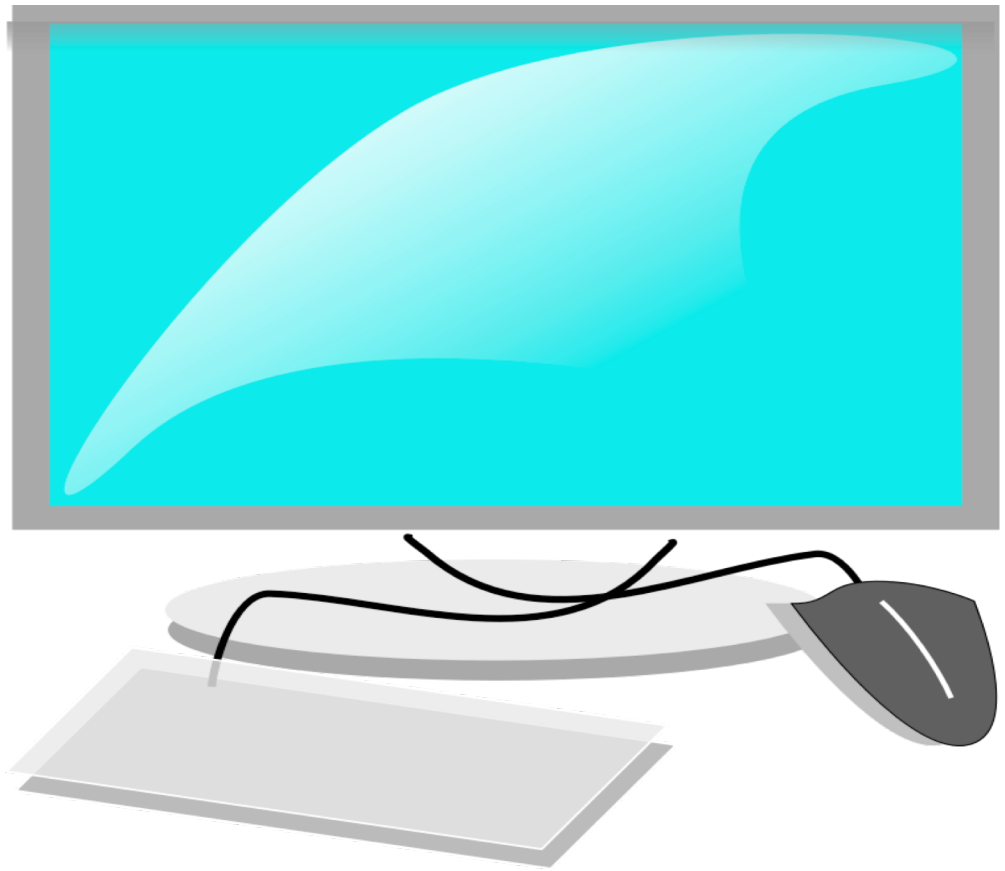
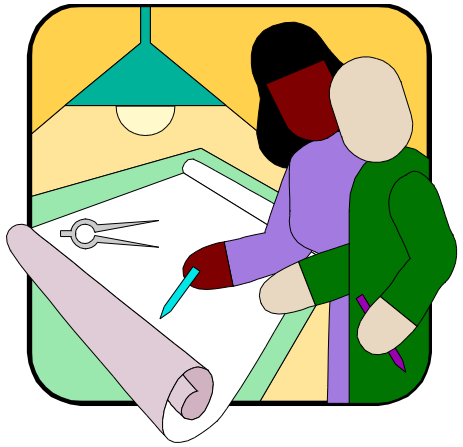
Doing A Meaningful Computer Design STEM Fair Project



The main purpose of the computer design process is to program a computer for people to learn about new ideas, learning how to do something, finding information that they want to know, or for the computer to perform a useful function.

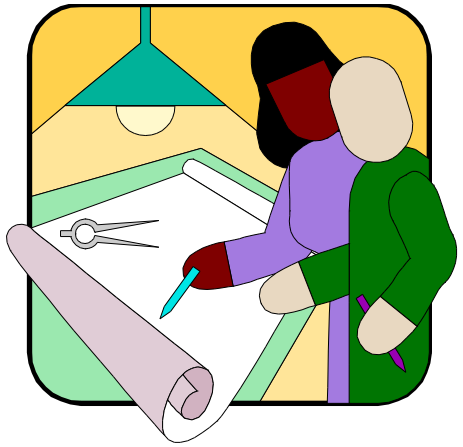
Computer Design Process

- **Define a Need** for the program you want to code into a computer as to what you want the program to do.
- **Research** your idea to learn about your content and what you need to know to program a computer.
- Establish the **Design Requirements** needed for the development of the program code--memory needed, what it will do (the performances), and accuracy. Include the **criteria** of what you want it to do and the **constraints** of what the limitations are.



