POWER UP Science Fair

AISES is a national, Native non-profit organization that nurtures community by bridging science and technology with traditional Native American values.

The AISES mission is to substantially increases the representation of American Indians, Alaska Natives, Native Hawaiians, Pacific Islanders, First Nations and other indigenous peoples of North America in science, technology, engineering and mathematics (STEM) studies and careers.

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AISES would like to thank Dr. Robert Whitman, Valerie Snow, and Bill Liles for their assistance in developing the AISES POWER UP Science Fair Manual.

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A Special thanks to Science Buddies.

The NAISEF Story…

The annual event, sponsored by the American Indian Science and Engineering Society (AISES) and other organizations, is a learning experience for American Indian and Alaskan Native (AI/AN) students. It fosters a love of learning as well as communication, professionalism, and enthusiasm. Additionally, students may receive prestigious academic and financial awards and recognition.

How did this activity come to be? In 1982 with a grant from the Fund for the Improvement of Post-Secondary Education (FIPSE), the Science Fair Initiative on American Indian reservations was launched. The Fair began with 14 schools and through the years has impacted over 5,000 students, teachers, schools and communities. In the years following this initiative, the National Science Foundation, National Aeronautics and Space Administration and the U.S. Geological Survey supported teacher development to strengthen elementary and secondary teach- ing of science, thereby increasing participation in the local fairs and assisting in the development of state level American Indian science fairs.

In 1988, the National American Indian Science and Engineering Fair (NAISEF) was established through an AISES partnership with three established American Indian science fair initiatives in North Dakota, Wisconsin and New Mexico. The NAISEF provides an important opportunity for students to do hands-on science; apply their knowledge of math and science; conduct research and collect data; and interact with professional role models in science, mathematics, and engineering. Students in grades 5-12 participate. NAISEF Grand Award Winners were automatically entered in the International Science and Engineering Fair (ISEF).

The National American Indian Virtual Science and Engineering Fair

In 2014, the NAISEF became a Virtual (online) Science and Engineering Fair. Like the NAISEF, the National American Indian Virtual Science and Engineering Fair (NAIVSEF) is a Society for Science and the Public (SSP) affiliated science fair and as such is part of the larger SSP fair network. Unlike live fairs, virtual fairs do not require travel as the fair and judging is conducted online and via teleconference calls.

Instead of preparing science fair poster boards, NAIVSEF participants submit their project presentations as videos and slideshows online and participate in telephone conference calls with a panel of three science fair judges. The paperwork participants submit is identical to the paperwork that they would submit for a live fair. In fact, they use the exact same forms and follow the same rules and procedures as any other science fair. AISES awards cash prizes to both senior (grades 9 through 12) and junior division (grades 5 through 8) winners. AISES also pays the travel and registration fees for the Senior Division Grand Award winners and their sponsors to attend the Intel International Science and Engineering Fair.

Science Fair History

Science Fairs came about as a result of a non-profit, Science Services that E.W. Scripps created to bridge the gap between scientific achievement and public knowledge of what was being achieved. At the time there were many articles and journal publications that were not easily understood by non-technical people. As a layman himself, Scripps' goal was to use Science Services as a mechanism of change to unite the public with the scientific community.

In 1941, Science Services joined forces with the American Institute of the City of New York and created Science Clubs of America. 800 Clubs were established throughout the United States. Through these efforts junior academies of science, museums and other science clubs became part of a net- work of 600,000 young scientists organized into 25,000 science clubs.

In 1942, The Science Talent Search, the oldest and most prestigious science contest for high school seniors, was established by Science Services and Westinghouse. The contest was created to encourage young people to pursue careers in science and engineering.

Since the early 1940's, local and regional competitions have sprung up around the U.S. among Science Club members and non-club members. Nurtured by Science Service, in 1950, high school finalist from these competitions met in Philadelphia to compete, the competition became the International Science and Engineering Fair (ISEF). It is the world's largest pre-college celebration of science and the world's only international science competition for students in grades 9 through 12 and is still going on today.

What is a science fair project?

There are many types of science fair projects, however most projects start with a question which can have many answers. A science fair project can be an investigation that is designed to solve a problem or answer a question. It is a science fair project because you use the Scientific Method to answer the question.

The idea behind a science project is to see "*what happens if...*"

What happens to one thing *if* you change something else while you keep all of the other conditions the same? All of a sudden you're a scientist.

That's the heart of all research, and a science project is just another name for research. One thing to keep in mind: science projects are not the same as science demonstrations. The idea behind a science project is to learn something new--through an experiment. You might guess the result before- hand, but you won't know for sure what will happen until you try out the experiment.

A science demonstration is different. It's fun to show that vinegar and baking soda together cause a reaction. And if the reaction occurs like a volcano, you really do see the reaction explode. But that's all it is--a demonstration. No new information has been discovered. You know exactly what the reaction is going to be, but if you change the variables and test differences, you now have a science fair project. (Note: science demonstrations may be acceptable at some science fairs. Check with your teacher about the rules.)

The actual science fair part is the fun part and takes place when everyone who has done a project gathers together to showcase their work, like at the National American Indian Science and Engineering Fair and Expo.

Why it's cool to Power Up Science Fair Projects?

