

What Makes a Good Science Project?

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What Makes a Good Project?

- **1. You are interested in the topic - it's something you like to think about.**
- **2. You can do a test to find an answer to a question.**
- **3. You can do it with only a little help from parents, teachers and friends.**
- **4. It doesn't hurt or scare people or animals, including you.**
- **5. It's a project that, even when you are done with it, makes you think of new things you want to know.**



Good Science

- *Where do ideas come from?*
 - Observations
 - Lab experiments
 - Product testing/originality

- *Hypothesis*



Try putting different words in these blanks...

- What is the effect of _____ on _____?
detergent germination of seeds
temperature the volume of air
- How/to what extent does the _____ affect _____?
humidity growth of fungi
color of a material its absorption of heat
- Which/what _____ (verb) _____?
foods do gerbils prefer
detergent makes the most bubbles



Good Science

- *Experiment*
 - Planning
 - Data
 - Controls
 - Sample size
 - Replications



- **Control Group** This is the set of test items that are treated as in a parallel experiment except for omission of the procedure or agent under test and which is used as a standard of comparison in judging effects.

- **Experimental Groups** The is the set of test items that undergo the various manipulation of variables.



- **Large Sample Size** Use at least 5 test items per experimental group. The greater the number used, the better.
- **Repetition** Repeat your trials many times (at least 3) to collect enough data to average and to demonstrate the validity of your method.
- **Test, Redesign, and Test Again** (for Engineering Projects)
You want your prototype to be successful and to meet your goal.



Good Science

- **RECORD YOUR OBSERVATIONS**
 - Data tables
 - Written observations



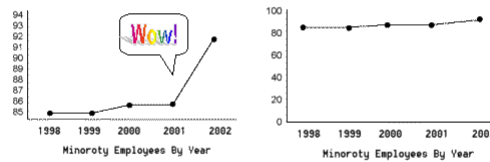
Good Science

- *Results*
 - Analysis
 - Graphs



1.21

Graphing Tricks 1



A Wow graph, showed on the left above, represents an attempt to show a statistic as extreme when in reality is very minor as shown in the graph on the right. These two graphs represent the same data, can you tell what's different?

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Microsoft Excel - osmosis data.xls

File Edit View Insert Format Tools Data Window Help Adobe PDF

E21

	A	B	C	D	E	F	G	H	I	J	K
1	Beaker	Before	After	Change							
2	1	17.1	20.8	-3.7							
3		18.9	22.5	-3.6							
4		10.9	19.6	-8.7							
5		18.9	23.6	-4.7							
6		22.6	26.7	-4.1							
7	2	19.2	19.1	0.1							
8		14.1	14.3	-0.2							
9		10.8	11.6	-0.8							
10		11.8	12	-0.2							
11		16.5	16.4	0.1							
12	3	17	13.5	3.5							
13		25.7	21.7	4							
14		15.8	8.4	7.4							
15		8.6	5.7	2.9							
16		15.9	12.1	3.8							
17											

