SCIENCE FAIR CENTRAL

TEACHER'S RESOURCE GUIDE

Get your students ready to show what they know!

ELMER'S

Discovery EDUCATION

About the DVD

*When embarking on a science fair project, videos can be a useful tool to get students excited and engaged. The videos listed at right are included on the enclosed **"Science Fair Central"** DVD. One focuses on the set of procedures commonly known as the Scientific Method, and another will take your students step-by-step through science fair planning. Finally, they'll meet the cream of the crop of young scientists with an inside look at the Discovery Channel Young Scientist Challenge.*

Show the videos separately or have students watch the DVD in its entirety to gain an insightful overview of the whole process, start to finish, before beginning their individual projects.

THE SCIENTIFIC METHOD (TRT 19:40)
Most students know that the scientific method is a set of standard procedures. This video explains each procedure in detail and also illustrates why the scientific method is so important: By following the same time-tested, universal set of procedures as every other scientist and student, they can ensure that anyone anywhere can repeat their experiments.

HOW TO PREPARE FOR A SCIENCE FAIR PROJECT (TRT 17:00)
By watching what real scientists do in the real world, students will get charged up to do real scientific investigation of their own. This segment begins by showing scientists in the field, putting the scientific method to practice as they test the effects of ozone on plants in makeshift outdoor laboratories. It then goes on to detail the necessary nuts and bolts of the science fair project. You'll learn everything you need to know, including the seven key steps of preparing a science project for school, district, or state competitions. Along with tips on long-range planning and scheduling, the video guides you through selecting a topic, doing research, developing a hypothesis, incorporating the scientific method, organizing notes, conducting an experiment, writing the abstract and research paper, designing an exhibit, and preparing an oral presentation. All the while, it encourages students to "let your creativity shine through!"

THE DISCOVERY CHANNEL YOUNG SCIENTIST CHALLENGE (TRT 43:25)
Watching this exciting and often humorous overview of the annual Discovery Channel Young Scientist Challenge will inspire students to reach for the stars as they join the finalists in exploring the forces of nature, including how to make a tornado, the science of tsunami waves, and flight navigation through fog. Celebrating curiosity, ingenuity, hard work and perseverance, it shows how science can be intellectually stimulating as well as incredibly fun.

TABLE OF CONTENTS

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SCIENCE FAIR ORGANIZER

TEACHERS, GET READY!

Countdown and Follow-Up

CHECKLISTS FOR PLANNING, EXECUTING AND WRAPPING UP A SUCCESSFUL SCIENCE FAIR

INITIAL PLANNING

❑ Coordinate the date for the science fair with your principal and/or school activity director.
(You might want to avoid the week before exams.)

❑ Reserve a location for the fair, such as a gym, library, cafeteria, or public facility.

❑ Establish committees to help different elements of the fair.

Key committees include:

- Judges Committee
- Publicity Committee
- Awards Committee
- Project Certification Committee
- Scientific Review Committee

For more information on setting up these committees, please visit www.discoveryschool.com/sciencefaircentral.

❑ If needed, make sure that you have a current rulebook from the International Science and Engineering Fair. You can order this publication through Science Service Inc. at:
1719 N Street, NW, Washington, DC 20036; or request a copy by phone (202-785-2255) or fax (202-785-1243).

❑ Provide the judging criteria to other teachers involved.
(See page 5 for Judge's Criteria.)

❑ Design a student registration card and set up a database to record all the registered students.

❑ Design a rotation schedule for student tours of the science fair. Schedule student, parent and teacher monitors to be on duty while the student body is viewing projects.

❑ Students should be involved with the setup and removal of projects, but request custodial assistance as needed. Enlist the art teacher, club or art classes to make posters and banners to advertise the science fair.

❑ Teachers, send a letter home to parents informing them of the upcoming Science Fair. You can download it at www.discoveryschool.com/elmers/resources. In addition, copy and send home pages 7-11. These tips and strategies will help parents and students to make science fair a success.

PREPARING STUDENT PROJECTS

❑ Practice the interview process as you prepare students for competition.

❑ Review class projects before entering them into the school's fair. Make sure that registration and other paperwork is completed for each entry.

❑ Have each student complete a science fair project application.

❑ Initial and number code each project.

