Laura Ingalls Wilder Elementary PTSA® everychild. onevoice.®

Wilder STEM Fair Project Handbook:

A Resource for Teachers, Parents, and Students

Updates 1/24

Table of Contents

1. GENERAL INFORMATION AND EXPECTATIONS

The Wilder STEM Fair is a celebration of all the wonderful STEM (science, technology, engineering, and math) learning at Wilder. This event provides an exciting opportunity for student enrichment outside the classroom. Students have the chance to explore a science, technology, engineering, or math idea that they are really excited about in a hands-on, in-depth manner.

All students will have the chance to view all student projects during the day with their class as well as with their family. Family viewing will be available from 6:00 pm - 8:00 pm, the evening of the STEM Fair.

This event is, first and foremost, a learning opportunity for students, therefore parents are asked to provide limited guidance and only help when necessary. Parents should assist their child find a project topic that is personally interesting to him or her. They should also help plan a schedule so that the project is completed on time. However, parents should not control a student's project or do the work for them. Instead, direct students to resources at libraries, on the Internet, at museums, etc. Please contact your student's teacher for questions about possible project ideas.

2. TYPES OF PROJECTS AND EXAMPLES

Students may choose from a wide variety of topics for their project. To help get started, three types of projects are described below: descriptive, investigation, and, invention projects.

DESCRIPTIVE PROJECTS
Descriptive Projects describe what you have learned about a particular topic. They are most appropriate for younger students, as they do not require an understanding of the Scientific Method. However, students should be thorough in presenting any scientific information that explains the topic.

Examples of Descriptive Projects include:
- Rock collections (Where are these rocks from? How were they formed?)
- Shell collections (How did each animal use its shell to survive?)
- Casts of animal tracks (How do the difference tracks compare among species?)
- Pressed flowers (What determines a classification of a flower?)
- Computers (Chart and diagram the history)
- Television (Discuss the evolution of technology. Who was involved?)
- Eyeball (Build a model of the inside of an eye)
- Solar system (Build a model showing how the planets rotate around the sun)
- Ben Franklin or another famous inventor (show their inventions & how they are used, maybe even assume the identity of the person & explain what he or she did)

INVESTIGATION PROJECTS

Investigation Projects involve collecting data in order to answer a question and requires an understanding of the Scientific Method. Students will identify a purpose, provide background information, form a hypothesis, describe their methods, analyze results, and draw conclusions (see Section 3 of this handbook "The Scientific Method").

Examples of Investigation Projects include:

- Pizza (a survey of what type of pizza kids like best)
- Stoplights (How many cars run a particular red light?)
- Weather (How often are weather predictions correct?)
- Dust (Should you dust before or after you vacuum?)
- Cereal (Which cereal gets soggy the quickest or the slowest?)
- Dog food (Which dog food do dogs really like best?)
- Mold (What makes different colors of molds?)
- Car speed (Which lubricant makes a toy car go faster down a ramp?)
- Boat sail (What material makes the best sail on a toy boat?)
- Freezing liquids (Do freezing temperatures change with different solutions?)
- Noise (Can noise be reduced by the material covering walls and floors?)

INVENTION PROJECTS

An Invention Project will develop something (or a way of doing something) that solves a problem or satisfies a need. It can be a completely unique and innovative design, or a redesign and improvement of something that already exists.

Ideas of things to invent include:

- What will make your Mom or Dad's job easier?
- What will help you clean up your room?
- How can you make your chores go faster?
- What new game can you invent?
- What will make riding in the car more fun?

3. THE SCIENTIFIC METHOD

The Scientific Method is a tool that scientists use to find answers to questions and should be utilized for Descriptive and Investigation Projects. The tool involves the following steps:

1. *Ask a Question/Determine the Purpose:* Why are you doing your project? What do you want to know or explain?
2. *Gather Background Information:* Research and gather information on the topic from various sources, and summarize the most important facts.
3. *Form a Hypothesis:* The hypothesis is simply an educated guess at the answer to your question, based on the information you have gathered.
4. *Design and Perform the Experiment:* Design and perform an experiment to test your hypothesis. Write down your methods. Record your observations in a logbook.
5. *Record Results:* Analyze the data you collected by making charts and graphs that make your results easy to understand. Explain what you think happened based on scientific principles. If possible, repeat your experiment to make sure your first results are correct.
6. *Draw a Conclusion:* The conclusion is a summary of what you have learned. Describe how your data answered your question, and whether your hypothesis was correct. Is more work needed? What could you do better next time? Although you may initially be disappointed, it's actually perfectly acceptable for a hypothesis to be proven wrong based on experiment, because the original question has successfully been answered.

