RESEARCH PROJECTS

From IDEA to DISPLAY BOARD to COMPETITION!

STUDENT, TEACHER, & PARENT GUIDE

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Last Revision 8/7/09, K. Kinsman

Introduction

Congratulations on accepting the challenge of entering a science & engineering research challenge/expo/fair. This guide is designed to help you succeed in your efforts.

What kind of project should I do? That's the question many of you are probably asking yourself.

A science or engineering research project can be an investigation into almost any area in which you are interested. It's an opportunity that can lead to the discovery of new personal knowledge. Your idea can take you to competition at several levels and to rewards such as prizes, scholarships and trips.

By working on a project, you begin to **understand the process of researching and developing ideas**. Tested and proven ideas lead to a better future for us all.

How do you choose a project? Collect ideas for projects as you talk with people and read articles. And, read the chapters in this guide for some additional helpful hints. Think about things that interest you. What questions do you have about those things that you might be able to answer by doing a research project?

Basic Ingredients

<table>
<tr>
<td>
<h2>Topic/Title</h2>
Choose a topic, and focus to make it specific. It should describe one of two types of projects:
Science Project
Engineering Project
Science projects focus on research and produce knowledge about the world, while Engineering projects focus on design and produce a physical product.
</td>
<td>
<h2>Scientific Method/Process</h2>
This is a method scientists follow to do their projects.
Purpose/Question
Hypothesis
Procedure
Research
Experiments Data Results/Conclusion
</td>
</tr>
<tr>
<td>
<h2>Engineering Method/Process</h2>
This is the method engineers follow to do their projects.
Problem definition and engineering goal
Approach
Analysis
Evaluation
Present result
</td>
<td>
<h2>Both Methods/Processes Include:</h2>
An abstract, which is a brief summary of the project.
An exhibit, which displays your project.
</td>
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</table>

From Topic to Title

Below are some guided suggestions of how you may go about choosing a topic for your project...

Student: ***How do I do a research project?***

Guide: What are you curious about?

Student: ***Well, I'm interested in:***

People	Diseases	Animals	Television
Plants	Electricity	Rocks	Pollution
Space	Solar Energy	Music	Water Conservation
Weather	Computers	Inventing Things	Etc... (there are infinite possibilities!)

Guide: Whoa! You could do a hundred projects in any of those. Decide what you're **really** curious about. What **really** gets you excited? What do you **really** want to know about? Then focus on something in particular.

Student: ***Oh, you mean like:***

- What makes a person an adult? (human subjects)
- How can I best train my pet? (animal sciences)
- How can plants be protected against pests? (plant sciences)
- What do different colors in rocks mean? (earth science)
- What's the difference between music & noise? (physics)
- How does weather change? (earth science; climatology)
- How does sickness affect people? (medicine & health sciences)
- Which TV show do people watch? (human subjects)
- How does electricity do work? (engineering—electrical)
- How can pollution be controlled? (environmental science)
- Which winter clothing is really best? (materials engineering or human subjects)
- Do movies change people's attitudes? (human subjects)

Guide: That's a much better list. It is the same set of ideas, but more specific. You need to be very specific so you can really figure things out. You should try for the most exact information you can discover. It's like the difference between estimating and measuring, kind of like telling people you fell off a tall ladder. Just think how they'd react if you told them you fell off an eighteen-foot ladder! Be specific if you want people to understand you. In science, information has to be exact if it's going to matter.

Student: ***Let's see if I can make my list more specific:***

- How do eighth graders compare with adults? (human subjects)
- Does the length of an animal training session make a difference? (animal sciences)
- Can companion planting protect beans from beetles? (plant sciences)
- How do cloud formations predict weather? (earth science)
- What influences the rate of recovery from the common cold? (medicine & health sciences)
- How do you design television programs based on surveys? (human subjects)
- Can a worn out battery do work? (engineering—electrical)
- Can smoke be captured from the air? (environmental science)
- Can mice decide the best insulation? (animal sciences & energy)
- Do movies affect people's hopes and fears? (human subjects)

Guide: Much better. Your list sounds like project titles! you could go on forever. Time to choose a project...

Project Types

Type 1: Science Project

How long does it take the heart to return to normal after exercise?
How rapidly does a plant make starch?

Either of these questions could become a science project. Follow the **scientific method/process**:

- **Purpose/Question**: Identify a question to be answered.
- **Hypothesis**: Form a guess to explain the behavior or answer the question (what do you think will happen?).
- **Procedure**: Develop a plan to test the accuracy of the hypothesis
- **Research**: Collect information to help you answer your question. Use books, magazines, interviews, and TV. Try contacting businesses, utilities, government offices, etc.
- **Experiment**: Test your hypothesis.
- **Data/Results**: Collect data from your experiment; analyze the results.
- **Conclusion**: Draw a conclusion about your hypothesis. What did your project teach you? Even if your experiment proved your hypothesis wasn't true, you've learned something of value.

Type 2: Engineering Project

What inclination produces the most solar gain?
Which arrangement of cores/coils produces the strongest electromagnet?

Either of these questions could become an engineering project. Follow the **engineering method/process**:

- **Problem definition**: Describe what the problem is and what solution is needed.
- **Approach**: Outline the plan to solve the problem.
- **Analysis**: Begin plan execution; collect information, design possible solutions, and check results.
- **Evaluation**: Evaluate possible solutions and choose the best one.
- **Present Results**: Write a complete description of the final solution.

Project Categories

The process of science focuses on **RESEARCH**, while the process of engineering focuses on **DESIGN**. Science produces **KNOWLEDGE** about the world, and engineering produces a **PHYSICAL PRODUCT**. *Investigations for a science or engineering project may be made with a collection or with a model. The model or collection by itself does not constitute a science or engineering project.* Every year a few exhibits are placed in the wrong category. The error usually arises when the student confuses the basic idea behind the project with some of the methods or equipment used to carry out the work. For example, many projects will involve the use of a computer, but only a few will quality for the Computer Science category. The Earth and Space Sciences category involves geology and astronomy. Solar collecting systems belong in the Environmental Science or Engineering category. Give yourself a chance to compete fairly by double checking your category with your teacher. And, talk with your teacher about protocol forms required before you begin your experiment, especially if humans, animals, tissue or DNA are involved.

CATEGORIES

Animal Sciences	Behavioral/Social Sciences	Biochemistry *(Senior Division ONLY)*
Cellular & Molecular Biology	Chemistry	Computer Science
Earth Science	Engineering	Energy & Transportation
Environmental Sciences/Management	Mathematics	Medicine & Health Sciences
Microbiology	Physics & Astronomy	Plant Sciences

For specific descriptions of each category, please go to our website…
http://stemed.unm.edu

Where to go, What to do

Student: ***It seems complicated. I think I'm getting a little confused.***

Guide: That's because you don't have much experience. It's like learning a new game, hobby, sport, or job. Nobody knows everything the first time. Talk to people who have done a project once or twice before. They will tell you that you'll pick it up as you go along.

Student: ***I'm still not too sure I remember it all.***

Guide: Look. You are finding out about something and making a display. Doing a science/engineering project is like doing a puzzle, playing a sport or giving a musical performance. You become better at it as you stick with it. Remember, your project idea can take you places.

Student: ***O.K. I've got an idea for a project. Where do I start?***

Guide: Well, first things first. Let's review an eight-week schedule:

8-Week Schedule

Week 1	Week 2	Week 3	Weeks 4 & 5	Week 6	Weeks 7 & 8
Think & read about the project.	Change title if necessary.	Conduct experiments.	Continue experiments.	Write your report and bibliography.	Finish the information you want on your board.
Talk to teachers, friends, and family.	Collect information.	Test many times to be sure.	Check outline.	Think about how you are going to organize your project exhibit board.	Assemble exhibit board.
Collect ideas. Become specific.	Research. Take notes. Write outline.	Keep careful records.	Write a rough draft of what you've done & learned.	For ideas on putting together a board, see the Appendix.	Practice presenting your project the same way you would to the judges.
Decide project title.	Check with teacher to see if you need prior SRC approval.	Meet with resources (people who can help with ideas).	Get teacher's opinion.	Check your project notebook to be sure all important data has been included.	See the Appendix for scoring information!
Write a description.	Fill out the required ISEF forms.	***Please be sure to check the ISEF Rules for Pre-College Research as well as the flowchart in the Appendix to see if your project is going to need to be approved by a Scientific Review Committee BEFORE you start gathering data or performing experiments.*** **IF YOUR PROJECT REQUIRES SRC APPROVAL PRIOR TO EXPERIMENTATION: Without the appropriate approvals BEFORE you start experimentation/data gathering, you could run the risk of being disqualified from local, regional, state, and/or international competition.**			
Get teacher's opinion.	Submit ISEF forms to SRC to get prior approval (if needed) BEFORE you start your experiments.				
Start EARLY especially if your project is going to need prior SRC approval. ***Please be sure to read the ISEF rules & look at the SRC Flowchart to determine if your particular project needs PRIOR APPROVAL!***	List all sources of information. Make sure you have at least 3-5 sources.				

