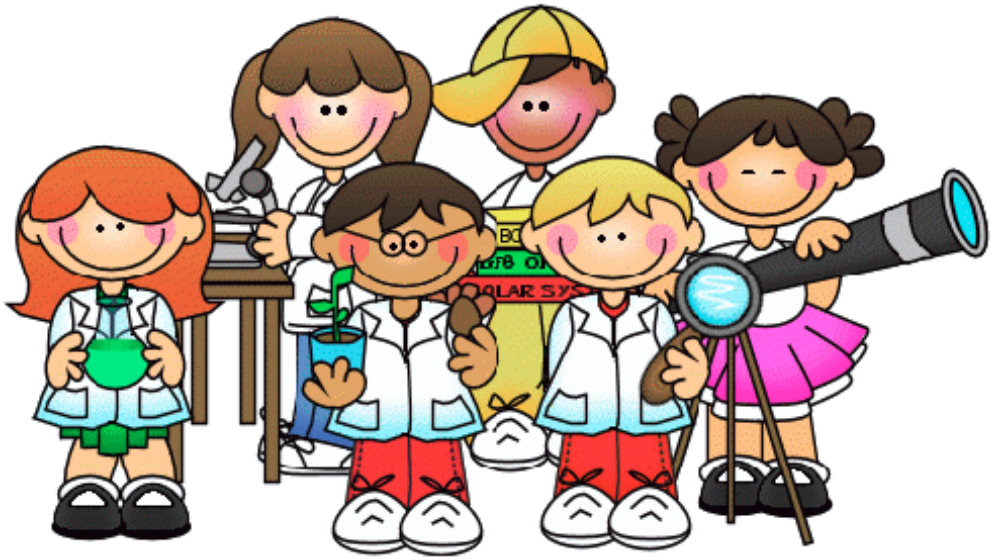
BUSD District
Science Fair/STEAM
Handbook

Distrito BUSD
Feria de Ciencias/STEAM
Manual



Project Guidelines

The project MUST engage students in research into a question to which they do not already know and cannot easily locate the answer. Students should also be able to articulate the purpose and/or importance of their research. Investigations that lack experiments, yet involve observations and data gathering, are also appropriate.

While collections, demonstrations of known information, models, etc. are excellent exercises, they are not appropriate for the STEAM/Science Fair. The old baking soda and vinegar volcano or an insect collection would, therefore, not be acceptable.

As students ask their questions and develop their hypotheses, design their experiments, gather their data, and complete their inquiry projects, they should also keep a notebook. The notebook must be submitted with the project and will be part of the project scoring.

A display showing the process and results enables the judges to view and evaluate the student's work. The display may be a "poster," but it should be affixed to a cardboard or form board for support.

Traditional Science Fair Projects

Traditional science fair projects should include a problem/question that can be answered through an experiment. Students must have a thoroughly developed hypothesis/prediction for their experiment/project. Some examples of possible problems/questions for the traditional science fair project are:

- How does increasing the salt content of water affect the density of the water solution?
- What effect do nutrients have on seed germination?
- How does acidity of water/soil affect plant growth?

Examples hypothesis: I think that as more salt is added to the solution, the density will increase more than the solution without any salt.

STEAM (Scienc**e T**echnology **E**ngineering **A**rt **M**ath**) Fair Projects**

STEAM Fair projects should also include a thoroughly developed problem/question as well as a clear solution to the problem/question. The problem/question should be timely with a real solution. The project should indicate what elements of STEAM were incorporated into the experiment as well as the project presentation. Some examples of STEAM-based projects are:

- In 2007 the United States Government enacted the Better Use of Light Bulbs Act (BULB) to increase the efficiency of light bulbs and reduce energy consumption in homes and businesses across the country. Your project should determine if using compact fluorescent lighting vs. incandescent lighting increases efficiency while reducing costs. The project should include a cost-saving analysis.
- Recently there has been a push to provide urban neighborhoods and communities with local, healthy, and sustainable sources of fruits and vegetables. Can these urban neighborhoods be built? What are options for providing continuous food sources? Design a neighborhood plan with solutions to provide residents with fresh fruit and vegetables. The project should include how the food sources will be divided among community members.

Example hypothesis: I think that urban neighborhoods that have dedicated land for community gardens with support from local businesses can provide a sustainable food supply of fruits and vegetables to residents.

Project Format

*Below is the suggested format for STEAM and Science Fair Projects. We encourage students to include examples and artifacts from their experiment/project as a part of the display. We also encourage the use of technology. Use at least three (3) sources of information on your topic, at least one source must be print (book, newspaper, magazine, encyclopedia), don't forget to cite each source you use.

