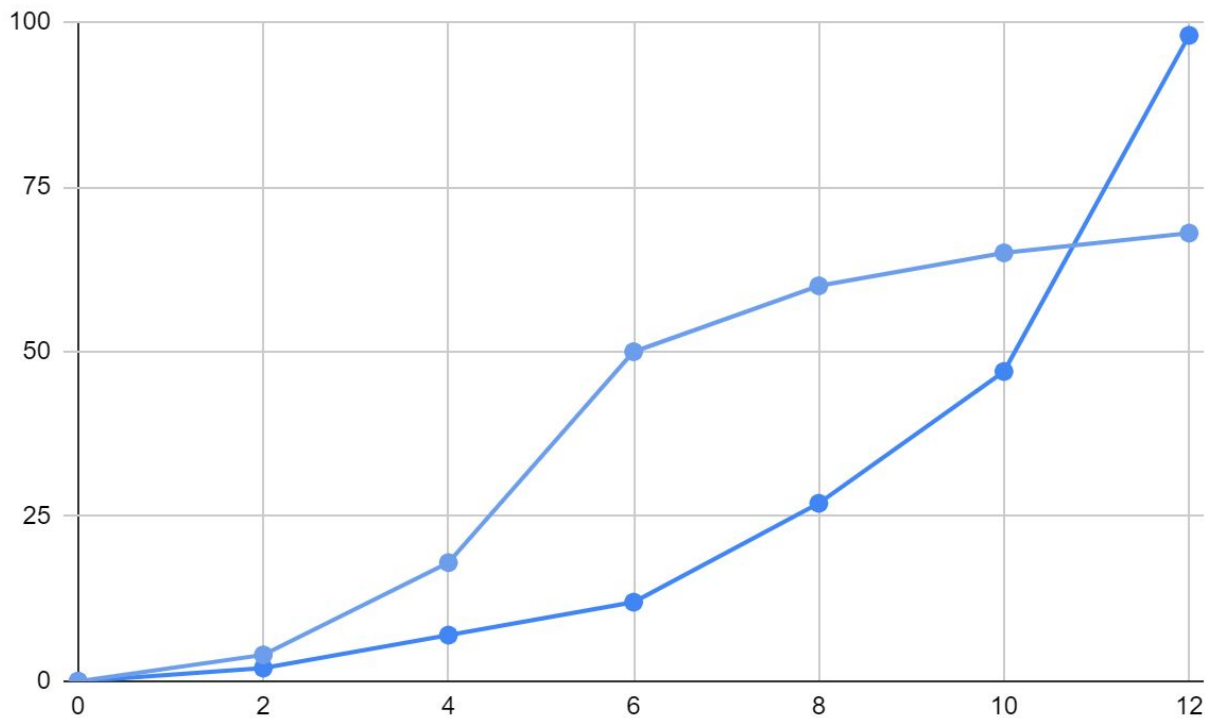
The diagram illustrates how to label a table. Arrows point from labels to specific parts of the table: 'Titles' points to the header row, 'Proper units' points to the first column's header, and 'Appropriate decimals' points to the decimal portion of a sales value.

Titles				
Temperature (Celsius)	Sales 1	Sales 2	Sales 3	
11.9	\$185.00	\$399.00	\$329.00	
14.2	\$215.00	\$476.00	\$406.00	
15.2	\$332.00	\$403.00	\$333.00	
16.4	\$325.00	\$562.00	\$492.00	
17.2	\$408.00	\$546.00	\$476.00	
18.1	\$421.00	\$576.00	\$506.00	
18.5	\$406.00	\$484.00	\$414.00	
19.4	\$412.00	\$575.00	\$505.00	
22.1	\$522.00	\$513.00	\$443.00	
22.6	\$445.00	\$401.00	\$331.00	
23.4	\$544.00	\$323.00	\$253.00	
25.1	\$614.00	\$285.00	\$215.00	