How To Do Scientific Experiments

Below are some examples of experiments. There is something wrong with each of them. Can you guess what it is?

1. Two fertilizers are being tested to determine which is best for growing beans.

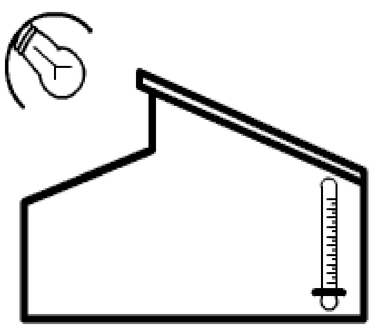
Fertilizer A in Sandy Soil

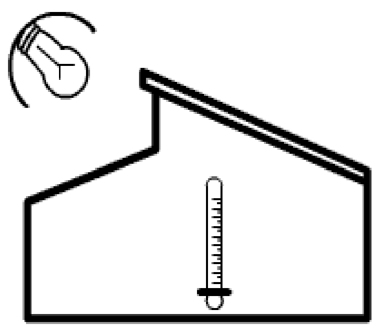
Fertilizer B in Clay Soil

ANSWER: The plant on the left has sandy soil, the right one has clay soil. How do we know if the plant on the right is growing better because of Fertilizer B, or because the plant is in different soil?

Any experiment must be controlled so that there is only one important difference. The conditions for the growth of these plants must be the same, except for the difference in fertilizers. That way if there is any difference in the growth of the plants, we would think it was caused by the different fertilizer.

2. A model of a solar home is being tested to determine which kind of building material gives back the most heat after the light is turned off.

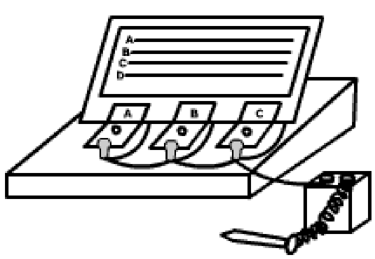




ANSWER: Can you see that the different thermometers are in difference places in the houses? How do we know whether the difference in temperatures is due to the difference in building materials or because the thermometers are in difference places?

Any experiment must be controlled so that there is only one difference. In this experiment, the only important difference should be building material.

3. A teaching machine is being tested to determine if it is an effective teaching tool.



ANSWER: Could it be that there was another important difference between these two groups besides the use of the teaching machines? Sure. One group is older.

Any experiment must be controlled so that there is only one difference. In this experiment, the only important difference between the two groups should be the use of the teaching machine.

Ten students are given 25 science facts to study. The oldest half study the facts with the teaching machine because they know how to work with it. The other half studies from a fact sheet.

All ten students are tested on the facts. The group that used the machine scores higher. This proves that the teaching machine is the best method of teaching.

The Research Report

Your research report provides a formal background for your project. It helps you put all your project experiences in order. And, it lets your teacher and the judges learn more about your efforts. This is one good way to begin.

PROJECT NOTEBOOK: The project notebook is a student journal. It includes dates, times, activities, notes, drawings, and observations. Each student on a team should keep his/her own project notebook. Project notebooks should be well organized and reflect student work. The project notebook is a rough draft and is generally handwritten.

OUTLINE: Copy the main ideas from your notebook into a simple outline. Organize your thoughts around the scientific method you've followed:

TITLE
I. Purpose
II. Hypothesis
III. Procedure
  A. Research
  B. Experiment
IV. Results
V. Conclusion

And, fill in your outline with information from your notes.

ROUGH DRAFT: Now write out the outlined information. Think of it as a letter to your teacher, or to one of the judges. Each section of your outline should be a separate paragraph.

PROOFREAD: Look over what you've written. Pretend you are the teacher or judge. Does the report make sense? Rewrite until every thought is clear. Ask at least one other person to check your paper—more if you have time.

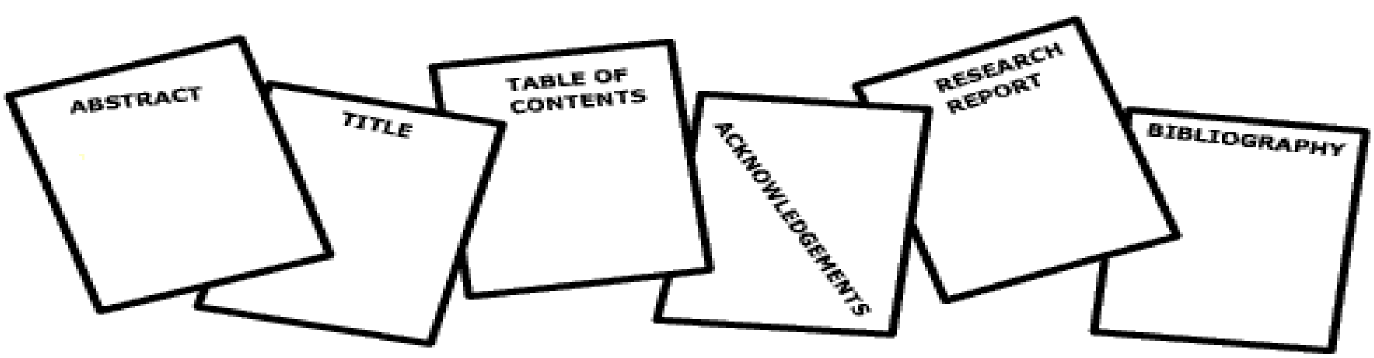
FINAL COPY: When you are sure that your rough draft tells the story of your project, write the final version.

ABSTRACT: This is a short version of your research report. it should be about 250 words, fit on one page, and contain only five paragraphs: 1) the Purpose, 2) Hypothesis, 3) Procedure, 4) Results, and 5) Conclusion. It should be no longer than 250 words (use only one side of a page). If it is typed, be sure to double space; if it is handwritten, skip lines.

Content - Your abstract is a summary, an overview of your project. It should include:

Purpose: Why did you do your project? What was the question you wanted to answer? What was the problem you tried to solve?
Hypothesis: This is a "best guess" explanation of what you think your experiment will prove.
Procedure:
  A. Research - Briefly explain your research plan. How did you gain information about your project?
  B. Experiment - Mention the goal and outcome of any experiments. Did they prove or disprove your hypothesis?
Results: What were the most important facts learned from the project?
Conclusion: What do your results mean? Can you compare the results to anything else you know? Do your results give you any ideas for future research?
Style: Be sure your thoughts are clear. Have someone check your spelling and grammar. If your paper is handwritten, be extra neat.

Now you are ready to present your research report with your exhibit. It could look like this:



Exhibits

Size - It must not be larger than 48 inches wide, 30 inches deep (front to back), and 9 feet tall (from the floor to the top of the display board). Keep your exhibit neat, uncluttered, and to the point.

Material - The materials must be strong, lightweight and self-supporting. You should be able to assemble it yourself. Be sure to make everything sturdy so it can be safely transported. Make sure you can fit it into your car. Fasten everything well. Use hardware not tape.

