Plano ISD Elementary

Science and Engineering

Fair

Student Handbook
2018-2019

Participating in a science and engineering fair is fun and rewarding. There are many important things to remember when planning and conducting a project. This handbook will assist you with questions you may have and give you the information you need for completing the project correctly. Remember to allow yourself plenty of time to carry out the project and have fun in the process. **Please read this handbook carefully as you decide upon your topic and prepare your project.**

The science and engineering fair is conducted for many reasons:

- To focus attention on scientific and engineering experiences in school
- To stimulate interest in scientific investigation and engineering beyond routine class work
- To recognize and commend youthful scientific and engineering talent and hobby pursuits
- To offer an opportunity for display of scientific and engineering talent through exhibit and demonstration
- To stimulate public interest in the scientific and engineering abilities of students

General Information

Campus Fairs:

- All elementary campus fairs must be held between **November 5, 2018** and **January 25, 2019.**
- Check with your individual school for the date students' projects are due for the Campus Science and Engineering Fair.
- All students in grades K through 6 may enter the Campus Fair.
- Kindergarten students do not compete beyond the Campus Fair.
- Lower Elementary (all first, second, and third grade projects) will be awarded one Grand Prize chosen from the 1st place winners.
- Upper Elementary (all fourth and fifth grade projects) will be awarded one Grand Prize chosen from 1st place winners.
- **No ties for first place or Grand Prize are permitted**.
- **All Grand Prize winners advance to the Elementary Regional Science Fair**.

Elementary Regional Science Fair:

- The Elementary Regional Science Fair will be held **February 4-5, 2019** at the Curtis Culwell Special Events Center, 4999 Naaman Forest Blvd, Garland, 75040.
- Each school may submit:
    - one Grand Prize entry from grades 1-3.
    - one Grand Prize entry from grades 4-5.
    - one Grand Prize entry per elementary feeder school for grade 6.
- The chairperson at each campus will submit the entry forms for all projects entered in the Regional Science Fair and parents will receive an invitation which includes important information about the Regional Fair.

General Rules

1. **All participants must comply with the Elementary Regional Safety and Display Rules on the following pages. Projects that do not comply cannot be judged.**

2. A student in grades K – 6 may enter only one project, and it must be his or her own work.

3. A student may enter a project as an individual or a group of **no more than three students.**

4. Group projects will compete with individual projects and will not be judged separately.

5. Siblings or friends in the same school or different schools may enter a group project together, but the project must be entered in the grade level of the oldest sibling or friend and in only one school.

6. The identical repetition of a previous year's work is not permitted; however, a student may exhibit previous research on a continuing problem, provided the research shows significant progress when compared with the previous year. A separate notebook showing previous research **must** be part of the new exhibit.

7. Teachers and technically trained professionals may give information and advice to all students entering projects but may not do the research or work for students.

8. All surveys and research performed with human subjects must be conducted outside of the school day. **School personnel may not assist with any research or surveys during the school day.**

9. A **Project Notebook** is not required but very **strongly suggested.** The notebook is possibly the most important and, at the same time, the most neglected phase of scientific investigations/engineering design process. See page 7 for more information on how to set up a Project Notebook.

10. **Metric measurements are required.**

11. **A student's name should not appear on the front of the project.** Student information (name, address, phone number, parent's name, grade, school, and teacher) should be placed in an envelope attached to the back of the display board. No previous awards of student or school's name may be displayed.

12. Students **may** make improvements to Grand Prize winning projects before the Regional competition.

14. Each student at a campus fair should be prepared to explain their project to a judge in the event an interview is requested. Interview processes vary from campus to campus. Interviews are not done at the Regional Fair because judging is conducted during the school day.

The decisions of the judges and officials are final and are not subject to review. Protests will not be accepted.

Getting Started

1. Start as soon as possible to prevent a last minute project and give yourself plenty of time to investigate your question/problem. A four to eight-week plan is best.

2. Brainstorm ideas and choose a topic. Be sure to carefully read the Safety Rules on page 5 before choosing a topic.

3. Decide on a question/problem to investigate/solve. Use page 6 to determine if your project is experimental based or engineering based.

4. Research information about what is already known about the topic/question/problem. Remember to keep notes in the Project Notebook on resources used. Use page 7 to determine components of the notebook.