Investigation projects can be either observational or experimental in design. In an ***Observational Investigation***, observations are made and recorded to test the hypothesis. The following example shows how the Scientific Method is used in an Observational Investigation Project.

Example of the Scientific Method in an Observational Project:

Question/Title	What type of bird is most prevalent near my house?
Purpose	To determine the most prevalent type of bird near my house.
Background Information	Common feeder birds in western North America include Chickadees, Nuthatches, Finches, Blackbirds, Thrushes, Sparrows and more.
Hypothesis	I hypothesize that there are more Red-winged Blackbirds than other types of birds near my house.
Experiment/Methods	Using a bird identification chart, I will record the numbers and types of birds I see near my yard and at my bird feeder. I will do this every morning before school, and every afternoon after school, for one week.
Results	Altogether, I saw 44 birds including 5 species. There were: 20 Varied Thrushes 11 Red-winged Blackbirds 9 Black-capped Chickadees 2 Western Scrub Jays 2 Cassin's Finch
Conclusion	The most common bird was the Varied Thrush, at least during the Spring when I took these measurements. They live in a tree in my yard and visit the bird feeder a lot. My hypothesis was not correct. Blackbirds were the second most common bird, not the first. This made me think of another question. If we changed the kind of bird food in the feeder, would different birds come to visit? This would be my next question to test.

In an ***Experimental Investigation***, one variable is changed while everything else stays the same in order to determine the effect of that one variable. The independent variable is the one that is changed. The dependent variables change in response to the independent variable. Each Experimental Investigation must have a control, or a sample, that has not been changed. The following example shows how the Scientific Method is used in an Experimental Investigation.

Example of the Scientific Method in an Experimental Investigational Project:

Question/Title	In which type of medium will marigolds grow best?
Purpose	To determine which type of medium marigolds will grow best in.
Background Information	Several different soils and media are available for growing plants. Some are rich in nutrients, some let water drain quickly through them, and some are light and fluffy.
Hypothesis	I hypothesize that marigolds will grow best in store-bought potting soil.
Experiment/Methods	We purchased 5 marigold plants as close in size as possible, rinsed the roots, and repotted in 5 different media: the soil it came in, sand, vermiculite, topsoil from our garden, and store-bought potting soil. Water, sunlight, and temperature were the same for all 5 plants over a 6-week period. Plant fullness, height, leaf color, and blossoms were measured.
Independent Variable	Planting media.
Dependent Variables	Plant fullness, height, leaf color, and blossoms.
Control Sample	A marigold in the soil it came in.
Experimental Samples	A marigold in sand. A marigold in vermiculite. A marigold in topsoil from your garden. A marigold in store-bought potting soil.
Results	The marigold in the potting soil was fuller and taller, the leaves were darker green, and it had more blossoms. (The actual measurements and photos should be displayed.)
Conclusion	My hypothesis was correct. The store-bought potting soil was best for growing marigolds. Maybe this is because it contains a mixture of the different media that provide nutrients and good drainage. My
	experiment is important because it will help us to choose a good soil for planting flowers this Spring.

4. THE INVENTION PROCESS

Following the steps in the Invention Process will help you develop an idea into a product:

1. Look for Problems that Need Solving. A problem that affects you or your family might be a good place to start. Determine the purpose of your invention.
2. Gather Background Information: You should research existing products; the Internet is a great resource. This will help you avoid duplicating existing inventions, and allow you to improve upon them.
3. Design and Develop your Invention: Be creative and use your imagination. Getting around existing problems will often require you to think outside of the box! Make a detailed drawing (or several drawings) and label all parts so others will be able to understand how your invention works. Make a model of your invention.
4. Test your Invention: You may need to test multiple prototypes before you have a successful invention. How effective or useful is your invention? How is your invention original, and how could you improve it further?
5. Keep a Log: Write down all of your ideas, research, setbacks, and successes. This is the written record of your invention process. Bring this to the Fair.
6. Name your Invention: Have fun with this! You can use rhyming words or your name in some form. Make it silly or serious.

