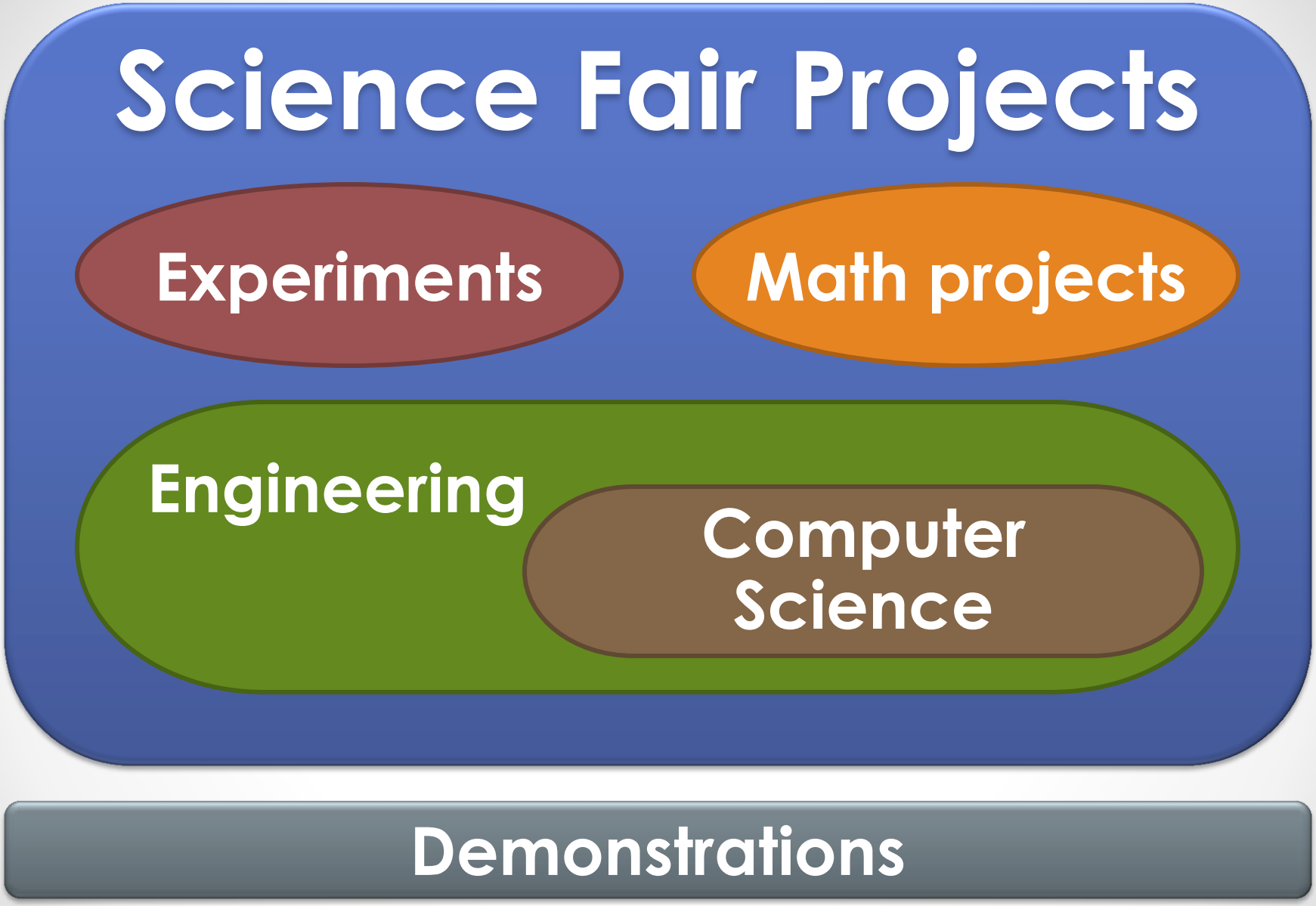
Science Fair Basics

Demonstrations vs. Experiments
The Scientific Method
Engineering Design Process
Grading/Judging
-
Abstracts