5. Gather and list the materials and/or resources needed.

6. Conduct the experiment/plan the engineering design.

    - Remember to use metric measurements.

    - Make notes in the project notebook about observations, problems that arise, changes needed when repeated and additional information discovered.

7. Record the results. Consider using tables, graphs, pictures and/or charts to display the results.

8. Interpret the data and other observations.

9. Write conclusions (experiment-based) or a summary of findings (engineering-based).

10. Write the report. Use page 7 to assist with what needs to be included in the report.

11. Think of an interesting and unique title.

12. Create a display board/exhibit. Be sure to review pages 10-11 when creating the board.

13. Review the Project Judging Criteria from page 12 to make sure your project is ready to be judged.

Safety Rules for 2018-2019

It is essential for teachers to inform students and parents of these safety rules.

For safety reasons, the Elementary Regional Science Fair DOES NOT ALLOW experimentation using dangerous equipment or substances that may be harmful to students or others. If you are uncertain about any safety rules, contact Jessica Malloy at jessica.malloy@pisd.edu.

Requests for approval or other information received during school holidays or breaks will be answered when school resumes.

Determinations of safety are made by the Regional Science Fair Committee and are final.

Students MUST:

1. Obtain approval of the District Science Coordinator (or representative) **BEFORE** beginning any project involving vertebrate or invertebrate animals, human subjects, or any potentially dangerous substance, material or equipment.
2. All investigations involving chemicals (including household chemicals) must be approved by the District Science Coordinator (or representative).
3. Have adult supervision when using equipment, sharp objects or chemicals (including household chemicals).
4. Follow local city ordinances and be supervised by an adult for any experiment involving fire and/or burning objects although these types of experiments are discouraged.
5. Observe proper safety protocol at all times (this includes the use of gloves, goggles, and aprons as appropriate).

Students MAY NOT conduct experiments that:

1. Involve any microbial cultures, mold, fungi or any possibly pathogenic substances. The only exceptions are:
    - experiments with baker's yeast so long as rDNA studies are NOT involved
    - experiments using manure with composting to test variables
    - experiments involving food preservation ***so long as when spoiling, rotting, or browning occurs the food is disposed of within 24 hours of the first sighting.***

2. Involve human parts, blood or other body fluids. (Experiments may include sterilized teeth that were naturally extracted by a dentist, primary teeth that were naturally removed, or hair clippings.)

3. Cause or may cause harm or injury to animals or human subjects including the ingestion or application of over-the-counter medications or controlled substances.

4. Involve explosives including guns, ammunition and rocket propellants.

Scientific and Engineering Processes and Practices

Keep in mind that although the steps are listed in sequential order, it is likely to return to previous steps multiple times throughout a project. It is often necessary to revisit stages or steps in order to improve that aspect of a project. In real life, the distinction between the two fields is not always clear. Scientists often do some engineering work, and engineers frequently apply scientific principles, including scientific processes.

Scientific Processes and Practices	Engineering Processes and Practices
State your question What is the problem you want to solve? Do background research Formulate a hypothesis and identify variables What do you think will happen? Design experiment, establish procedure Define your variables Determine data to be collected What materials are needed? Test the hypothesis by doing an experiment Observe Collect data Organize data Analyze the results and draw conclusions What did you learn?	Ask: What's the problem? What are the constraints? Imagine: Do background research and search the literature to see what already has been done Brainstorm possible solutions and choose the best one Plan: Draw a diagram and make a list of materials needed Create: Follow the plan and test it Improve: Make the design better and test it

Project Notebook

The project notebook is a detailed account of every phase of the process from brainstorming to data collection to the final conclusions drawn along with a report of the project.

The Project Log is proof that certain activities happened and when they happened. All the data gathered during your project should be carefully recorded in this section. Certainly this includes the data gathered as a result of the investigation/design process itself, but it also includes much more. Use it regularly and write down everything. A simple log book with words or drawings is appropriate for Kindergarten projects.

The Project Report is possibly the most important and, at the same time, the most neglected phase of scientific investigations/engineering design process. If scientists and engineers as a group fail to report their results, then each of us might wake up in a whole new world every day, doomed to repeat the failures of the past or else to waste time and effort in the rediscovery of old knowledge.

