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The Pikes Peak
Regional Science Fair
Judging Handbook

Rob Kolstad, Ph.D., Head Judge
V1.7.2 – 14 January 2019

Changes From Last Year
No major changes for 2019. Mostly just updated year tags on the forms.

Judging: The Big Picture
Science Fair “category judging” has many goals. Our ultimate goal is to rank the projects into 1st, 2nd, 3rd, . . . places within a category and then to choose the overall Fair winners from the category winners. We accomplish this goal by using a huge number of judges to rate each project with scores that run from 0 to about 180 points.

Note that “category judges” differ markedly from “special [award] judges” in that the category judges are ranking the participants in categories whereas special award judges are seeking projects with special properties (e.g., “Best photographs”, “Most ecological”, “Best use of robotic technology”). This handbook is for category judges; each special award has its own criteria and methodology for judging.

A “Project” is an investigation for science folks and a constructed project for engineering students.

IMPORTANT POINTS
If you read nothing else in this document, please read the boxes like this one.

Other goals include:
• encouraging Fair participants to continue to pursue their interests in Science,
• rendering advice on how to leverage students’ skills and desires, and
• sharing judges’ knowledge with the participants.

Of course, it’s always a goal for everyone to enjoy their day at the Fair.

The students are competing for recognition, trophies, ribbons, cash prizes, special awards, and sponsored trips both to the Colorado State Science and Engineering Fair and the International Science and Engineering Fair.

MAIN CATEGORY JUDGE GOAL
Rate, then rank, the top students in each division and overall (for prizes) and encourage all competitors to keep up the good work.

Some Details
To achieve a ranking, judges rate (give a score to) the student’s work in planning and executing a science project, their oral presentation, their backboard, and (to an extent) the results of their experiment or project. After the judging phase, judges meet in the deliberation phase to rank the students in their divisions and, subsequently, determine the overall winners in the junior and senior divisions.
Each project is judged by several different judges, each of whom assigns a numerical score and assessment of effort and special innovation level. The aggregate of all (generally six or more) judges’ scores is massaged statistically to find a provisional rank for a given student (thus reducing reliance on or impact of any single judge). Committees then discuss, debate, and choose the category winners and overall Fair winners using the list of high-scorers as a starting point.

Science vs. Engineering

Science projects explore the science world by performing experiments, usually with a controlled variable and some perturbations that can be measured and analyzed.

Engineering projects generally create a new device or procedure then evaluate it against a set of experiment-supplied criteria.

The PPRSF judging forms apply (with some applied thinking) to both science experiments and engineering projects (otherwise we’d kinda have to have separate fairs).

The biggest difference between science experiments and engineering projects is that an engineering project has an evaluation function, statistic, or some other bar (all of which might be pre-ordained before the project begins) while a science experiment that has a ‘control’ for comparison.

PPRSF judge Jeff Olsen help me to render the generic real-life engineering project flow:
- State problem to be solved
- Define requirements
- Design device/solution
- Implement device/solution
- Test under a variety of conditions
- Iterate: evaluate weaknesses (often using the criteria from the requirements), redesign, re-test
- Final Evaluation

Nowadays, the PPRSF forms evaluate these steps in these sections (and more):
- State problem to be solved → “Project is well-defined”
- Define requirements → “Relevant & appropriate variables & testing”
- Design device/solution → Entire second judging section ‘Project Design & Variables’ and third section ‘Materials/Procedure’
- Project execution → “Project execution”
- Test under variety of conditions & Iterate: evaluate weaknesses, redesign, re-test → “Measurements valid...” and “Development ... appropriately iterated” [improved wording]
- Final Evaluation → “Data limitations,” “Understanding of analysis,” and “Your impression of interpretation/analysis”

About Timeliness

One of the most important results a judge provides is a reasonable, fair, timely score for each project he or she judges. Scores that fail to arrive in a timely manner after a round finishes cannot be used to rank the competitors. Spending three hours judging a project would probably yield a ‘better’ or more precise result;
unfortunately, we must conduct the Science Fair in an extraordinarily limited time frame and must do the best job we can in that time frame. Thus, fear not being off by a point or two either way when judging a project: The other judges for that project will surely average out any slight differences.

**JUDGING SCHEDULE**

Judges must precisely follow the judging schedule in order to ensure the success of the day-long event – do not skip projects, reorder projects, linger too long, or finish more than a minute or two early. Forms must be turned in to the runners immediately after each Judging Round.

Here is a potential schedule for this year’s Fair; the only real issue is how fast the schedules can be made ready for pickup:

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:10 am</td>
<td>Sched Pickup</td>
</tr>
<tr>
<td>9:20 am</td>
<td>M1</td>
</tr>
<tr>
<td>9:50 am</td>
<td>M2</td>
</tr>
<tr>
<td>10:15 am</td>
<td>M3</td>
</tr>
<tr>
<td>10:40 am</td>
<td>M4</td>
</tr>
<tr>
<td>11:05 am</td>
<td>M5</td>
</tr>
<tr>
<td>11:30 am</td>
<td>Break</td>
</tr>
<tr>
<td>12:45 pm</td>
<td>A1</td>
</tr>
<tr>
<td>1:15 pm</td>
<td>A2</td>
</tr>
<tr>
<td>1:40 pm</td>
<td>A3</td>
</tr>
<tr>
<td>2:05 pm</td>
<td>A4</td>
</tr>
<tr>
<td>2:30 pm</td>
<td>A5</td>
</tr>
<tr>
<td>2:55 pm</td>
<td>Break</td>
</tr>
<tr>
<td>3:05 pm</td>
<td>Finish</td>
</tr>
</tbody>
</table>

- At 9:00 am, judges head from the training lecture hall to get their schedules near Berger Hall, UCCS’s now remodeled former gymnasium.
- Round 1 includes five sessions; the first is 30 minutes (to get used to locations, runners, etc.) while the rest are 25 minutes.
- Morning judging ends at 11:30 or so. Please hang out during the break at the last morning project for five minutes as we scan the forms to make sure they are OK.
- Precise lunch schedule and location will be announced on Saturday.
- Meet outside Berger Hall again for the afternoon judging schedule and commence afternoon judging as advised. Five more 25 minute sessions just like the morning follow.
- Hang out at the last project again for about five minutes to ensure your forms scanned correctly.
- At 3:15, Finalist and Platinum (overall Fair) judges meet (at a place to be named Saturday) to determine the Fair’s winners.

