Engineering Workshop #2: Designing and Collecting Data

11/17/18

Agenda

- Preparing and conducting experiments
- Organizing data into graphs, charts and figures
- Reading and analyzing data
- Unexpected results
- Peer mentoring
- Setting up and organizing a "scientific" notebook

Before the Fair

- Screening! Visit https://www.gsdsef.org/teachers/screening-teacher for more info.
- Must do for Entrance to the Fair, coordinate with your teacher.
- Staggered dates throughout January and February, different for every school.
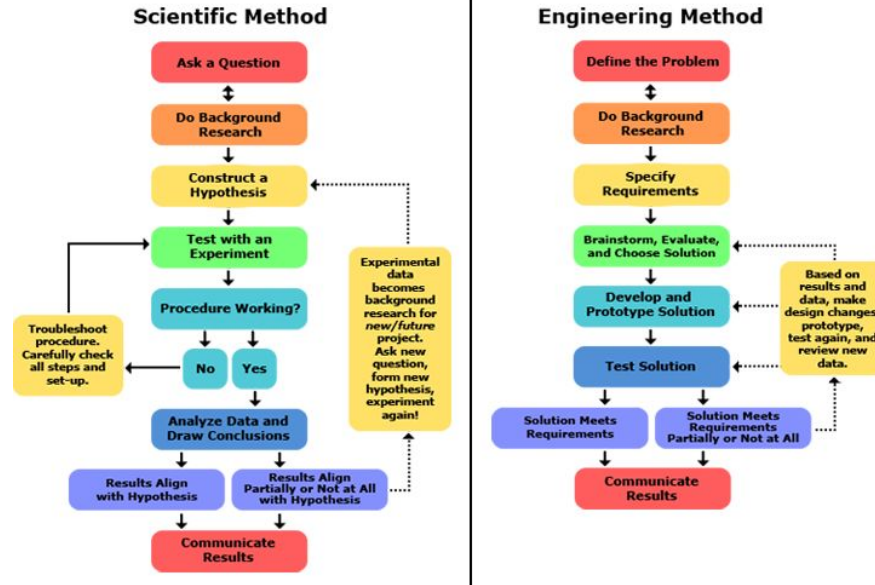
Fair Week Schedule

Tuesday, March 12th: Project Set-Up Day **1-7pm, may come at any time

Wednesday, March 13th: Judging Day! **Students present all day

Thursday, March 14th: Awards Ceremony **Evening

Sunday, March 17th: Family Fun Day/Clean Up Day **Boards must be cleaned up by 4pm

A note on Engineering vs. Science

Background Research

- Look for new data that hasn't been tested (we want something new!)

-If similar tests were tested and posted, search for existing results and see how they made the project testable.

- Additionally this data is citable and can be used as evidence to back your own testing results, however make sure you conduct your own tests.

-See what other prototypes are out there, how can they be improved to meet a goal?

Engineering Goal/Statement of Problem or Purpose

- What you want your "end product" to be, the goal you are trying to achieve
- NOT a hypothesis
- Define clear and concise criteria

Testing and Experimentation

-Make sure you have a plan before continuing to testing (Engineering goal, values to test, how you are going to test etc)

- Make sure to do multiply trials of testing

-Test in the same conditions ALWAYS

Ex: Plan to test buoyancy of apples using (30 apples)

Make sure supplies are available (In this case 30 apples and a tub of water) and check if testing gets the results you want, if not correct your experiment until you run accurate trials. Don't only bob the apples 30 times but do it multiple times, 3 sets of testing or more is advisable.

Data Collection

- Even with a prototype or product created, data needs to be collected.

-Make note of all planned and unplanned issues that could be affecting or could be affecting your data (wind condition, temperature etc)

-Record all values of data (Conditions Included) even if it yields unplanned results

-All data is good data! It is GOLD to judges.

Analyzing and Organizing Data

- See if results are consistent with previous testing and or testing from other sources

-If different analyze data and look for potential influencers

-Organize data into graphs or a more readable format if possible. The goal is make sure values are easily readable and interpretable

-Ex: Take data collected and convert it's numerical form into different kinds of graphs for organization. Compare results gained, to existing results.

Interpretation of Results / Unexpected Results

- Observe if engineering goal was achieved

- See if precision and accuracy is achieved. Are values clumped together? Do the values seem viable based on the facts you know?

-For unexpected results find the variable that is potentially affecting intended testable value. Record this as a variable factor in your testing and if needed run more tests that may have this variable excluded to get intended "more accurate" results.

Notebook

Link to GSDSEF Notebook example:

https://www.gsdsef.org/sites/default/files/notebook_rev_for_2019b.pdf

Review of Literature

5 to 10+ typed pages and will summarize the information you found about your topic <u>before</u> you start your experiment

1. Start with an introductory paragraph that generates interest and indicates what is coming

2. describe information you found while researching your topic.

3. Give credit where credit is due!

4. Have a concluding paragraph that "pulls" it all together.

Statement of Problems or Purpose

- State problem or purpose of your experiment.

- Answer: Why are you doing this? What does this achieve? What are you trying to solve or create?

Ex:

Don't do: "I want to solve (insert very specific problem) by (insert solution)"

But instead: "Within the genre of (insert science topic) there exists problems with (insert more specific topic). Thus I propose to create a solution by using (insert method) to solve (the specific problem)"

Hypothesis

- Keep in mind the goal and the issue that is to be solved here

- Make a prediction in the form of a statement that answers the question at hand

- Use all knowledge gained during the review of literature stage to make such prediction

Materials and Procedure

- Everything you used in your experiment should be listed on this page

- Give a step-by-step description of your experiment procedures (Set up and Data collection)

- Procedure should be written in a manner that an identical experiment should be able to be tested based off of your description

- *MORE IS ALWAYS BETTER WHEN YOU DO YOUR EXPERIMENT!

Findings

- Polished version of the raw data like responses, reactions, results you observed and recorded

- KEEP the raw data and include it in the end of the notebook

- Be sure to label all parts of your graph appropriately

Peer Mentoring!!

Please feel free to approach us with any questions, or we will come and talk to you all :)

Future Workshops

- January 12th, 2019 8:30-11:30am
  - Room 306
  - Designing your board, any last screening questions.
- February 27th, 2019 4:40-7pm
  - Location TBD
  - All about judging, what to expect at the fair, practicing your presentations!