COORDINATING JUDGES *(IF NECESSARY)*

❑ Secure more than an adequate number of judges. (You might want to set up a database of their names and contact information.)

❑ Meet with the judges to cover the schedule, evaluation criteria and the judge's worksheet.

❑ Call each judge before the science fair to confirm date and time. Send abstracts for the projects he or she will be judging.

❑ Have clipboards, name tags and pencils available for the judges the day of the fair. If possible, provide a room and refreshments for the judges.

DAY OF THE FAIR

❑ Collect registration cards from the students as they bring their projects in for setup. (Projects should not be accepted unless they have been reviewed by a teacher and are properly labeled and numbered.)

❑ Have an assistant help you tabulate the scores.

❑ Arrange the tables to fit the space available.

❑ Allow plenty of space between the rows so students, parents and judges can pass through easily.

❑ Cover tables with thin vinyl or butcher paper in school colors.

❑ Remind students that they are an important part of their displays, too. They are representing their school to the public and should be dressed appropriately, should not chew gum or listen to music, and should respect other students and judges. Also, be sure they are prepared to describe their projects to a judge in a clear, succinct presentation.

AFTER THE FAIR

❑ Send thank-you notes to those involved, from judges and committee members to the parent and teacher monitors.

❑ Evaluate your school's fair with the committees and/or science department. Target areas that could be improved for next year's science fair. Plan a special school announcement of the winners.

❑ Plan some type of special recognition for the winners that will encourage them to advance to the next level of competition.

❑ Have a meeting with the winning students and their teachers. Complete the official registration for the next level and return it before the deadline.

SCIENCE FAIR JUDGE'S CRITERIA

THINGS TO CONSIDER IN JUDGING DISPLAYS

CREATIVE ABILITY/ORIGINALITY

❑ There was an original question asked.

❑ The approach to answering the question was creative.

❑ The creativity of the study was within the student's ability.

❑ The student used the scientific method in experimentation rather than only descriptions and observations.

SCIENTIFIC THOUGHT

❑ The scope of the study was within the student's ability.

❑ The study was well-thought-out and showed initiative in thought and design.

❑ The goals and objectives of the study were well defined.

❑ The scientific literature was examined.

❑ A logical hypothesis was developed for this study and the data collected related to the hypothesis.

THOROUGHNESS

❑ The student collected all available data and identified all controls.

❑ The sample sizes and population sources were carefully chosen.

❑ The variable of each experiment was clearly defined.

❑ The student anticipated the problems encountered.

❑ The student related the work to that reported in the literature.

❑ The data were collected in quantitative units and thoroughly analyzed.

❑ The student conducted several experiments, not just one.

❑ The study was completed or brought to a logical stopping place.

SKILL

❑ The experiments' protocols were handled with skill.

❑ The experiments were designed with care and anticipation.

❑ The data measurements were done precisely.

❑ The study was skillfully designed and was not too complicated.

❑ Technical problems were overcome and not merely avoided.

❑ A detailed notebook and log were kept.

❑ This study was the student's alone and excessive help was not utilized.

SCIENCE PROJECTS ALLOW STUDENTS TO:

- Use the scientific method to develop an understanding of controls and variables.
- Take an open and creative approach to problem solving.
- Sharpen their research and writing skills.
- Learn the difference between personal opinion and scientific fact.
- Understand the importance of time management.
- Develop public speaking skills, poise and the ability to think on their feet.
- Be recognized for academic achievement.

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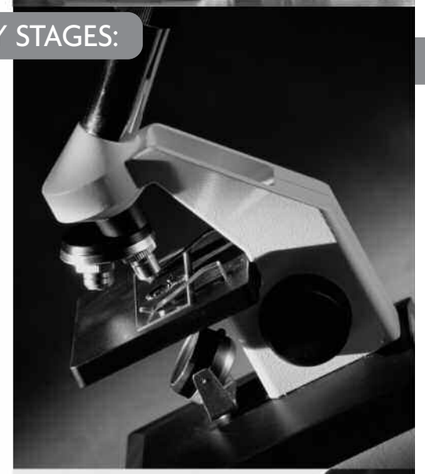
RESEARCH

The Key To A Successful Project



RESEARCH IS A VITAL PART OF THE PROCESS DURING THREE KEY STAGES:

1. BRAINSTORMING RESEARCH

To help your students decide what to do.