The two sections should be clearly labeled using tabs or post its so judges can clearly see the two components.

Notebooks should include:

- Part 1: Project Log
    - detailed day-by-day (date each entry) notes on the progress of the project from your first brainstorming session through to your last work session
        - What you are actually doing
        - Problems you encounter
        - Things you would change if you were doing this again
    - drawings that might help explain your work
    - data that was gathered during the course of your work (notes, charts, tables, graphs)

- Part 2: Project Report
    - project title
    - your question
    - your hypothesis, along with your reasoning for why you arrived at that hypothesis (experiment-based projects)
    - your research
    - list of variables or constraints (see page 7 for important information about variables)
    - materials
    - procedure
    - a summary of your observations and results from the investigation/design
    - statement of support or non-support of the original hypothesis based on the data gathered in your investigation
    - description of any problems or unusual events that occurred during the investigation/design that might have affected your results
    - changes you would recommend for next time, and what further investigations might need to be done to fully answer the question
    - anything you learned in addition to what you expected to discover
    - acknowledgments—you should always credit those who assisted you including individuals, businesses, and institutions
    - references

All about Variables

Independent Variable - what is changed **on purpose** in the course of the procedure

Dependent Variable - what is not changed directly, but rather changes by itself in **response to** changes in the manipulated variable during the course of the procedure

Constant – a factor that is kept constant or held fixed. A constant is held fixed so that it doesn't affect the outcome of the experiment.

Only one independent variable should be changed at a time and repeated trials should be conducted. If more than one variable at a time is changed, scientists and engineers will not know what affects their results.

Examples of Variables

Let's say that the following hypothesis had been selected:

The cheaper the paper towel, the less water it will absorb.

Independent Variable: price (brand) of paper towel

Dependent Variable: amount of water that is absorbed

Constant: size of paper towel
amount of water poured on each towel
temperature of the water used
container in which towels are placed
method of pouring

Display Rules for 2018-2019

It is essential for teachers to inform students and parents of these display rules.

The Elementary Regional Science Fair DOES NOT ALLOW the display of organic or potentially dangerous materials and the display of non-essential objects is discouraged. Anything that could be considered hazardous to the public is prohibited. Final d*eterminations of allowable components on displays are made by the Regional Science Fair Committee.*

<u>Display Requirements</u>:

1. The display board must be self-supporting, single-sided and must NOT exceed the size requirements: **30 inches deep, 32 inches wide, and 80 inches high**. All components of the display must be on the table within the display space.
2. Personal information including names, addresses, or phone numbers (student, teacher, parents, test or survey subjects), information identifying the student/school/district, accomplishments (previous awards), and acknowledgements may NOT be included on the display or in reports/journals.
3. Display materials are NOT encouraged. Any model/apparatus included with display must fit within the dimensions of the display space provided.
4. When possible photographs/drawings should be used instead of actual objects or apparatus.
5. Electronic exhibits are prohibited. The site does not accommodate the use of electricity for project displays.