Safety - Anything which might be hazardous is prohibited. Do not use open flames, dangerous chemicals (even household cleansers can be very dangerous when mixed), unshielded light bulbs, etc. You will need to supply your own electrical cord if needed. Be sure it's in good shape and uses a three-prong (grounded) plug. Check with your teacher for complete rules. Also, if you are working with live vertebrate animals, you will need to check with your teacher for special permission. ***Be sure to read the Display & Safety Rules for the current fair year!***

Display - Use attractive lettering. You might like to make up your own cut-outs because small stencil letters can be hard to read. Use one-color printing to avoid confusion. Spell correctly. Main points should be large and simple. Details must be clear 3-5 feet away. You may include any of the following:

Posters - These "advertise" the main features of your project. You might use drawings, pictures, outlines, etc.
Graphs - There are many types. Line graphs, bar graphs, and picture graphs all serve to illustrate some kinds of results. Check your math textbook for more information.
Models - Be able to explain them!

Photographs, Slides - These can display information you couldn't bring to the fair. They can also show different stages of your project's development.

Final Preparations

Student: ***I guess I might have to look over all that a few times, but it doesn't look too bad. Basically all I need to show is the exhibit itself, including the abstract?***

Guide: That's it! You might want to include your *bibliography.* That's a list of all the materials you read during your research. Your teacher can help you with the proper form. And you can do a *research paper.* It is something you can read over while you are waiting to be questioned. The judges might like to read it too!

Student: ***Questions? Judges?!!!***

Guide: You can also exhibit any *notebooks* you have kept during your project.

Student: ***What's this about judges?***

Guide: You might even practice giving a *speech* to your family, friends, or class. It will prepare you for talking to the judges.

Student: ***Judges! Wait a minute. What's all this about judging?***

Guide: School science fairs use judges to select the best projects. If you win at your school fair, you might be eligible to go to the regional science fair. There you will be competing with hundreds of students from other schools. Many thousands of dollars' worth of awards, prizes, and scholarships are given out.

Student: ***I don't know about this judging stuff!***

Guide: It's not tough. Judges are people who enjoy talking to people about their exhibits.

What Judges Look For

What to Do and Say...

Follow the scientific/engineering process as you describe your project.

- Practice presenting your project to your family and friends.
- Be neat in appearance and polite in manners.
- Speak to the judges as conversation partners. Look directly at them. Speak slowly. Be sure they understand you.
- The interview is an essential element in the evaluation of the research project. Be prepared to answer a variety of questions and discuss the scientific concepts that support the study. The dress code is business/business casual.

What Judges Look For...

Creative Ability: Does the project show originality in framing the problem, in analysis or interpretation of data, or in the construction, design or use of equipment?

Scientific Thought/Engineering Goals: Has student identified a clearly stated problem that is limited enough so that a solution is possible, clearly defined the variables, provided controls if indicated, collected adequate amounts of data, arrived at conclusions that are supported by data, identified further research if indicated?

Thoroughness: Was the project carried out to complete its original aim? Is there replication or is it only a single experiment? Does experimenter show a knowledge of other approaches/ideas concerning the project? How much time was spent on project?

Skill: Does the experimenter exhibit necessary laboratory skills, computational skills, observational skills, and design skills? Was equipment built by student? What support did experimenter receive from school, home, experts?

Clarity: How clearly is student able to discuss his/her project? Is understanding of principles in evidence? Is written material expressed well, with data and results presented in a clear manner? Does the project display explain itself in a clear and orderly manner?

Now, you're ready to get started on a challenge that could be fun, which is the biggest prize of all!

Where to Look for Information for Your Project:

- http://stemed.unm.edu (click on Science Fair, then on Links to Resources)
- http://www.societyforscience.org/isef (access ISEF Rules and Forms here)
- Internet searches (check out http://www.sciencebuddies.com)
- Libraries - school, local, university
- Telephone Book/Yellow Pages
- State, County, City Agency Listings
- Hospitals
- Museums
- Training Facilities
- Military Bases
- National Laboratories
- Universities
- Medical Schools
- Scientific Laboratories
- Public Health Department/Environmental Health Department
- U.S. Forest Service
- NMSU Cooperative Extension Service
- Friends, family, acquaintances with experience in the area of your research

Appendices

Do I Need SRC/IRB/IACUC Approval Before I Start My Project?

Science Fair/Expo Board—Recommended Layout ENGLISH

Science Fair/Expo Board—Recommended Layout SPANISH

Project Scoring Rubric for Judges—SAMPLE

Defining Project Excellence

Glossary of Common Terms

Basic Statistical Analysis

Grading Rubric for Research Projects

New Mexico Agencies That Can Provide Information About Your Project

National Organizations That Can Provide Information About Your Project

Suggestions to Parents and Students as You Start on This
Year's Research Project Together

Ideas & Notes Pages

Student Research Projects
Is SRC or ACUC Approval Needed BEFORE I Start?

DOES YOUR PROJECT INVOLVE…

Asking your friends or other people questions?
Experiments on yourself?
Experiments with people in any way other than pure observation OR product testing of engineering projects?

(HUMAN SUBJECTS – add'l forms required)

DOES YOUR PROJECT INVOLVE…

Your pet OR any other animals that have bones (except people)?
ALL vertebrate animal protocols **must** be submitted to the Regional Fair Animal Care & Use Committee for PRIOR approval.

(VERTEBRATE ANIMALS – add'l forms required)

DOES YOUR PROJECT INVOLVE…

Mold or fungus? Bacteria? Viruses?
Anything that might make you sick?
Cultured samples collected from the environment?
DNA from one organism inserted into the DNA of another?
Anything coming from a human or animal body?
Cheek cells or other cells? Teeth? Bone?
Fluids such as blood, saliva, or urine?

(POTENTIALLY HAZARDOUS BIOLOGICAL AGENTS— add'l forms required)

IF YES,

YOU MUST HAVE SRC/IRB or ACUC APPROVAL BEFORE STARTING EXPERIMENTATION.

See http://stemed.unm.edu for more information & deadline dates for this year.

You &/or your teacher MUST submit your paperwork for pre-approval by the Regional SRC/IRB/ACUC by 12/15/08 IF:

Your project involves ANY type of Vertebrate Animals

OR

Your school DOES NOT have it's own SRC/IRB for other types of projects requiring pre-approval.

IF NO,

If your project **DOES NOT** involve Human Subjects, Vertebrate Animals, or Potentially Hazardous Biological Agents as described to the left, you **DO NOT** need SRC/ACUC approval before starting your project & may begin.

DOES YOUR PROJECT INVOLVE…

Any chemical such as household cleaners, solvents, metals, or organic chemicals?
Model rockets? Lasers? UV Light? Radiation?
Guns, Gunpowder, Explosives?
Trebuchet? Potato Cannons? Archery?
Anything else that might be considered dangerous or hazardous?
Prescription drugs?
Alcohol, wine, or beer?
Cigarettes or other tobacco?
Any product which cannot be legally purchased by students under age 18?

(HAZARDOUS or CONTROLLED SUBSTANCES/DEVICES— Form 3 Req'd)

IF YES,

YOU MUST HAVE YOUR TEACHER/SCHOOL'S APPROVAL TO PROCEED WITH THIS PROJECT.

You MUST complete ISEF Form 3 – Risk Assessment thoroughly & in detail.

APPROPRIATE SAFETY PRECAUTIONS & ADULT SUPERVISION MUST BE IN PLACE.**

****Inadequate safety measures or lack of appropriate supervision could result in disqualification of a project.****

Research Project Exhibit Board

TITLE

The title should be descriptive of the project. It may be stated as a question.

PROBLEM STATEMENT

State the purpose of the project or problem to be investigated. It may be stated in the form of a question.

ABSTRACT

This is a clear, concise (250 words or less) description/summary of the entire project.

Judges look at the Abstract and decide whether or not the student took their research seriously, understands the project, and can clearly explain what was done.

HYPOTHESIS

A statement of what is expected to happen during the research project.

MATERIALS

A list of specific materials used, amounts, etc.

PROCEDURES

A numeric, step-by-step list describing what will be done to complete the research project.

DATA & DATA ANALYSIS

This is the most important part of the board. This is where you share the data you collected along with the analysis of that data.

PHOTOS CHARTS

GRAPHS

RESULTS

This is a statement of what happened during the experiment. It could be considered a narrative of the charts and graphs.