Title: Think of an interesting and catchy title for your project

Purpose: Statement about something in the world you are curious about or why you wanted to learn about this or were curious about this topic.

Problem/Question: Must be something that can be tested or evaluated. Pick something that has one manipulated variable that can be tested.

Hypothesis/Prediction: What is your educated guess about the outcome of your project?

- Restate the question entirely with a guess (ie: will or will not/is or is not).
- Do not include reasoning because anything put into a hypothesis must be tested before the reason can be included.

4 Steps to a great hypothesis:

1. State your hypothesis with "I think that…"
2. Include all manipulated variables in your hypothesis ex: (adding salt, acid, etc).
3. Use the future tense when writing out your hypothesis (ie: will or will not)
4. Restate the question entirely. Do not change the meaning of the problem/question.

Example: Problem/Question: Will a plant fed water grow more than a plant fed acid or oil?
Hypothesis: I think that a plan fed with water will grow more than a plant fed acid or oil.

Materials: A numbered, detailed list of materials that would be needed to conduct the investigation. Include quantities, amounts, types, (be specific).

Diagram: A detailed diagram of the project set-up with labeled variables, amounts, or times. Make sure to label your diagram!

Controlled Variables: Things that are kept the same to make the test fair. If they were not the same, it would be impossible to determine which variable affected the investigation. For STEAM projects, this could be time, space, etc.

Manipulated Variables: What was changed on purpose to find an answer or make a comparison? '

Procedures: List the steps in the investigation in sequential order. Directions someone else could follow to complete the investigation.

Data/Results: Collect the data. Prepare the charts, journals, diagrams, photographs, or tables that you may need. Students can represent the data as percentages, averages, graphs, etc.

Conclusion: Explain what happened (use your data). What was discovered? There are 4 steps to a successful conclusion:

1. Explain if the hypothesis was proved or disproved. "My hypothesis was proved/disproved because…"
2. Discovery – What did you find out?
3. Proof – Data accumulated must be presented from smallest values to largest values.
4. Ending – What conclusion can you make from the data?

Note: A conclusion is not making observations about the data or speculations about the results. Instead, save that for the discussion. A conclusion is answering the question and using the data to prove what you are stating.

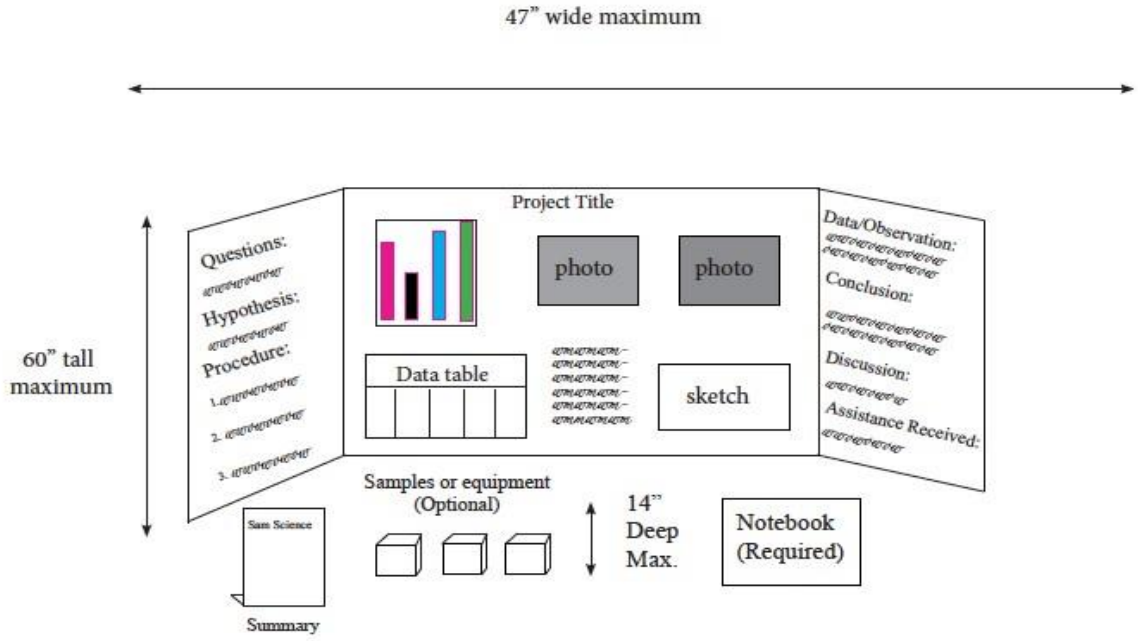
Discussion: (Use what you discovered to answer the questions. What did you learn?)