Computer Design Process

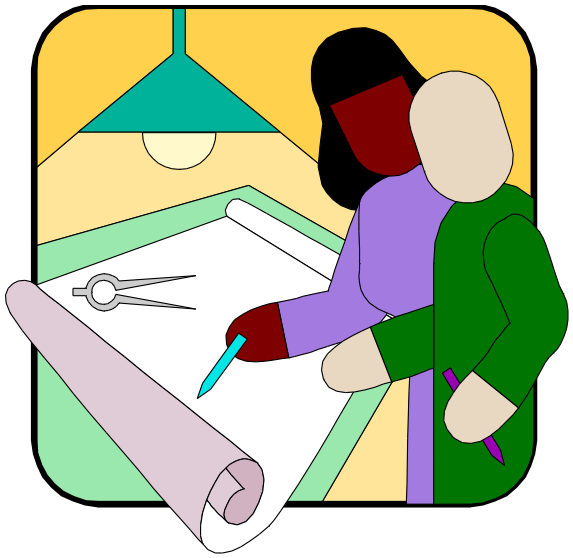
- **Design a Plan and Methodology.**
  - Write a beginning program showing using codes by brainstorming ideas to achieve the desired results.
  - Continue to write different codes that would achieve the desired results.
  - Finally, focus on one type of program code that you like that would achieve the desired results.
  - Devise a data gathering plan that is systematic and organized.



Computer Design Process

Programming and Testing the Code

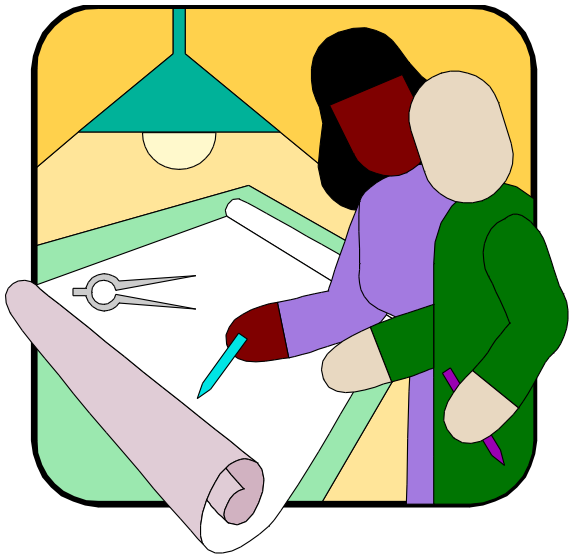
- Program your computer with the chosen code.
- Test your program many times, and record the results in your journal.
- Analyze your results to see if it follows the criteria and constraints.
- If needed, follow up with redesigning followed with more retesting, recording, and analyzing.
- Keep doing this until you are satisfied that the performance meets the criteria and constraints.
- Testing should be done not only by you but by others.



Computer Design Process

Reflection

- Write a reflection in your journal of a detailed account of the process involved in creating the program.
- Show a strong conclusion of what you found out about developing and using the program.
- Show a strong application of your project to real world ideas.
- Your writing should show strong evidence of learning.