5. DISPLAYING YOUR PROJECT

Your display must be free standing and your space is limited to 3 feet in width by 2 feet in depth.

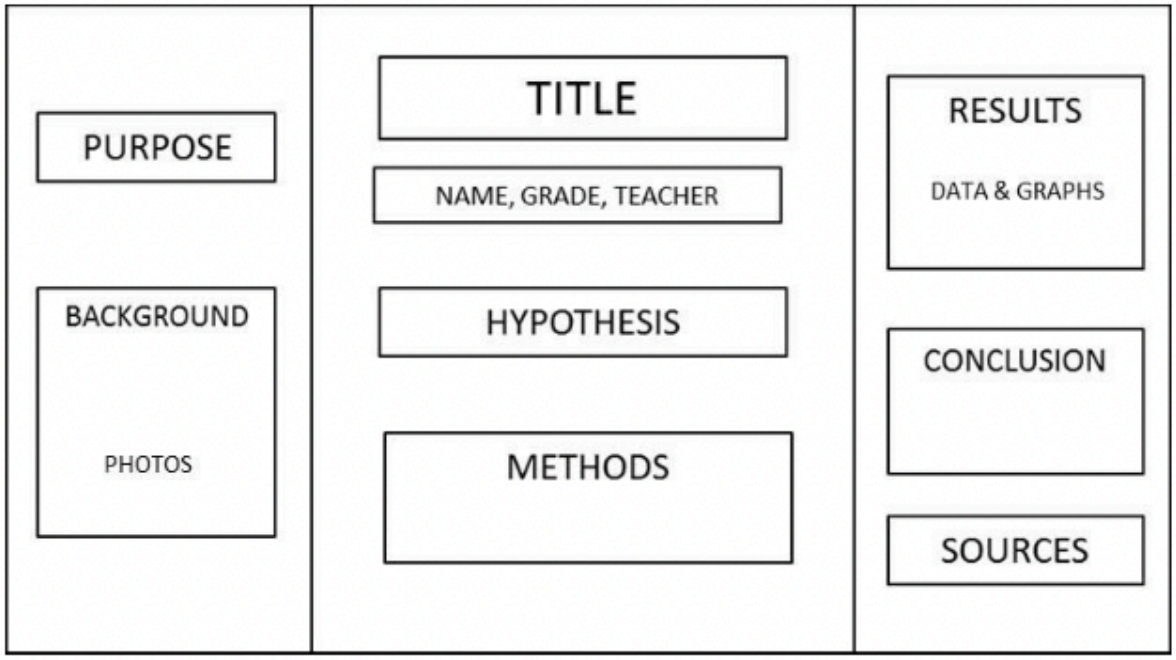
- Tri-fold poster boards: Wilder PTSA will provide one Tri-Fold board for each project submission. Tables will also be provided.
- If your display will require electricity, please note it on the Registration Form.

Displays for Descriptive Projects should include:

- Title of your project (and your name, grade, and teacher)
- Background Information (if appropriate, include charts, illustrations, photos, etc.)
- Bring your collection, model, or diorama
- Sources of information

Displays for Investigation Projects should include:

- Title of your project or question you are answering (and your name, grade, and teacher)
- Purpose
- Background Information
- Hypothesis
- Experimental Methods (explain your experiment and if applicable, identify the variables and control)
- Results (include observations, charts, and graphs and bring your log book)
- Conclusion
- Sources of information



Displays for Invention Projects should include:

- The name of your invention (and your name, grade, and teacher)
- Purpose
- Background Information (include other existing products or methods that have the same purpose)
- Design and Development (include a drawing or diagram of your invention and a description of how it works, and bring your log book)
- Bring your invention, or a model or photograph of your invention; you should also include photographs of all major prototypes made (and their problems) before achieving the final product.
- Summary (include how successful your invention was, who will use it, and improvements you would make next time.)
- Sources of information
- Below is a suggested layout for an Investigation Project. Descriptive and Invention Project layouts will look a little different. But all displays should be neatly organized and easy to follow.
- Include photos in your display to make it more interesting. Students may use the 3 by 2 foot space in front of the poster to display items and materials.