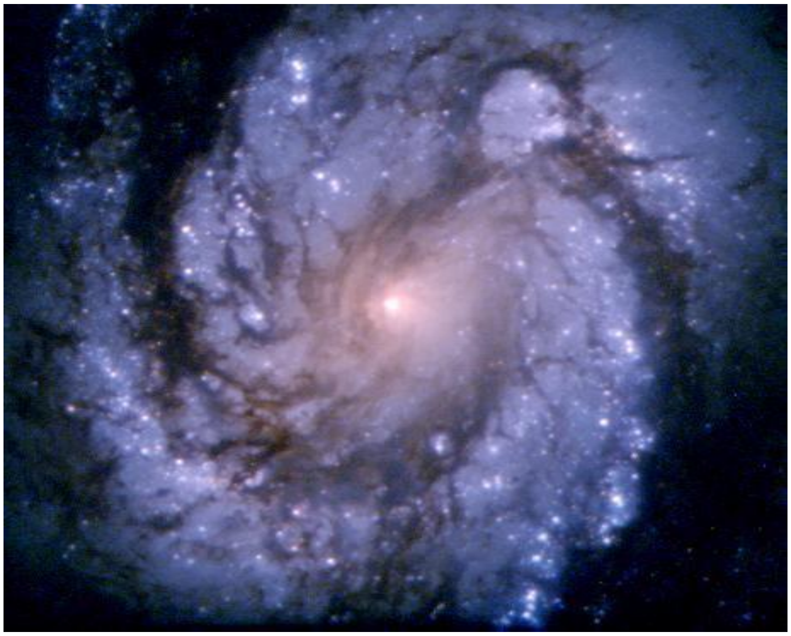
It is understandable, with today's crazy lifestyle, why many students do not participate in all of the activities offered through educational and afterschool programs. However, AISES is here to say that getting involved in a science fair can open up many doors for Natives students. Not only can you win scholarships and prizes, but you can carve the path to become a future scientist, technologist, engineer or mathematician.

We all know that there is a misconception of science geeks and nerds. Well, it is okay to be a nerd or a geek! Also, science fair projects are fun and take no more time than normal homework. And many times you can use your science project as part of a science, math, and/or language arts class assignment.

If you are still not sure about whether or not you want to do a science fair project, think about this:

In 2010, Albuquerque resident Erika Alden DeBenedictis (18 years old at the time) of Albuquerque Academy, won $100,000 by developing a software navigation system that would allow spacecraft to exploit low-energy orbits for the physics & space sciences project she submitted to the Intel Science Talent Search. According to the NASA- approved Interplanetary Superhighway concept, the gravity and movement of planets create a network of low- energy opportunities that allow for more efficient transit routes through the solar system. Working at home and building on existing research, Erika developed an original optimizing search algorithm that discovers energy minimizing routes in specified regions of space and would allow a spacecraft to adjust its flight path en route. She believes her novel single-step method of repeated orbit refinement could work with essentially autonomous spacecraft, and may be a practical step forward in space exploration.

Because of her science fair project, Erika shaped her future to go to any college of her choosing and had helped NASA make major strides in space exploration, all by the time she was 18. Isn't that amazing and inspirational?



Pictures provided by Hubble Site, http://hubblesite.org/gallery/album/

Now are you ready to Power Up your Science Project?

Definitions You Should Know Before Starting Your Project

Experiment: Is a method of investigating causal relationships among variables, or to test a hypothesis. An experiment involves controlling one 'input' variable, holding all others constant (to the best of your ability) and measuring the effect on an output variable of a change in the control variable.

Fair Test: Is making sure that you change one factor at a time while keeping all other conditions the same.

Variables: Is any factor, trait, or condition that can exist in differing amounts or types. An experiment usually has three kinds of variables: independent, dependent, and controlled.

Independent Variables: Is the variable that is changed by the scientist. To ensure a fair test**,** a good experiment has only one independent variable. As the scientist changes the independent variable, he or she observes what happens.

Dependent Variable: Is what you measure in the experiment and what is affected during the experiment. The dependent variable responds to the independent variable. It is called dependent because it "depends" on the independent variable. In a scientific experiment, you cannot have a dependent variable without an independent variable.

Controlled Variable: Is a variable that remains unchanged or is held constant to prevent its effects on the outcome and therefore may verify the behavior of and the relationship between independent and dependent variables.

Correlation: The degree to which one phenomenon or random variable is associated with or can be predicted from another.

Science Fair Projects and Requirements

Each science fair follows specific guidelines and eligibility criteria. As part of the International Science and Engineering Fair (ISEF) network and affiliation, NAISEF adheres to the same rules. For ISEF rules visit the Society for Science & the Public's website, http://www.societyforscience.org/isef/ .

Power Up Your Science Fair Project with the Scientific Method

What is the Scientific Method?

The Scientific Method is a means by which you can ask and answer a scientific question by making observations and doing experiments. The scientific method begins when you ask a question about what you have observed: Who, What, When, Where, Why, How or Which? It is a great way to approach anything you are curious about.

Why use the Scientific Method?