Proper units

Appropriate decimals

# Labeling a Graph



# Components of a Graph

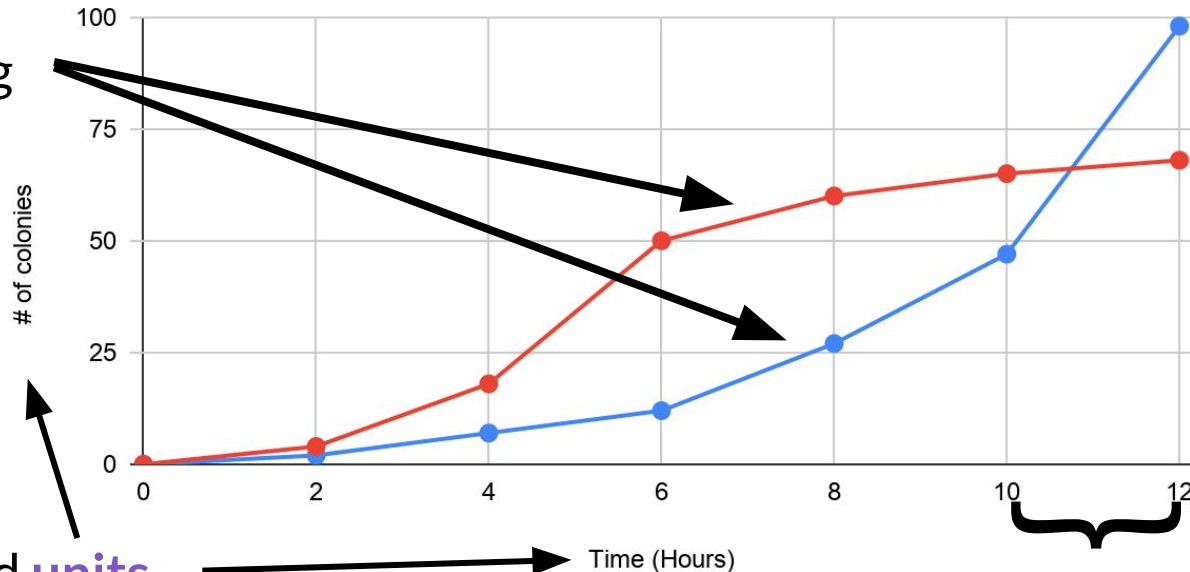
Descriptive Caption/ Title

Growth of Bacteria Species 1 and 2

● Species 1 ● Species 2

Legend

Distinguishing  
colors



Axes Labels and units

Uniformly spaced numbers



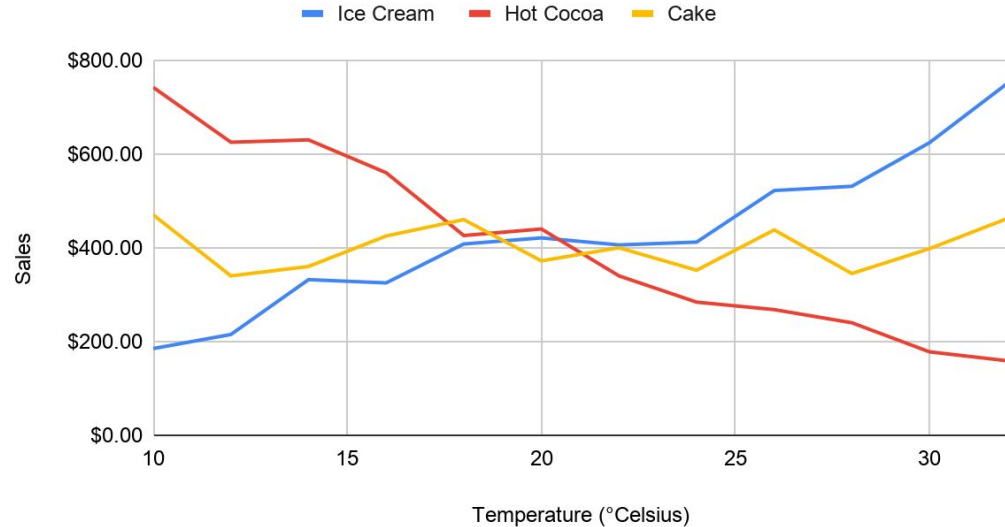
# Exercise in Data

- Data is the bulk of your research
- Multiple trials, organization, and systematic data collection
- Make sure you offer interesting interpretations
- Show that you understand the correlations