CONCLUSIONS

Discuss the meaning of the results and whether or not the hypothesis is accepted or denied (proven or unproven).

APPLICATIONS/ FUTURE RESEARCH

Tells how the research can be applied and any questions that developed that will or could be researched in the future.

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STEM EDUCATION OUTREACH PROGRAMS

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La Tabla de Investigue Proyecto

TITULO

El titulo deberá describir el proyecto. Y también se podrá quedar como una pregunta.

EXPLICACION DEL PROBLEMA

Establezca el proposito de su proyecto o problema para hacer su investigación. Usted lo puede establecer como una pregunta.

ABSTRACTO

Este es claro y conciso (250 palabras o menos) describer brevemente todo el proyecto.

Los Jueces observan lo Abstracto y de esa manera deciden si el estudiante esta haciendo su investigación seriamente, si entiende lo que es el proyecto, y puede explicarlo claramente.

HIPOTESIS

Explicar lo que se espera que va a suceder durante la investigación del proyecto.

MATERIALES

Una lista especifica de los materiales que ulitizo, cantidades, etc.

PROCEDIMIENTOS

Enumera, paso por paso y en una lista, describe lo que va terminado, para asi completar las investigación del proyecto.

DATOS Y ANALISIS DE DATOS

Esta es la parte mas importane ensu presentación. Es cuando se compate la información recopilada juntamente con el analisis de datos.

FOTOS CARTELES

GRAFICAS

RESULTADOS

Esto es una explicación de lo que paso durante el experimento. Puede ser narrado con cartels y graficas.

CONCLUSIONES

Hablar sobre el significado del resultado para determinar si la hipotesis es exceptada o rechazada (aprovada o desaprovada).

APLICACIONES/ INVESTIGACIONES FUTURAS

Te dice como la investigación puede ser aplicada en cada pregunta que se desarrolle y como pude ser aplicada en la invertigación a futuro.

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STEM EDUCATION OUTREACH PROGRAMS

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Project #: ________________ Judge: ________________________________

FINAL OVERALL SCORE COMPUTATION

Transfer each section's score to the appropriate box below. Add these scores together to find the Total Overall Score for this project.

A Scientific Thought/ Engineering Goals	+	B Creative Ability	+	C Thoroughness	+	D Skill	+	E Clarity	+	F *TEAM Projects ONLY*	TOTAL OVERALL

A. Scientific Thought/Engineering Goals

Select whether the project is an **experiment**, a **study**, or an **innovation**. Determine the level of the project by matching the description with the project. Circle the deserving number of points out of a **maximum of 30 points** (25 points for team projects).

SCORING RANGE →	ACCEPTABLE Level 1	GOOD Level 2	VERY GOOD Level 3	EXCELLENT Level 4	EXCEPTIONAL Level 5
EXPERIMENT (Scientific Thought) Investigation undertaken to test one or more hypotheses.	*Duplication and reporting of an experiment to test a previously confirmed hypothesis*	*Extension of a known experiment via modification of its procedure, data collection, analysis, or application.*	*A new approach to the design, modification, or application of an existing experiment with control of some variables.*	*A new experimental approach to a research problem in which most of the significant variables are controlled.*	
STUDY (Scientific Thought) A collection and analysis of data showing evidence of a correlation or pattern of scientific interest. Variables are identified and controlled.	*Study and presentation of printed material related to the basic issue.*	*Study of material collected through compilation/ expansion of existing data & observation. The study attempts to address a specific issue.*	*Study based on new observations and research of a previously studied topic. Appropriate analysis of data/correlations made.*	*A new approach to the study of a problem which correlates information from a number of sources. The report also offers new insights or solutions to the problem.*	
INNOVATION (Engineering Goals) The development and evaluation of models or innovative devices using techniques or approaches from the field of technology or engineering.	*Building models or other devices that duplicate existing technology, minimal reporting.*	*Makes improvement to an existing technology or uses an existing technology for new applications.*	*Design and build an innovative adaptation of an existing technology for a new application.*	*Build a novel technology or integrate technologies to form an innovative system that has commercial or human benefit.*	

SCIENTIFIC THOUGHT – Issues to Consider

- *Is the problem stated clearly/unambiguously?*
- *Was the problem sufficiently limited to allow plausible attack?*
- *Was there a procedural plan for obtaining a solution?*
- *Are the variables clearly recognized and defined?*
- *If controls were needed, did the student(s) recognize their need and were they correctly used?*
- *Are there adequate data to support the conclusions?*
- *Does the student recognize the data's limitations?*
- *Does the student understand the project's ties to related research?*
- *Does the student understand what further research is warranted?*
- *Did the student cite scientific literature or only popular literature?*

ENGINEERING GOALS – Issues to Consider

- *Does the project have a clear objective?*
- *Is the objective relevant to the potential user's needs?*
- *Is the solution workable? Acceptable to the potential user? Economically feasible?*
- *Could the solution be utilized successfully in design or construction of some end product?*
- *Is the solution a significant improvement over previous alternatives?*
- *Has the solution been tested for performance under the conditions of use? Testing might prove difficult, but should be considered.*

SCORE for Section A: *(30 points max for Individual; 25 points max for Team)*					
Individual	1 2 3 4 5 6	7 8 9 10 11 12	13 14 15 16 17 18	19 20 21 22 23 24	25 26 27 28 29 30
Team	1 2 3 4 5	6 7 8 9 10	11 12 13 14 15	16 17 18 19 20	21 22 23 24 25

A Score:

<table>
<tr><th>SCORING RANGE →</th><th>ACCEPTABLE
Level 1</th><th>GOOD
Level 2</th><th>VERY GOOD
Level 3</th><th>EXCELLENT
Level 4</th><th>EXCEPTIONAL
Level 5</th></tr>
<tr><td colspan="5">B. Creative Ability
• Does the project show creative ability & originality in the questions asked? The approach to solving the problem? The analysis/interpretation of the data? The use of equipment? The construction or design of new equipment?
• Creative research should support an investigation and help answer a question in an original way.
• Creative contribution promotes an efficient/reliable way to solve a problem. Is it gadgeteering OR real creativity?</td><td>B
Score:</td></tr>
<tr><td>SCORE for Section B:
(30 points max for indiv.;
25 points max for Team)</td><td>Individual
1 2 3 4 5 6
Team
1 2 3 4 5</td><td>Individual
7 8 9 10 11 12
Team
6 7 8 9 10</td><td>Individual
13 14 15 16 17 18
Team
11 12 13 14 15</td><td>Individual
19 20 21 22 23 24
Team
16 17 18 19 20</td><td>Individual
25 26 27 28 29 30
Team
21 22 23 24 25</td></tr>
<tr><td colspan="5">C. Thoroughness
• Was the purpose carried out to completion within the scope of the original intent?
• How completely was the problem covered?
• Are the conclusions based on a single experiment or replication?
• How complete are the project notes?
• Is the student aware of other approaches or theories?
• How much time did the student spend on the project?
• Is the student familiar with scientific literature in the studied field?</td><td>C
Score:</td></tr>
<tr><td>SCORE for Section C:
(15 points max for Individuals;
12 points max for Team)</td><td>Individual
1 2 3
Team
1 2</td><td>Individual
4 5 6
Team
3 4 5</td><td>Individual
7 8 9
Team
6 7 8</td><td>Individual
10 11 12
Team
9 10</td><td>Individual
13 14 15
Team
11 12</td></tr>
<tr><td colspan="5">D. Skill
• Does the student have the required lab, computation, observational and design skills to obtain supporting data?
• Where was the project done? Did the student receive help from parents, teachers, scientists, or engineers?
• Was the project done under adult supervision, or did the student largely work alone?
• Where did the equipment come from? Was it built independently by the student? Was it obtained on loan? Was it part of a lab where the student worked?</td><td>D
Score:</td></tr>
<tr><td>SCORE for Section D:
(15 points max for Individuals;
12 points max for Team)</td><td>Individual
1 2 3
Team
1 2</td><td>Individual
4 5 6
Team
3 4 5</td><td>Individual
7 8 9
Team
6 7 8</td><td>Individual
10 11 12
Team
9 10</td><td>Individual
13 14 15
Team
11 12</td></tr>
<tr><td colspan="5">E. Clarity
• How clearly does the student discuss the project and explain the project's purpose, procedure, and conclusions? Make allowances for nervousness. Watch out for memorized speeches that reflect little understanding of principles.
• Does the written material reflect individual understanding of the research?
• Are the important phases of the project presented in an orderly manner?
• How clearly is the data presented?
• How clearly are the results presented?
• How well does the project display explain itself?
• Was the presentation done in a forthright manner, without cute tricks or gadgets?
• Did the student do all the exhibit work or did someone help?</td><td>E
Score:</td></tr>
<tr><td>SCORE for Section E:
(10 points max.)</td><td>1 2</td><td>3 4</td><td>5 6</td><td>7 8</td><td>9 10</td></tr>
<tr><td colspan="5">F. Teamwork (TEAM PROJECTS <u>ONLY</u> – 16 pts max.)
• Are the tasks and contributions of each team member clearly outlined?
• Was each team member fully involved with the project and is each member familiar with all aspects of the project?
• Does the final work reflect the coordinated efforts of all team members?</td><td>F
Score:</td></tr>
<tr><td>SCORE for Section F:</td><td>1 2</td><td>4 5 6</td><td>7 8 9 10</td><td>11 12 13</td><td>14 15 16</td></tr>
</table>

