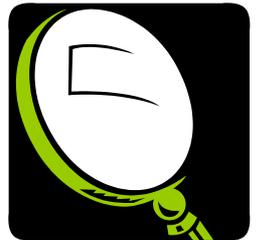


Science Is....

- ... a body of knowledge about our natural world and how it works,
 - **CONTENT KNOWLEDGE**
- ... a process of exploration and discovery,
 - **INQUIRY PROCESS**
- ... the quest for solutions to human needs.
 - **SOCIAL CONTEXT**



The “Triad” of Science

*A good Science
Fair project
will blend all
three of these
aspects of
science!*



Selecting a Topic

- **Choose a topic that interests YOU!**
 - An extracurricular activity that you enjoy: music, sports, outdoor activities
 - An issue that affects your life
 - A topic that fascinates
- Determine if the project is feasible
 - Do you have enough time to complete the project?
 - Do you have the resources available?
- Look at ISEF abstracts to get ideas

Selecting a Topic

- **What NOT to do**
 - Use a “canned” project from a website like Science Buddies
 - Pick a project based on parental or teacher influence
 - Pick a topic that does not interest you

Plan Ahead

- **Creating a Research Plan**
 - Rationale
 - Research Question, Hypothesis or Engineering Goal
 - **PROCEDURE**
 - Risk & Safety
 - Data Analysis Procedure
 - **BIBLIOGRAPHY**

Habits of Scientific Thinking

- Skepticism
 - Withhold decisions
- Open-mindedness
 - Consider all alternatives
- Rationalism
 - Seek objective, empirical evidence
 - Differentiate between fact and opinion

First Step

- Form an Hypothesis or Statement of a Problem
 - Your hypothesis should state what you believe will happen as a result of your experiment
 - Your problem statement (engineering) should state the problem that you are trying to solve
 - Your research should inform the development of your hypothesis or your problem statement

Design Controlled Experiments

- Design a controlled experiment to test the hypothesis.
 - Designed to measure a single variable condition.
 - Any pair of samples differs in only one way.
 - Other environmental conditions are controlled.
 - Everything else about any pair of samples is the same.

Manipulated Variable	“Independent variable” - treatment that is changed or manipulated; Each sample is subjected to different conditions for the manipulated variable: treatment, amount, time, duration, etc.; “cause”
Controlled Variable	Identical in all conditions; ruled out as affecting outcome
Responding Variable	“Dependent variable” - properties that are observed or measured; “effect”
Uncontrolled Variable	Factors which may impact experimental samples or subjects differently, resulting in effects that are not due to the manipulated variable. Ex. Experimental error, bias, environmental conditions

Make Predictions

- Making predictions are important for conducting your experiments and analyzing the results
- Helps *you* have a sound project
- Format of a Prediction statement
 - *If (this idea is true)...*
 - *And I (do this action) ...*
 - *Then (this result will occur).*

Obtain and Analyze Results

- Collect data through observation and measurement.
- Choose quantitative over qualitative measurements.
 - Quantitative data can be analyzed graphically and statistically.
 - *Is variability associated with manipulated variable greater than variability due to chance or other variables?*

Draw Conclusions

- Formulate conclusions based on the interpreted data.
- Identify if your hypothesis is consistent with the observed results.
- Conclusions are only as good as the data is accurate.
- Revise hypothesis, redesign experiment, and conduct further studies as necessary.

Additional Resources

- [PRSEF Student/Teacher Handbook](#)
 - Science Fair Project Suggested Timeline
 - Top Projects to Avoid
 - General Guide for Scientific Resources
 - Recommended Chemistry Resources
 - Visual Display Guidelines
- [How to do a Science Fair Project \(NASA/JPL\)](#)
- [Using Statistics in Science Fair Projects](#)
- [Engineering Design Process \(TeachEngineering\)](#)