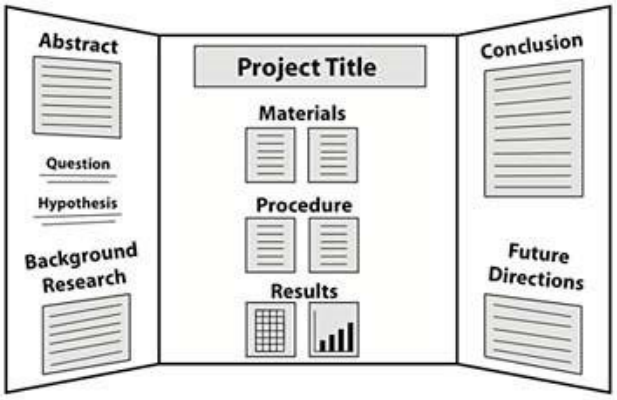
1. Analyze what you learned about your results and data
2. Discuss why or why not your hypothesis was proved or disproved.
3. Discuss experimental design flaws or changes that could have been made.
4. Can you make a prediction about real-world situations from what you learned?

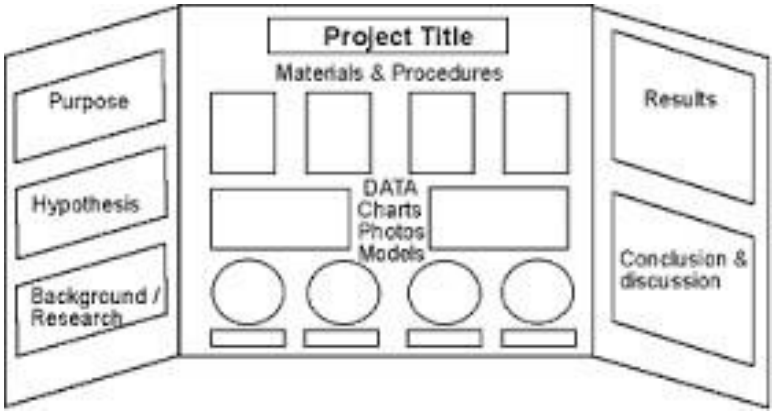
Display:

1. The student's original laboratory/research notebook must be present for inspection by the judges.
2. The complete summary must be displayed with the project.
3. Student name(s) should be on the back of the display and inside cover of the notebook.
4. Display Size Limitations
    - Project display boards are not to exceed 60" tall x 47" wide.
    - Each project will have an allotted table space of 14" deep (front-back) by 47" sideways.
    - Projects will be displayed on tables. They must be self-supporting.
    - All projects must fit within these size limitations. This includes elements of the project that may extend or protrude.
    - The display may consist of a "poster" affixed to a cardboard or foam board display board.
5. Safety and Ethics: See Display Regulations at www.usc.edu/CSSF
    - All projects must adhere to all Sonoma County laws for public safety. Lasers must be appropriately shielded. Projects must sustain their own weight.
    - No hazardous materials may be exhibited at the project display. This includes, but is not limited to, acids, unsecured glassware, mercury (including glass thermometers), hazardous microbes, carcinogenic and radioactive materials, open flames, and unsealed foodstuffs, which may attract pests. For these items, the substitution of illustrations or photographs is encouraged. Materials in violation of this rule will be removed by the Science Fair coordinators.
    - Displays may not contain any living organism except plants. The display of preserved animals is not permitted. Projects may not display photographs or procedures detrimental to the health and well-being of vertebrate animals. Photographs of surgical procedures may not be exhibited.
    - Projects involving animals must be in compliance with the rules of the California State Science Fair. See their website for research and display regulations under "Information for Students" at www.usc.edu/CSSF
6. Electricity will not be available.
7. If a computer is required for a project display, it is entirely the student's responsibility. Be sure that your battery is charged.

Project Display Examples







Bellevue Union School District Science Fair Project Summary

Project Title:

Student(s)' First and Last Name:

Student(s)' Grade:

Student(s)' School:

Purpose/Objective(s)/Goal(s):
(One or two simple sentences)

Problem/Question

Hypothesis/Prediction
(One or two sentences. If you are doing an experiment, the hypothesis might be an if…. then… sentence)

Methods and Materials
(Simple and Clear)

Results/Data Summary
Summary Sentence (Summarize results in one or two sentences)
Results Summary (Summarize results; don't give all the details)

Conclusions

Discussion
Did the results support the hypothesis or answer the question?
Mention some of your data that supports your conclusion.
Does your project indicate or lead to other work?

