Students' Guide to Science Fair Judges & Judging

A Guide to Preparing to Do Your Best

Your science fair project has been a lot of hard work over several months. Probably the scariest part of a science fair is the judging. So much is unknown. But it's probably also the most exciting part of the science fair. Actual scientists, who spend their lives doing research like yours, are going to ask you questions and decide which projects move on to the next level of competition. What can you expect of the judging process, the decision-making process and the judges themselves?

Judges typically spend about 5 minutes talking with you about your project. Please do not get discouraged if you find yourself waiting. For most categories there are far more students than judges, so they space out. Some projects will have more judge interviews than others, but do not worry. While more judges could be a good sign you're being considered for an award, sometimes projects have more judges because of awards only specific projects are eligible for.

What is a scientist who judges a science fair like? That's like asking what a middle school student is like! Scientists have all sorts of personalities and act differently at different times. They're like everyone else. Your interactions with each judge might be different. You might have some judges who smile a lot, or look stern, or talk a lot, or mainly listen, or ask only pointed questions, or give only encouragement. Maybe a judge will look at your board with piercing eyes and remain mostly quiet except for asking some pointed questions while looking skeptical. Does that mean you've done something wrong? No. Science is about putting ideas to the test, so every scientist is educated in college and graduate school to think carefully about every possible alternative to every claim somebody makes. That's why the models that survive scientific inquiry are so strong. Your judge might get wrapped up in thinking about your project like the work of any scientist. Asking you harsh sounding questions can even be a compliment. I've known judges with a gruff exterior who later share with me enthusiastically how they forgot they were talking to a high schooler because the work was so strong! Please consider your experience with judges yet another opportunity to learn. You're building skills for speaking with composure and engaging a diverse audience.

How do judges make decisions? What is going on in the minds of judges? Judges are following a rubric. The rubric comes out of dozens of interviews with judges from diverse disciplines, so it reflects the intuitions scientists have for what makes good research. Judges rate your project on 4 dimensions (idea, presentation, method, & results). Within each dimension they are looking for many different qualities. It's not an exact checklist because each science is a bit different and even within a science projects come in different varieties (e.g., test a hypothesis, solve a problem). Here is a summary of the 4 dimensions with good (😊) and bad (☹) qualities judges think about.

Project Idea

What is the overall quality of the project idea: the research question, the hypothesis to be tested, the problem to solve, or the proof or computer program to be constructed?

- ☹ Lacking independent motivation to think scientifically and instead simply copying an idea from a website or book.

☹ A fancy-sounding idea that seems to explain everything, but really cannot be put to the test because, no matter what happens, the idea seems "right" (e.g., Deepak Chopra on Physics; Sigmund Freud on Psychology). Nothing makes a scientist cringe like an *unfalsifiable* claim!

☺ Genuinely asking "why" or "how" about something you care about.

☺ A creative idea for a hypothesis or a passion for solving a pressing real-world problem.

☺ A student-motivated idea discussed with a mentor and refined to address a meaningful question in the field today.

Presentation within the Scientific Context

What does the student know about the relevant science and about how to present science? How well did you show this knowledge by finding background research (e.g., literature review) and creating a poster?

☹ A sloppy or disorganized poster. Put time and effort into it!

☹ A sloppy or disorganized oral presentation. You don't have to memorize a talk, but plan your key points, and practice (e.g., with parents, teachers, or friends).

☺ Following the conventional order for a science report (e.g., introduction, method, results, discussion).

☺ Well-prepared tables and figures (e.g., label axes).

☺ Knowledge of the science (e.g., correct use of key terms, knowing important distinctions).

☺ Citing high quality lay person sources (e.g., Scientific American). Primary sources are wonderful too, if you muddle through trying to understand them (but please do not cite something you haven't read).

Research Methodology

How did the student find out if his or her hypothesis was supported by the evidence? Was it an appropriate method? Was care taken to avoid common methodological mistakes? Did you consider different methodological approaches? Was sufficient data collected?

☹ The method does not match the hypothesis.

☹ Serious methodological errors (e.g., non-random assignment, confounds). For example, you study how soda discolors teeth. You have pulled teeth from a dentist and your baby teeth. If all the pulled teeth are put in soda and all the baby teeth are put in water (control), then you don't know if the darker color of the teeth is soda or the source of the teeth (i.e., confound). Instead divide the teeth randomly.

☺ Taking careful measurements to minimize error.

☺ Collecting enough data to test your hypothesis.

☺ When you designed your study, you considered methodological choices and know why you chose one research method over another (e.g., observation vs. experiment; between- vs. within-subject).

☺ Showing perseverance or creativity when you experience a stumbling block.

Results & Interpretation

How does the student summarize results? How do you connect the results to the hypothesis and method? How do you interpret the results in the larger scientific context? Do you see the limitations in how much we can interpret the results?

- ☹ Just showing raw data instead of summarizing to find a pattern (e.g., averages, scatterplot).
- ☹ Mistakes in calculations (e.g., arithmetic error when calculating average).
- 😊 The results are a test of the hypothesis and come from data collected with the method. It's okay if your hypothesis is not supported. Being a scientist means we often face discovering our ideas are not true.
- 😊 Summarize results in meaningful, descriptive ways (e.g., mean, mode, median, standard deviation) to uncover patterns (t-test, correlation, best-fit equation). Online I provide a one-page summary of statistics. If the math is beyond what you have learned in school, trying to learn more is a great way to distinguish your project. A mentor might help you learn these skills. However, please do not have a mentor calculate results for you.
- 😊 Recognize how much you can generalize your interpretation of your results and how the interpretation may be limited (e.g., correlation vs. causality).

Science fair projects are a hard. But most things worth doing are. If you're driven to try and win the science fair, that's a wonderful goal. Hopefully this guide helps. Please know that most students who advance to the next level made a high-quality project the previous year, thought carefully about how they could improve, and then chose to do a more advanced project the following year.

Though awards at the science fair might be the most obvious accomplishment, they're not the be all, end all. By doing a science fair project you're learning how to think of ideas, put ideas to the test, find authoritative sources of information, plan a long-term project, handle stumbling blocks and build your resilience, and present to an audience. Regardless of your career plans, these are useful life skills so please focus on all of your accomplishments!

Kevin Grobman (kgrobman@csumb.edu)