Refer to "Where Do Ideas Come From?" on page 2 of the Student Magazine SHOW OFF! for ideas, and encourage your students to use the magazine as a resource.

2. PRELIMINARY RESEARCH

To fine-tune the topic, ensure its viability, and help formulate the hypothesis.

This involves a combination of research as we commonly define it (using library books, periodicals and the Internet to gather information from a range of sources) and hands-on exploration and experimentation. The goal is for students to learn as much as possible about their selected topic, as well as to refine it, test ideas, and formulate a question that leads to an effective hypothesis. For example, the question "Which makes plants grow faster: natural light or artificial light?" might lead to the hypothesis: "Plants grown under natural light will grow faster than those under artificial light."

Your students may have a burning scientific question to answer, or just a few aspects of a topic they are curious about. Remind them to keep exploring, tinkering and jotting down ideas until a "problem" is uncovered, and to run some preliminary tests to see if their topic and hypothesis are viable. If this step is successful, students should get your approval before beginning their experiments.

3. MAIN RESEARCH

To learn background information, deepen understanding of underlying scientific principles, collect pertinent data, and master the topic.

Students should start researching their topic at a local or school library. Standard and science encyclopedias are a great place to start, as are relevant books in the Juvenile or Young Adult sections. The Internet should only be used once these other areas are thoroughly explored. Here are three important reminders for your students:

- Use reliable sources with reliable information. (Remind them that the Smithsonian Institution is a reliable source; Joe Smith's Way Cool Science Site is not.)
- Don't plagiarize!
- Keep track of all sources of information in a logbook, including the publication's name, author, publisher, copyright date, and relevant page numbers. (Refer to page 2 of the Student Magazine for more information on logbooks.)

RESOURCES

(Down)loads of Info for Project Ideas and Research

WEB RESOURCES

GENERAL AND REFERENCE

National Science Digital Library: **http://nsdl.org**

Created by the National Science Foundation to provide organized access to high- quality resources and tools that support innovations in teaching and learning at all levels of science, technology, engineering, and mathematics education.

ScienceMaster:
www.sciencemaster.com
An award-winning site designed for middle school and high school students, parents and teachers. Collects the best content from NASA, the USGS, the EPA, NOAA, and leading educational institutions.

National Science Teachers Association:
www.nsta.org/middleschool
NSTA's Middle School page is a good resource for both teachers and parents. In the Teacher Resources area, you'll find the best teacher-approved books and software, targeted to your grade level and subject area.

Research Matters at Harvard University:
www.researchmatters.harvard.edu

Smithsonian Science and Technology:
www.si.edu/science_and_technology

Howstuffworks "Science Channel":
http://science.howstuffworks.com

Everyday Mysteries: Fun Science Facts from the Library of Congress:
www.loc.gov/rr/scitech/mysteries/mysteries-home.html

Elmer's Products, Inc.
www.elmers.com

Discovery Education's Science Fair Central
www.discoveryschool.com/sciencefaircentral

Discovery Channel Young Scientist Challenge
www.discovery.com/dcysc

SCIENCE FAIR AND EXPERIMENT IDEAS

MIT's Invention Dimension: Fun Sites for Kids:
http://web.mit.edu/invent/r-archive-2.html

Exploratorium's Hands-on Activities:
www.exploratorium.edu/explore/handson.html

TryScience—Science Fair Project Ideas from Science Museums:
http://tryscience.org/home.html

All Science Fair Projects:
www.all-science-fair-projects.com

Sports Science in the Yahoo! Directory:
http://dir.yahoo.com/Recreation/Sports/Science

PRINT RESOURCES

SCIENCE FAIRS & EXPERIMENTS

The Scientific American Book of Great Science Fair Projects by Marc Rosner, Wiley: 2000

Fizz, Bubble & Flash!: Element Explorations & Atom Adventures for Hands-On Science Fun! (Williamson Kids Can! Series) by Anita Brandolini, Ph.D., Williamson Publishing Company: 2003

The Everything Kids' Science Experiments Book: Boil Ice, Float Water, Measure Gravity—Challenge the World Around You! (Everything Kids Series) by Tom Robinson, Adams Media Corporation: 2001

Sports Science Projects: The Physics of Balls in Motion (Science Fair Success) by Madeline Goodstein, Enslow Publishers: 1999