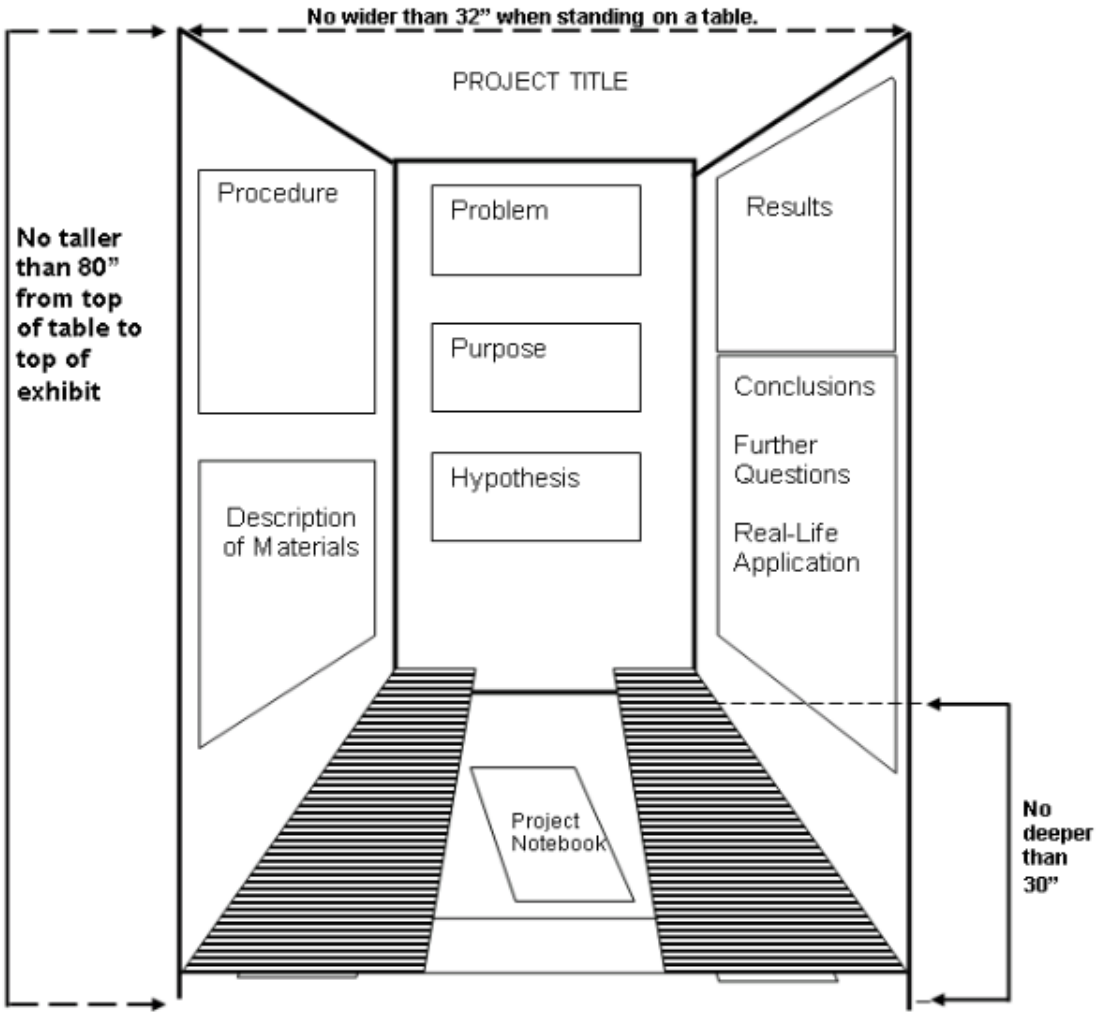
<u>Project displays may NOT include the following items</u>:

- Liquids, including water
- Food “stuffs” (candy, gum, popcorn, etc.)
- Food or liquid containers or wrappers
- Live animals (vertebrate or invertebrate) or animal tissues including eggs or egg shells
- Preserved animals or their parts including teeth and hair
- Living plants or plant materials, which are in their raw, unprocessed, unmanufactured or natural state such as leaves, seeds/nuts, bark, stems, or roots
- Soil, sand, clay, rocks, etc. or waste products
- Laboratory/household chemicals (including detergents)
- Dry ice or other sublimating solids
- Glass (test tubes, syringes, pipettes, or similar devices)
- Needles or other sharp/pointed objects
- Flames, open or concealed, or flammable display materials
- Lasers
- Inflated balloons
- Photographs showing the face of the student or subjects

Experiment Based-Project Display Sample

An **experiment-based** project starts with a question that can be tested. Once the question is developed, it is easy to define the variables and the methodology. A hypothesis is formed and a procedure is developed that will test one variable at a time with multiple data sets in order to accept or reject the hypothesis.

For example, a student may want to determine which boat shape is least likely to tip over. This project could begin with the student designing several different boat shapes, then testing them with the same amount of weight placed inside each boat. Not only is it important to design an experiment that can integrate scientific methods, but it is also important to link the experiment to being useful in real life. For instance, when purchasing a kayak for an inexperienced person, what design would be best for stability?