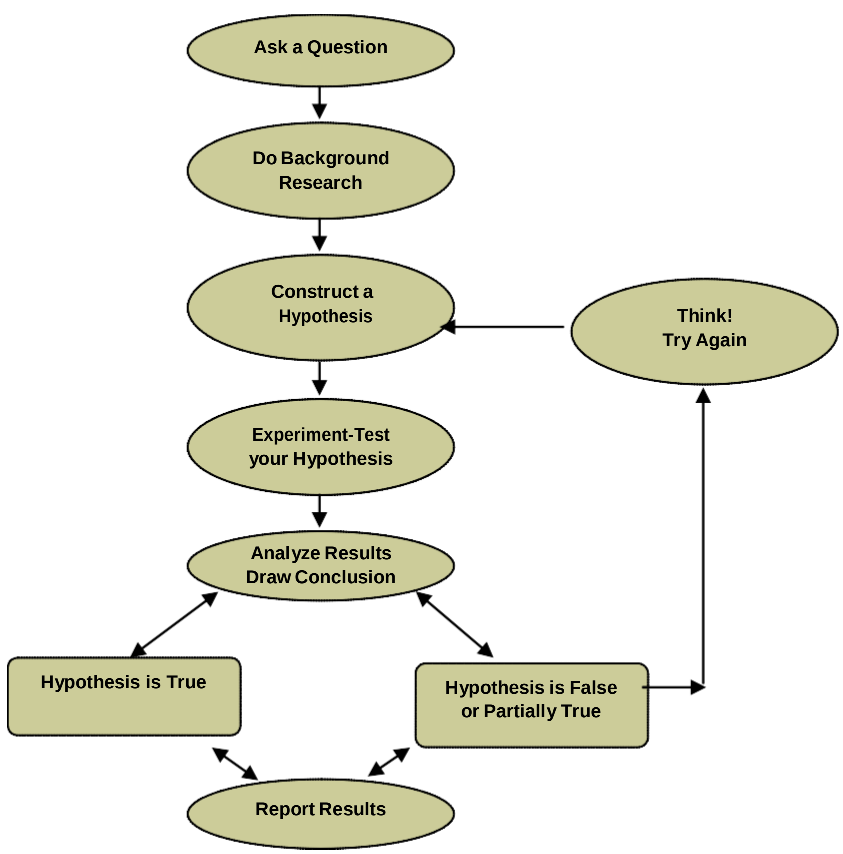
You can use the scientific method for any process, however, it is mainly used as a system for experimentation. Scientist use the scientific method to search for the cause and effect relationships found in nature, laboratories, etc. The main purpose of this system is to design an experiment that can be easily tested and analyzed.

Who uses the Scientific Method?

There are many different types of scientists, who use the method, including: Physicists, Chemists, Biologists, Engineers, Historians, Mathematicians, Psychologists, Anthropologists, etc. Basically, anybody who conducts experiments.

Steps of the Scientific Method

1. Ask a Question
2. Do Background Research
3. Construct a hypothesis
4. Experiment – test your hypothesis
5. Analyze data
6. Report results



Get started using the Scientific Method

1. Ask a Question

Identify a question or a problem to be answered and what solution may be called for it (If you can find the answer easily online-you probably need to ask the question differently).

What are your interests?

What's happening in the world today?

What's happening in your community?

How do our traditional methods compare to modern methods?

What have you always wanted to know about?

What do you think is cool?

How can you make a difference in the world?

How can you make something better?

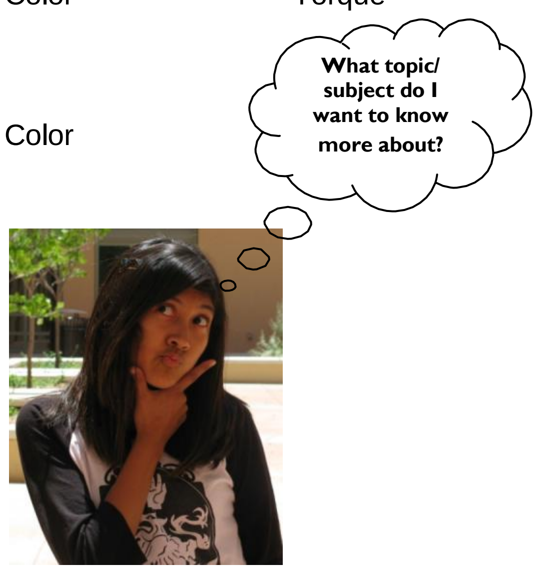
What are you curious about?

<u>Teacher note:</u> If the questions above do not inspire the student have him or her make a list of the first five to ten topics/subjects that come to mind. Topics/subjects can be anything. Then, have the student list five to ten sub-topics/subjects for each of them. Like so:

Food	**Planes**	**Sports**	**Plants**	**Cars**
Taste	Size	Football	Growth	Speed
Smell	Speed	Throwing	Water	Shape
Calories	Weight	Kicking	Seeds	Tires
Composition	Designs	Running	Color	Torque

With these topics you can compare types of:

Food Fuel Plays Temperature Color



2. Do Background Research

Now that you have a testable topic or question in mind, it is time to do the research. Background research can come from many sources. These sources will help you answer your question. You can use books, magazines, interviews, journal and newspaper articles, the Internet (do not use Internet sources only), publications from non-profit organizations, scientist from local schools and universities, specialized personnel or you can contact local, state and federal institutions.

Background research will help you gain specific knowledge about your topic and process information on their observations. It will help spark ideas about the variables (see definitions) you will be using and will provide a basis for the predictions that may happen while investigating your hypothesis. Lastly, it will help you understand how their information should be interpreted and how to explain your results to their audience. Research will help you understand your topic and develop your question and hypothesis. Research can be done at home, school, public library, college/university or a professional work place, etc.

Background Research Plan Checklist

Taken from: 3 September 2010, http://www.sciencebuddies.org/science-fair-projects/project_hypothesis.shtml

What Makes a Good Background Research Plan?	For a Good Background Research Plan, You Should Answer "Yes" to Every Question
Have you identified all the keywords in your science fair project question?	Yes / No
Have you used the question word table to generate research questions?	Yes / No
Have you thrown out irrelevant questions?	Yes / No
Will the answers to your research questions give you the information you need to design an experiment and predict the out- come?	Yes / No
Do one or more of your research questions specifically ask about any equipment or techniques you will need to perform an experiment? (if applicable)	Yes / No
If you are doing an engineering or programming project, have you included questions from Engineering & Programming Project Tips?	Yes / No

<u>Note:</u> A minimum of five major references are required. <u>Only two Internet references</u> will be allowed, please do not use Wikipedia as a reference.

Research tools:

- Background Research Plan Worksheet
- Bibliography Information Template, use tool to collect information needed to complete your bibliography
- MLA format samples, use to cite all references in your bibliography (may use a different format, be consistent)

Background Research Plan Worksheet

Name: ___________________

1. What is the question you are trying to answer with an experiment? ____________________

____

2. List the key terms and phrases from your question and the general topic.

______________________ ______________________ ______________________
______________________ ______________________ ______________________
______________________ ______________________ ______________________

3. Now that you have identified some questions to guide your background research. You may want to develop 2-3 questions for each word.

