

Student Research Projects



Information & Tools Packet

Dear Parents/Guardians and Students,

Research projects allow students to think outside the box of the typical “science fair” project and realize that they can do a project on any topic that may be of interest to them. Whether their topic of interest is math, science, social studies or language arts based. We now have the opportunity to allow students to practice their inquiry and critical thinking skills which we have worked so hard to teach them since elementary school. This can lead to greater understanding of and appreciation for the world around them, which in turn can lead to more ambitious and intelligent citizens.

Doing a research project can be a fun and rewarding experience. You will get to create your own question and possibly discover an answer to it by doing research and conducting your experiments. The scientific inquiry process will help to guide you through this process and might even lead to a great discovery!

SO... ASK questions, INVESTIGATE a possible answer, CONNECT your findings to the real world, DISCUSS your findings with the public, and REFLECT on what it all means.

Parents/Guardians please review this packet with your child. Sign the line below and have your student return this sheet to me in class.

If you have any questions please feel free to contact me at: _____

Thank you.

Parent/Guardian Signature

Date

Following the steps in this packet will not only guide you through each step of the scientific process, but will also help you put it all together at the end.

Good luck with your project!

Scientific Inquiry Process: A Brief Overview

A research project needs the following because the focus is on RESEARCH:

- It must start with a purpose or question or a problem to solve. The question must be answered by using the scientific inquiry process and not just a report based on what is already known.
- Students need to understand that the scientific inquiry process is a systematic way of attempting to determine the truth. In this attempt, the scientist has to guard against any biases that s/he might have entering into the investigation.

HYPOTHESIS:

Based on research, past knowledge and experiences, investigators usually have an educated guess about the answer to the question being investigated. This guess is stated as the hypothesis to be tested. The hypothesis may be proven false or it may be given support by the results of the test.

Example Hypothesis:

If a baking soda solution is added to bean plants then the plants will grow better because the baking soda will carry more oxygen to the roots.

CONTROLLED EXPERIMENT:

The hypothesis is tested by the means of a controlled experiment. This type of experiment has two parts, the experiment and the control over it. All the other parts of the experiment are identical in every way except for the one variable that is being tested.

Example of Controlled Experiment:

In the case of the bean plants being watered with the baking soda mixture, some plants would not be watered with the baking soda mixture and those would be the control plants. Then some of the plants would be watered with the baking soda mixture and those would be the plants that would help test your hypothesis. All the plants must be treated the same in all other respects: kind of pot, soil, water, temperature, light, etc. Using many plants for each group and taking pictures as changes occur are highly recommended.

Name: _____

Period: _____

Student Research Project Checklist & Grading Rubric

- 9 to 10 points** = **Excellent** – Exceeds expectations
- 7 to 8 points** = **Very Good** – Meets all expectations
- 4 to 6 points** = **Okay** – Includes all required information but does not meet one or more of the expectations
- 1 to 3 points** = **Poor** – Does not include some required information and does not meet one or more of the expectations
- 0 points** = **Incomplete** – Required information or part is not included

| PARTS OF A RESEARCH PROJECT | Self-Assessed Points | Actual Points |
|--|-----------------------------|----------------------|
| RESEARCH QUESTION Research question is well written. | 0 1 2 3 4 5 6 7 8 9 10 | |
| RESEARCH SUMMARY Research summary is complete, well written, has no first person references, and is in paragraph form. It includes correct parenthetical documentation of sources. It includes research about the dependent variable, the independent variable, and leads the project to a logical hypothesis. | 0 1 2 3 4 5 6 7 8 9 10 | |
| HYPOTHESIS The hypothesis is in the correct format, with no first person pronouns. It is specific and relates to the information presented in the research summary. | 0 1 2 3 4 5 6 7 8 9 10 | |
| MATERIALS The materials list includes <u>all</u> materials required to run the experiment with correct names for all instruments as well appropriate amounts needed where appropriate. | 0 1 2 3 4 5 6 7 8 9 10 | |
| PROCEDURE The procedure is complete and thorough. It includes all the steps necessary to run the experiment. It is written so that any person could follow it and duplicate the experiment exactly. It does not have any first person pronouns. | 0 1 2 3 4 5 6 7 8 9 10 | |
| GRAPH(s) The graph includes the averages from the data table. It is neat, easy to read and shows the results of the experiment clearly. The graph is labeled correctly as a figure. | 0 1 2 3 4 5 6 7 8 9 10 | |