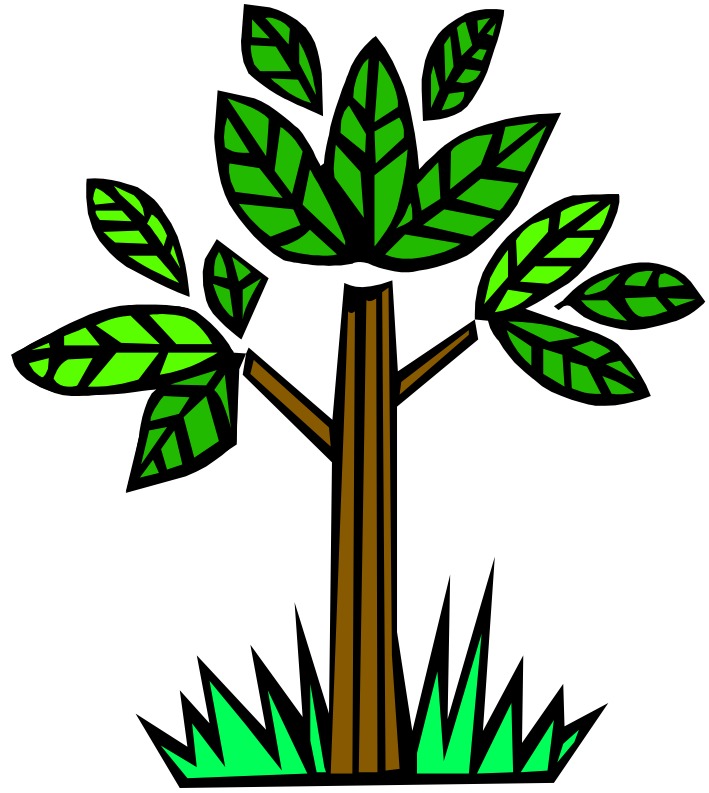
Other Things That are Required When doing a Computer Design STEM Project

- You need to have a STEM fair journal that shows the work you did and the results following the Computer Design Process.
- You need a display board that shows all the steps of the Computer Design Process.
- An interview will be conducted to see if you can explain the Computer Design Process in reference to your project.

How to prepare the journal, display board and for the interview will be shown later in this document.

Computer Design Process

Choose a Subject You Are Interested In For a Computer Design Project



Examples of Projects
"What can you do with….?"

- Finding information about a subject.
- Helping learn math concepts.
- Helping with reading comprehension.
- Helping with science concepts.
- Helping with memory.
- Helping with problem solving.
- Learning new information.
- Helping learn through a learning process.
- Helping with learning about art, dance, drama, etc.
- Making something work for a useful function.
- Anything you can think of that is needed to help people out.

Follow the Computer Design Process While Doing Your STEM Fair Project

- On the next few slides are the steps of the Computer Design Process.
- Please follow each step of the Computer Design Process as completely as you can.
- Be sure to do each step. Do not skip any steps.
- Write everything you do in your journal.

The Computer Design STEM Journal

Before you begin, you need a journal.

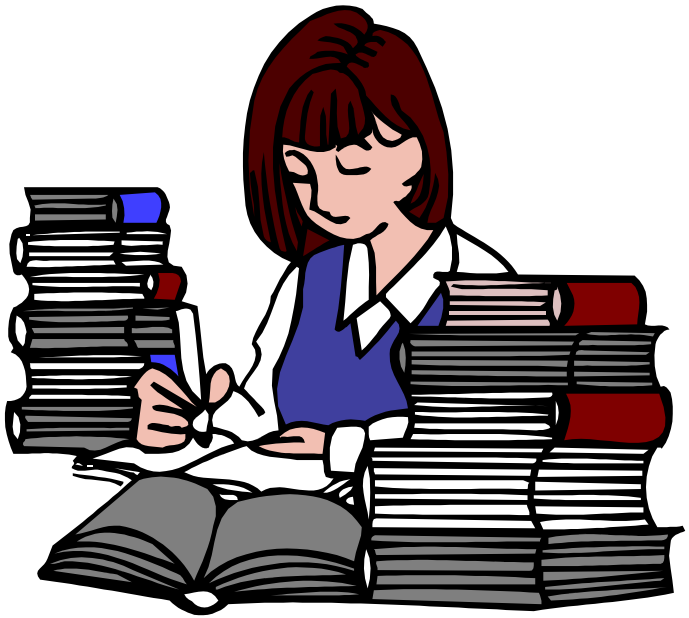
- STEM fair projects need to show a record of everything done by you as an "computer programmer".
- This record is kept in a journal, recording all the things you do each day you work on your project.
- The journal will have the detailed work you did for each step of the computer design.
- You need a title page and a table of contents in the journal.
- The table of contents will include all the steps of the Computer Design Process.
- Be sure you date each day you work on your project.

Define a Need

- Begin by writing a need and/or purpose for the program you want to develop.
- It could be something that you:
  - Want people to learn
  - Want people to know
  - Help to learn something in an easier way.
  - To perform a useful function.
- Write it so the need is clearly understood.