Why?
Why does___happen?
Why ________?
How?
How does___happen?
How does___work?
Who?
Who needs___?
Who invented ___?
What?
What is___made of?
What is the relationship between___and ___?
When?
When was__discovered?
When______?
Where?
Where does___occur?
Where does___get used?

4. Now think about your experiment…. Do you know any formulas that will help you? Write down any step or task that requires a formula or equation.

____

____

____

Bibliography Information Template

For Encyclopedias				
Article Title	**Year**	**Encyclopedia Title**	**Publisher**	**Volume/Page (s)**

For Encyclopedias With an Author					
Author (s)	**Year**	**Article Title**	**Encyclopedia Title**	**Publisher**	**Volume/Page (s)**

For Internet Sources (no author)			
Article Title	**Date (Year/Month/Day)**	**URL (Internet Site Address)**	**Access Date**

For Internet Sources With an Author				
Author	**Date (Year/Month/ Date)**	**Article Title**	**URL (Internet Site Address)**	**Access Date**

Book			
Author (s)	**Title**	**Publisher**	**Year**

For Magazines and Other Periodicals				
Author	**Date (Year/Month/ Date)**	**Article Title**	**Magazine Title**	**Vol./No./Page (s)**

Use to keep track of your references

MLA Examples

"Chapter 12. How to Write a Bibliography - Examples in MLA." A Research Guide for Students, 12 Mar. 2009. http://www.aresearchguide.com/12biblio.html.

Stylebook with one author or editor:
Bell, Stewart. The Martyr's Oath: The Apprenticeship of a Homegrown Terrorist. Mississauga, ON: Wiley, 2005.

N.p. = No place of publication indicated.
Capodiferro, Alessandra, ed. Wonders of the World: Masterpieces of Architecture from 4000 BC to the Present. Vercelli: White Star, 2004.

Book with two authors or editors:
Bohlman, Herbert M., and Mary Jane Dundas. The Legal, Ethical and International Environment of Business. 5th ed. Cincinnati, OH: West, 2002.

Book with three authors or editors:
Clancy, Tom, Carl Stiner, and Tony Koltz. Shadow Warriors: Inside the Special Forces. New York: Putnam, 2002.

Book with compilers, or compilers and editors:
McClay, John B., and Wendy L. Matthews, comps. and eds. Corpus Juris Humorous: A Compilation of Outrageous, Unusual, Infamous and Witty Judicial Opinions from 1256 A.D. to the Present. New York: Barnes, 1994.

Note abbreviation: comp. = compiler or compiled by

Article in an encyclopedia with no author stated:
"Nazi Party." New Encyclopaedia Britannica. 1997 ed.

Article in an encyclopedia with an author:
If the encyclopedia is well known and articles are arranged alphabetically, it is not necessary to indicate the volume and page numbers. If the encyclopedia is not well known, you must give full publication information including author, title of article, title of encyclopedia, name of editor or edition, number of volumes in the set, place of publication, publisher and year of publication.
Kibby, Michael W. "Dyslexia." World Book Encyclopedia. 2000 ed.
Midge, T. "Powwows." Encyclopedia of North American Indians. Ed. D.L. Birchfield. 11 vols. New York: Cavendish, 1997.

Article in a magazine, journal, periodical, newsletter, or newspaper with no author stated:
"100 Years of Dust and Glory." Popular Mechanics Sept. 2001: 70-75.

Book, movie or film review:
May use short forms: Rev. (Review), Ed. (Edition, Editor, or Edited), Comp. (Compiled, Compiler).Creager, Angela N.H. "Crystallizing a Life in Science." Rev. of Rosalind Franklin: The Dark Lady of DNA, by Brenda Maddox. American Scientist Jan.-Feb. 2003: 64-66.

Definition from a dictionary:
When citing a definition from a dictionary, add the abbreviation Def. after the word. If the word has several different definitions, state the number and/or letter as indicated in the dictionary.

"Mug." Def. 2. The New Lexicon Webster's Encyclopedic Dictionary of the English Language. Canadian ed. 1988.

Government publication:
Cite government document in the following order if no author is stated: 1) Government, 2) Agency, 3) Title of publication, underlined, 4) Place of publication, 5) Publisher, 6) Date.

Canada. Minister of Indian Affairs and Northern Development. Gathering Strength: Canada's Aboriginal Action Plan. Ottawa: Minister of Public Works and Government Services Canada, 2000.

Basic components of an Internet citation:
1) Author.
2) "Title of Article, Web page or site" in quotation marks.
3) Title of Magazine, Journal, Newspaper, Newsletter, Book, Encyclopedia, or Project, underlined.
4) Editor of Project.
5) Indicate type of material, e.g. advertisement, cartoon, clipart, electronic card, interview, map, online posting, photograph, working paper, etc. if not obvious.
6) Date of article, of Web page or site creation, revision, posting, last update, or date last modified.
7) Group, association, name of forum, sponsor responsible for Web page or Web site.
8) Access date (the date you accessed the Web page or site).
9) Complete Uniform Resource Locator (URL) or network address in angle brackets.

a. Internet citation for an advertisement:
IBM. Advertisement. 23 Mar. 2003 <http://www.bharatiyahockey.org/2000Olympics/ibm.htm>.

b. Internet citation for an article from an online database (e.g. SIRS, eLibrary), study guide, magazine, journal, periodical, newsletter, newspaper, online library subscription database service, or an article in PDF with one or more authors stated:

Bezlova, Antoaneta. "China to Formalize One-Child Policy." Asia Times Online. 24 May 2001. 10 Oct. 2005 <http://www.atimes.com/china/CE24Ad02.html>.