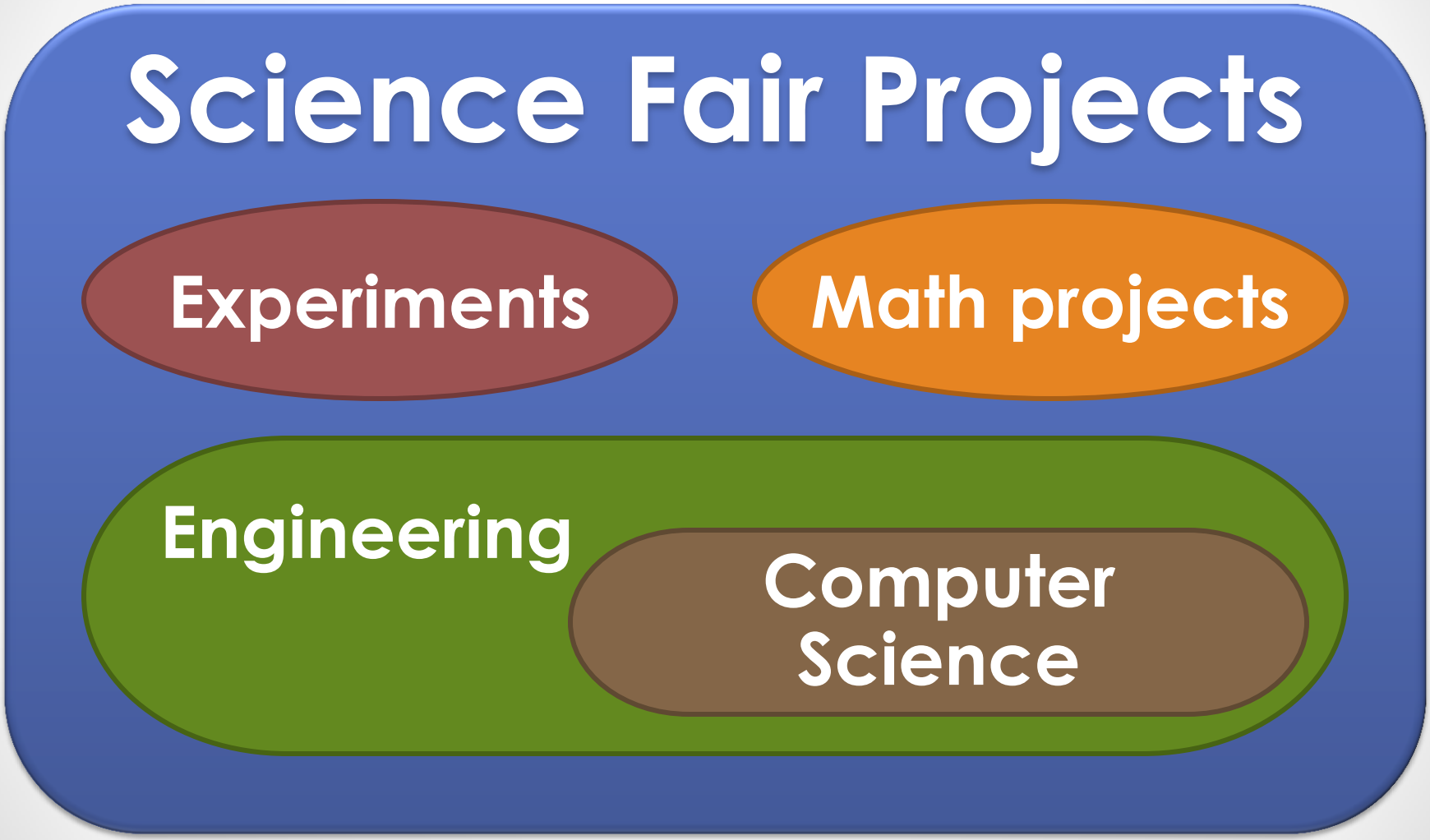
Workshops for CUSEF/SLVSEF 2011

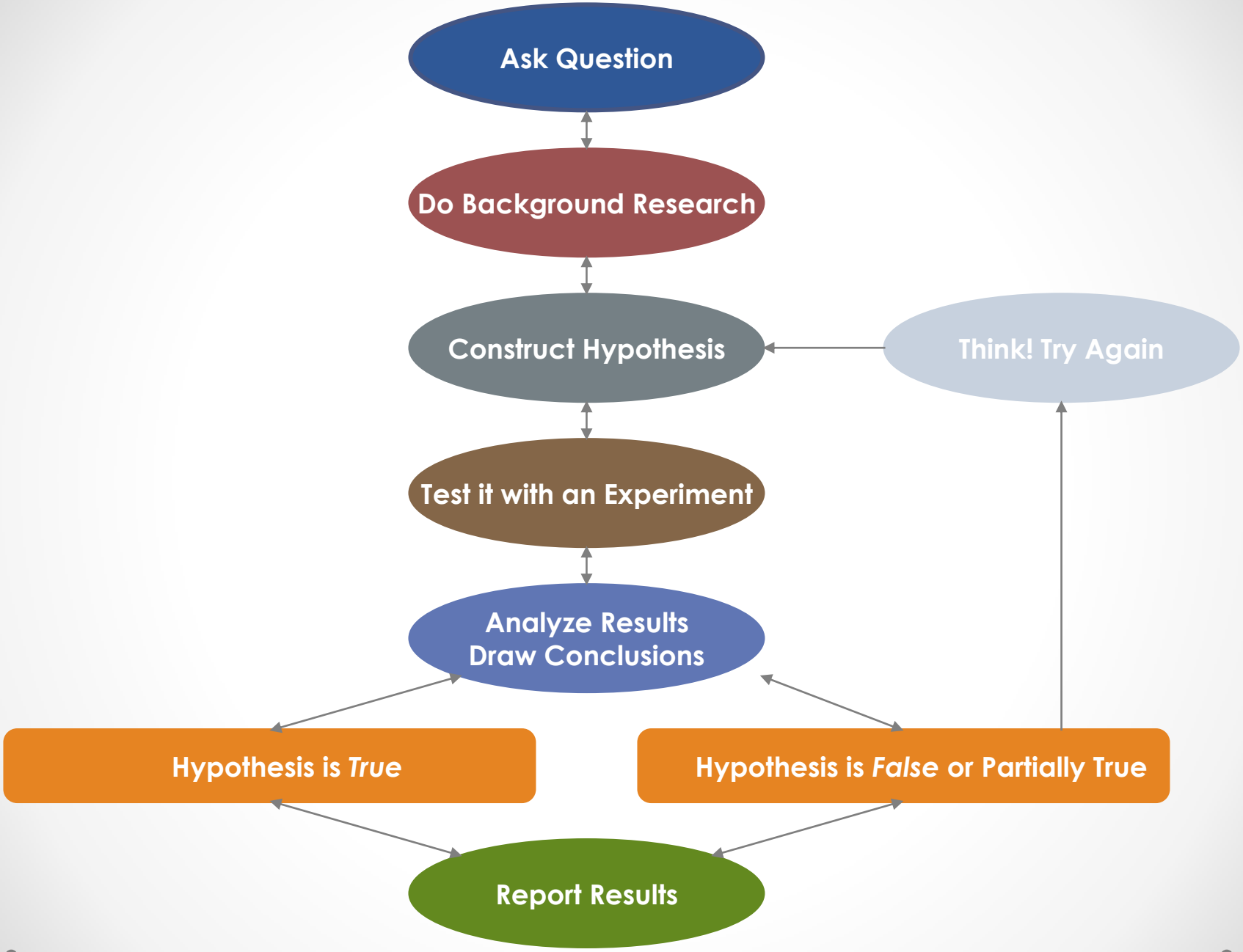

Science Fair Projects
Experiments
Math projects
Engineering
Computer Science
Demonstrations

What is a demonstration?

- A **demonstration** shows how something works.
- An **experiment** manipulates variables.
- To change a demonstration to an experiment, modify the project to include an independent and a dependent variable.
- Examples: Volcano, Motor.

It's About Process!