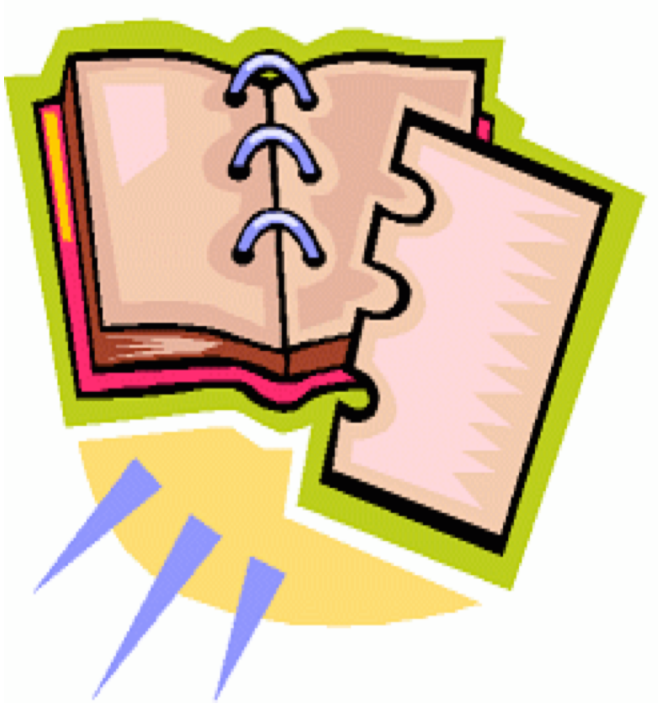
Research Your Type of Design

- Before you begin designing, you need some background knowledge about your subject. Use some of these resources:
  - Encyclopedias
  - Science Magazines
  - Science Textbooks
  - Library Books
  - Internet
  - Interviews
  - Letters
  - Phone Calls
- You need to research your topic by using at least three sources.
- Record the information you learned in your journal.



Computer Design Requirements

- Based on your research, you now have an idea of what type of program you want to code and its importance.
- Establish the design requirements (criteria and constraints) needed of what you expect the program to do when it is tested.
- The requirements will relate to:
  - How much memory you will need.
  - What the program will be able to do.
  - What the final outcome of the program will help with.
  - The accuracy of the performance.
- The program will need to be tested to see if the desired results came about.



Design Plan and Methodology

Beginning Program Designs

- Begin by brainstorming program codes that might work according to your requirements.
- Write three or four codes that you feel would have the same desired results.
- Focus on one that you think would be he best.

Design Plan and Methodology

Final Program Design

- As you focus on one, continue to write up a series of operations for the program code.
- You are to show the changes in the development of the program code tweaking it as you get closer to the desired results.
- The code development needs to show progress as you work on it.

Programming, Testing, Recording and Analyzing the Code

Programming

- When you have finished designing the code, you need to put this code into your computer.
- If you have decided to change the code while doing this, then go back into the design and show your changes.
- Begin again and put the final code into your computer.

Programming, **Testing**, **Recording** and Analyzing the Code Results

Testing and Recording

- After coding your computer, the code needs to be tested to see if it works according to the design requirement.
- Run the computer program using the code. Record what is actually happening during testing in your journal
- Be as descriptive as possible.
- Test it two or three times to get accurate data.

Testing, Recording and **Analyzing** the Code Results

Analyzing the Data

- Look at your data carefully to see if the results match the design requirements.
- Write down what you see that is working well and needs no changing.
- Write down what needs to change for the program results to match the design requirements.

Redesign, Retest, Record And Analyze

If your program didn't work exactly to the design requirements, you will need to make adjustments.

- Redesign by changing the code as to the notes you took in your journal.
- Keep accurate notes of the changes you needed to make just in case you need to go back and look.
- Make the changes on your computer by changing the code.
- Retest the program two or three times and write down what you see happening.
- Analyze the data to see if it matches the design requirements.