Help Received
Who provided what kind of help?

☐ Science OR ☐ STEAM

BUSD Science/STEAM Judging Form

Student Name(s): _____ Project #_____

Mandatory Components Are Present:
[ ] Project is Inquiry-Based [ ] Display [ ] Typed Summary [ ] Notebook

Score: Page 1_____ + Page 2_____ = ____ **TOTAL** (includes bonus 0-30 points) [ ] Adding Checked?

Ribbon Color (circle): none White (80-94 pts) (70-79%) Red (105-109 pts) (80-89%) Blue (110-125+ pts) (90%+)

Scored Sections	Points Possible	Points Earned	• **Commendations** • **Suggestions for improvement**
A. Summary Sheet & Notebook • **Summary Sheet:** Complete • **Notebook:** Kept up throughout the project, entries dated, table of contents, page numbers. The notebook may be hand-written or typed • Both should be neat, easy to understand, with proper spelling and grammar.	20		[ ] exceptional, excellent [ ] needs improvement
B. Project Display • Display is self-explanatory, easy to understand • Sections neatly and clearly labeled (question, hypothesis (if experiment), procedure, data, conclusions, etc.). • Spelling and grammar are correct. Writing is neat. • Meets requirements. (size: max. 47" wide, self-standing). • Overall appearance and quality. Creativity of display.	25		[ ] exceptional, excellent [ ] needs improvement
C. Creativity, Originality & Skill Level • The approach to the investigation was scientific • The problem is new, different, and/or meaningful (purpose/benefit to society) • A well-developed **original or creative approach** was used • Procedure steps were listed and appropriate • Is well organized/clear/concise • Safety issues, if any, were addressed • Adequate sample size used for experiment • The approach and level of difficulty were reasonable for a student of this age • Technical problems, if any, were overcome and not merely avoided • The study was carefully designed and appropriate for the student's skill level, age, and resources • The study was clearly the student's work. (It is appropriate for students to receive help and instruction from others, but the project should be done by the student. **All help should be clearly noted and credited**.) • Data collection and measurement were done carefully and recorded neatly and accurately in the notebook • Resources used for evidence/research are adequately cited • Conclusions accurately based on data	30		[ ] exceptional, excellent [ ] needs improvement
Total Points Page 1 (sections A-C):	75		[ ] adding checked?

D. Scientific Thought/Organization • Based on a clear question (and hypothesis, if experiment) • Project was well thought out and used an approach that was reasonable and appropriate for the question, hypothesis and student's age and resources • Data and conclusion relate to the question/hypothesis • **<u>If experiment</u>**, variables are used and identified • Experiment was performed multiple times or multiple angles were considered for experiment/problem • Data displayed in a clear manner, preferably using a data table, graphs, photos, etc. The data presented are recorded in the notebook	25		[ ] exceptional, excellent [ ] needs improvement
E. Scientific Rigor & Thoroughness • Evidence of **preliminary research**, reading and preparation prior to starting actual experimentation (sources cited) • All pertinent data recorded, thoroughly analyzed and clearly communicated • **Conclusions clearly based on data collected** • Connections between experiment/investigation, data, etc. clearly shown • Accuracy, reliability, and reproducibility of the data were evaluated. Adequate data collected/enough trials for conclusion drawn, Controls clearly identified • Possible sources of error and uncontrolled conditions discussed. • Use of scientific tools and technology were appropriate	25		[ ] exceptional, excellent [ ] needs improvement
F. Interview (Bonus) • Student has prepared a brief (1-2 minute) presentation • Student's answers indicate comprehension of scientific principles and practices. Understanding of the science behind the project is shown • Interview leaves no doubt that the student understands the project and that the project was done by the student rather than by a teacher, mentor, or other helper • Student is able to explain the purpose, procedure, and conclusion(s) in a clear and concise manner • If a group project, each member showed understanding of the work, although different group members might have had different responsibilities within the team	25		[ ] exceptional, excellent [ ] needs improvement Up to 25 bonus pts
G. Judges' Discretion (Bonus) Occasionally a project may very well done, but the criteria above may not clearly reward the student for their good work. A student may have undertaken an exceptionally **difficult challenge**; demonstrate exceptional **creativity**; have a **creative display**; etc.	5		Up to 5 bonus pts
<u>Total Points Page 2</u> (sect D-E 50 pt poss. With Bonus 80 pt poss.)	80		[ ] adding checked?