**About Projects**

Most PPRSIF students create science projects which have a hypothesis and then test that hypothesis by comparing some variant scheme’s properties with ‘standard’ results from a ‘control’. A few students fabricate Engineering projects, which feature development of a device or method along with its evaluation using some absolute measurements (which are often compared to measurements of some similar device).

Science projects carry with them several potentially surprising properties:

- A valid science project is not required to have practical application
- A valid science project might have a hypothesis that’s been rejected
• Science projects might, by chance, reproduce some work already performed by others (anyone from other students through top scientists) in the past. Good projects generally have a new twist or a different approach or idea. This should be judged in a manner appropriate to the contestant’s competition level.

• Completely original research is hard! It’s not precisely required. However, we don’t reward demonstration projects that merely confirm or demonstrate well-known results (presuming the student knows about them beforehand). It’s OK to “discover” Ohm’s law for a sixth grader. It’s not OK to confirm it as the centerpiece of a project. Note: It’s possible that the notion of “Reproducing other scientists’ work” might see a surge in popularity as the problem of successfully repeating previous research becomes more prominent in certain scientific communities.

Please don’t reduce Science projects’ scores because of impracticality of the project’s final goals (e.g., to cure cancer quickly) or because of a hypothesis whose opposite turned out to be true (unless, of course, this wasn’t recognized). Note that the practicality of the end-result is different from practicality of finding that result – the experiment itself must be able to be completed.

As a brief aside, exhibits that appear as if they were created by a professional might actually be created by a professional! Try to assess this carefully.

<table>
<thead>
<tr>
<th>PROJECT TYPES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projects judged as ‘science’ projects have a hypothesis, experimental observations, and results/analysis. Projects judged as ‘engineering’ projects create some new entity which is then evaluated according to contestant-specified criteria.</td>
</tr>
</tbody>
</table>

**Group Projects**

Some projects are created by two or three students instead of just one. These projects are scored identically to single-person projects and compete head-to-head with them.

However, if one or more members of the group is not present, be sure to mark that on your score card. If you wish, you can inform them that they are not eligible for category awards if any of their members is absent. Continue the scoring and discussion, but everyone should know the project will not earn any category awards.

**Encouragement**

Nothing turns a student to a non-science career faster than suffering through Simon Cowell-like criticism at a Science Fair. Please leave every student with a positive attitude about his/her project and the Fair [4].

**ENCOURAGEMENT**

Please praise and encourage the competitors; avoid all but the most constructive criticisms if at all possible.
Judging Philosophy

Like football polls and beauty contests, ranking Fair contestants contains an element of personal subjectivity. The PPRSF mitigates this in several ways:

- By using forms with extremely detailed point allocations that enable judges from widely varying backgrounds to arrive at similar or identical scores for a project, even when judging at different times.
- By judging each project with several judges independently. These judges’ scores are combined to form the project’s score.
- By employing ‘finalist’ judging committees that include judges who have seen almost every project to be considered for awards and thus enable ‘baseline judging’ where projects are ranked above or below each other only by those who have seen both projects.

These three points combine to form the backbone of the Fair’s credibility, fairness, and ranking defensibility.

Of course, student presentations and familiarity with their project at 9:10 AM on Fair day are dramatically different than at 2:00 PM after they have spoken with the better part of a dozen judges. This is just the way Fairs work.

Judging Flow and Background

Judging takes place across two very similar rounds. The first and second round forms were combined into one comprehensive judging form starting in 2009.

Judges generally judge in their assigned category of expertise throughout the fair schedule (or at least their general area – life science or physical sciences). At the lunch break, scores are sorted so that the afternoon schedules ensure that Finalist Judges and Platinum Judges see the top-ranked projects in each category.

PPRSF believes in ‘baseline’ judging that requires final judges to make a direct, personal comparison between sets projects before those projects are declared as Category or Fair winners.

The 2006 Fair marked a departure from traditional science fair judging criteria like: “Science and engineering thought,” “Clarity and drama of the display,” “Skill,” “Concept originality,” and “Thoroughness.” Why? Because the abstraction level of those concepts is so high that without concrete guidance, one might award almost any project a wide range of perfectly justifiable scores.

Furthermore, each of those abstract categories requires evaluating the entire project before a score can be ascertained. This is at odds with the normal flow of project judging in which a student gives a brief oral presentation followed by a discussion with the judges.

The judging forms contain sections that mirror the flow that a judge can use to guide discussion: project selection, procedure, and execution. They also have sections for the student’s communication, results, and interview.