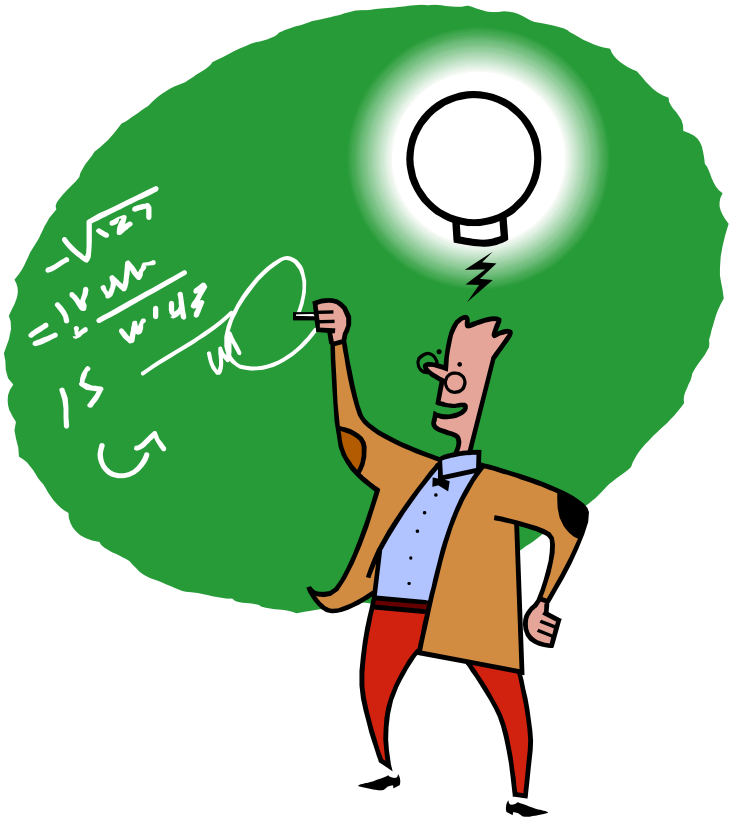
Redesign, Retest, Record And Analyze

- If the results match the design requirements, then you are done.
- If the results don't match the design requirements, then redesigning, changes to the code, testing, recording and analyzing should continue until you you are satisfied with the tested results.
- Be sure to write down all the changes made and the testing results of each change.

Reflection
What Did You Find Out?

Write about these ideas in your journal and anything else you can think of.

- Write a detailed description in creating and programming the computer.
- Write did you learn while doing your project?
- How did the results validate what was expected to happen?
- What did you learn from your project?
- In what ways is your new program important?
- What are other questions you have now?
- What might you do differently next time if you made one again?
- How can the information you learned be applied to real life?
- Does what you write show evidences of learning?



The Display Board

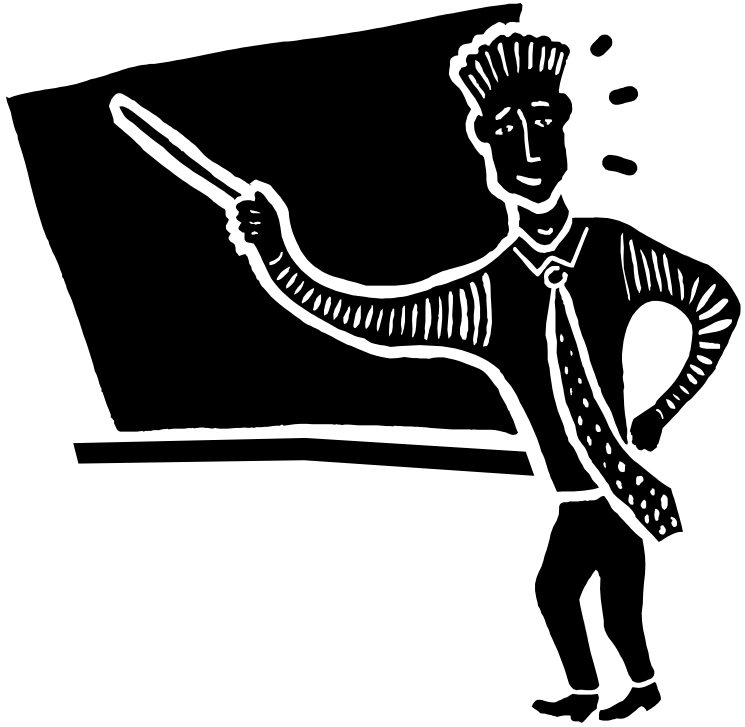
This is your Showcase!

You need a display board.