Interview:
Blair, Tony. Interview. Prime Minister's Office. 31 May 2003. 13 Apr. 2006 <http://www.pm.gov.uk/output/Page3797.asp>.

Longin, Hellmut. Telephone interview. 3 May 2006.

Lecture:
State name of speaker, title of lecture in quotes, conference, convention or sponsoring organization if known, location, date.

Bradley, Vicki. "Marriage." Agnes Arnold Hall, U of Houston. 15 Mar. 2003.

3. Construct a Hypothesis

What is a hypothesis?

A hypothesis is supposition or tentative explanation for (a group of) phenomena, (a set of) facts, or a scientific inquiry that may be tested, verified or answered by further investigation or methodological experiment.

In other words a hypothesis is an educated guess to explain an observation made, which is then explored further through experimentation.

Now that you have a better understanding of your topic/or question now is the time to refine your question and construct your hypothesis. (A hypothesis is an "educated guess" reported about how something works.) Specifically "If I do this____, then_____will happen."

Students must state a hypothesis that is easily measurable. It is not important for a hypothesis to be accurate! Make sure you can measure outcomes.

Your hypothesis should answer your question.

Hypothesis Checklist

Taken from 3 September 2010, http://www.sciencebuddies.org/science-fair-projects/project_hypothesis.shtml

What Makes a Good Hypothesis?	For a Good Hypothesis, You Should Answer "Yes" to Every Question
Is the hypothesis based on information contained in the Research Paper?	Yes / No
Does the hypothesis include the independent and dependent variables?	Yes / No
Have you worded the hypothesis so that it can be tested in the experiment?	Yes / No
If you are doing an engineering or programming project, have you established your design criteria?	Yes / No

Example:

***Topic/Subject*:** Arm length and throwing distance
Specific: Is there a correlation between arm length and football throwing distance?
***Hypothesis*:** Individuals with longer arms can throw a football further.

4. Experiment – Test Your Hypothesis

Now that you have a hypothesis, you need to create an experiment to test whether your hypothesis is true or false.

In a sentence or two, explain how you plan to test your hypothesis?

A well-designed experiment takes into account all of the parts that may impact the results of the experiment. Those factors are the variables (see definitions).

The first part of your experiment will be designing a plan that involves how you will change your independent variable (see definition) and how you will measure the impact that the change has had on your dependent variable (see definition). To make sure you are running a fair test experiment you must make sure that the only thing that changes is the independent variable and the controlled variables stay constant.

Run your experiment a **minimum of five times**, more is better. It is very important that you confirm your results. Running the experiment a number of times ensures proper results. Record the results for each trial (even if they don't go with your other results).

Key Elements of an Experimental Procedure

- Description
- Step-by-step list of everything you perform
- How you will change and measure your independent variable
- How you will measure the results
- Must specify how many times you intend to repeat your experiment
- Most importantly, your experiment should be easy to replicate by someone else!

Experimental Procedure Checklist

Taken from 3 September 2010, http://www.sciencebuddies.org/science-fair-projects/project_experimental_procedure.shtml

What Makes a Good Experimental Procedure?	For a Good Experimental Procedure, You Should Answer "Yes" to Every Question
Have you included a description and size for all experimental and control groups?	Yes / No
Have you included a step-by-step list of all procedures?	Yes / No
Have you described how to the change independent variable and how to measure that change?	Yes / No
Have you explained how to measure the resulting change in the dependent variable or variables?	Yes / No
Have you explained how the controlled variables will be maintained at a constant value?	Yes / No
Have you specified how many times you intend to repeat the experiment (should be at least three times), and is that number of repetitions sufficient to give you reliable data?	Yes / No
The ultimate test: Can another individual duplicate the experiment based on the experimental procedure you have written?	Yes / No
If you are doing an engineering or programming project, have you completed several preliminary designs?	Yes / No

Start thinking about how you plan to collect and report your data.

Outline your procedures step by step.

What materials will you need to complete your experiment?

Example:

Problem:
Is there a correlation between arm length and football throwing distance?

Hypothesis:
Individuals with longer arms can throw a football further.

Materials:
Measuring tape
football
15-20 participants (7th grade males)

Variables:
Independent Variable – arm length
Dependent Variable – throwing distance
Control Variable- 7th grade boys, same throwing method, all testing done same time of day if need more than one day for testing

Procedures
Step 1: Measure participant’s arm (total length, wrist to elbow and elbow to shoulder)
Step 2: Have participant throw football (describe throwing method)
Step 3: Measure throw distance
Step 4: Document data in table
Step 5: Repeat steps 2-4, 5 times (more is better)
Step 6: Repeat steps 1-5 for each participant

<u>Note</u>*: *Some experiments may require additional ISEF paperwork prior to experiment start date. Please see flow chart to see if project needs additional ISEF forms.

Do I Need SRC/IRB Approval Before I Can Begin My Project?

Does your project involve….
Asking your friends or people questions? Experiments on yourself? Experiments with people in any way other than observation or product testing of engineering projects? (Human Subjects)

No

Does your project involve….
Your Pet? Any other animals that have bones (except people)? All vertebrate animal protocols must be submitted to the Regional Fair SRC for approval**.** (Vertebrate Animals)

No

Does your project Involve….
Prescription drugs? Alcohol, wine, or beer? Cigarettes or other tobacco? Gunpowder? Any product which cannot be legally purchased by students under at 18? (Controlled Substances)

No

Does your project Involve….
Mold or Fungus? Bacteria? Viruses? Anything that might make you sick? Cultured samples collected from the environment?

Does your project Involve….
DNA from one organism inserted into the DNA of another organism?