METHODOLOGY

Each project is judged by many judges – don’t worry about making a small mistake. Two similar judging rounds of five projects each today.
Vocabulary

Some quick definitions:

- The *participant, contestant, or student* is the person whose Science Fair project is being judged. They are 6th through 12th graders (generally 11-18 years of age). When more than one person created the project, it is a *group project* and is judged exactly as other projects, with the additional proviso that all group members should be participating.
- This document uses *project* to refer the experiment, constructed entity, or whatever entity is the focus of any given student’s entry.
- The *backboard* is generically all the presentation materials that a student uses to display his/her project.

Measurement

Measurements make up an important piece of almost every Science Fair project. The terms *accuracy, precision,* and *resolution* are handy to discuss measurements.

- *Accuracy* pertains to the absolute error of a measured or calculated value. Better accuracy means a smaller deviation from the variable’s exact value (and better accuracy is often highly regarded).
- *Precision*, for our Fair, refers to the number of digits a measurement produces. More precision is not always better! Consider the idea of stating that a book weighs 0.91359213985721385 kilograms. If the book weighs 1.0 kilogram, the measurement was very precise but not very accurate. Many students confuse precision with accuracy and claim very high precision measurements whose accuracy falls off after two or even fewer significant digits.
- *Resolution* refers to the ability of a measuring device to separate two very close measurements. For example, if a time interval counter has a resolution of 10 ns, it could produce a reading of 3340 ns or 3350 ns but not a reading of 3345 ns. Instruments are rarely more accurate than their resolution.

Judging

Part of the judging form is designed to capture whether the student followed the basic precepts of a science (or engineering) project. Do they have a [good] backboard? Did they cite the hypothesis? Did they collect and analyze data? Did they draw a valid conclusion?

**APPROPRIATE TO AGE GROUP**

**IMPORTANT:** Many questions are marked “appropriate to age group”. Judge competitors as compared to members of their peer group, not against Newton and Einstein (or yourself).

Our goal in judging is to garner, for the group as a whole, a spread of scores (ratings) so that we can sort them into rankings. Do not fear giving someone a great score, an average score, or a below-average score (even a score close to 0). These forms are shared by both junior and senior students and must distinguish among the very best of the competitors at the highest level in addition to working for what might be the worst projects at the lowest level. Some lower level students will receive fairly low scores – and that’s fine. They are competing with their peers, not the higher-scoring senior group (who probably have 5-6 important years more experience).
ABOUT LOW SCORES

Each year, some judges award near-perfect scores to most of their judged projects/students. “Oh, they worked so hard.” These scores contribute nothing to the overall rating or ranking procedure. Our smoothing algorithm ignores abnormally high or low scores. Please tally each of the almost three dozen criteria by thoughtfully evaluating the student’s true performance as compared to what you’d expect from a perfect project (often a perfect project for that age group).

The PPRSF does not judge students based on their grooming, dress, race, gender identity or expression, relatives, piercings, haircut, tattoos, age, creed, sexual orientation, religion, or school attended. We are judging the students and their Science Fair project using a variety of criteria:

- Project Selection
- Solution & Procedure
- Execution and Data
- Communication and Exposition
- Results
- Interview

The point values for these categories (as implemented by the multiple line items in each of them) map nicely to the traditional criteria and have the added advantage of removing redundancy from the scoring.

Steps for Judging a Project

Following a simple checklist will all but eliminate simple errors and engender a pleasant judging experience for all concerned:

---

JUDGING CHECKLIST

Read this checklist!

- Find the judging sticker for the current round to learn the ID number of the next project to be judged. Affix it to a scoring form, preferably without wrinkling it. If you mangle the label bad enough, ask a runner to fetch you another one (and another scoresheet).
- Find that project (use the signs on the ends of the tables). This year, it is not known of all projects will fit in a single room. The introductory lecture will clarify where projects reside.
- Introduce yourself and confirm that the name on the sticker is the name of the contestant. “Hi, I’m Dr. Albert Einstein, and I’ll be judging your project today. You’re Neils Bohr?” Wrong person? Find the proper project!

Exceptions:

- The project is not present. Check the “No Project” box on the score sheet; hand the sheet to a runner. Browse other projects and have pleasant conversations with students or staff. Do not vary your judging schedule; wait until the appropriate time to judge others on your list.
- The project is present but no student(s) is(are). Ascertain what’s going on (perhaps there’s a note? perhaps their neighbor knows?). If, after waiting a few minutes, it appears no student will be present, check the “No Student” box on the score sheet and hand it to a runner. Browse other projects and have pleasant conversations with students or staff. Do not
vary your judging schedule; wait until the appropriate time to judge others on your list.

• A group project is missing one or more of its members. Explain that the project will not be considered for category prizes since not all members are present. **Check the ‘Incomplete Group’ box and conduct a normal encouraging interview with regular scoring.**

• The student probably has a short presentation; let them talk for no more than **THREE MINUTES**. Really: **CUT THEM OFF AT 3.0 MINUTES.**

• Work your way through a discussion of the items on the judging score sheet, marking points as you assess the project’s strengths. Of course, you can always change your assessment of the points as you learn more about the project.

• Three to four minutes before the end of the round (an announcer will remind you), finish up with the student, complete marking the score form, and create the feedback form.

• For the feedback form: Write a few positive remarks and **no more than one constructive criticism** (e.g., “Next year, you might consider taking multiple observations in order to confirm the effect of the stimulus.”). Of course, you can omit the criticism if you wish. Generally, everyone hates being criticized, of course.

• Find a runner (they wear distinctive hats) and give your score sheet to them for transport to scoring headquarters.

• Commence judging the next project (and start over at the beginning of this list).

• For the final project in the morning and afternoon, please linger for about five minutes while your form is checked for proper scanning.