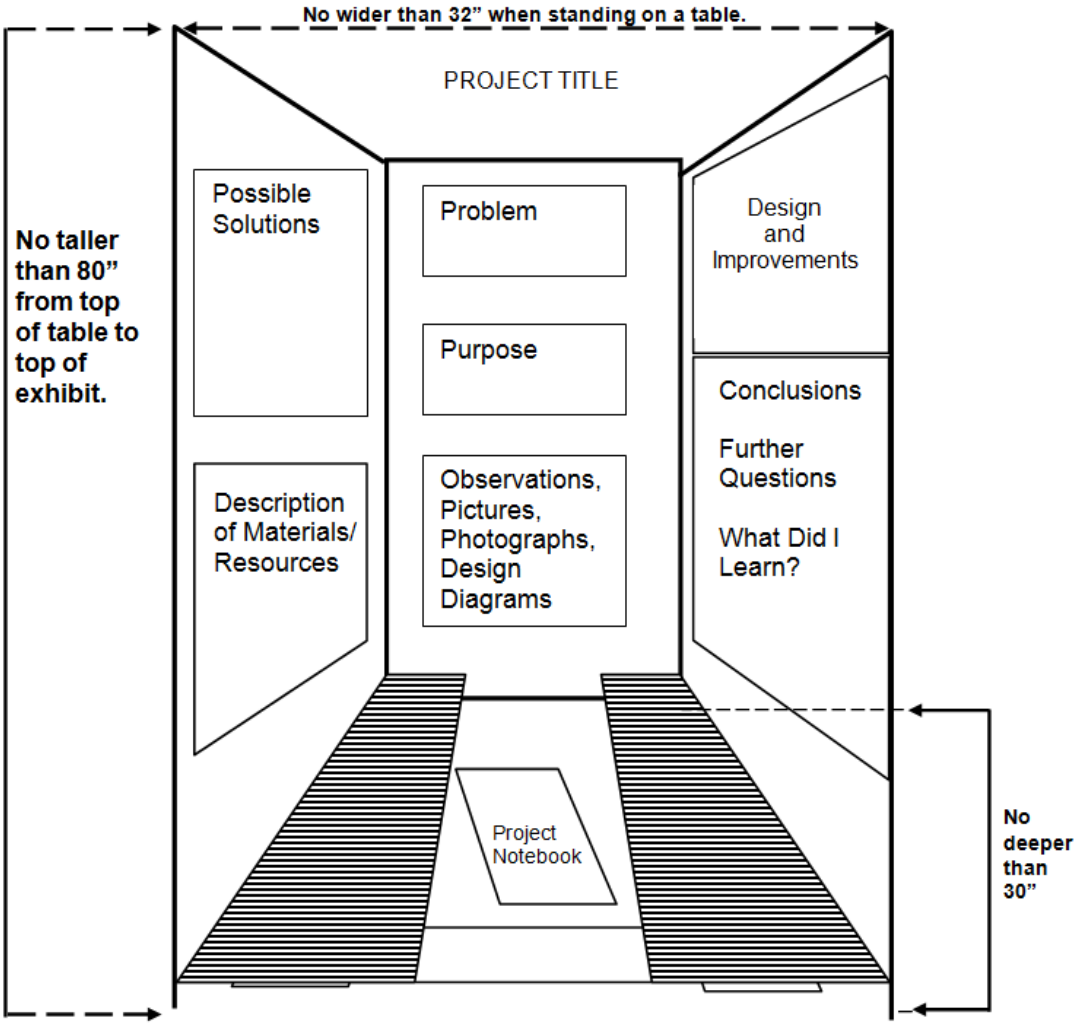


Photographs used on the display board may not show the student's face or any other faces. The student's name may not appear on the front of the display board or in the project notebook. The Campus and Regional Science Fair officials are not responsible for items lost or damaged at the fairs. Please make copies of all research done and your project notebook. Since the exhibit areas cannot be completely secured please copy anything that could not be replaced. Students should display photographs in place of actual objects.

Engineering Based-Project Display Sample

An **engineering-based** project starts with a problem. The project should state the engineering goals, the development process and the evaluation of improvements by following the engineering design process. This is a series of steps that engineers follow to come up with a solution to a problem. Many times the solution involves designing a product that meets certain criteria and/or accomplishes a certain task.

For example, a student has a problem of snacks being taken from a lunch box. In order to solve this problem, the Engineering Design Process could be used to design a lunch box alarm to protect valuable snack items.