6. RULES

Projects involving live animals, fish, insects, etc. must be pre-approved by a teacher and closely monitored by a parent to ensure that organisms are treated ethically. Projects should not cause unnecessary stress or harm. Animals may not be brought to the fair. Therefore, the only way to demonstrate the use of animals in a project is via photos, video, etc. It must be clear and true that the animals were always treated in a humane way.

- Safety is a top priority for the event, and anything deemed to pose a danger would not be allowed. Projects MAY NOT include the use of dangerous chemicals, extreme temperatures, high voltage, explosives, mercury thermometers, open flames, certain lasers or other very bright light sources, fluorescent light bulbs, or anything capable of producing dangerous noise levels, etc.
- Volcanoes are not allowed.
- Molds, mildews, etc. are NOT ALLOWED per district guidelines.
- Displays may not use running water (they may include static water if student takes responsibility for cleanup).
- Wilder Elementary and the STEM Fair volunteers assume no responsibility for loss or damage. Please leave all valuables at home.
- Projects are entered into at the risk of the students. Parental judgment needs to be exercised where appropriate.

7. JUDGING

The Wilder STEM Fair is a non-competitive, non-judged event. However, students will have the opportunity to present their projects to their classmates and/or answer questions. All participating students will receive a Blue Ribbon for participation and a Certificate of Completion.

8. PROJECT IDEAS

- Food preference in gerbils
- Does adding salt to water change the temperature at which it boils?
- The effect of temperature on how long a soap bubble lasts
- The effect of different light intensities on the growth of sunflower plants
- The effect of light on the growth of bread molds
- Which bird feed do birds like best?
- The effect of acid rain on the growth of plants
- The effect of acid rain on the germination of apple seeds
- Using black walnut juice and marigolds to prevent weeds in your garden
- The effect of sugar water on the survival of cut flower stems
- The effect of salt on the growth of bean plants
- Hummingbird color preferences at feeders
- Bird feed consumption at different colored bird feeders
- Bacterial growth in apple juice and apple cider
- Does auxin affect seed germination?
- Can magnesium affect seed germination?
- Will acid rain affect the cell structure of spirogyra algae?
- The effect of surface area on burn time
- Does the life of a light bulb depend on its wattage?
- The effect of wire coils on the strength of an electromagnet
- Packaging eggs and shock resistance
- The effect of friction on velocity
- The effect of temperature on golf ball performance
- The effect of temperature on the rate of water absorption in cut carnations
- The effect of the color of light on the growth of sunflowers
- How changes in gravitropic responses affect plants
- The feeding habits of winter birds
- The germination of gamma grass, Tripsacum Dactyloides
- Hydroponics: Growth for the future
- A comparison of the heat conducting abilities of different metals
- Prejudices in children: When do they start?
- The effects of a classroom seating arrangement on student performance
- The effects of a small magnetic field on the movement and behavior of laboratory mice
- The effect of paper airplane design on flight distance and flight time
- A comparison of the water content of different kinds of fruit
- The amount of fat in fast foods and store-bought hamburgers
- The effects of car exhaust fumes on the growth of plants
- The effects of the amount of water on the number of stomata in peas
- The effects of wing shape on lift
- An investigation of the mysteries of Fibonacci
- Does light affect population growth rate in euglena?
- The effects of radiation on pea seeds
- The effects of humidity on the behavior of isopods
- Are soap bubbles good for anything but a bath?