**Demonstration Projects**

A “Demonstration Project” is one in which a student merely reproduces some result or project, e.g., the construction of an electromagnet without adding any innovation at all. Some demonstration projects are quite elaborate. The 2005 Fair featured a demonstration project that isolated genes responsible for dyslexia. While a fabulous work with meticulous effort, it was nevertheless a very weak project via a vis science since nothing remotely new was envisioned, created, tested, or hypothesized – it was a strict reproduction of well-known (to some) procedures from the annals of science – **and the student knew this.**

The judging forms are designed to preclude demonstration projects from placing highly at the Fair. If you do happen to spot one, please write “Check this project (demonstration)” in the thoughtfully-provided box on your scoring form so our backup judges can make sure all is well.

**The Assignment Sheet**

<table>
<thead>
<tr>
<th>Assignment Sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>This section tells how the assignment sheet and score sheet work – don’t miss the important bits!</td>
</tr>
</tbody>
</table>
Just before the morning and afternoon rounds of judging, administrators will distribute a sheet to you with several sticky labels for score reporting. These labels describe each project to be judged and the time to judge it.

Below is a typical **morning** assignment sheet for a finalist judge (despite the form’s assertions about the year):

<table>
<thead>
<tr>
<th>ID: 0086</th>
<th>Richard Colarco</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session: MORNING 2018</td>
<td>SUMMARY</td>
</tr>
<tr>
<td>Finalist Judge for Categ. 8C</td>
<td>M1  8C2</td>
</tr>
<tr>
<td></td>
<td>M2  8C6</td>
</tr>
<tr>
<td></td>
<td>M3  8C13</td>
</tr>
<tr>
<td></td>
<td>M4  8C10</td>
</tr>
<tr>
<td></td>
<td>M5  8C7</td>
</tr>
</tbody>
</table>

At 3:05, follow afternoon discard instructions.

<table>
<thead>
<tr>
<th>M1  9:20 am 0086 ENG 1</th>
<th>M2  9:50 am 0086 ENG 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aidan Euler</td>
<td>Alicia Granados</td>
</tr>
<tr>
<td>Li-fi</td>
<td>Pedaling green energy</td>
</tr>
<tr>
<td>8C2</td>
<td>8C6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>M3  10:15 am 0086 SCI 3</th>
<th>M4  10:40 am 0086 SCI 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jayden Leonard</td>
<td>Andrew Hamilton</td>
</tr>
<tr>
<td>To burn or not to burn</td>
<td>Catapults and counterweights</td>
</tr>
<tr>
<td>8C13</td>
<td>8C10</td>
</tr>
</tbody>
</table>

| M5  11:05 am 0086 ENG 5 | |
|------------------------| |
| Jennifer Liu           | |
| Designing an automated dog elevator | |
| 8C7                    | |

The diagram below annotates a typical sticky label for a first judging session that starts at 9:20 am (your label might say 9:15 or 9:20 or some other time, depending on that year’s schedule):
The various fields are easy to understand:

- **Session name & time** is a mnemonic codename for the session (M for morning; A for afternoon) along with the time you should be at the described project to start judging.
- **Sci/Eng** tells the student’s idea of whether this is an engineering or science project.
- **Judge Order** tells the order to use the labels. This one is first.
- **Contestant** is the name of the student (captain, for groups) you will be judging.
- **Project Title** is the name of the project (use it to verify you’re at the right place).
- **Judge ID** is the number and name of the judge performing the assessment along with the contest year (so we don’t mix up labels from different years).
- **Barcode Key** is how the scanner/computer figure out which judge assessed which project (and when).
- **Schedule** (tiny print) is so that we can find you if something goes wrong with your form.
- **Project ID** tells you which project you should judge.

**Summary**

The assignment sheet of sticky labels tells you where to be and when. Double-check the participant’s name and project ID. Don’t forget the letters for challenge and effort for final scoring. Hand the form to a runner when you’re done.

**The Score Sheets**

THE JUDGING FORM

The next pages tell how to fill out the form. It’s worth reading what each of the scoring lines means!

Judges will mark the same type of form for each kind of project (Science and Engineering) and for both the morning and afternoon judging rounds.

Each section below shows an excerpt of the judging form along with explanation on how to complete it. When interviewing the student(s), color the bubble for a line item as you determine its value. No need to record the numerical value, just make a great bubble.
Aligning the Label

The first action to perform for each judging session is to affix the label onto the judging form. The gray outline precisely matches the size of the label. Please do your best to get within a quarter inch or so. It’s easy to peel the label from the label sheet and then lay it down from bottom-to-top or left-to-right. Don’t try to smash it down all at once – you’ll wrinkle it (and then you’ll have to ask the runner for a new label). Likewise, don’t try to get the middle right and smooth ‘out’ from there. Start at an edge.

![Align Label Accurately]

Marking Absencees

Once the label is affixed, assess the presence of the project and student(s). Bubble the appropriate circle (as described above) if the project is absent, no students are present, or not all students are present. If no students (or project) are in evidence, return the form to a runner and enjoy a few minutes of browsing (do not change your schedule!). If students are present, continue the interview.

These bubbles are directly to the right of the top of the assignment label:

| 0 No Project | 0 No Student | 0 Incomplete group |

Reminder: Be sure you have the proper student/team! Introduce yourself and verify their name(s).

Coloring the Bubbles

Now it’s time to commence recording your scores. You can begin while the student or group presents their (optional) three-minute spiel. When you have chosen a score/evaluation for some given aspect, use your pencil to color one of the elongated circles like this:

![Filled-In Oval]

The fastest (and most effective and accurate) way to make such a pretty filled-in-oval is to use a number two pencil and circle around inside the oval until it is completely black.