Elmer's Surviving Science Fair! A Guide to a Successful Science Fair Project by Steven L. Jacobs, PhD. D., Showboard: 2005

INVENTIONS

**Eureka! Great Inventions and How They Happened* by Richard Platt, Kingfisher: 2003

The Book of Inventions by Ian Harrison, National Geographic: 2004

Scientific American Inventions and Discoveries: All the Milestones in Ingenuity From the Discovery of Fire to the Invention of the Microwave Oven by Rodney Carlisle, Wiley: 2004

**Fantastic Feats and Failures* by the Editors of YES magazine, Kids Can Press: 2004

WORKING SCIENTISTS AND THE SCIENTIFIC METHOD

**The Case of the Monkeys That Fell from the Trees: And Other Mysteries in Tropical Nature* by Susan E. Quinlan, Boyds Mills Press: 2003

**Hidden Worlds: Looking Through a Scientist's Microscope* (Scientists in the Field Series) by Stephen P. Kramer, Houghton Mifflin: 2001

How to Think Like a Scientist: Answering Questions by the Scientific Method by Stephen P. Kramer, HarperCollins: 1987

**The Sky's the Limit: Stories of Discovery by Women and Girls* by Catherine Thimmesh, Houghton Mifflin: 2002

**Field Trips: Bug Hunting, Animal Tracking, Bird-Watching, Shore Walking* by Jim Arnosky, HarperCollins: 2002

**What Does a Wheel Do?* by Jim Pipe, Copper Beech Books/Millbrook

That's the Way the Cookie Crumbles: 62 All-New Commentaries on the Fascinating Chemistry of Everyday Life by Dr. Joe Schwarcz, ECW Press: 2002

Sciencing: Learning About the Scientific Method (Science Action Labs) by Edward Shevick, Marguerite Jones, Judy Mitchell (ed.), Teaching & Learning Company: 1998

SCIENCE REFERENCE

The American Heritage Student Science Dictionary by American Heritage, Houghton Mifflin: 2002

Ultimate Visual Dictionary of Science (Ultimate Visual Dictionary) by Dorling Kindersley Publishing: 1998

DK Encyclopedia of Nature by Dorling Kindersley Publishing: 1998

**Scholastic Atlas of Weather* by Marie-Anne Legault (ed.), Scholastic Reference: 2004

***Received "Outstanding Science Trade Books for Students K-12" honor by NSTA (National Science Teachers Association)**

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TEACHERS:
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PARENTS, GET INVOLVED!

Encourage and Assist Your Kids

MOTIVATING YOUR YOUNG SCIENTIST

Deciding on a topic is often the hardest part of the process. Students should come up with their own original ideas, but parents can help in a number of ways.

- Pick up a variety of reading materials at the library and set the pile on the coffee table.
- Take a family trip to a science museum.
- Take a nature walk and bring small notebooks and pencils for everyone in the family (parents included). Wherever you go, sketch and jot down observations just like real explorers do.
- Encourage your child to draw on his or her personal interests. Sometimes a hobby or favorite sport will spark an idea.
- Once a decision has been made, make sure the topic can be explored and the experiment conducted in the amount of time given, and that your child will have access to the materials and equipment required.
- As the deadline approaches, relieve some of the stress. Remind your young scientist—and yourself—that the purpose of the project is to learn about science, not to win the competition.

USING THE SCIENTIFIC METHOD

The Scientific Method is a set of general guidelines for conducting science experiments in a systematic way to ensure objectivity and consistency. Professional scientists around the world and middle school students at science fairs across the country all apply the same basic methodology and speak the same universal language when they use the scientific method.

Different books and teachers may use slightly different terms, and more or less of them, to identify the steps of the Scientific Method. But all share these three: hypothesis, procedure (usually called the "experiment"), and conclusion.

Here's the general outline:

- Scientific problem (Pose a question.)
- Hypothesis (Make an educated guess.)
- Materials and equipment (Figure out what is needed. Are materials affordable? Easy to obtain? Safe? Do they abide by classroom and science fair regulations? Do they require electricity?)
- Procedure (Create a detailed, step-by-step process for conducting the experiment.)
- Number each step and include a control and a variable.
- Observations (Conduct the experiment and make notes about what happens.)
- Conclusion (Answer the question. Did the results prove or disprove the hypothesis?)