- All the steps of the Computer Design should be on the display board except the research.
- Give yourself at least 1 week to make your display board.
- Make it:

  Neat, Creative, Easy to Follow, Errorless (no scribbles), and Informative

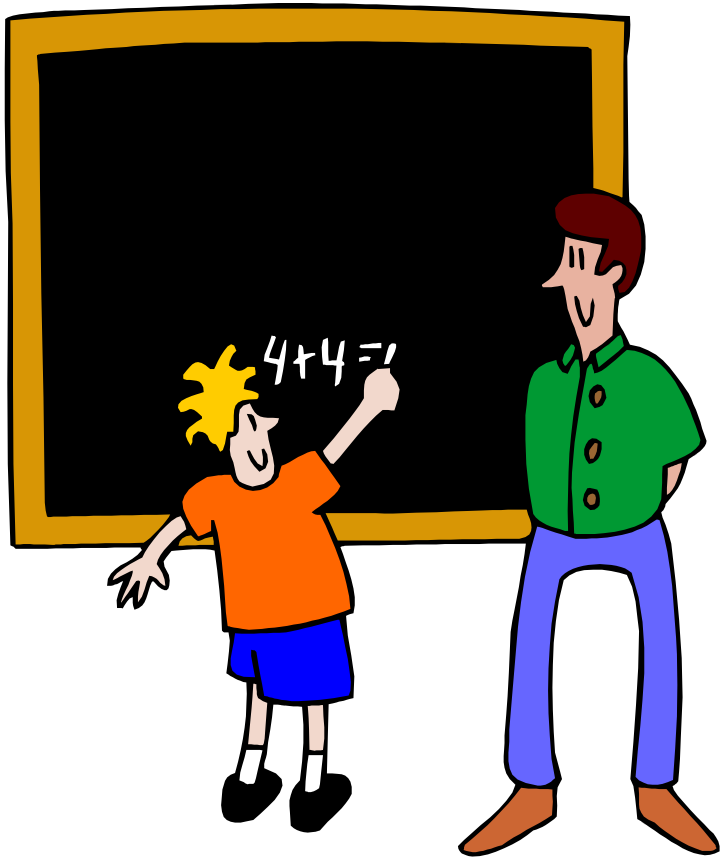
- Your display board should reflect your journal but may not have as much information as your journal.



The Interview

You will be interviewed.

- Know these things (but not limit to just these ideas).
  - Information you have read about.
  - All the things you did while following the computer design.
  - What you learned from your project.
  - How the projects has helped you better understanding the world around you.
  - Other questions you now have.
  - What you would change next time if you did the project again.

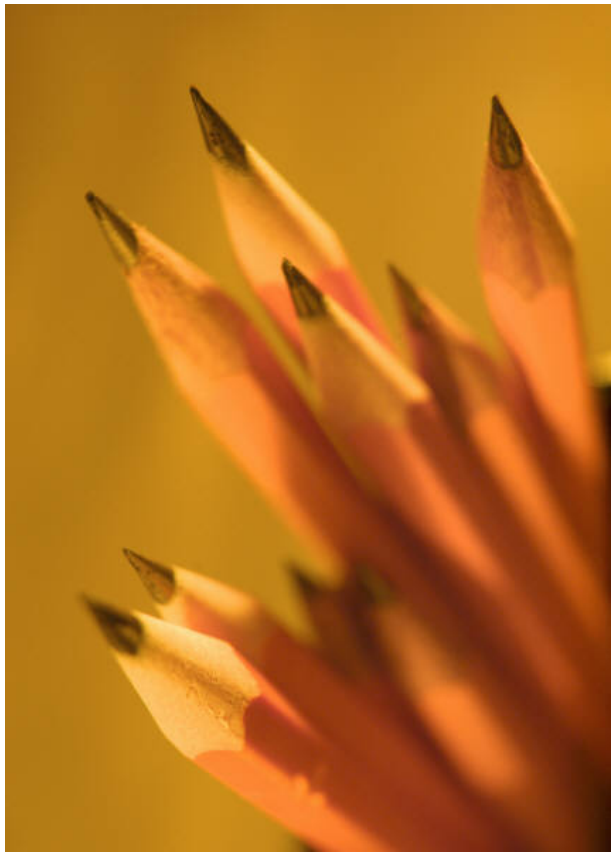


Thoroughness

- Follow through with these ideas:
  - Goals of the project
  - Creativity in the design
  - Clarity
  - Appropriate methods
  - Appropriate equipment
  - Appropriate grade level
  - Knowledge
  - Enthusiasm
  - Individual effort
  - Completed journal
  - Creative display board