After http://sciencebuddies.org/science-fair-projects/project_scientific_method.shtml

Computer Programming		Math Projects
Engineering Process	**Scientific Method**	**Mathematical Reasoning/Proof**
Define a need	State your question	Define what is known
Do background research	Do background research	Research & define all terminology
Establish design criteria	Formulate your hypothesis, identify variables	Make a conjecture/assumption based on what you know
Prepare preliminary designs	Design experiment, establish procedure	Perform calculations
Build & test prototype	Test your hypothesis by doing an experiment	Look for counter examples
Test & redesign as necessary	Analyze your results and draw conclusions	Recalculate and write up steps to the conclusion
Present results	Present results	Present Results

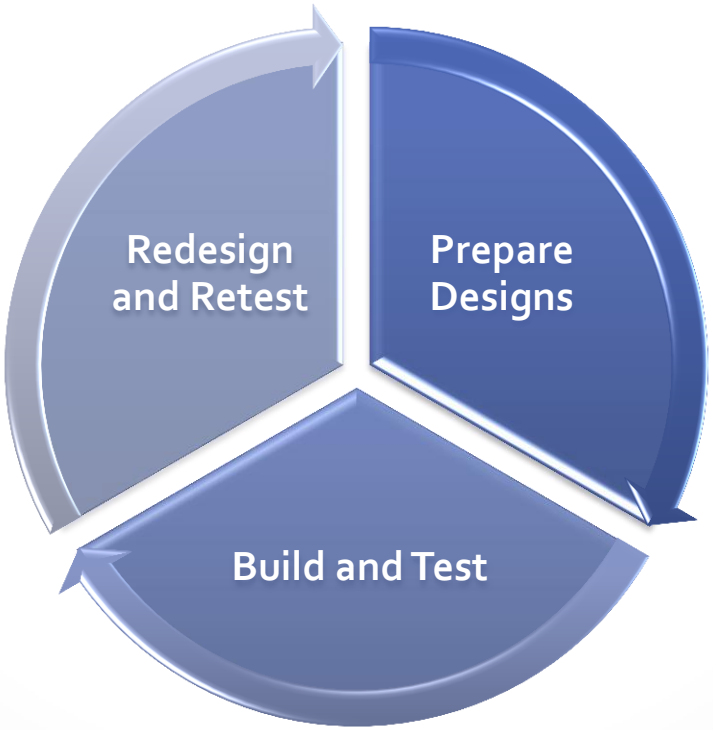
Scientific Method & Engineering Process Comparison used with permission from Science Buddies.

Computer Science Projects

- Computer science projects are (usually) a special type of engineering project.
- Scientific Method or Engineering Design Process?

Iteration!

- A process of repeating a sequence of steps, each time coming closer to your goal.



Step-by-Step

1. **Define a need.**
   - Clearly define the problem you are going to solve or the situation you are going to improve.
   - Express it as a goal.

2. **Do background research.**

More Steps

3. **Establish designs criteria.**
   - Requirements that will be used to make decisions about how you build/program the product.
   - Remember your target user/customer.
4. **Make preliminary designs.**
   - Write it down, sketch it out, etc.
   - Consider and explore alternatives to your approach.

A Few More Steps

5. **Build and test.**
   - Use a "test plan" and analyze your data.
6. **Redesign and retest.**
   - Modify, redesign, debug, etc. until you have achieve your design goal.
   - A technical approach to your analysis is essential. Learn from your failures.

The Finish

7. Present your work.

- Outline the engineering design process that you used.
- Highlight the final product, its merit, originality, and usefulness.

Mistakes to avoid

- No need, no project.
- Gadgeteering is not engineering.
- Testing without asking the user.
- No analysis of prototype and redesign test results.

Grading and Judging

- "Technicians follow the recipe, but engineers create the recipe."
- Is this a copy? An adaptation? Something new?
- Does the student understand the underlying science?
- Is it practical?
- Does the student understand design tradeoffs? Safety factors? Economics?
- Success – did it work? If it failed, does the student understand why? Can s/he offer improvements?

Thanks to Allen Wallace and Bruce Kawanami

An Abstract about Abstracts

- An abstract is a concise (<250 word) summary of a project.
- Include purpose, problem, general procedures, summary of data/analysis and conclusions.
- Format/tone.
- Used for SRC, special awards, Grand Awards judging.

Summary

- Make a demonstration an experiment by adding variables.
- Science experiments, engineering projects, computer science projects, and math projects are *all* valid science fair projects.
- Use the right process.
- An abstract is a summary—and it's important.