| | | |
|---|-------------------------------|--|
| <p>CONCLUSION</p> <p>The conclusion includes a restatement of the question as the purpose for the experiment. It includes whether the hypothesis was right or wrong, data to support the conclusion about the hypothesis, any errors that occurred during the experiment, and finally interesting questions that your results lead you to ask. It is well written and does not contain any first person pronouns.</p> | <p>0 1 2 3 4 5 6 7 8 9 10</p> | |
| <p>BIBLIOGRAPHY</p> <p>The bibliography is in the correct format, including alphabetical order. It includes at least 2-3 sources (one book, one periodical, one internet site).</p> | <p>0 1 2 3 4 5 6 7 8 9 10</p> | |
| <p>DISPLAY BOARD</p> <p>The display board stands on its own and is large enough for everyone in the class to see. It includes all of the above parts, suggested order (left to right – Research Question, Introduction, Abstract, Hypothesis, Materials, Procedure, Data table, Graph, Conclusion, and Bibliography). Title is on the center portion of the board. The board is well laid-out, attractive, and easy to read. Name and teacher is labeled on the back top left corner of display board.</p> | <p>0 1 2 3 4 5 6 7 8 9 10</p> | |
| <p>PEER EDITING</p> <p>Your project was edited by a member of the class and you were able to edit someone else’s project.</p> | <p>0 1 2 3 4 5 6 7 8 9 10</p> | |
| <p>PROJECT DEADLINES</p> <p>All of the required parts of the research project were turned in on time. This includes topic selection, research question, research, hypothesis, materials and procedure, data table and graph, conclusion, and bibliography per the packet.</p> | <p>0 1 2 3 4 5 6 7 8 9 10</p> | |
| <p>Total Points =</p> | | |

TEACHERS: You may want to adjust the grading rubric to take into account students completing & turning in all required ISEF protocol forms especially if you plan to have students try to qualify for regional competition with their projects.

The Project Notebook

You will need to keep and maintain a notebook for your research project. The Table of Contents should be the first page in your notebook and should list the sections below. We will be working on setting the notebook up during a class period.

Include the following items in your notebook:

- **Research Project Information Booklet (*which is this handout*)**
- **Section I: Research**
 - ✓ Literature Research (*done in the library*)
 - ✓ Bibliography (*where did you get your research from*)
- **Section II: Problem Statement and Hypothesis**
 - ✓ List of possible variables and your hypothesis
- **Section III: Paperwork**
 - ✓ Approved paperwork (ex: ISEF required forms; additional ISEF protocol forms as required dependent upon the nature of the project)
- **Section IV: Project Diary- notes about your project**
- **Section V: Data**
 - ✓ Data from at least 3 experimental trials
- **Section VI: Conclusion**
 - ✓ Any conclusions that you have come up with
- **Section VII: Abstract**
 - ✓ Your abstract
- **Section VIII: Tri-fold display board-copies of whatever is on your display board**
 - ✓ Any information for your display board

Topic Selection

This is one of the most difficult things about doing a science fair project. Keep in mind as you are picking a topic that you will have to live with it for about 10-12 weeks. Once you choose an idea that you like, spend a few quiet moments thinking about how the whole project would work. If you can imagine obstacles that will be too difficult, then find a new topic. Don't forget the cost of supplies and time constraints.

Sometimes the most interesting projects come from things that you like to do in your spare time. Think of your hobbies, sports, clubs, chores at home, etc. Is there some aspect of these that you could measure and test?

There are several science project books in the Science Department. The library has some as well. Remember that these books describe simple ideas, and you will probably have to expand on an idea from them to make it measurable and experimental.

In the space below, describe in one paragraph what you would like to do for a science project. Cut it off when you are done and turn it in.

Your topic is due on: _____

----- cut here -----

Name: _____

Period: _____

MY TOPIC:

Teacher's initials _____

Date: _____

Research and Bibliographical Explanation

When you do research, you want to find information that can teach you something about the independent and dependent variables of your project. Learn about the topic so that you can make a hypothesis in the next step based on intelligent information. Your conclusion will have to be related to what you learn about the variables now and how they turn out in your experiment. Therefore, the research is the foundation of a good hypothesis and a meaningful conclusion.

DON'T COMPLAIN ABOUT HOW HARD IT IS TO FIND SOURCES FOR YOUR TOPIC!

Don't wait until the last minute. Take advantage of the librarians. Visit other libraries (public libraries, university libraries, etc). This step is not hard, but it requires you to plan ahead and be persistent.

YOU MUST HAVE AT LEAST 3 SOURCES:

1 BOOK

1 PERIODICAL (*professional journal, magazine article, etc.*)

1 OTHER (*encyclopedia, Internet, interview with and expert in the field, book, etc.*)

Come up with keywords for your research. Use your independent and dependent variables, any words or phrases related to them, or synonyms.

Your research resources are due on: _____

KEYWORDS:

Books

Title: _____

Author(s): _____

Publishing company: _____

City where it was published: _____

Date of publication: _____

Pages used: _____

Rewrite the information above in the correct bibliographic format. Use the following examples to help you.

Bibliography:

Two things learned from this source:

1.

2.

Teacher OK: _____

Date: _____

Internet Source

If this source is a book or periodical, see the previous pages for the kind of information necessary. If it is an Internet source, obtain the information below:

Title of article: _____

Author(s): _____

Web Address: http://_____

Date of document or date downloaded: _____

Rewrite the information above in the correct bibliographic format.