Some folks like to get imaginative and use other marking methods. These will not work. Do not make your “bubbles” like these:
They include: an unfilled oval, an ‘X’, a check, an ‘X’ made with a super-fine pen, a dot that is so small it can’t be detected, a poor erasure, and a blobby mark that is just plain undecipherable.

**Judging Criteria**

Each subsection below details one piece of the judging form and explains the judging criteria to be applied to that section.

**Project Selection**

The Project Selection section assesses how well the project’s problem is defined, how original the project is, and the quality of the hypothesis or engineering goal.

<table>
<thead>
<tr>
<th><strong>PROBLEM SELECTION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>★ Problem is well-defined</td>
</tr>
<tr>
<td>★ Originality of project</td>
</tr>
<tr>
<td>★ Quality of hypothesis or Engineering Problem</td>
</tr>
<tr>
<td>0 – Not so clear</td>
</tr>
<tr>
<td>0 – Unoriginal/copy</td>
</tr>
<tr>
<td>8 Original</td>
</tr>
<tr>
<td>0 – Weak</td>
</tr>
</tbody>
</table>

**Appropriate to Age Group**

The bold star that precedes some questions is intended to be a reminder that the particular question should be evaluated in the context of the student’s level. Senior high school students, for instance, are probably geared up for dramatically greater challenge than sixth-graders. Over half the evaluation criteria are marked this way!

Note that adults’ expectations of Science Fair projects generally run toward the very high side. Try to evaluate projects relative to the levels displayed at this Fair; you’re unlikely to find a double-blind cure-for-cancer study here.

**Judging Non-adults**

Many judging criteria are “starred” to indicate “judge appropriate to age group.” Bear in mind that none of the participants is a college graduate – they are fascinated and learning; they are not, generally, subject matter experts. Please have appropriately low expectations.

**Problem is Well-Defined**

Typical ways to evaluate ‘well-defined’ include: Could a layman understand what challenge is being tackled? How about a 10th grader? Is the project’s idea and/or purpose clearly stated.

**Originality of Project**

This question has a 10-point weighting scale because it’s the one that really gets judges’ attention at subsequent Fairs. Unoriginality is easy to see; “completely original” is not. Mark your evaluation as best you can to give your subjective viewpoint on just how original this project appears to be (being age-appropriate, of course).
Note that some extremely complex laboratory or engineering projects might actually get a 0 here since they have nothing “new” or “novel” (at least to the student) to report as a result or as an approach. Combining well-known processes in a new way counts as “original” because the combination is original even if the components are not. Likewise, “twists” or new insights contribute to originality. Low scores here for copying; higher scores for new ways to combine elements or new (at least unusual or uncommon) questions to ask/answer.

All-in-all, is this a good hypothesis or a good engineering problem? Examine the hypothesis (or engineering problem statement) and determine (again, mostly subjectively) its strength. “Water appears to flow at room temperature” is a fairly weak hypothesis compared to “Transparent aluminum exhibits superior strength with temperature insensitivity”. A good hypothesis is non-obvious (to its poser!) and connotes a medium (and appropriate) amount of work to verify/test it.

**Project Design & Variables**

This section assesses the clarity and practicality (as far as completing the project goes) of the project’s design. It also assesses the relevance and evaluation techniques for the identified variables.

A project’s ‘variables’ include all those environmental and other influences on the outcome of a project. If plants are being grown with outdoor light, is the variability of seasonal sunshine taken into account? If one is measuring the speed of sound, are the variables of temperature, pressure, and humidity understood? Of course, this is always in the context of age group: one would not necessarily expect a sixth grader to know the subtleties of the relationship between humidity and the speed of sound in air.

Once measured, variables are used in a few ways:

- **Evaluation on an absolute scale** (“this car can climb a 45 degree slope”)
- **Comparison to similar measurements** (“this plant was third tallest in its group”; “this paper towel picked up more water than any other paper towel tested”)
- **Comparison to a control value** (“on average, rats taking the new drug lived 45 days longer than their counterparts who were administered a placebo”)

Appropriate to age group, students need to explain how all variables are/were measured, controlled, or constructively ignored (i.e., acknowledged but explicitly disclaimed to be outside the project’s purview). Note that students’ sophistication about variables is much lower in middle school than high school.

Science experiments compare two (or more) sources of data (e.g., a control plant grown outdoors and an experimental plant grown under a special light). Engineering projects create a new device or process from scratch. Thus, engineering projects evaluate their results against absolute evaluation criteria (or
specifications or another product/implementation) rather than by comparing with some other instance in their project. This is reflected in the science vs. engineering versions of this section.

<table>
<thead>
<tr>
<th>PROJECT DESIGN &amp; VARIABLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>★ Understandable research/project design</td>
</tr>
<tr>
<td>★ Practical &amp; affordable</td>
</tr>
<tr>
<td>★ Relevant &amp; appropriate variables chosen</td>
</tr>
<tr>
<td>★ How to evaluate variables</td>
</tr>
</tbody>
</table>

Understandable As presented by the display and the verbal discussion, is the project’s design easy to understand? Can it be explained without resorting to jargon or gibberish? Some students will try to overwhelm judges with jargon; mark them down appropriately.

Practical & affordable This question examines the project’s procedures (not its results). Does this project require the resources of IBM’s national research laboratory to complete? If so, it’s not affordable.

Variables Chosen Are the variables in the experiment properly defined and laid out? Are controls included if appropriate?

How to evaluate variables Is the procedure for evaluating the observation values for the variables well-explained? Feel free to ask about this or any other issue: the three-minute introduction is for whetting appetites, not explaining the entire project.