PROJECT AREA	SUBSECTION	DEFINING EXCELLENCE
Clarity	"Curb Appeal"	Clear at first glance what the project investigates. Attention grabbing without cute tricks. Good use of color & organization.
	Explanatory	Without the student, the project display speaks for itself.
	Presentation of Data & Results	Phases of the project are presented in an orderly manner. Data and results are clearly displayed with labels and units as appropriate.
	Objective/Conclusions	The conclusion clearly states whether or not the objective and/or hypothesis was met and why or why not.
Thoroughness	Completion	The project carries out its purposes to completion within the scope of the original aims. The problem has been adequately covered without obvious omissions.
	Replication	The project was repeated at least once, or several trials were done where appropriate.
	Data	Notes, if appropriate, were taken and are complete. Numerical data was taken and data is clearly tabulated and graphed, if appropriate.
Skill	Student's Skills	The student has the skills required to do the work to obtain the data to support the project: laboratory, computational, design, &/or observational skills.
	Techniques, Tests, &/or Equipment	The student is familiar with the techniques, tests, etc. that were performed including the concepts behind them. Equipment was built by the student or borrowed; or the student worked with it enough to become completely familiar with it.
	Assistance	Considering if the work was done at home, in the school laboratory, in a university setting, etc., the student demonstrates that the skills were learned and acquired with some assistance.
Scientific Thought **Refer to this section for projects using the Scientific Method/Process*	Statement of Problem or Objective	The problem or objective is stated clearly and unambiguously.
	Limitation of Problem or Objective	The problem was sufficiently limited so that it was possible to attack. Working on a very difficult problem without a solution or working on a very simple problem is not indicative of a "good" scientist.
	Procedure	The procedural plan is clear as to what the student actually did. The plan is also appropriate for obtaining a solution to the problem.
	Variables	The variables are clearly recognized and defined. If controls are appropriate, there is recognition of their need and they were used correctly.
	Data	Adequate data was acquired to support the conclusions. Limitations of the data are recognized.
	Research	The student understands how the project could be expanded and how it relates to research. Some references to scientific literature (not simply popular literature) are made.
Engineering Goals **Refer to this section for projects using the Engineering Process*	Objective	The project has a well-defined and clear objective.
	Relevance	The objective has a clear relevance to the need of the potential user.
	Solution	The solution is workable, acceptable to the potential user, and economically feasible.
	Successfully Utilized	The solution can be successfully utilized in the design or construction of some sort of practical end product.
	Acceptable Alternative	The solution is an acceptable alternative to the objective. It represents a significant improvement over previous alternatives.
	Tested	The solution has been tested to see if it will perform under the conditions of use. If this would be difficult, has the problem at least been considered and discussed?
Creative Ability	Question & Approach	The project shows creative ability and originality in the question asked and in the approach to solving the problem.
	Analysis of Data	The data has been handled in a way that shows creative thought and originality.
	Interpretation of Data	Data has been thoroughly thought out with justifications of any trends, conclusions, omission of some data, etc. showing creative ability.
	Equipment	Equipment has been used in a new way OR new equipment construction or design shows creative ability and originality.

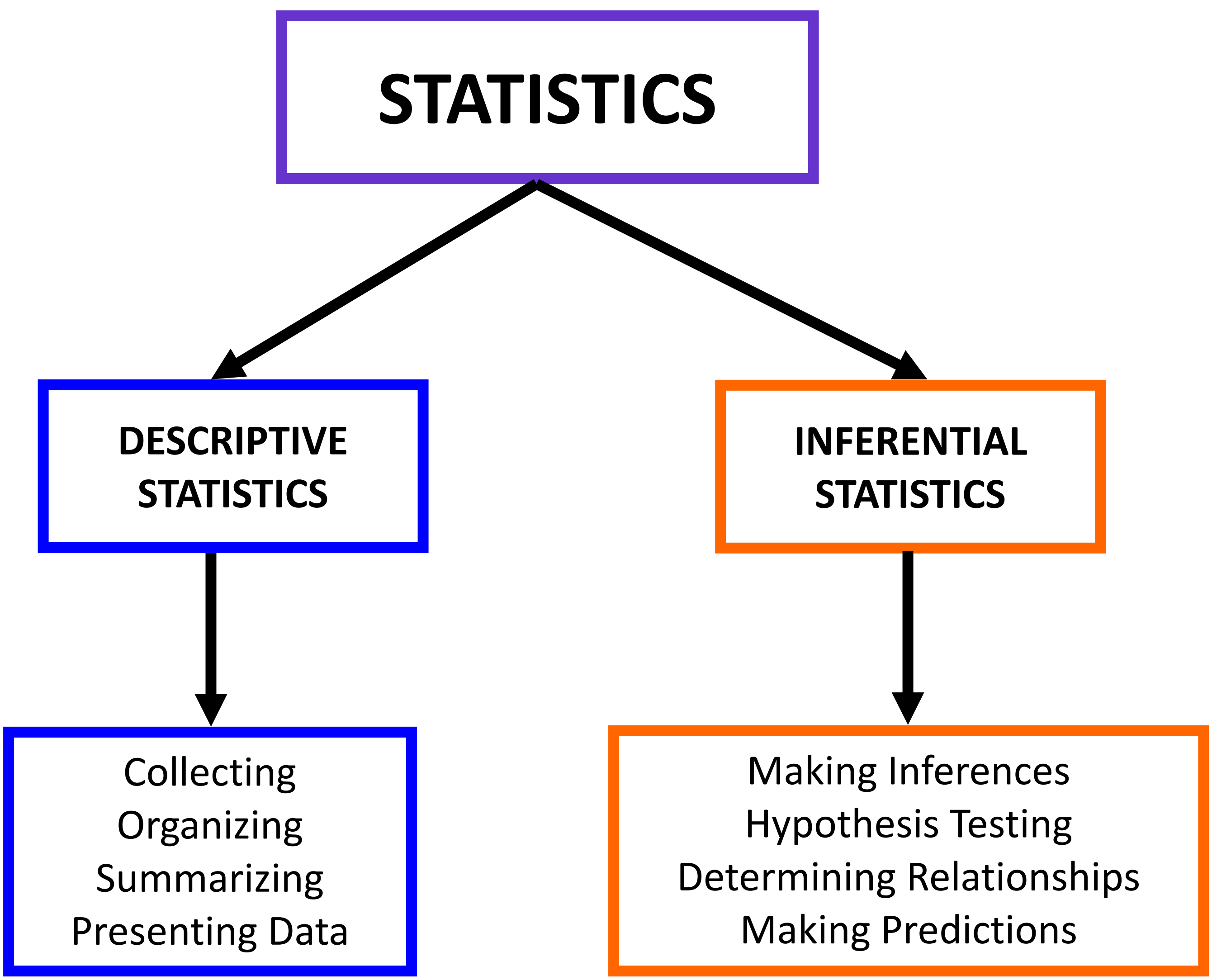
TERM	DEFINITION
Abstract	A description of the entire project that is no longer than 250 words. It must be typed and include all the parts of the project.
Conclusion	The solution or answer to a problem. The conclusion is what the researcher has learned about the problem through experimentation. Tells why you got your results.
Constants	Many factors can affect the dependent variables besides the independent variable that you are testing. ALL of these others need to be held constant (and therefore, these are your constants) in order for the results to strongly verify that it is only your designated independent variable that is affecting the outcome. However, this is not always possible, and in those situations, many trials are needed to statistically mollify the other factors' effects.
Control	A variable that must remain the same in all situations. It is a reference used to gauge how the dependent variable has changed from what is normal or ordinary. A control is not always possible.
Data	Pieces of information that a researcher will gather and look at. Data consists of information collected through research, experiments, and observations. Conclusions can be made based on data.
Data Table	A T-shaped diagram that displays raw data from an experiment. It includes a dependent and independent variable.
Dependent Variable	The effect that you measure as a result of hanging the independent variable.
Display Board	A tri-fold cardboard display that explains your project.
Experiment	The test of the hypothesis.
Hypothesis	Include the independent and dependent variables and a "because" statement. This will answer your question/problem. Leave out the phrase "I believe…" The hypothesis is an educated explanation as to what you think will happen.
Independent Variable	The variable or factor that you manipulate or change ***Example***: How does the amount of water affect the height of plants? ***Independent variable***: amount of water ***Dependent variable***: height of plants
Observation	The use of the five senses (seeing, hearing, smelling, tasting, or touching) to collect information.