Bibliography:

Two things learned from this source:

1.

2.

Teacher OK: _____

Date: _____

Bibliographic Format: Using APA Guidelines

Book With One Author

Author. Title . Place of publication: Publisher, copyright date.

Encyclopedia

Author. "Title of article." Title of encyclopedia, copyright data. Volume number, pages of article

Materials from the Internet

Author (if known). "Title of page or document." Date of document (if known). Available <http://address.file>. Date of access.

CD-ROM or DVD

Author (if known). "Title of Article" Name of CD. Place of publication: Publisher, copyright year.

Your teacher may also recommend a source such as www.easybib.com where you can enter your sources and get help formatting your bibliographical citations properly!

Writing the Hypothesis

The next step is to turn your topic question, research and variables into a hypothesis. A hypothesis is a sentence or a question that identifies the independent and the dependant variables.

Independent variable: the variable or factor that you change

Dependent variable: what are you measuring for, what change(s) do you expect to see?

Independent Variables

Dependent Variables

| | |
|-------|-------|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

When writing your hypothesis you state how you believe that the independent variable will affect the dependent variable and why you believe that to be. It is normally one sentence that states what you think the answer to your topic question is based on your research. If the independent variable is changed then the dependent variable will be, because of this reason.

Example Hypothesis:

IF the temperature of the air in a balloon is increased, THEN the balloon will expand, BECAUSE of the increased speed of the molecules take up more space.

Your hypothesis is due on: _____

----- cut here and turn in -----

Name: _____ Period: _____

Write your hypothesis:

IF _____

THEN _____

BECAUSE _____

The Final Experimental Design

The following are the parts of the experimental design with a brief description of each section of the design.

- 1) **Title:** Be descriptive & creative
- 2) **Hypothesis:** Include If..... then..... Because
 - a. **Variables:** What are the items that can change the outcome of the experiment?
 - b. **Controls:** Which variables are you going to hold constant?
- 3) **Procedure:** A list of all the steps of your experiment in the exact order you will perform them. Be clear, but keep it simple. Other people should be able to repeat your experiment by following your procedure. If doing a survey you must attach a copy of the survey. If doing an engineering project you must include a detailed drawing of the project.
- 4) **Key Bibliographical References:** Properly formatted references
- 5) **Materials and Equipment:** Include all materials and equipment needed, specifying amounts needed
- 6) **Data:** What format is your data going to be reported in?
 - a. **Observations:** What did you see that happened?
- 7) **Conclusions:** What did you think happened during your experiment?

**All the above is what will be included on
your display board with the addition
of your project abstract.**

Required Forms

The following forms are required for ALL projects:

- **Form 1** – Checklist for Adult Sponsor
- **Form 1A** – Student Checklist
- **Research Plan**
- **Form 1B** – Approval Form
- **Form 1C** – Institutional/Industrial Setting (*ONLY if doing research in one of these facilities*)
- **Form 7** – Continuation Projects (*ONLY if project is a continuation from previous year*)

Additional Forms

The following forms **MAY** be required depending upon the type of project being done, level of risk of the project, etc.:

- **Form 2** – Qualified Scientist
- **Form 3** – Risk Assessment Form
- **Form 4** – Human Subjects
- **Form 5A** – Vertebrate Animal (*NOT being done in a Regulated Research Institution*)
- **Form 5B** – Vertebrate Animal (*BEING DONE in a Regulated Research Institution*)
- **Form 6A** – Potentially Hazardous Biological Agents
- **Form 6B** – Human and Vertebrate Animal Tissue

All forms are available on the following website:

<http://www.societyforscience.org/isef/document/form2009.pdf>

TEAM PROJECTS CONTRACT

STUDENTS:

- 1) We understand it is our responsibility to work as a team.
- 2) We will evenly divide the work.
- 3) We understand that once the project is approved, we can't break up the team no matter what happens.
- 4) We understand failure to work as a team will severely affect our grade for this project.

STUDENT #1 SIGNATURE: _____

DATE: _____

STUDENT #2 SIGNATURE: _____

DATE: _____

STUDENT #3 SIGNATURE: _____

DATE: _____

PARENTS/GUARDIANS:

- 1) I agree to my student participating in a team research project.
- 2) I understand it is necessary for the students to get together to work on this project.
- 3) I assume responsibility to provide transportation for my student so he/she can work on the team project.
- 4) I understand failure of the students to work as a team will severely affect their grade for this project.

PARENT #1 SIGNATURE: _____

DATE: _____

PARENT #2 SIGNATURE: _____

DATE: _____

PARENT #3 SIGNATURE: _____

DATE: _____

Student Research Topic Paper

Name: _____ Period: _____ Date: _____

What topic do you want to explore? _____

How will you measure the results? List the tools/materials needed. _____

Will you need chemicals? Yes No

If yes, which ones? _____

What else will you need to do your experiment? _____