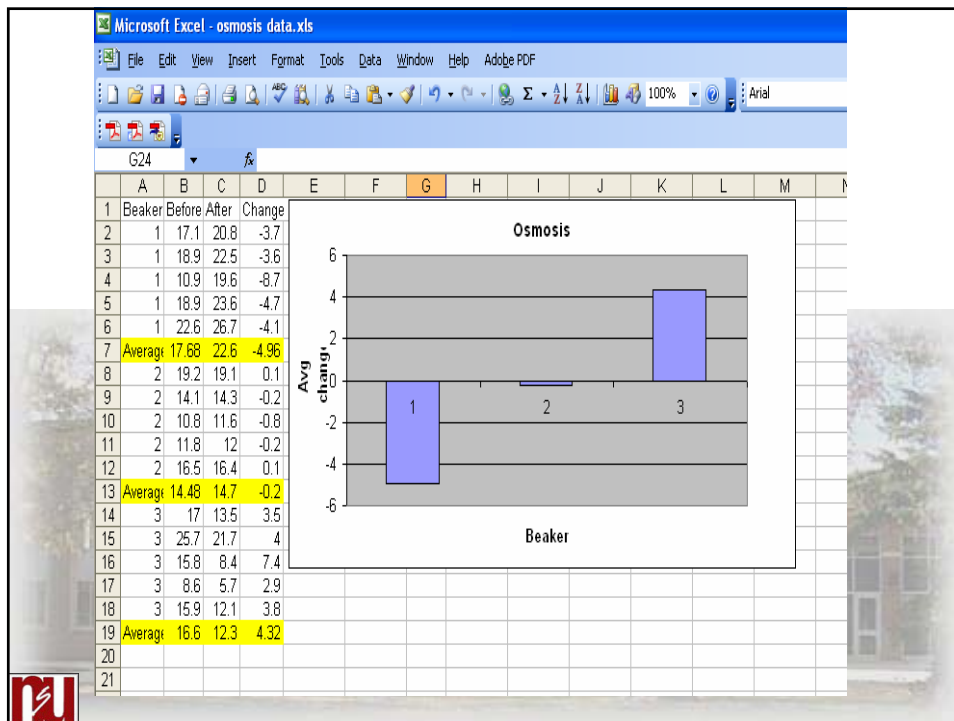
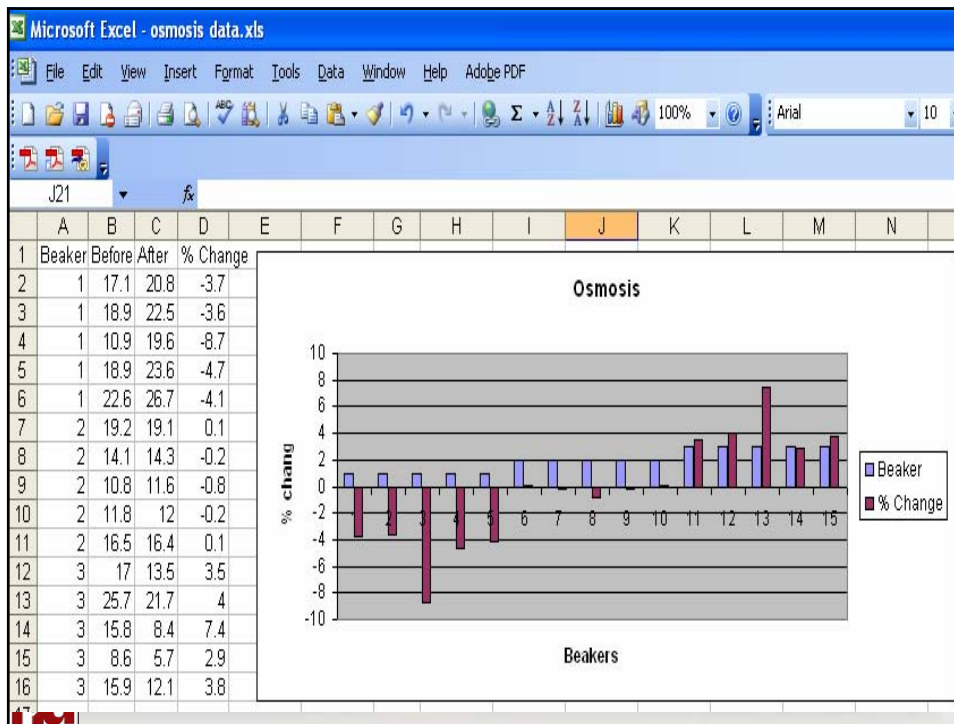
Osmosis Experiment

Weight (gram)

Before & After

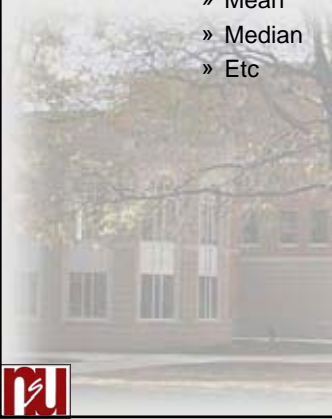
Legend: Before (Blue), After (Red)





Good Science

- **Results**
 - Analysis
 - Statistics
 - *Descriptive*
 - » Mean
 - » Median
 - » Etc



1. **Mean** = Sum of scores divided by the number of scores (often referred to as the statistical average)

Pronounced "x-bar" → $\bar{x} = \frac{\sum x}{N}$ ← Capital Sigma for "Sum of"