# What graphs, and when?

Temperature (°C)	Ice Cream	Hot Cocoa	Cake
10	\$185.00	\$742.00	\$470.00
12	\$215.00	\$625.00	\$340.00
14	\$332.00	\$630.00	\$360.00
16	\$325.00	\$560.00	\$425.00
18	\$408.00	\$426.00	\$460.00
20	\$421.00	\$440.00	\$372.00
22	\$406.00	\$340.00	\$400.00
24	\$412.00	\$284.00	\$352.00
26	\$522.00	\$268.00	\$438.00
28	\$531.00	\$240.00	\$345.00
30	\$624.00	\$178.00	\$398.00
32	\$750.00	\$159.00	\$462.00

The Effect of Outside Temperature on Ice Cream Store Sales



## Line graphs

- Change over time, or trends

## Interpretation example: Summarizing Results

- As temperature rises, Ice Cream sales rise
- As temp. Increases, Hot Cocoa sales decrease
- Cake sales appear to be temperature independent

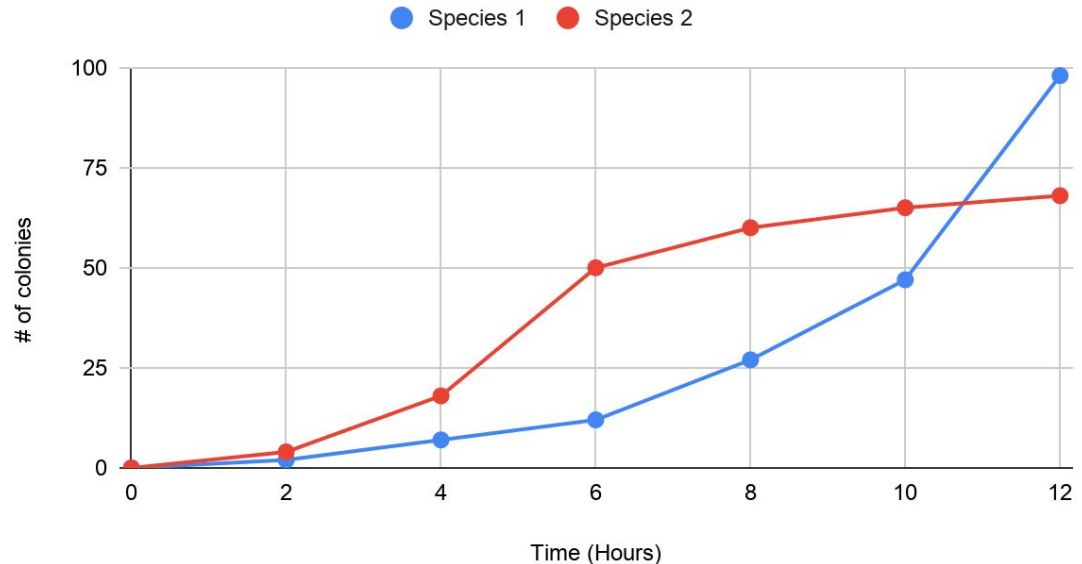
# What Graphs, and when?

Time (hours)	Species 1	Species 2
0	0	0
2	2	4
4	7	18
6	12	50
8	27	60
10	47	65
12	98	68