TERM	DEFINITION
Operational Definition	The way a researcher measures variables. The operational definition explains specifically how each variable will be measured (hours, degrees, meters, liters, grams, decibels, etc.).
Procedure	A step-by-step description of how to do your experiment. This must be numbered. Include the amounts used of each material. Be as specific as possible.
Project/ Research Notebook	A log of your experimental process. Include the date/time, what you did, and observations. Your Project Notebook should also be used to take notes during your literature research.
Project Report	A report that contains all parts of the project. This should be typed and in a 3-ring binder. Be sure to accurately cite your sources in the bibliography.
Purpose	The purpose is a description of what you will do. What's the point of your project? Why does it need to be done?
Qualitative Data	Sensory (sight, touch, smell, hearing, taste) information that is used to draw conclusions.
Quantitative Data	Numerical (number) information that is used to draw conclusions.
Raw Data	The initial quantitative information that a researcher gets while conducting an experiment. All raw data is written in a data table in the researcher's Project Notebook.
Research	When you do literature research, you want to find articles and books that can teach you something about the independent and dependent variables.
Results	Tells what happens in your experiment. Use graphs and explain them.
Testable Question	A question that can be measured.

Statistics

The science of collecting, organizing, summarizing, analyzing, and making inferences from data.

Statistics is divided into two broad areas: ***descriptive statistics*** and ***inferential statistics***.



<u>Statistics for the Utterly Confused</u>. Lloyd R. Jaisingh, McGraw-Hill Companies, Inc., ©2000, p. 4.

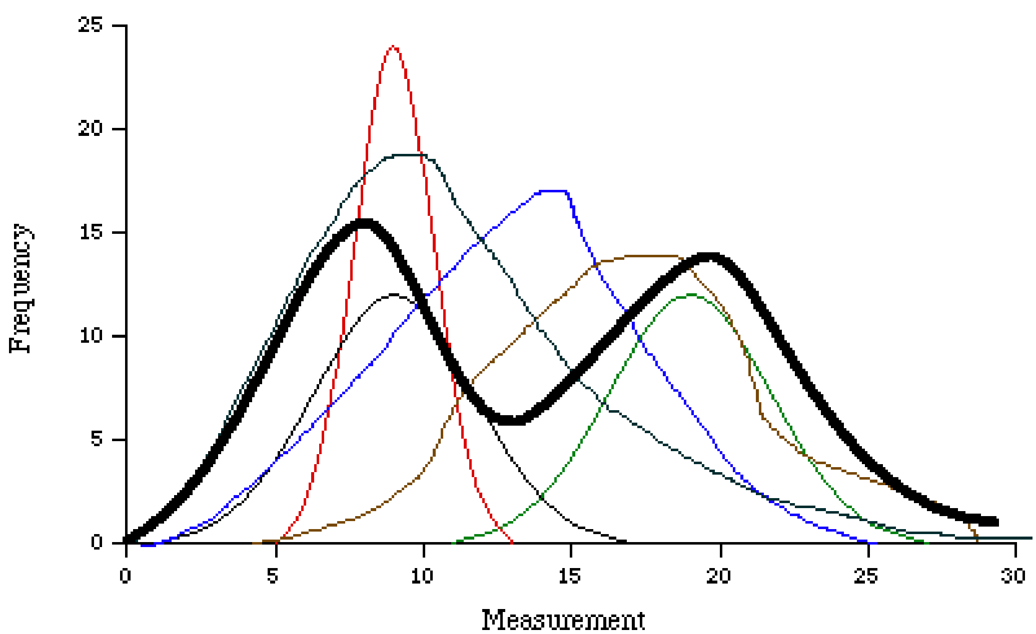
Descriptive Statistics

Descriptive statistics are used simply to describe the sample with which you are concerned. They are used first to get a feel for the data, second for use in the statistical tests themselves, and third to indicate the error associated with results and graphical output. Many of the descriptions or "parameters" such as the mean will be familiar to you already and probably use them far more than you are aware. For instance, when have you taken a trip to see a friend without a quick estimate of the time it will take you to get there (= mean)? Very often you will give your friend a time period within which you expect to arrive "say between 7.30 and 8.00 traffic depending." This is an estimate of the standard deviation or perhaps standard error of the times taken in previous trips. The more often you have taken the same journey the better the estimate will be. It is the same when measuring the length of the forelegs of a sample of donkeys in a biological experiment.

All examples on this page refer to samples and not the population as a whole. All the following can be calculated using the "descriptive statistics" or "summary statistics" function in Excel or any of the statistics software.

Measures of Central Tendency

Most data sets have many values that cluster about the most common value (mean). The number of data points with a given value will decline the farther the value is from the mean. This phenomenon can clearly be seen in the following frequency distribution graphs.



Do ensure that your data does not follow the pattern displayed in bold "bimodal distribution". This suggests that you have sampled two populations (such as male and female where sexual dimorphism is apparent) and such data cannot be analyzed easily.

Mean

The most common description of the central tendency is the mean ($\bar{x}$) and is found using: $\frac{\sum x}{n}$ i.e.

28.5

18.75

22.9

25.4

24.55

23.7

23.9

By examination of the data the mean can be estimated at around 24. Using the above equation, it is:

$$\frac{28.5 + 18.75 + 22.9 + 25.4 + 24.55 + 23.7 + 23.9}{7} = 23.96$$

Median

However, the mean can distort the picture if there are a few extreme but legitimate values (not affected by inaccurate measurements). The median can help with this scenario and is found by locating the "middle" value.

22.9 23.7 <u>23.9</u> 24.55 25.4 28.5

If *n* is an even number the median is the mean of the two middle values.

Mode

This is the value that occurs most often and does not exist in many data sets including the one above. It is of use where the above two parameters cannot be found; most often in categorized data sets i.e. from the following pitfall trap data

Coleoptera	Molluscs	Annelids	Mammals	Dipterans	Homoptera	Hemiptera
35	12	14	2	25	17	20

The mean for each category is already displayed and the median is irrelevant. The mode is the Coleoptera group with 35 hits.

Measures of Dispersion and Variability

We can describe data more fully using other parameters that are also used in the hypothesis tests.