Does your project Involve….
Anything coming from a human or animal body? Cheek cells or other cells? Teeth? Bone? Fluids such as blood, saliva, or urine?

No

Does your project Involve….
Any chemicals such as household cleaners, solvents, metals or organic chemicals? (Chemicals/Hazardous Substances)

No

Does your project Involve….
Model Rockets? Lasers? UV Light? Radiation? Guns, gunpowder, explosives? Trebuchet? Potato Cannons? Archery? Anything else that maybe hazardous? (Hazardous devices)

No

You DO NOT need SRC Pre-Approval. You may proceed with your science fair project.

If you answer yes to any of these

YOU MUST HAVE SRC PRE-APPROVAL!

Schools can create their own Institutional Review Board (IRB). The IRB evaluates the potential physical and/or psychological risk of research involving human subjects. An IRB must include: a) an educator, b) a school administrator, c) or one of the following professionals; medical doctor, physician's assistant, registered nurse, a psychiatrist, psychologist, licensed social worker or licensed clinical professional counselor. For a complete list of rules and guidelines please see the Intel ISEF International Rules & Guidelines.

You are almost finished! Just a couple of more steps!

5. Analyze Data

Once your experiment is complete, you must collect all of your results and analyze them to see if your hypothesis was true or false. One of the goals of analyzing your data is to determine if there was a relationship between the independent and dependent variables.

Were there patterns in your data? Did the change you made to the variables have an effect that could be measured?

In many instances your hypothesis will be false, as explained earlier this was a possibility. Do not change your data to match your hypothesis.

What is data analysis?
Data analysis involves working to uncover patterns and trends in data sets.

When analyzing your data you should keep these questions in mind:

- What can be learned from looking at this data?
- How does the data relate to my original hypothesis?
- Did your independent variable cause changes in your dependent variable?

After you analyze your data, you should be able to answer all of these questions.

What type of data presentation will represent/illustrate your data the best?

Types of Data Presentation:

Graph
Chart
Table
Equation

Example:

Participant	Wrist to elbow	Elbow to shoulder	Total arm length	Throw 1 (distance)	Throw 2 (distance)	Throw 3 (distance)	Average Distance
Participant 1	9 inches	11 inches	26 inches	50 feet	55 feet	52 feet	52.33 feet
Participant 2	8 inches	10 inches	24 inches	47 feet	50 feet	75 feet	57.33 feet
Participant 3	12 inches	13 inches	33 inches	70 feet	71 feet	71 feet	70.66 feet
Participant 4							

Average= (Throw 1 + Throw 2 + Throw 3) / 3

6. Report Results

Once data has been analyzed, it is time to summarize your results. Your final report will entail putting together the information you have collected and summarizing it into one document. A science fair report is no different than other reports you have written.

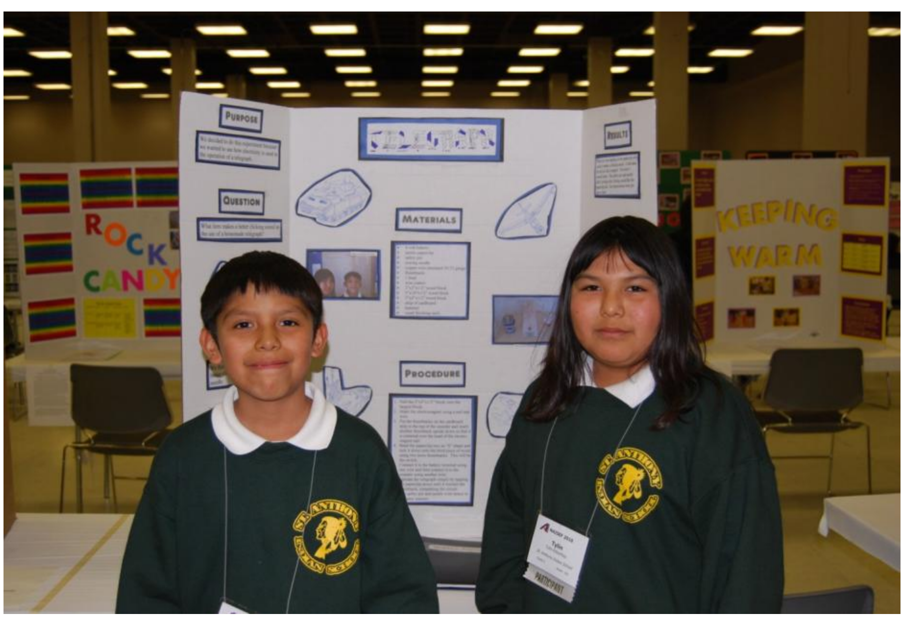
The report should include:

- Title Page
- Abstract
- Table of Contents
- Background Research
- Research Plan:
  - Question, Hypothesis and Variables
  - Materials List
  - Experiment Procedure
  - Data Analysis
  - Bibliography
- Data Explanation
- Conclusion

Other things to think about while writing your report-
Was your hypothesis correct?
Why do you think your hypothesis was correct or not correct?
What could you have done differently?

***Note*: A science fair report is not required, but is recommended.**

Congratulations you have just completed the Scientific Method.
It is now time to formalize your research plan and complete your abstract.
The majority of your research plan is already done; time to format.



Completed Research Plan

Your research plan should follow this format:

- Problem/question
- Hypothesis/Engineering Goals
- Methods/Procedures
  - -procedures
  - -data analysis
- Bibliography

Example:

Problem/Question:
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Hypothesis:
Individuals with longer arms can throw a football further.

Materials:
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15-20 participants (7th grade males)

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Step 3: Measure throw distance
Step 4: Document data in table
Step 5: Repeat steps 2-4, **a minimum of 5 times**
Step 6: Repeat steps 1-5 for each participant

Data Analysis
Averages for each participants football throws will be calculated to determine if there is a correlation between arm length and throwing length/distance.