COMPILING THE PROJECT REPORT

Science is complicated, but a project report should be clear and concise. It should present highly detailed information as simply as possible while conveying a solid understanding of the underlying scientific principles explored in your child's procedure. It should include the following sections:

- Title Page
- Table of Contents
- Introduction (or "Abstract")—a short summary that includes the hypothesis, procedure, materials, results, and conclusion; how your child came up with the idea; and why it's important
- Question and Hypothesis
- Experiment (include materials)—Each step should be numbered and written like a set of instructions.
- Data and Results
- Conclusion
- Bibliography and Sources
- May also include: Review of Literature, Tables and Figures, and Acknowledgements

Important reminders for your child:

- Don't plagiarize
- Explain complicated scientific principles and terminology in your own words
- Proofread, proofread, proofread

SIX WEEK SCHEDULE

Encourage your students to think of their science fair projects as a series of short steps, and to use this schedule to keep track of their progress.

Date of the science fair: _____ **Date to begin working on project :** _____
(Six weeks before science fair opening date)

SCHEDULED WEEKLY EVENTS

Scheduled Completion | Actual Completion

❑ **WEEK 1: START UP!**

- ❑ Choose a topic or problem to investigate.
- ❑ Start a journal to keep all your notes and research along the way.
- ❑ Begin primary research: Write for information from experts, such as scientists, businesses and government agencies. Set up interviews when necessary.
- ❑ Begin secondary research: Search printed sources (books, journals, magazines, and newspapers) and electronic sources (Internet and software).

❑ **WEEK 2: RESEARCH & REVISE**

- ❑ Change your topic or problem if necessary.
- ❑ Decide how to set up your investigation or experiment, including the procedure and necessary materials.
- ❑ From your initial research, write your hypothesis.
- ❑ Continue your research using the best resources you found. Interview experts for more information.

❑ **WEEK 3: OUTLINE & INVESTIGATE**

- ❑ Complete initial research.
- ❑ Set up outline for written report.
- ❑ Start your experiment or demonstration collection.
- ❑ Record observations in your journal.
- ❑ Begin collecting or buying materials for your display.

❑ **WEEK 4: RECORD & REPORT**

- ❑ Work on first draft of written report.
- ❑ Continue to record observations from your experiment in your journal.
- ❑ Write down or sketch preliminary designs for your display.

❑ **WEEK 5: DESIGN & REFINE**

- ❑ Write second draft of your report.
- ❑ Start assembling display unit.
- ❑ Begin designing signs, labels, charts, graphs, or other visual aids for display.
- ❑ Write text for background of display and plan its layout.
- ❑ Continue to record observations from experiment.
- ❑ Take any photographs you need.

❑ **WEEK 6: FINISH UP!**

- ❑ Complete your experiment or collection.
- ❑ Analyze observations and write up your results.
- ❑ Write, type, and proofread final version of written report.
- ❑ Have photographs developed and enlarged.
- ❑ Type explanations or background information and mount them to your display.
- ❑ Finish constructing your display, including graphs, charts and visual aids.

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PROJECT DISPLAY

THE WINNING DISPLAY

The display should be eye-catching and creative, yet straightforward and well organized. This can be a tough balance. Remember:

- The real purpose of the display is to summarize the project. It should not contain any extra data or unnecessary graphics.
- The audience is seeing the project for the first time. Make sure everything is explained clearly.
- Required categories, such as question, hypothesis, procedure, materials, results, and conclusions, should be arranged in a logical sequence on the display board.
- Charts, graphs and tables should be clearly labeled, with units of measurement clearly indicated; all photos and illustrations should have captions.
- The table top is the perfect place to display some of the materials and critical parts of your procedure. Make sure students plan ahead.