Range - the highest and lowest value in a data set 18.75 - 28.5 and 2 - 35 respectively in the above data sets

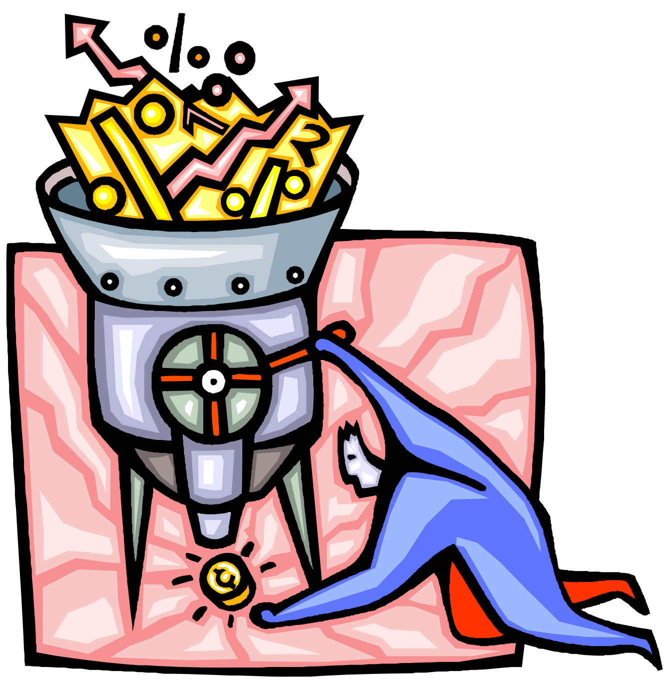
Standard Deviation (*s*) - Useful to assess how variable a sample is. But the coefficient of variation is easier to use.

Coefficient of Variation - Useful to see how much variation occurs within your data set. The higher it is the more data points you need to collect to be confident that the sample is representative of the population. It can also be used to compare variation between data sets.

Calculated using: $\frac{s}{\bar{x}} \times 100$ where *s* is standard deviation.

Variance (*s^2*) - This is the most difficult value to use and need only be considered when using t-tests or ANOVA. Two or more s^2 values can be compared statistically using the F-test or homogeneity of variance tests.

Standard Error (SE) - This is essential to assess how closely your sample relates to the population. By calculating the 95% confidence intervals ($\bar{x} \pm 1.96 \times SE$) you can say that the population mean has a 95% chance of being within this range. Such information should be included in graphical output.



SOURCE:

Descriptive Statistics; *On-Line Statistics; Ted Gaten Department of Biology gat@le.ac.uk; University of Leicester; University Road; Leicester; LE1 7RH (http://www.le.ac.uk/biology/gat/virtualfc/Stats/descrip.html).*

Standard Deviation and Variance

The variance and the closely-related standard deviation are measures of how spread out a distribution is. The variance is computed as the average squared deviation of each number from its mean. For example, for the numbers 1, 2, and 3, the mean is 2 and the variance is:

$$\sigma^2 = \frac{(1-2)^2 + (2-2)^2 + (3-2)^2}{3} = 0.667$$

The formula (in summation notation) for the variance in a population is

$$\sigma^2 = \frac{\sum (X-\mu)^2}{N}$$

where μ is the mean and N is the number of scores.
When the variance is computed in a sample, the statistic

$$S^2 = \frac{\sum (X-M)^2}{N}$$

(where M is the mean of the sample) can be used. S^2 is a biased estimate of σ^2, however. By far the most common formula for computing variance in a sample is:

$$s^2 = \frac{\sum (X-M)^2}{N-1}$$

which gives an unbiased estimate of σ^2. Since samples are usually used to estimate parameters, s^2 is the most commonly used measure of variance. Calculating the variance is an important part of many statistical applications and analyses. It is the first step in calculating the standard deviation.

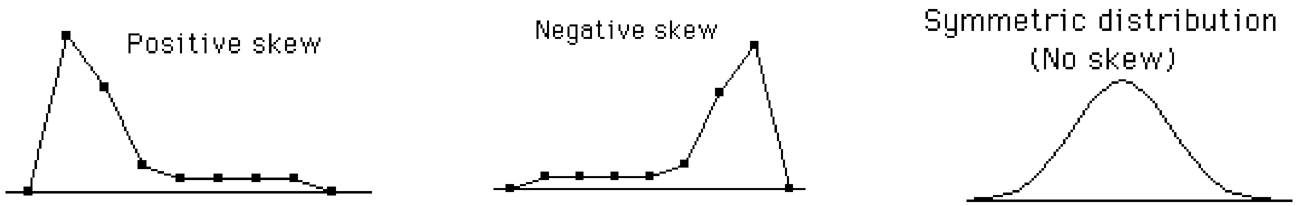
Standard Deviation

The standard deviation formula is very simple: it is the square root of the variance. It is the most commonly used measure of spread.

An important attribute of the standard deviation as a measure of spread is that if the mean and standard deviation of a normal distribution are known, it is possible to compute the percentile rank associated with any given score. In a normal distribution, about 68% of the scores are within one standard deviation of the mean and about 95% of the scores are within two standard deviations of the mean.

The standard deviation has proven to be an extremely useful measure of spread in part because it is mathematically tractable. Many formulas in inferential statistics use the standard deviation.

A distribution is skewed if one of its tails is longer than the other. The first distribution shown has a positive skew. This means that it has a long tail in the positive direction. The distribution below it has a negative skew since it has a long tail in the negative direction. Finally, the third distribution is symmetric and has no skew. Distributions with positive skew are sometimes called "skewed to the right" whereas distributions with negative skew are called "skewed to the left."



SOURCE:

http://davidmlane.com/hyperstat/A16252.html

OTHER RESOURCES:

The Cartoon Guide to Statistics
Authors: Larry Gonick & Woollcott Smith
©1993
http://www.amazon.com/exec/obidos/ASIN/0062731025/hyperstatonline/002-8506707-1997616

Research Project Grading Rubric

Student Name: ____

ASSIGNMENT	DATE DUE	POSSIBLE POINTS	DATE TURNED IN	POINTS EARNED
Question		20		
Hypothesis		100		
Title		20		
Research Topic		20		
Material to be Used		100		
Procedure		100		
Research Paper Outline		100		
Research Paper 1st Rough Draft		100		
Bibliography		25		
ISEF Forms 1, 1A, 1B *AND* Additional ISEF Forms for Special Projects		50		
Results, Project Notebook, Graphs		100		
Conclusion		100		
Final Research Paper		200		
Tri-Fold Exhibit Boards Due		200		
Participation in Local School Fair/ Expo		50		
In-Class Oral Presentation		100		

A Sampling of New Mexico Agencies That Can Provide Information About Your Project

(*) indicates web address for multiple organizations

Albuquerque Aquarium & Rio Grande Botanic Garden
505-764-6200
2601 Central NW
Albuquerque, NM 87104
http://www.cabq.gov/biopark/

Bureau of Mines & Mineral Resources
505-835-5420
NM Tech
801 LeRoy Place
Socorro, NM 87801-4796
http://geoinfo.nmt.edu/

Energy, Minerals & Natural Resources-Santa Fe
505-827-5950
2040 S. Pacheco
Santa Fe, NM 87505
http://www.emnrd.state.nm.us/EMNRD/Mining/

Energy Conservation & Management Division
505-827-4323
P.O. Box 1948
Santa Fe, WM 87504

Explora Science Center
505-224-8300
1701 Mountain Road NW
Albuquerque, NM 87104
http://www.explora.mus.nm.us

Forestry Division
505-827-5830
P.O. Box 1948
Santa Fe, NM 87504

Game & Fish Department
505-841-8881
P.O. Box 25112
Santa Fe, NM 87504
http://www.wildlife.state.nm.us

Governor's Commission on Disability
505-827-6465
Lamy Bldg.
491 Old Santa Fe Trail
Suite 117
Santa Fe, NM 87501-2753
http://www.gcd.state.nm.us

Inquiry Facilitators (IF, Inc.)
724 South Camino del Pueblo
Bernalillo, NM 87004
505-867-2007
http://www.gotoif.org

Museum of New Mexico
505-827-6463
24 Hours Museum Information
P.O. Box 2087
Santa Fe, NM 87504
http://www.museumofnewmexico.org/

National Atomic Museum
505-245-2137
1905 Mountain Road NW
Albuquerque NM 87104
http://www.atomicmuseum.com

New Mexico Department of Health
505-827-2613
Harold Runnells Bldg., P.O. Box 26110
Santa Fe, NM 87502