N represents the number of scores → "x" represents each score

2. **Median** = Middle Most Number

$$M_d$$

3. **Mode** = Most Frequently Occurring Number

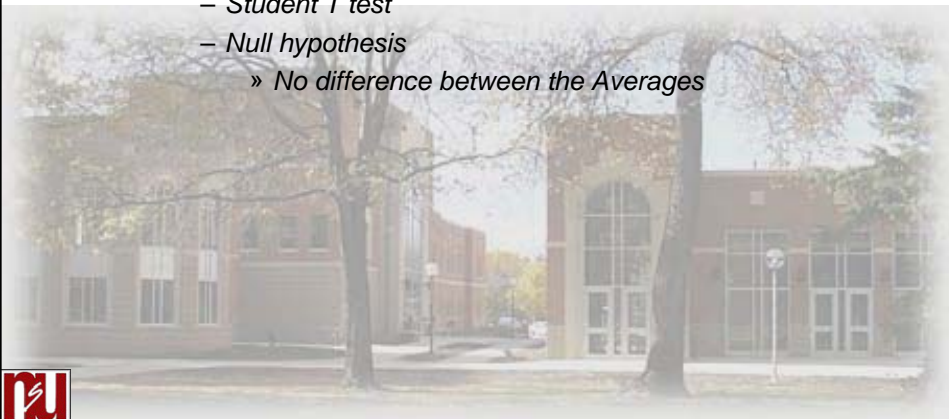
$$M_o$$

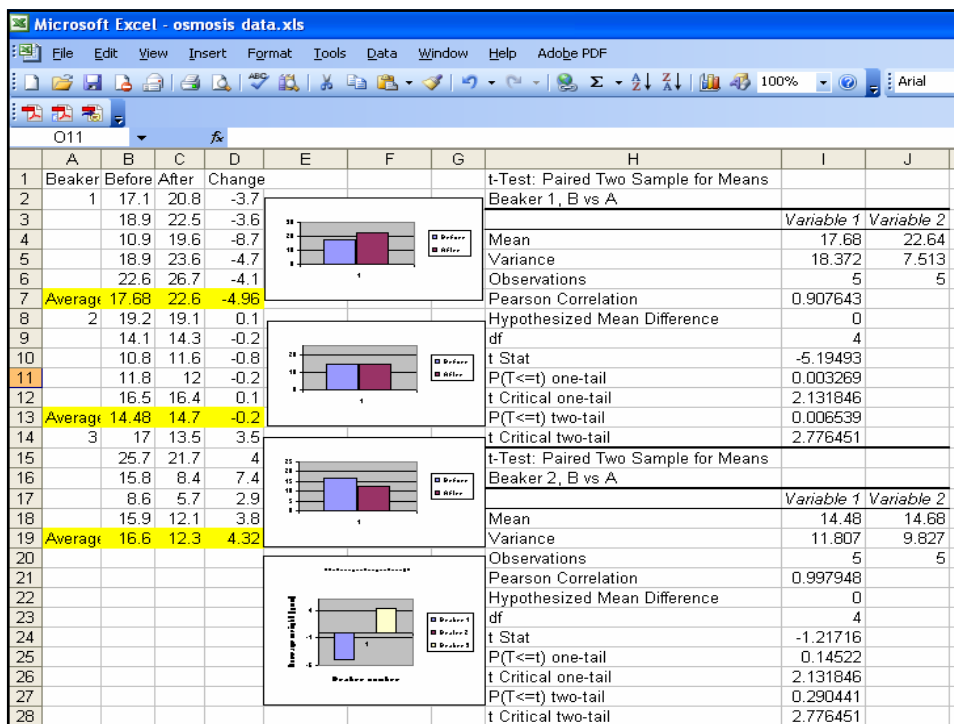
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Good Science

- **Results**
 - Analysis
 - *Student T test*
 - *Null hypothesis*
 - » *No difference between the Averages*