- Learning styles and memory retention
- The effects of car exhaust on seed germination
- Why do rocks sink and supertankers float?
- The effects of ultrasonic waves on the growth of peas
- A study of bridge construction
- Which brand of gum is the most viscous?
- The effect of design on the efficiency of a propeller
- The effects of heavy metals on the growth of plants
- The effects of ultraviolet light on the photosynthetic rate of soybeans
- The fermentation of yeast: optimal temperature and pH
- The effects of water flow on a water wheel
- Day or night: When do amaryllis plants grow more?
- The effects of stress on the germination of corn seedlings
- The effect of rotation on fruit fly development
- Comparing the tensile strength of different metals
- A study of a goldfish's ability to learn a maze
- The effects of microwave radiation on seed germination
- The effects of caffeine on the respiratory rate of cockroaches
- How does watching fish affect people's blood pressure?
- The effects of distractions on memory and learning
- The effects of music on the ability to memorize nonsense syllables
- The design and construction of a rigid sail model for all vessels
- An analysis of the nutrient content of breakfast cereals
- The use of pitfall traps to determine insect diversity
- The effects of fluorescent light on the learning abilities of white mice
- An analysis of the relationship between music and plant growth response
- Osage oranges: Determination of a natural cricket repellent
- The effects of nicotine on the cell shape and survival of euglena
- The amount of vitamin C present in ordinary foods
- The effects of electric currents on germinating seeds
- Comparing the effects of antibacterial soap on bacterial growth
- The antibacterial effect of common sauces
- Is the purity of bottled water consistent with the claims that distributors make?
- A study of the effects of the plant hormone, auxin, on the growth of bean plants
- The effects of eye dominance on task performance
- The effect of age on successful mating in fruit flies
- Multiple intelligence in the career world
- The fungi around us
- The effects of acidity on metals
- Which form of insulation is most effective?
- How terraces help stop soil erosion
- Determination of vitamin C in aging fruit
- The effects of vitamin C on the visible characteristics of the wild type fruit fly
- Gender-based memory

WEBSITES FOR ADDITIONAL INFORMATION AND PROJECT IDEAS

All Science Fair Projects
With complete instructions
http://www.all-science-fair-projects.com

Science Buddies
Topic selection wizard, How-To Guide, many ideas
http://www.sciencebuddies.org/science-fair-projects/project_ideas.shtml

Science Fair Projects and Experiments
Hundreds of topics and ideas
http://www.juliantrubin.com/fairprojects.html

Science Fair Homepage
Designed to aid students
http://www.cdli.ca/sciencefairs

Grade School Science Project Ideas - Sharp School
Lots of tips and ideas to create a successful project.
https://cdn5-ss18.sharpschool.com/UserFiles/Servers/Server_221181/File/Academics/Science%20Fair/2019-20%20Science%20Fair/project_ideas.pdf

9. AWARDS

Each student who submits a project for the STEM Fair will receive both a Blue Ribbon for participation and a Certificate of Completion.

10. REMINDERS

Before the Fair:

Since these are home projects, it's a good idea to get started right away!

- Be creative in coming up with a subject that interests you in science that can be displayed in a form suitable for group viewing. Experiments, demonstrations or collections can be elaborate or simple depending on the child's age.
- Fill out a Registration Form and return to your teacher or to the office before the due date.
- Partners need to turn in only one entry form listing all participants.Do not duplicate entries for each person.
- A write-up should accompany the project. The write-up should be age appropriate with student name(s), grade level and project title.
- Parents, please help with developing ideas, gathering materials and filling out the Registration Form. Also, provide encouragement, but remember, the project display can be no bigger than the size of your school desk (approximately 24-28 inches).
- To display information, we recommend that three sided display boards be used. However, you may use poster board as long as it is free standing (due to limited wall space). Information may also be written on a regular sized piece of paper with your project.
- HAVE FUN LEARNING!

Day of the Fair

- Project check-in hours are before school on the morning of the STEM Fair, from 800-8:30 am.
- Projects will be displayed in the school gym for the entire day. There will be a volunteer in the area at all times to monitor the environment.
- If this time does not work for you, please contact stem@wilderptsa.net to make other arrangements.
- Do not bring valuable, breakable, or any items that you are concerned would be lost or damaged. Neither Wilder staff nor STEM Fair volunteers are responsible for lost or damaged items.
- During the Fair, plan to spend time some standing at your project to offer explanations and answer questions. But also be sure to visit all the other projects and fun activities during the Fair.
- HAVE FUN SHARING WHAT YOU'VE LEARNED AND LOOKING AT OTHER DISPLAYS!

After the Fair

- All projects must be taken home the night of the STEM Fair, by 8:00 pm. Nothing can be left overnight!
- If you have a display but are not able to stay for the whole event, be sure to make arrangements to have your equipment picked up the night of the STEM Fair.
- HAVE FUN!