Maternal & Child Health Bureau
505-476-8585
Adolescent Health Section
505-476-8577
Child Health Section
505-476-8590
Infectious Disease Prevention
505-827-2422

New Mexico Energy, Minerals, & Natural Resources Dept.
505-827-5970
2040 5. Pacheco
Santa Fe, NM 87505
http://www.emnrd.state.nm.us/*

New Mexico Ecological Services
505-761-4525
Field Office
2105 Osuna NE
Albuquerque, NM 87113
www.fws.gov/*

New Mexico Commission for the Blind
505-827-4479
PERA Bldg. #553
Santa Fe, NM 87503
http://www.state.nm.us/cftb/

New Mexico Commission for Deaf & Hard of Hearing Persons
505-827-7584
1435 St. Francis Drive
Santa Fe, NM 87505
http://www.nmcdhh.org/

New Mexico Environmental Department
1190 St Francis Drive
P.O. Box 26110
Santa Fe, NM 87502
http://www.nmenv.state.nm.us/*

Air Quality Bureau
505-827-1494
Groundwater Protection & Pollution Prevention Bureau
505-827-2900

Hazardous & Radioactive Material Bureau
505-827-1557
Occupational Health & Safety Bureau
505-827-2888
Solid Waste Bureau
505-827-0197

NM Environmental Education Center
505-281-5259

NM Museum of Natural History
505-841-2800
1801 Mountain Road NW
Albuquerque, NM 87104
http://www.nmmnh-abq.mus.nm.us/nmmnh/nmmnh.html

NMSU Cooperative Extension Service
505-646-3015
c/o Energy Specialist
MSC 3 AE
P.O. Box 30003
Las Cruces, NM 88003
http://www.cahe.nmsu.edu/ces/

NM Oil & Gas Association
505-982-2568
P.O. Box 1864
Santa Fe, NM 87504
http://www.nmoga.org

New Mexico Solar Energy Industries Association
505-884-1980
P.O. Box 90275
Albuquerque, NM 87107

New Mexico Solar Energy Association
P.O. Box 8507
Santa Fe, New Mexico 87504

Rio Grande Zoological Park
505-843-7413
903 10th St. SW
Albuquerque, NM 87102
http://www.cabq.gov/biopark/zoo/index.html

State Engineer, Interstate Stream Commission
505-827-6158
Bataan Memorial
P.O. Box 25102
Santa Fe, NM 87504
http://www.ose.state.nm.us

SW Environmental Center
505-522-5552
1494 A South Solano
Las Cruces, NM 88001
http://www.wildmesquite.org

Southwest Cultural Resources Center
505-988-6766
1220 S. St. Francis Drive
Santa Fe, NM 87504

Department of Transportation
Federal Aviation Administration
505-856-4700
(Radar, Microwave, Flight Standards)
2445 Alamo SE, 2nd Floor
Albuquerque, NM 87106
http://www.faa.gov

A Sampling of National Organizations That Can Provide Information About Your Project

Alliance to Save Energy
202-857-0666
1200 18th Street NW Suite 900
Washington, D.C. 20036
http://www.ase.org/

American Chemical Society
202-872-4590
http://www.acs.org/education/

American Coal Foundation
202-466-8632
1130 Seventeenth Street NW, Suite 220
Washington, DC 20036
http://www.teachcoal.org

American Gas Association
703-841-8676
http://www.aga.org

American Institute of Biological Sciences—Mentor Info
http://www.mentornet.net/html/main_mentors.html

American Paper Institute, Inc.
212-340-0600
260 Madison Ave.
New York, NY 10016

American Petroleum Institute—Educational Services
202-682-8117 or 682-8115
1220 L. Street, NW
Washington, DC 20005

American Solar Energy Society
2400 Central Ave., Unit 0-1
Boulder, CO 80301-9880

American Wind Energy Association
http://www.awea.org

USDA Forest Service
505-842-3292
517 Gold SW
Albuquerque, NM 87102
http://www.fs.fed.us/

U.S. Fish & Wildlife Service
505-761-4525
2105 Osuna NE
Albuquerque, NM 87113

Department of Educational Activities
1155 16th St. NW
Washington, DC 20036

Department of Energy
link to: listing of DOE '800' Information Lines

U.S. Geological Survey
505-262-5300
4501 Indian School NE, Suite 200
Albuquerque, NM 87110

Division of Resource Planning, Youth & Protection
505-438-7512
http://nm.blm.gov*

- **Land & Mineral Support Team**
- **Planning & Policy Team**
- **Civil Engineers**
- **Wildlife Management**
- **Archaeology**
- **Biological Resources**
  505-438-7432
- **Fluid Minerals**
  505-438-7404
- **Solid Minerals**
  505-438-7453
- **Div. of Mineral Resources**
  505-438-7450

National Park Service
505-988-6100
Southwest Regional Office
P.O. Box 728
Santa Fe, NM 87504-0728
http://www.nps.gov

EPA Office of Solid Waste Management Association
http://www.epa.gov/osw/

Edison Electric Institute
202-508-5661
ATTN: Director of Customer Program
701 Pennsylvania Avenue NW
Washington, DC 20004-2090
http://www.eei.org/

Educational Programs Department
1515 Wilson Blvd.
Arlington, VA 22209

Energy Information Administration
EI-30, Forrestal Building
Washington, DC 20585
http://www.eia.doe.gov/index.html

Florida Solar Energy Center
305-783-0300
300 State Rd. 401
Cape Canaveral, FL 32920

Mineral Information Institute
475 17th Street Suite 510
Denver, CO 80202-4015

National Appropriate Technology Assistance Service
1-800-523-2929
P.O. Box 2525
Butte, MT

National Hydrogen Association
http://www.ttcorp.com

North American Association for Environmental Education
513-698-6493
http://www.naaee.org/

Renewable Fuels Association
202-289-3835
1 Massachusettes Avenue NW Suite 820
Washington, DC 20001
e-mail: etohrfa@erols.com
http://www.ethanolrfa.org/

Renew America
202-232-2252
1400 16th St. NW, Suite 71
Washington, DC 20036

Science Buddies
Help with choosing a project topic, etc.
http://www.sciencebuddies.org

Suggestions to Parents and Students as You Start on This Year's Research Project Together…

1. **The most important ingredient in any project is the amount of work the student accomplishes, how much knowledge he or she acquires, and how much initiative is displayed. Many abilities are developed: researching, organizing, outlining, measuring, calculating, reporting, and presenting. They involve the reading, writing, arithmetic, and social skills so much a part of successful daily living.**

2. **Although it is to be the student's effort, there is no substitute for a parent's support.**

3. **Do not worry about the project's performance at the fair; if strengthened thinking skills and increased knowledge have occurred, then a prize has truly been won.**

4. **Areas in which a parent's assistance will be necessary include:**

Safety

Be sure that poisons, dangerous chemicals, and open fires are avoided. Learn and practice electrical safety if electricity is used in the project. If any aspect of the project appears to be dangerous, it should not be included.

Transportation

Help will be needed for the transportation of materials to the fair, although it is better if the student can set up and take down the exhibit with a minimum of assistance.

ISEF Rules/Forms Compliance

Please be sure to review the current ISEF Rules for Pre-College Research (http://stemed.unm.edu) along with the forms that your student may need to complete in order to exhibit in local, regional, and/or state competitions. You may need to help fill these forms out!

5. **Areas in which a parent's assistance may be welcome include:**

- Suggesting project ideas (these may be connected with your work).
- Technical work such as construction and photography.
- Being an interested listener.
- Transportation to libraries, businesses, museums, nature centers, universities, or any source of project information.
- Help filling out required forms BEFORE any established deadlines!

Ideas & Notes

TOPIC IDEAS...

QUESTIONS TO ASK...

WHERE TO LOOK FOR INFORMATION...

PEOPLE/PLACES TO CONTACT...

NOTES...

More Notes

STUFF I MIGHT NEED...

THINGS TO CONSIDER...

INDEPENDENT VARIABLES...

DEPENDENT VARIABLES...

MORE NOTES/QUESTIONS...

Even More Notes

BRAINSTORMS, IDEAS, & EVEN MORE NOTES...