Good Science

- *Conclusions*
 - Summarize results



Conclusion

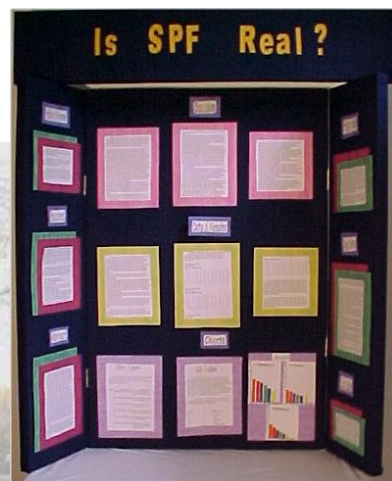
As stated in my hypothesis, I believe that the size of Sun ray angles at noon cause seasonal temperatures, small angles causing warm temperatures and large angles causing cold temperatures. The experimental data supported my hypothesis, indicating a direct relation between the angle of the Sun's rays and the air temperature. This direct relation between the ray angles and the temperatures was found to apply over different seasons. The smaller the ray angle, the warmer the season, and the greater the angle, the cooler the season. Experimental data also showed an inverse relation between the Sun's noon altitude and the angle of the Sun's rays; thus, as the altitude of the Sun increases, its ray angle decreases. The experiments confirmed that more direct Sun rays (those with the least angle) heat the earth more.

Through my research as well as experience, I discovered that the length of each day is not exactly the same. Ideas for a future experiment would be to determine the effect of day length on the average daily temperature.



Presentation

- *Story Board*
- *Titles*
- *Layout*
- *Stress the importance of grammar, spelling, scientific notation, etc.*



Sample titles from ISEF

- Effect of UV Irradiation on Untreated Water
- Investigations of the Fern Life Cycle and its Implications
- Lichens as Bioindicators of Air Quality in Juneau, Alaska
- An Investigation of Cold Tolerance in *Andropogon gerardii* (Big Bluestem)



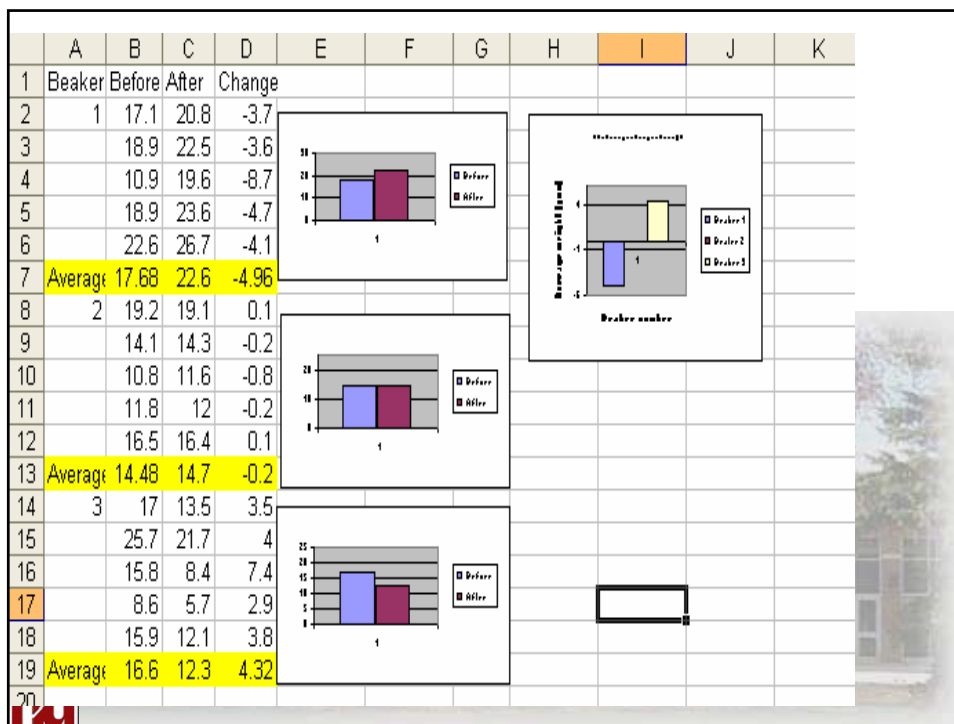
Presentation

- *Results*
 - A picture is worth a thousand words and
 - A graph is a “picture”
 - Less is More!!!

- Avg, Avg, Avg

- Data table
- Graph





Web sites:

- [All Science Fair Projects](#)
[Science Fair Projects with Complete Instructions](#)
- [Experimental Science Projects: An Introductory Level Guide](#)
- [Science Fair Central](#)