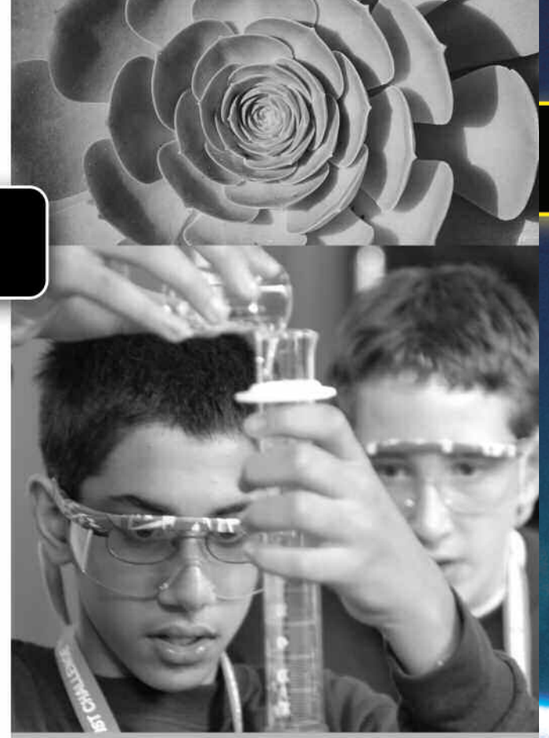
Tips for students:

- Take photos of the project far enough in advance so they can be developed (and redone if necessary).
- Sketch out the layout before cutting and gluing items on the board.
- Proofread every line of text—including captions and labels— before cutting them out and gluing them on the board.
- Use rubber cement to attach pieces to the display board. Other materials may cause wrinkling or bleeding.

ITEMS FOR DISPLAY

Students should start planning their displays as soon as they begin their projects. Some of the items that should be on display are:

- Pictures taken during the experiment
- Data notebook or background research notebook
- Any equipment or material used in the experiment *(that is not excluded by the rules)*
- Abstract
- Title (as a header at the top of the display board)
- Hypothesis
- Procedure
- Results
- Conclusions
- Applications
- Charts, graphs, tables, or other visual aids
- Statistics, where appropriate



ELMER'S SCIENCE FAIR CHECKLIST: ✔

- ❑ *Project display boards*
- ❑ *Project protector*
- ❑ *Science titles*
- ❑ *Header cards*
- ❑ *Adhesive products, such as glue stick, rubber cement, or school glue*
- ❑ *Paint pens*
- ❑ *Letters and numbers stencil kit*

HOW TO

SHOW WHAT YOU KNOW!

How to create effective and informative presentation boards.

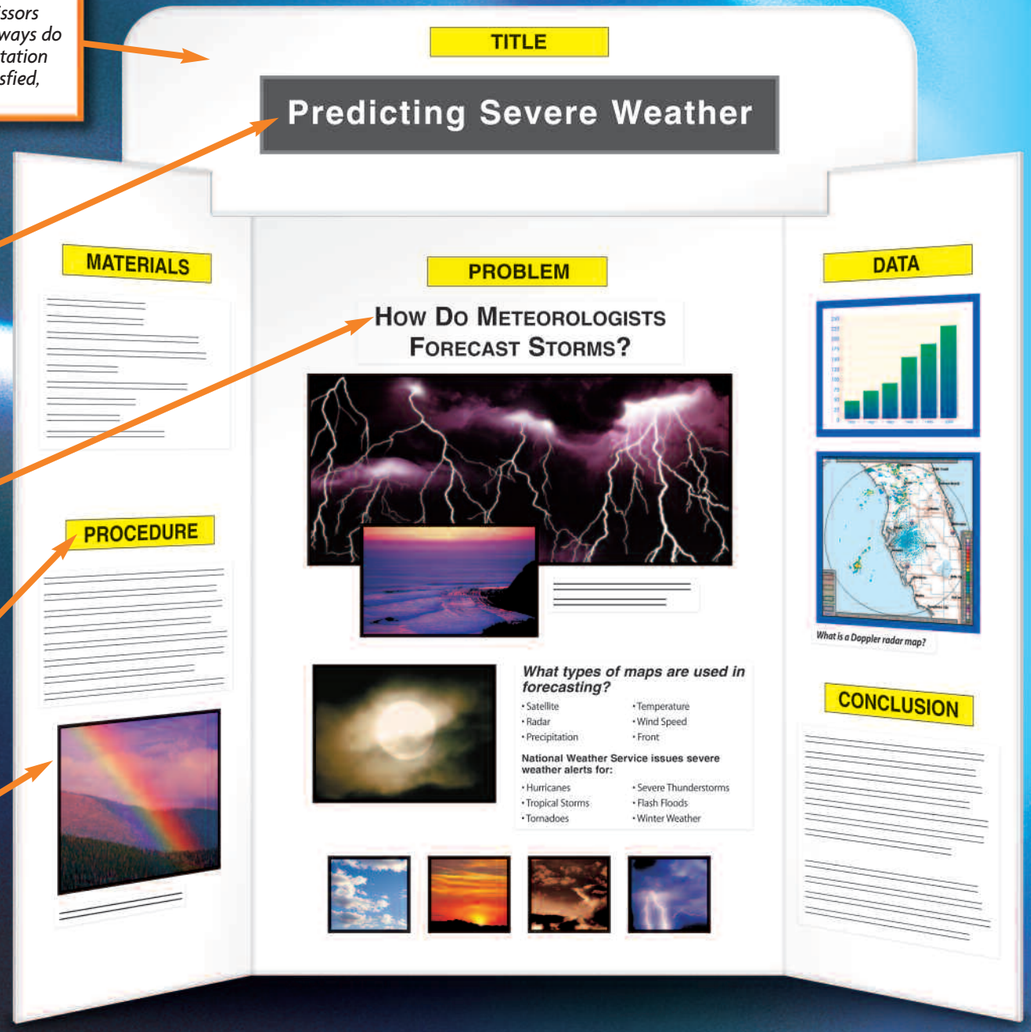
Successful projects begin with the right supplies; start with a sturdy foam display board and be sure to keep glue, scissors and a ruler on hand. Always do a layout of your presentation first. When you are satisfied, glue it all into place.