Participant	Wrist to elbow	Elbow to shoulder	Total arm length	Throw 1 (distance)	Throw 2 (distance)	Throw 3 (distance)	Average Distance
Participant 1	9 inches	11 inches	26 inches	50 feet	55 feet	52 feet	52.33 feet
Participant 2	8 inches	10 inches	24 inches	47 feet	50 feet	75 feet	57.33 feet
Participant 3	12 inches	13 inches	33 inches	70 feet	71 feet	71 feet	70.66 feet
Participant 4							

Average= (Throw 1 + Throw 2 + Throw 3) / 3

Bibliography: minimum of five references

Abstracts

What is an abstract?
An abstract is an abbreviated version of your science fair project final report. Your abstract will be the leading document into your report, as well as on your display board.

Why do an abstract?
Abstracts are a very important part of your science fair project, it is a summary of your entire project and makes people and judges aware of what they are looking at. Think of your abstract as an advertisement of your project. Make it exciting, fun and interesting.

Abstracts are required to be no longer than 250 words and to fit on one page. Abstracts are different from research plans.

Key elements of an abstract are:

- Purpose of the experiment
- Procedures
- Data
- Conclusions

Tips for writing an abstract

Many scientist agree that an abstract should have the following five aspects:
1. An Introduction
2. A Problem Statement
3. Procedures
4. Results
5. A Conclusion

Things to Avoid:

- Jargon or technical terms most people won't understand
- Acronyms
- Tables and graphs
- Long and drawn out explanation

Keep each section to one-two sentences when possible.

<u>Note:</u> Abstracts are required by the scientific review committee to participate in NAISEF/NAIVSEF and the ISEF.

Abstract Example

Do individuals with longer arms throw a football further, than those with shorter arms? It was hypothesized that individuals with longer arms could throw a football further than those individuals with a shorter arm length. Fifteen individuals were tested. Each individual was in the 7th grade, age 12, and in good health. They were asked to throw the football five times from the one yard line of the middle school foot- ball field. Each throw was measured with a tape measure and recorded. The results of the experiment showed that arm length was a deciding factor in the average throw of an individual. Those with a longer arm span threw an average of 20 feet longer than those with a shorter arm span.

Proofreading

What is proofreading?
Proofreading refers to the process of reading written work for “surface errors.” These are errors involving spelling, punctuation, grammar, and word choice.

Why should you proofread?
Proofreading is an important practice you should learn to incorporate into your everyday life. By proofreading and correcting your mistakes, you look more professional. It is easy to make errors that can offend people.

Who can help proofread?
Anybody can help you proofread! You should first read your writing for any obvious errors and then have a teacher, friend, parent, or adult help you.

What should you proofread?
Everything: Abstract, report, and display board.

Tips for Proofreading
1. Familiarize with common grammatical and spelling mistakes.
2. Read your document slowly and out loud.
3. Read your writing, sentence by sentence, from the last sentence to the first sentence.
4. Use your dictionary to check any words of which you are unsure of and to check for correct prepositions, verb tenses, and irregular forms.

Plagiarism

What is plagiarism?
To plagiarize means to steal and pass off the ideas or words of another as one’s own; to use another’s work without crediting the source; to commit literary theft; to present, as new and original, an idea or product derived from an existing source.

All of the following are considered plagiarism:
- Turning in someone else’s work as your own
- Copying words or ideas from someone else without giving credit
- Failing to put a quotation in quotation marks
- Giving incorrect information about the source of a quotation
- Changing words but copying the sentence structure of a source without giving credit
- Copying so many words or ideas from a source that it makes up the majority of your work

Why is it wrong?
If you plagiarize how will you ever learn? You are in school to learn, if you plagiarize than you are not learning the lessons that are being taught. Plagiarism is also wrong because it is dishonest. If you use somebody else’s work, give them credit. There are many sources out there to teach you how to cite and give credit correctly. Lastly, plagiarism can get you into a lot of trouble. You can get fired from work or kicked out of school! And the people who you stole ideas from can legally prosecute you; this is not something you want to have on your record.

Project Paperwork

The following paperwork is required for all NAISEF/NAIVSEF projects.

Research Plan
Abstract

NAISEF/NAIVSEF paperwork

- Registration form
- Liability form

ISEF paperwork

- Checklist for Adult Sponsor (1)
- Student Checklist (1A)
- Approval Form (1B)

Additional ISEF paperwork
Please review flow chart on page17 to see if your project requires additional ISEF forms.

- Regulated Research Institutional/Industrial Setting Form (1C)
- Qualified Scientist Form (2)
- Risk Assessment Form (3)
- Human Subjects Form and Consent Forms (4)
- Vertebrate Animal Form (5A)
- Vertebrate Animal Form (5B)
- Potentially Hazardous Biological Agents Risk Assessment Form (6A)
- Human and Vertebrate Animal Tissue Form (6B)
- Continuation Form (7)

Links to the ISEF forms can be found on the ISEF website: http://www.societyforscience.org/isef/

Submitting a project to NAISEF/NAIVSEF

- Do you have all your forms completed (signed and dated correctly)?
- Submit all project paperwork by stated DEADLINES.

***Note*: all projects must be reviewed and approved by the NAISEF/NAIVSEF Scientific Review Committee (SRC).**

Project Paperwork Revisions

Depending on the rules of your fair, revisions may be requested to ensure projects follow all rules and guidelines. They may request clarification on specific sections in your research methodology.