Materials/Procedure This section assesses the cleverness of materials/equipment use and quality of the procedure.

<table>
<thead>
<tr>
<th>MATERIALS/PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>★ Ingenuity/adaptation/practicality of equipment &amp; materials</td>
</tr>
<tr>
<td>★ Concise, reasoned procedure</td>
</tr>
</tbody>
</table>

Ingenuity How clever was the use of materials and equipment? Does the project display elegance in its use of materials and equipment?

Concise, Reasoned Procedure Is the procedure well-done and professional? Is it executable?

Measurements & Notebook This section assesses the effectiveness of the data collection procedure and the project’s (usually hand-written) notebook. Key points include:

- Data must be observed and properly recorded
- Data should be observed multiple (three is a good minimum, if possible) times to ensure reproducibility and mitigate observational errors.
- Notebooks must be created during experimentation, not afterward. Ask to see their notebook; see if it looks like it was produced afterwards (e.g., if it is meticulously typeset) or during experimentation.
Judge Larry Mott feels notebooks are extremely important; some of his comments are paraphrased here:

Better notebooks extend for some months prior to the fair and include musings, data, mistakes, and show the flow of the project. I use the notebook during judging to gauge the quality of the projects. It is a direct indicator of the amount of work that went into the project and a dead giveaway if the student did not do the majority of the work.

Those who render inappropriate assistance do not think of doing a notebook if they are behind the curtains directing a project. I like to open the notebook at random and ask a specific question about an entry, an experimental result, an apparatus sketch, a data table, etc. The answers are very revealing indeed. Having the experimental data is just as essential as having the results.

Typed or neatly hand-written notebooks are likely to have been created after the project (a no-no). RBK adds that, of late, some students keep computer-generated notebooks as they go along. Finally, there are generally no erasures in proper notebooks, only lines through incorrect observations.

<table>
<thead>
<tr>
<th>Project Execution</th>
<th>Poor</th>
<th>Barely OK</th>
<th>Average</th>
<th>Above Average</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurements valid &amp; recorded</td>
<td>Incomplete</td>
<td>Mostly</td>
<td>Valid &amp; Recorded</td>
<td>Clear</td>
<td>&amp; Thorough</td>
</tr>
<tr>
<td>Development and/or measurements appropriately iterated</td>
<td>Not/Can’t</td>
<td>A bit</td>
<td>Somewhat</td>
<td>Mostly</td>
<td>Appropriately iterated or 3 measurements</td>
</tr>
<tr>
<td>Quality notebook created throughout project’s execution</td>
<td>None/ Created Late</td>
<td>&lt; 75%</td>
<td>75-90%</td>
<td>Mostly</td>
<td>Very thorough</td>
</tr>
</tbody>
</table>

Twelve years of iteration on the forms and never once did the forms directly ask, “How well was the project executed?” All assessments were indirect. This is the direct question: How well-done was it? Choose an item from ‘Poor’ to ‘Excellent’ to reflect your assessment.

This item assesses whether the data measurements were well-done in a professional manner. Check the data’s representation, the notebook, and the oral presentation to deduce if the data has been properly observed and recorded.

For science projects, measurements (or samples, in some cases) need to be reproducible and replicated during experimentation to ensure that any given data reading is not a fluke.

Use good judgment here, e.g., measuring three successive gas-consumption runs of a new vehicle is just as good as measuring the height of three different plants grown under red light. Note that three is often the magic number for science experiments.

For engineering projects, new versions or prototypes should be created – as appropriate – as problems with initial versions are observed. Of course, if the project is launching the Falcon Heavy, only one launch will occur and such
iteration is done on paper. But, for example, the baseball mudding machine from years back was iterated multiple times. The winning version exhibited at the Fair was Version 3 (with major changes in each upgrade).

Check the notebook to make sure it was created during the full duration of the project. A notebook that is beautifully typeset and obviously re-done after the project gets no credit here (which is usually very counterintuitive to the student). No notebook means 0 points here. Typically, one asks the student to share their notebook so it can be examined.

**Data Analysis**

This section includes far more judgment than some of the previous ones. It assesses the analysis and statistics shown in the project.

<table>
<thead>
<tr>
<th>DATA ANALYSIS</th>
<th>0 - No mention</th>
<th>1 Fleeting recognition</th>
<th>2 Good understanding</th>
<th>3 Limited listed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality notebook created throughout project’s execution</td>
<td>0 - No mention</td>
<td>1 Fleeting recognition</td>
<td>2 Good understanding</td>
<td>3 Limited listed</td>
</tr>
</tbody>
</table>

The student needs to demonstrate an understanding of the limits of measurements (especially regarding precision and instruments’ limitations).

Too often, students get “help” from a well-meaning mentor who chooses statistics or tabular/graphical presentation techniques that are beyond the student’s abilities. This question asks for your judgment about that understanding. Query the student with relevant questions like, “Just what is a standard deviation?”

Exercise your best judgment here to share your overall impression of the project’s interpretation and analysis of the collected data.

**Results**

This section awards points for how well the project achieved the goals it set out to achieve.