## Line Graph

- Discrete points
- Also change over time
- Larger sample size

Growth of Bacteria Species 1 and 2



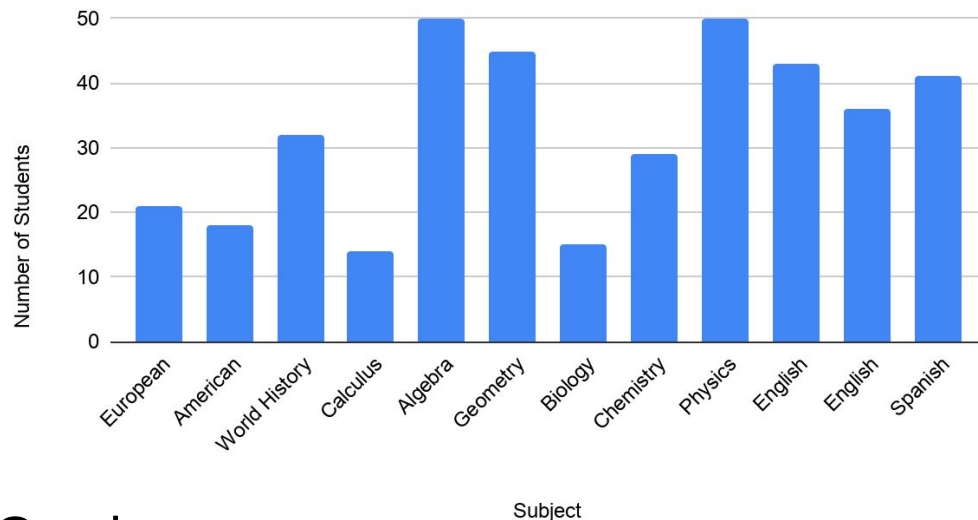
Interpretation example: Summarizing Results  
Species 1 has an exponential growth and surpasses species 2's population at 10.5 hrs.



# What Graphs, When?

Class	# of students
European History	21
American History	18
World History	32
Calculus	14
Algebra	50
Geometry	45
Biology	15
Chemistry	29
Physics	50
English Language	43
English Literature	36
Spanish	41

Popular Subjects



## Bar Graph

- Frequencies
- Categories and percentages

Interpretation example:

Algebra and Physics are the most popular subjects with 50 students, composing about 10% of all students.

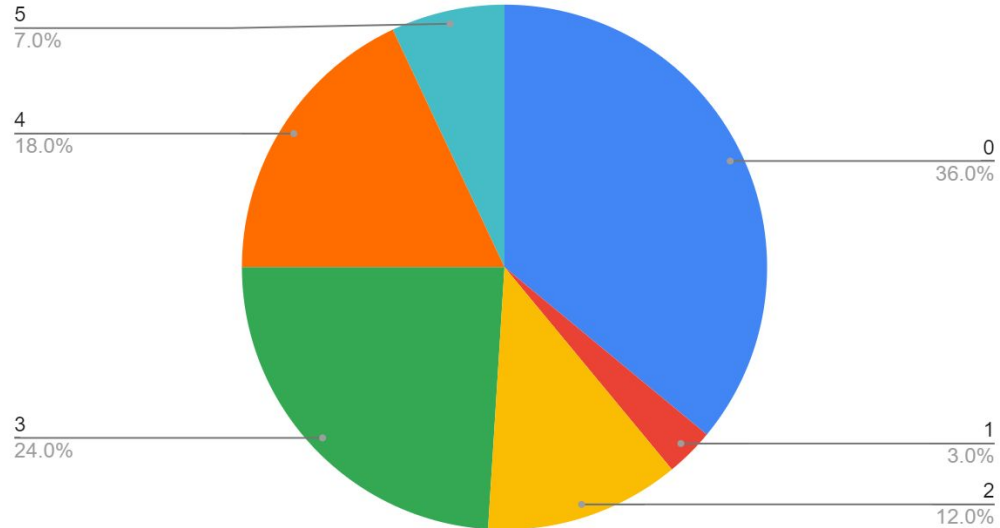
# What Graphs, When?

Ranking	Percent of people
0	36
1	3
2	12
3	24
4	18
5	7

## Pie Charts:

- Percentages
- Parts of a whole
- binary (yes/no)

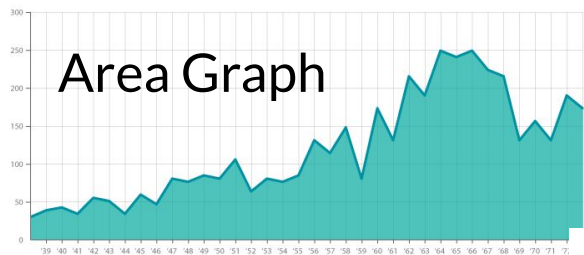
How Students Ranked an Experience



Interpretation example:

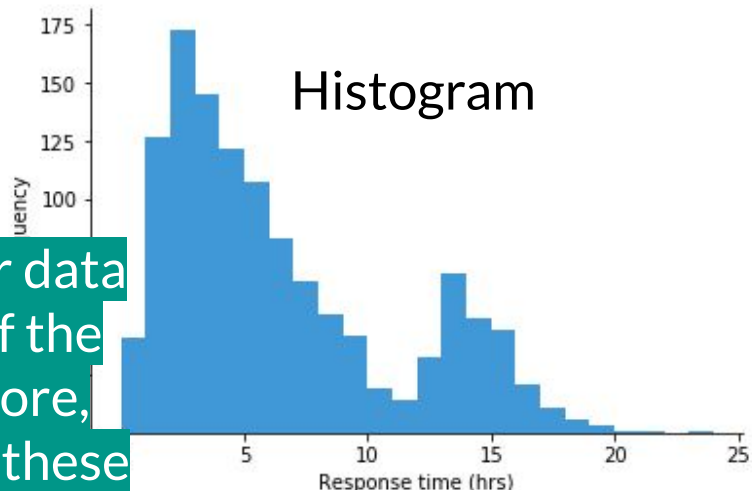
51% of people ranked the experience a 2 and below.  
The most frequent response was 0, with 36%.

# Other types of graphs:



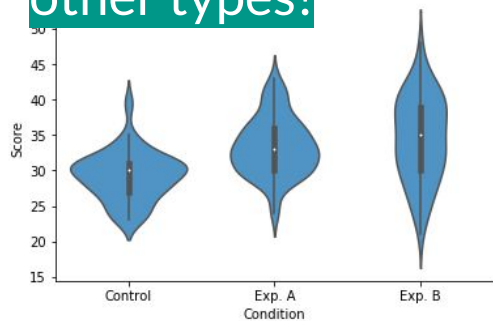
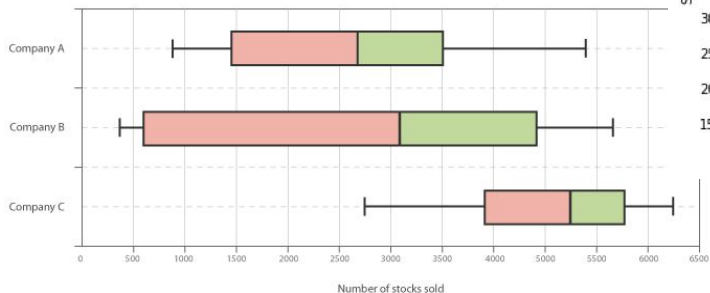
Area Graph

If you think your data doesn't fit any of the graphs from before, talk to us about these other types!

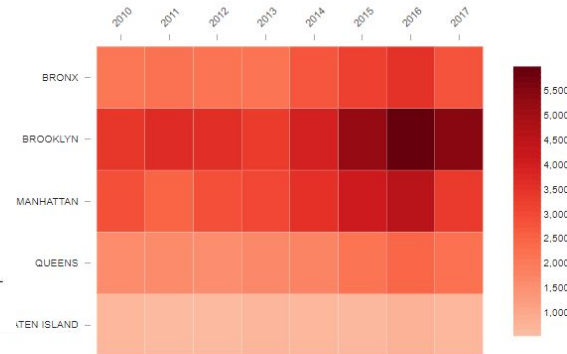


Histogram

## Box and Whisker Plots



Violin Plots



Heatmaps

# Ex: Finding an Average

- Average # of students per subject? = 
$$\frac{\text{Sum of values}}{\text{Number of values}}$$

Class	# of students
European History	18
American History	21
World History	29
Calculus	38
Algebra	50
Geometry	44
Biology	39
Chemistry	30
Physics	44
English Language	22
English Literature	26
Spanish	44

$$\frac{(18 + 21 + 29 + 38 + \dots + 26 + 44)}{12} = \frac{405}{12}$$

$$= 33.75 \approx 34 \text{ Students}$$

Interpretation ex:

There was an average of about 34 students per class.

# Finding a Percentage (and when to use it)

- Percent of students taking Spanish during this period?