2019-20 STEM Fair Entry Form

- Before you begin your project for the school STEM fair, you need to fill out the 2019/20 Central Utah STEM Fair Entry Form.
- Filling out this form helps you know what you need to do to qualify for the school fair, district fair, and the Central Utah STEM Fair.
- It gets you started in the right direction.
- There are three pages to this form that needs to be filled out.
  - Page 1 Student Information and "Special Projects' Signature Page"
  - Page 2 Science Fair Project Research Plan
  - Page 3 Safety Rules and Signatures



STEM Fair Rules

Some STEM fair projects may be dangerous to humans and animals. If your project includes any of the things written below, signatures must be obtained by professionals to make sure it is safe. These rules are set by the International Science Fair committee and need to be followed when doing a STEM fair project. **If these rules are not followed, the project will be disqualified for any science fair competition.**

1. Using Humans
2. Using Vertebrate Animals
3. Using Hazardous Substances or Devices
4. Using Bacteria, Mold, Fungi, Viruses, Parasites, Human or Animal Fresh Tissues, or Body Fluids
5. Using controlled substances

The following slides go into detail of the projects listed above and the signatures that need to be obtained to qualify to be in the school and district STEM fairs. Page one on the CUSF STEM Fair Entry Form is for the signatures needed.

Also note: Growing any microorganisms must be done in a lab. Any microorganisms that are grown at home will disqualify the science fair project for any competition.

Some STEM Fair Projects Need Signatures

If you do a science fair project using humans you need approval and signatures from:

- **Your school science teacher**
- **A school psychologist (from your school), psychiatrist, a medical doctor, physician's assistant, or a registered nurse.**

Note: All people used in the experiment must sign a consent form. If children are used who are under 18, parents must sign a consent form for each of the children used.

Some STEM Fair Projects Need Signatures

If you do a science fair project using vertebrate animals you need approval and signatures from:

- **Your school science teacher**
- **A biomedical/biological scientist (veterinarian in this case)**

Note:

- **Pets can only be used for these experiments and used for observational purposes only for behavioral study.**
- **There can be no pain or discomfort to the animal(s) during the experiment.**
- **Proper care must be provided at all times.**

Some STEM Fair Projects Need Signatures

If you do a science fair project using controlled substances (prescription drugs, tobacco, alcohol) you need approval and signatures from:

- **Your school science teacher**
- **A biomedical/biological scientist**

Note:

- **An adult must directly supervise the experiments.**
- **Students must adhere to all federal, state and local laws when acquiring and handling controlled substances.**

Some STEM Fair Projects Need Signatures

If you do a science fair project using hazardous substances or devices (chemicals, firearms, welders, lasers, radioactive substances, radiation you need approval and signatures from:

- **Your school science teacher**
- **A school administrator from your school**

Note:

- **An adult must directly supervise the experiments.**
- **Adhere to federal and state regulations governing hazardous substances or devices.**
- **Follow proper safety procedures for each chemical or device used in the research.**

Some STEM Fair Projects Need Signatures

If you do a science fair project using bacteria, mold, fungi, viruses, parasites, human or animal fresh tissues, or body fluids you need approval and signatures from:

- **Your school science teacher**
- **A biomedical/biological scientist**

Note:

- **Elementary students cannot use blood in experiments.**
- **Organisms collected in petri dishes must be sealed, grown and stored only in a controlled place like a science lab under the supervision of a scientist. They cannot be grown and stored at home. They will be disqualified if they are grown and stored at home.**
- **Using plant parts, hair, sterilized teeth, and fossilized tissue in experiments need no signatures.**

Using People in Your Experiment

If you use people in your project, you must get proper signatures to use them.

- If they are 18 and over, you need to have them sign a paper saying that it is all right to use them in an experiment.
- If they are under 18, you need to have the parents of these children sign a paper saying that is is all right to use them in an experiment.

For More Information and Help on Putting a STEM Fair Project Together…

You can visit the Central Utah STEM Fair Website at:

http://cusef.byu.edu

Questions or Puzzled?

If you have any questions about the rules or procedures, contact paul.nance@jordandistrict.org or call at 801-244-6479.