The Scientific Method

- **Choose a topic.**
- **State the question.**
- **Read about your topic (an encyclopedia is a good source) and ask others about it.**
- **Form a "hypothesis".** This is your guess to answer your question based on what you have learned from your reading.
- **Observing and experimenting.** How will you test your guess to answer your question?
  - *Plan* what materials you will need.
  - *Estimate* how much time it will take you to finish. Will you have enough time?
  - *Keep a notebook* and record everything about your project. The first entry should be your original questions or idea - include notes you have taken when reading about your subject. Make it easy to read. Use sketches, drawings, graphs, etc.
  - *Test different conditions* one at a time (i.e. different temperatures, what time of day, the amount of water, number of weights, etc.)
  - *Repeat the experiment* several times and average your results.
  - *Record your results*; pictures, drawings, graphs, or tables will help your display.
- **What does it all mean?**
  Show the meaning of your observed information on graphs and tables. State your interpretation.
- **Conclusions**
  - How would you now answer your original question?
  - What errors may have affected your results?
  - How does the project apply to "real life"?

Guidelines for Successful Projects
(Sample)

1. Successful projects follow the scientific method and ask original questions.
2. Successful projects will be neatly displayed. The display should include the title (often, a question), the student's hypothesis, a description of the experiment (pictures or drawings are encouraged), the student's results, and an answer to the question (conclusions).
3. Students present their projects to the judges. A short oral description (5 min) should demonstrate understanding and perspective.
4. Successful projects receive parental input, but allow the *student to do the work.*
5. Successful projects are creative and enjoyable for the students and their audiences.

**** All projects that have followed these guidelines should receive an award. Every student can win!***

Bibliography

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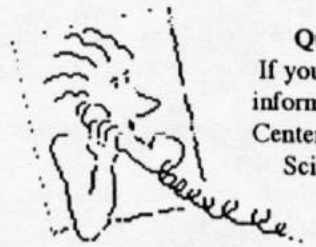
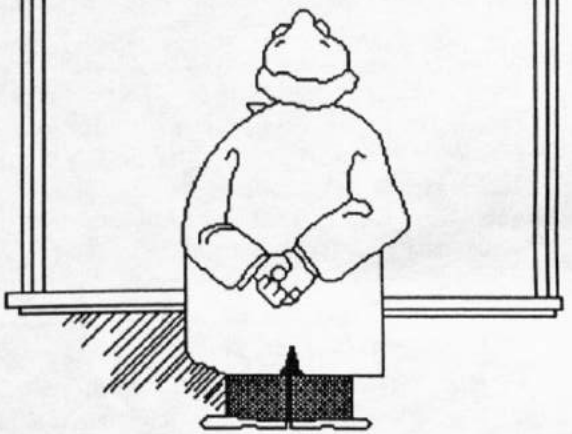
Van Deman, B.A. and E. McDonald, *Nuts and Bolts. A Matter of Fact Guide to Science Fair Projects*, The Science Man Press, Harwood Heights, IL. (1986).



Questions?
If you desire more information, call the Center for Integrated Science Education at 581-4171.

Science Fairs

An Elementary School Guide



How to Begin

- **Pick a date, time, and specific place.**
- **Develop guidelines and criteria by which all projects will be categorized and judged,** i.e. an original experiment following the scientific method, an organized display of the project, an oral presentation reflecting the student's knowledge.
- **Recruit teachers, PTA, administrators, and parents to provide input and assistance.** (Consider publicity, an assembly with students, finding judges.)
- **Consider high school/college students and local professionals as mentors.**
- **Send a note home containing pertinent information.**

You have decided to put on a science fair in your school. ***Congratulations!*** Science involves asking questions, making guesses about the answer (hypothesis), performing experiments to test the hypothesis, and drawing conclusions. This guide is mainly for teachers and other school fair organizers. Here you will find ideas on how to get started, how to involve parents, methods to assist students in their projects, judging tips, and a list of alternatives to science fairs. Remember, science fairs succeed because teachers take the time beforehand to help students formulate ideas and help students complete their projects.

Suggested Types of Projects

- ***Collections (K-3 only)*** - These should be accompanied by written material.
- ***Demonstrations (K-3 only)*** - These involve demonstrating a scientific concept or process.
- ***Inventions*** - Students can identify a need and invent something to meet the need. The upper grades should include experimentation and library research.
- ***Personal Experiments*** - These are the essence of science. Students follow the scientific method to make an educated guess to a question, perform experiments to test their guess (their hypothesis), and draw conclusions based on what they observe.

Alternatives to Science Fairs

- ***Class fairs*** - Have a miniature science fair with your class.
- ***Class project(s)*** - Involve the entire class in one or more projects using the scientific method.
- ***Demonstrations/Collections*** - a demonstration or collection fair can help students learn to classify or to demonstrate a scientific concept.

Helping Students

Help students choose a topic of interest by referring to local science museums, newspapers, old science text books, the library, project titles from previous projects, or individuals who have some interest in science (parents, relatives, university professors, high school science teachers). Topics don't have to be "chemistry, physics or biology." They can be anything which allows students to ask questions and discover answers. Remember, students need direction throughout the project, not just at the beginning.

Choose a Date!!

Developing Appropriate Questions

- "Computers" - Too general.
- "How can computers help teach children to read?" - Better, but still too general.
- "At which of the following will children spend more of their leisure time learning to read: computers, books, television, or other people?" - This may take some thought, but is certainly original.
- "Caffeine" - Too general.
- "How do drinks with caffeine affect people?" - Better, but should be even more specific.
- "How will drinking regular vs. decaffeinated coffee each morning affect my parents' dexterity?" - Most specific.
- "How does drinking alcohol affect math skills?" - Although original, this is not an acceptable topic as it poses a safety hazard.
- "Which beverages affect students' ability to do math?" - Safe (no alcohol) but still vague.
- "Does exercise enhance math skills in 4th grade students?" - Specific and experimental.
- "How does temperature affect the pressure of carbonated drinks?" - Experimental.

Judging

Judges must be educated as to how the fair is to be judged. What criteria are expected for outstanding projects? Are students doing this for a grade? How will awards be given? Usually, one judge can evaluate 20-30 projects. Do you want each project to be judged twice by different judges? Do the students know this? Plan to select an appropriate number of judges. After two hours, it becomes harder for the judges to effectively evaluate the projects.

Judges should base their evaluations on criteria laid out previously. Ideally, students are present during the judging to explain their project to the judge. Each student should receive some constructive input.

"Non-competitive fairs" are becoming more popular. Every student receives an award if they follow certain guidelines and present an adequate oral description of their project.

Outcome/Assessment

Were students given enough time to prepare their projects? How closely did students follow the scientific method? Did parents help with the projects? (Too much?) What went well with judging? Improvements? What will we did differently next year? *(Pass this information to the person in charge of the fair next year!)*

Safety is Important!

In approving projects, steer students from projects that may be harmful. Pay special attention to heat, chemicals, electricity, live animals, and toxic substances.