***Note*: AISES staff will contact sponsor or student by email if revisions are needed.**

Judging Tips

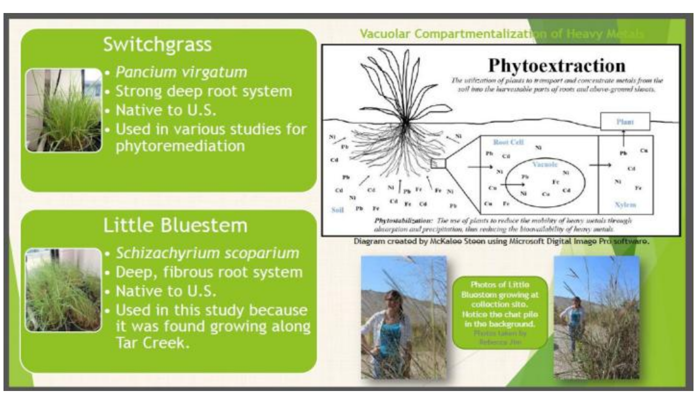
Judging time is a time to be a shining star or more accurately a shining scientist. This is a chance for you to speak with professionals and mentors who are interested in your science project. If you are prepared for your interview, you will make a great impression. While preparing for your interview, keep these things in mind:

- Make sure you are knowledgeable about your science fair project
- Write up a short summary and practice it a few times in the mirror
- Practice explaining your science project in non-technical terms
- Do not just recite your speech, speak in your own voice
- Do not make up things you don't know. Simply state "I don't know"
- Treat each person that looks at your project like they are a judge; they may be an important contact for you (at a live fair)
- Do not mumble. You sound much more professional when you speak clearly
- Do not fidget, can be distracting to a judge (at a live fair)
- Anticipate interruptions
- Always, always ask for feedback after the science fair, there is always room for improvement
- Put effort and time into your display board, video, and/or slideshow
- Make sure to proofread your display and project abstract and research paper
- Dress professionally or nicely. Do not wear jeans and a t-shirt (at a live fair)
- Make your display board/Slideshow attractive and easy to read
- Practice makes perfect

<u>Factors Judges Consider When Scoring Your Project:</u>

1. Creative Ability
2. Scientific Thought and Engineering Goals
3. Thoroughness
4. Skill
5. Clarity
6. Teamwork (if a team project)
7.

Example of a slide from NAIVSEF Slideshow:



NAIVSEF Entry 2014 – McKalee Steen (Senior Division)

Examples of Poster Board Presentations at a Past NAISEF:

Project ideas

Animal Sciences
Temperature Water and the Color of Fish
Pollution and the Effect on Habitat

Behavioral Sciences
Memory and Television
Gender and Visual Selective Attention

Biochemistry
Process of Protein Synthesis
Efficiency of Lactase

Cellular and Molecular Biology
Nicotine and Cancer
Chromosomes and the Effects on Genetics

Chemistry
Distillation of Water
Chemical Change in Combustion

Computer Science
Image Compression vs. Image Quality: Best Tradeoff
Create Your Own Software Program

Earth and Planetary Science
Ocean Currents and Global Warming
Global Warming and the Effects on Ecological Niches

Engineering: Electrical and Mechanical
Electronics and Solar Energy
Effects of Friction on Objects in Motion

Engineering: Materials and Bioengineering
Metals and Corrosion Resistance
Crosswinds and Bridge Building

Energy & Transportation
Solar Powered Cars
Fuel Cells for Cars

Environmental Management
How No-Plow Farmers Try to Save Our Soil
How Does Soil Effect the Ph of Water

Environmental Sciences
The Effects of Lead in Soil
How Frog Health Determines the Health on Ponds

Mathematical Sciences
Dice Probabilities
The Birthday Paradox

Medicine & Health Sciences
Influence of Color on Blood Pressure
Cell Phone Radiation and the Effects on a Body

Microbiology
Germ Invasion and Disinfectants
Ultraviolet Rays and the Effects on Bacteria

Physics and Astronomy
Magnetic Fields and Solar Storms
Most Efficient Position of Windmill Blades

Plant Sciences
Root Pressure
Heat produced by Seedlings

Sample Lesson Plan for Teachers

<table>
<tr><td colspan="2">INSTRUCTOR</td><td>DATE</td></tr>
<tr><td colspan="2">COURSE TITLE</td><td>LESSON NUMBER</td></tr>
<tr><td>UNIT</td><td colspan="2">SPECIFIC TOPIC</td></tr>
<tr><td colspan="3">INSTRUCTIONAL GOAL
Science Fair Projects</td></tr>
<tr><td colspan="3">PERFORMANCE OBJECTIVE
Students will be able to utilize the scientific method to complete their science fair projects.</td></tr>
<tr><td colspan="3">LESSON CONTENT
Steps of the Scientific Method
Research Methods and Reports
Bibliography and citing references correctly
Research Plans
Abstracts
Plagiarism
Creative Thinking
Sentence Structure
Library Skills</td></tr>
<tr><td colspan="3">INSTRUCTIONAL PROCEDURES
Review each step of the Scientific Method
-Give examples

Brainstorm
-Ask a question
-Topics/ Subjects
-Key words for Research

Research topics around question/topic/subject
-Types of resources
-Deadline for research to be completed
-Reference information for bibliography

Construct hypothesis and clarify question
Determine if prior approval is needed (ISEF Forms)
Research Plan content
Analyze experiment data, use tables, graphs, charts, etc. to help draw conclusion.
Finalize research plans, bibliographies and abstracts</td></tr>
<tr><td colspan="3">EVALUATION PROCEDURES
Quiz-List steps of the scientific method
Students will meet deadlines established in project timeline
Final evaluation will be completion of science fair project</td></tr>
<tr><td colspan="3">MATERIALS AND AIDS
Power Up Science Fair Manual, library, internet, Research Plan Worksheet, Bibliography Information template, ISEF forms</td></tr>
</table>

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