

Types of Science Fair Projects: Advanced Workshop

Demonstrations, experiments,
engineering projects, and
computer science projects

Science Fair Projects

Experiments

Math projects

Engineering

Computer Science

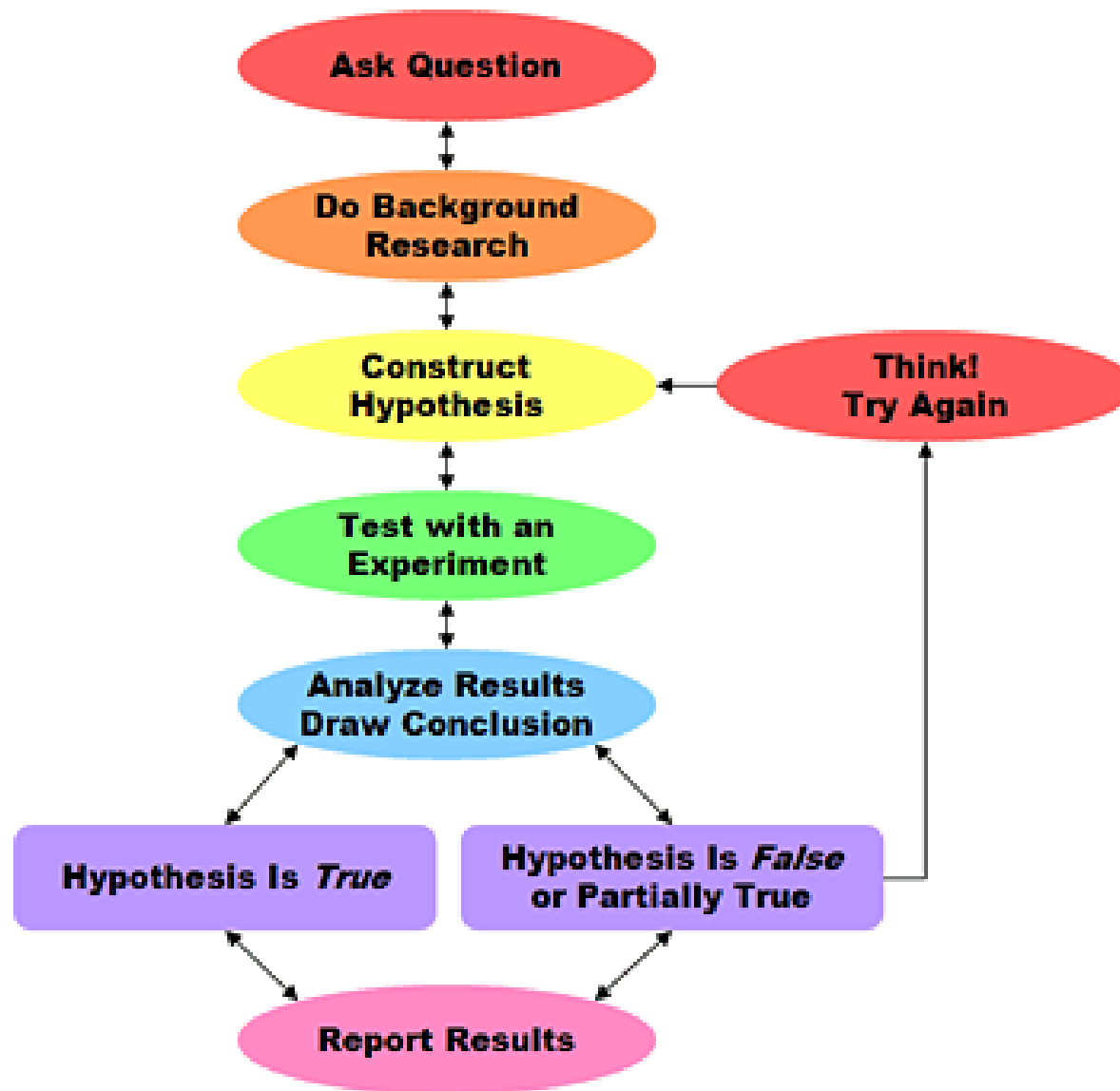
Demonstrations



The Process is the Key

- Science, engineering, and mathematics each have their own process for coming to new knowledge.
- No matter what kind of project you are doing you must follow the process appropriate to your discipline.

Key to success: Do it step-by-step!





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 a special type of engineering projects and therefore follow the engineering design process.
- Improve existing things and create new ones.

Engineering

Computer Science

1a: Find a need

Computer Science

Computers take too long to scan for virus, malware, and spyware infections

“Engineering”

Elderly and disabled people have trouble reaching items that are on high shelves

1b: State a goal

Computer Science

“The goal of this project is to write, test, and optimize software that decreases the time it takes to scan a computer for virus, malware, and spyware infections.”

“Engineering”

“The design and construction of kitchen shelving that lowers itself to help short, weak, or disabled persons easily reach items stored on high shelves.”

2: Background Research

Computer Science

Define a target user.

What already exists to fill this need?

What do my users want?

“Engineering”

Define a target user.

What already exists to fill this need?

What do my users want?

3: Design Criteria

Computer Science

Scans 1,000 files in 0.5 sec w/99.9% accuracy

Scans faster than X

Consumes < 15 MB

Cost < \$XXX.xx

“Engineering”

Shelves lower 45 cm.

Safely move 16 kg up and down

Shelves tilt < 10°

Cost < \$XXX.xx

4: Preliminary Designs

Computer Science

The 1st iteration of code

Multiple approaches to the program

Evaluation of options

“Engineering”

Written, detailed designs

Multiple approaches to the problem

Evaluation of options

5: Build and Test

Computer Science

Just “test”; we “built”
in step 4

Run the program using
a test plan (1000 files)

Record data (duration,
accuracy, bugs, etc.)

“Engineering”

Select appropriate
materials

Build it

Use test plan and
record results

6: Redesign and Retest

Computer Science

Debug, debug, debug

Optimize code after each iteration

Document the process

“Engineering”

Failure analysis

Learn from each iteration

Document the process

7: Present Your Work

Computer Science

Communicate both the process and the product

Quantitative evidence for success with rigorous analysis

Clarity

“Engineering”

Communicate both the process and the product

Quantitative evidence for success with rigorous analysis

Clarity



Keys for Success

- Be as quantitative as possible.
 - Design criteria
 - Test plan
 - Failure analysis
 - Redesign and retest
- What was gained (lessons, skills, techniques, etc.) from each iteration?

Science Fair Projects

Experiments

Math projects

Engineering

Computer Science