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Rules for Judging

Judges look for well thought-out research. They look at how significant your project is in its field as well as how thorough you were.

Before starting your project, read the Judging Form carefully. Make sure you understand each of the categories because your project will be judged on these categories. If you have questions, please discuss them with your teacher or the campus fair chairperson.

Project Judging Criteria

Project Title:_____ Project #:_____

Experiment-Based Projects	Engineering Projects	
Research Question ● clear and focused purpose ● testable using scientific methods	Research Problem ● description of a practical need or problem to be solved ● definition of criteria for proposed solution ● explanation of constraints	10 points
Design and Methodology ● well-designed plan and data collection methods ● variables and controls defined, appropriate and complete	Design and Methodology ● exploration of alternatives to answer need or problem ● identification of a solution ● development of model/prototype	30 points
Execution: Data Collection, Analysis & Interpretation ● systematic data collection and analysis ● reproducibility of results ● appropriate application of mathematical and statistical methods ● sufficient data collected to support interpretation and conclusions	Execution: Data Collection, Analysis & Interpretation ● prototype demonstrates intended design ● prototype has been tested in multiple conditions/trials ● prototype demonstrates engineering skill and completeness	30 points
Creativity ● Project demonstrates creativity/originality/innovativeness in one or more of the above criteria		10 points
Presentation and Documentation ● Logical organization of material ● Clarity of graphics and legends ● Supporting documentation well-selected and displayed (notebook and report)		20 points

Helpful Hints

A GOOD TITLE
Your title is an extremely important attention-grabber. A good title should simply present your research and should make the casual observer want to know more.

TAKE PHOTOGRAPHS
Many projects involve elements that may not be safely or practically exhibited at the fair but are an important part of the project. Photographs of these phases of experimentation can be used in the display. You may NOT use photographs depicting animal dissections or other surgical techniques. You must receive permission to photograph or videotape human test subjects. Photographs used may not show the student's face or any other faces.

BE ORGANIZED
Make sure your display is logically presented and easy to read.

EYE-CATCHING
Make your display stand out. Use neat, colorful headings, charts and graphs.

CORRECTLY PRESENTED AND WELL-CONSTRUCTED
Be sure to adhere to the size limitations and safety rules when constructing your display. Display all required forms in your project notebook.

CAREFULLY PREPARE YOUR PROJECT NOTEBOOK
A project notebook is your most valuable piece of work. It is a day-to-day record of your work. Accurate and detailed notes make for a logical and winning project. Good notes show consistency and thoroughness to the judges and help when writing a paper. A well-written report that includes all needed information is essential to a good project. Check your sentence structure, flow of ideas, and spelling. Make certain the report is a summary of all of your work.

VISUAL DISPLAY
You want to attract and inform. Construct a clear and concise display. Make headings stand out and label everything clearly and correctly.

Helping Your Children with Their Project

Things a parent may do:

1. Give encouragement, support, and guidance. (Be positive!)

2. Make sure your child feels it is his or her project. Make sure the project is primarily the work of the child.

3. Realize that the main purpose of a fair is to help your child use and strengthen the basic skills he or she has learned and to develop higher-level skills.

4. Realize your child will need help in understanding, acquiring, and using the major science and engineering processes and practices (researching, organizing, measuring, calculating, reporting, demonstrating, experimenting, collecting, constructing, presenting).

5. Help your child design a safe project that is not hazardous in any way.

6. Provide transportation to places such as libraries, nature centers, universities, etc. that can help find project information. Several sources will take time to help your child find ideas and give suggestions for successful project.

7. Help your child develop the necessary technical skills and/or help the child do the technical work such as building the exhibit and doing the photography.

8. Be sure that your child states in the paper and/or exhibit the help he or she has received from you or others. This will help judges to make a fair evaluation of the project.

9. Buy or help find the necessary materials to complete the project.

10. Realize that a good project doesn't have to cost a lot of money. Many times a simple project that is well displayed and explained is the best.

11. Help your child keep a record (project notebook) of all he or she does and a list of references used.

12. Be positive and supportive if your child doesn't win a prize at the science and engineering fair. The skills the child has gained are worth all the effort. Help your child to begin a plan for next year.