<table>
<thead>
<tr>
<th>RESULTS</th>
<th>0 - Minimal</th>
<th>2 Adequate</th>
<th>3 Mostly</th>
<th>4 &gt;= 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete, thorough coverage</td>
<td>0 - Minimal</td>
<td>2 Adequate</td>
<td>3 Mostly</td>
<td>4 &gt;= 95%</td>
</tr>
<tr>
<td>Honest, logical results relevant to hypothesis/engineering plan</td>
<td>0 - Minimal</td>
<td>2 Adequate</td>
<td>3 Mostly</td>
<td>4 &gt;= 95%</td>
</tr>
<tr>
<td>Data/results justify conclusion</td>
<td>0 - Minimal</td>
<td>2 Adequate</td>
<td>3 Mostly</td>
<td>4 &gt;= 95%</td>
</tr>
</tbody>
</table>

Does the experiment as executed meet the promise of the procedures and materials section? Examine the results to determine if they are honest, logical, and relate properly to the initial hypothesis. “Results” are very similar to “data”, though a certain amount of aggregation, summarizing, and/or statistics is implied.
Data/results justify conclusion

Does the totality of the data enable the experimenter(s) to reach the conclusion that is presented?

Display and Exposition

The display is usually a backboard but can also be a more novel presentation. This section assesses the completeness and neatness of the display in addition to the overall verbal presentation of the project itself.

<table>
<thead>
<tr>
<th>DISPLAY and EXPOSITION</th>
<th>Purpose, hypothesis, procedures, material/equipment (notebook), analysis, &amp; conclusion</th>
<th>Neatness</th>
<th>Progression of verbal exposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 4 Missing</td>
<td>10 3 Missing</td>
<td>15 2 Missing</td>
<td>20 1 Missing</td>
</tr>
<tr>
<td>Messy</td>
<td>2 OK</td>
<td>3 Good</td>
<td>4 Great</td>
</tr>
<tr>
<td>Haphazard</td>
<td>2 Confused</td>
<td>3 Clear</td>
<td>4 &amp; Logical</td>
</tr>
</tbody>
</table>

A complete display has all these items: purpose, hypothesis (or goal in the case of engineering projects), procedure(s), material/equipment listing (though this might appear in a notebook), data/results (potentially in summary form), analysis, and conclusion. Count them up (ignoring quality) and deduct points if some items are not present.

Note, however, “that no particular credit should be given (or deducted) for purchased or borrowed equipment that is not part of the work of the student and serves only as a tool in the investigation” [8].

Neatness

Neatness is slightly distinguished from “professional”. A backboard can be extraordinarily well done with hand-lettering or very sloppy/messy with fancy computer-generated elements (though computer-generated elements do not generically incur much of a penalty). How does it look to you? Please don’t go into the chosen typeface for discussion; those sorts of “taste” issues run long, deep, and with little helpful meaning.

Progression of Verbal Exposition

Students can choose any ordering and organization they wish for their (albeit brief) presentation and in the way they answer your questions. What is your opinion of their introduction and responses?

Research

This section assesses whether the student performed background research about the project. The timing of the research is not discussed.

<table>
<thead>
<tr>
<th>RESEARCH</th>
<th>Cited authoritative appropriate literature</th>
<th>Other approaches/theories</th>
<th>Further research/development listed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – No</td>
<td>2 1-2 Cites</td>
<td>2 Adequate</td>
<td>3 Excellent</td>
</tr>
<tr>
<td>Little mention</td>
<td>2 Some knowledge</td>
<td>3 Good listing</td>
<td>5 Excellent</td>
</tr>
<tr>
<td>Little</td>
<td>2 Adequate</td>
<td>3 Excellent</td>
<td></td>
</tr>
</tbody>
</table>

Most literature citations these days will be web-based. It is still relatively easy to count the reasonable citations (e.g., Readers Digest is rarely a good source of scientific information; neither are websites promoting a given agenda). If you are not familiar with some website, ask the student about it.
“Is this from a company? a school? a library? How did you find this website?”

Sometimes students don’t understand that a reference to http://www.google.com is not as complete as it needs to be; they get less credit here.

Is the contestant aware of how other people approached the problem they are solving?

Students are told to indicate further research for their project. This means that further research appears printed on their backboard or in their notes/notebooks – not solely presented verbally. Relevance to the current project is a plus.

**Presentation/Interview**

This section continues assessment of the verbal presentation and student’s general interactive responses to judges’ questions. While the interview is not strictly part of the project, it nevertheless has tremendous influence on the final results. This section is almost entirely subjective and enables a judge to award points for interview quality.

<table>
<thead>
<tr>
<th><strong>PRESENTATION/INTERVIEW</strong></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proper focus on important ideas</td>
<td>No focus</td>
<td>Good focus</td>
<td>Great focus</td>
<td>Outstanding focus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engagement level</td>
<td>Little</td>
<td>Somewhat</td>
<td>Fully</td>
<td>Enthusiastic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Proper Focus**  
Does the student exhibit enough knowledge and skill to focus responses on the request information? Too often students will carry on at length in hopes of hitting a gold nugget somewhere in their information; this should not be rewarded.

**Engagement Level**  
This question rewards those students whose attitude is one of strong participation or even enthusiastic passion.

**Impressions**

The newest section here is ‘Extemporaneous thinking ability’ which is really ‘Ability to think on one’s feet.’ This section was added in order to identify those students who have memorized their entire presentation along with answers to popular questions. Pick some random question about the project or its notebook to test this ability.

**For group projects, deduct points in each category where each member is not represented somewhat equally in question-answering, e.g., if one person does all the talking.** Group projects might have a single spokesperson for the initial presentation, but all members should be answering judge questions. Group projects are intended to be projects with equal contributors! The current guideline for two students is that the each student’s participation level needs to be between 1/3 and 2/3 of the total question/answer time. For three students, think more like 1/4 to 1/2 the time for each student (imbalance is a fact of life; we’re concerned with gross imbalances).
Extemporaneous Thinking Ability

Students talking from a script often cannot answer questions outside its strict bounds. This category (which judges both verbal communication skills and thinking on one’s feet) rewards those who have deep subject knowledge and can answer questions from that depth. Of course, these students simply might not have a complete knowledge of their subject matter (since not a single one of them has a Ph.D.), so the answer “I don’t know” is perfectly reasonable (and expected!) for challenging questions. This is a subjective category; please share your assessment.