Class	# of students
European History	18
American History	21
World History	29
Calculus	38
Algebra	50
Geometry	44
Biology	39
Chemistry	30
Physics	44
English Language	22
English Literature	26
Spanish	44

$$\begin{array}{rcl}
 \text{Number of students} & & \\
 \hline
 \text{Total Students} & \times & 100 \% \\
 \\
 44 & & \\
 \hline
 405 & \times & 100 \% \approx 11 \%
 \end{array}$$

Interpretation ex:

About 11% of all the students at this school were in Spanish class during this period.

# Summarizing, Reviewing, and Interpreting Your Results

You've learned about how to use some excellent data analysis techniques! Now how should you talk about what those graphs mean?

# Written Results

- Facts only! No opinions
- Statements based on your data
- Use numbers (mean, median, standard deviations)




VS.

# Discussion

- Interpretations of your results!
- Theories/opinions based on your results
- How do your results support your hypothesis?



## Putting Together Your Project Notebook: Findings: Review the Results

- Identify trends or patterns in the data
  - Do the Math!!! You may have to make calculations to interpret your findings.
    - Mean
    - Median
    - Mode
    - Standard deviations
    - Standard error
    - Compare/contrast the trials data.
    - Summarize the data as ratios or percentages.
- 





## Putting Together Your Project Notebook: Findings: Review the Results

**Review** your data. Look at the results with a critical eye. Ask yourself these questions:

- Do you have enough data?
- What information does the data you collected tell you?
- What trends or patterns do you see?
- Did you get the results you expected?
- If you have unexpected results, try to figure out why. Was there a problem with your hypothesis? Did you make a mistake?

# Putting Together Your Project Notebook: Findings: Summarize the Results

- Summarize, use objective observations
- without using the word “I” and with no opinions.
- Did something happen that you didn’t expect? Make sure to highlight it
- Use your calculations and data to support your claims



# Putting Together Your Project Notebook:

## Findings: Summarize the Results

Sample statements to use to summarize your results.

- The most/least frequent response was \_\_\_ by give #.
- The difference between \_\_\_ and \_\_\_ was --%, -#- unit of measurement.
- The average of \_\_\_ was    .
- The graph showed    .
- The \_\_\_ increased/decreased by    (unit of measurement).
- The average \_\_\_ decreased/increased by    % over the (length of time).
- The difference between \_ and \_\_\_ was    (unit of measurement, %...).
- In comparison,    .

**Use units of measurements in your statements as appropriate!**

# Putting Together Your Project Notebook:

## Findings: Summarize the Results in Writing--

### Example Statements:

- The most **frequent** response for 30 5<sup>th</sup> grade students was 3 hours per day for TV viewing with an **average** of 2.8 hours.
- The untreated control plates grew on **average**  $43.25 \pm 29.1$  CFUs. The zinc oxide plates grew on **average**  $3 \pm 6$  CFUs, and both the copper and silver nitrate groups had 0 CFUs. ...
- Colloidal silver showed an average inhibition zone of 2.13 (Trial 1) and 7.25 (Trial 2) for Staph epi group **compared** to the E. coli group demonstrating an inhibition zone of 1.38 (Trial 1) and 2.0 (Trial 2). Thyme oil group had zones of inhibition **greater** the 20mm in both E.coli and Staph epi. group for both trials.
- The balloons with 1-candle power had an **average** flight time of 14.8 s. Balloons with 2-candle power had flight time average of 13.0 s. The 3-candled balloons had times average flight time of 10.4 s. The number of candles determined the speed at which the balloon rose: three candles were quickest and the single candle balloon the slowest with a **difference** of 4.4 s.

# Thanks for your time!

Next Workshop: Workshop #4 - Abstract, Screening, Slides (Jan. 16, 9-10 am)

Breakout rooms (if you have an updated zoom, please choose your room, otherwise rename yourself with the number, e.g. 3 Jane Doe) :

**1 - Tables/Graphing in Microsoft Excel** (Jessie & Kelly)

**2 - Tables/Graphing in Google Sheets** (Kavya)

**3 - Rates and Percentage Diff.** (Ainsley)

**4 - Life Sciences** (Anjana & Margaret)

**5 - Physical Sciences** (Jessica)