Create a short, catchy headline that can be read from about 3 ft. away. Mounting it on a header card ensures an eye catching and stable display.

Use a subhead to describe your headline in more detail.

Stick - on letters and project titles can make headings look great.

Photos, charts, graphs and illustrations create interest and visually identify your subject matter.



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A Common Bond

It's only fitting that Elmer's and Discovery Education join together to promote innovation, creativity, and the highest standards of excellence in science fairs across the country. The two leaders in their respective industries have always provided the highest quality products for creative learning at home and at school, and have never lost sight of a shared core belief: That students learn best through active, hands-on learning.

Discovery Communications, Inc. (DCI) launched the Discovery Channel Young Scientist Challenge (DCYSC) in partnership with Science Service in 1999 to nurture the next generation of American scientists at a critical age when interest in science begins to decline. Elmer's has been a proud sponsor of DCYSC since 2004. The competition is designed to encourage the exploration of science among America's youth. Science Service, one of the most respected non-profit organizations advancing the cause of science, has a sterling reputation for conducting high-quality competitions on the national and international levels.

Every year, more than 75,000 students from around the country enter science projects in a local or regional Science Service-affiliated fair in hopes of earning a nomination to enter the **DCYSC.**

Student entries are evaluated by three judges chosen from a pool of qualified science teachers, scientists and science writers. From this initial evaluation, the DCYSC judges select the top 400 students as semifinalists and the top 40 students as finalists. Students are judged based on the scientific merit of their original science project, in addition to their ability to effectively communicate the goals of their project and the science underlying it. The 40 finalists are invited to travel, all-expenses-paid, to Washington, D.C., to participate in "Finalists' Week," which takes place every October. During "Finalists' Week," the students will compete for more than $100,000 worth of scholarships and special prizes, as well as the title of "America's Top Young Scientist of the Year."

For more information about the DCYSC please visit: www.discovery.com/dcysc.

Elmer's Fun Facts:

1. It is estimated that over **47 million** elementary school students use Elmer's Glue on a weekly basis.

2. Elmer's Glue was used to build a **pasta bridge** that could support 2,350 lbs. The bridge was built by a high school student and was the winning entry in a pasta-bridge building contest held in Rhode Island.

3. **Elsie the Cow** became Borden's very popular "Spokescow" in the late 1930s. She was a big hit at the 1939 New York World's Fair, and soon afterwards the character of Elmer the Bull was created as Elsie's husband. In the late 1940s, Borden's new Chemical Division asked to use Elsie for its new white glue product. The thought of Elsie representing a non-food product didn't seem appropriate, so as a compromise, Elmer was loaned to Chemical as their very own "spokesbull." To this day, Elmer the Bull still represents the most recognized adhesive company.

For more fun facts about Elmer's and to learn about upcoming science fair-related activities please visit: www.elmers.com.

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