General Impression of Responses

This is your opinion of the ‘big picture’ of the interview: did you have confidence in the student? Was the student informative, intelligent, polite, able to respond to questions, and forthcoming? This category depends entirely on your judgment. This is a subjective category; please share your assessment.

General Impression of Knowledge

Does the student have a clue what they are talking about? Any bluffing is pretty much an instant 0 in this category. This scoring item is also subjective.

Project as a Whole

This section contains subjective questions about the big picture of the project’s quality and organization in addition to oral and written description.

Project Quality and Depth

Is quality evident throughout the project? High marks for meticulous, in-depth work. As you examine the display and listen to the oral presentation, assess the project’s quality. Determine how far the student has really gone (e.g., measuring paper towel liquid absorption has less depth than creating a new substance harder than diamond).

Organization

High marks here for a methodical approach from the beginning to the end of the project. A slapdash project assembled the day before the Fair will generally earn low marks here.
Special Innovation Level

The PPRSF judging form assesses many items, but in the past it has failed to collect data on true innovation (e.g., nuclear fusion, cure for cancer, breeding of dinosaurs from DNA – truly unique, innovative, clever, somewhat useful projects).

This item asks you to tell us if the project is “special”. Probably 98% of the projects will be ‘Not Special’ or ‘Noticeable’. The other few (perhaps a couple in any given year? perhaps 0?) should score higher here. Don’t feel bad if you don’t see a cure-for-cancer level of project; they are very, very rare.

Overall Level of Challenge

Relative to the student’s current academic level, determine whether the work in the project was below, at, above, or even way above the student’s grade level. We record a letter here, since it’s not a question where scoring increases by a point or two. Those students outperforming their grade level reap much higher rewards.

Work Performed By Student

It is expected and encouraged that students solicit and receive help on their project. The key thing to evaluate is “what parts of the project that would have been appropriate for a student to perform were, in fact, implemented by the student?” Of course, if the majority of the project was something that a student could not implement (but was nevertheless implemented), then points should be deducted here. This item actually multiplies the total score by a number less than 1.0; be sure you mark it as best you can.

Too often it’s easiest just to ask the exhibitor how much of the work he/she did and/or who helped them and how much. A quick follow-up, “Did you really build this electron microscope from scratch?” usually reveals the truth of the matter fairly quickly. Note that research supervision does not count against the "100% of the work" evaluation, nor does the occasional over-the-shoulder advice or even hands-on assistance – these are youngsters, not graduate students or industry-based engineers.

Completed Forms

Once you’ve completed marking the form (shortly after you finish interviewing the student), please hand the form to a runner (identified by a unique hat) who will convey it to scoring table.

Judging Forms

The next two pages show the judging forms.
Pikes Peak Regional Science Fair 2019

ALIGN LABEL ACCURATELY

16 circles to fill on this side

Write notes to back office judging staff inside this box
Pikes Peak Regional Science Fair 2019

RESULTS
- Complete thorough coverage
  - Minimal
  - 2 Adequate
  - 3 Mostly
  - 5 ≥ 95%

Honest, logical results relevant to hypothesis/engineering plan
- Minimal
- 2 Adequate
- 3 Mostly
- 4 ≥ 95%

Data/results justify conclusion
- Minimal
- 2 Adequate
- 3 Mostly
- 4 ≥ 95%

DISPLAY and EXPOSITION
- Purpose, hypothesis, procedures, data/results, material/equipment, analysis, & conclusion
  - Messy
  - 2 OK
  - 3 Good
  - 4 Great
  - 6 Stellar

Progression of verbal exposition
- Haphazard
- 2 Confused
- 3 Clear
- 4 & Logical
- 5 & Succinct

RESEARCH
- Cited authoritative literature
  - No
  - 2 1/2 Cites
  - 3 3/4 Cites
  - 4 5 or more cites

Other approaches/theories
- Little mention
- Some knowledge
- 3 Good listing
- 5 Excellent

Further research/development listed (i.e., areas of improvement)
- Little
- 2 Adequate
- 3 Excellent

PRESENTATION/INTERVIEW
- Proper focus on important ideas
  - No focus
  - 3 Good focus
  - 5 Great focus
  - 7 Outstanding focus

Engagement level
- Little
- 3 Somewhat
- 5 Fully
- 7 Enthusiastic

IMPRESSIONS
- Extemporaneous thinking ability
  - Poor
  - 2 OK
  - 3 Good
  - 4 Very good
  - 5 Excellent

General impressions of responses
- Poor
- 2 OK
- 3 Good
- 4 Very good
- 5 Excellent

General impression of knowledge
- Poor/bluffing
- 2 OK
- 3 Good
- 4 Very good
- 5 Expert

PROJECT AS A WHOLE
- Project quality and depth
  - Average
  - 3 Good
  - 5 Excellent
  - 7 Superior

Organization
- Average
- 3 Good
- 5 Very organized
- 7 Superior organization

Special Innovation Level (Impression)
- f Not Special
- g Noticeable
- h Unique
- i New & special
- k Almost cure for cancer

Overall challenge level
- f Below grade
- g 80-84%
- h 85-89%
- i 90-94%
- j 95-100%

Percent work performed by student
- a <80%
- b 80-84%
- c 85-89%
- d 90-94%
- e 95-100%

JUDGING FLOW OVERVIEW
- Proceed to project location; perform introductions (i.e., verify proper exhibit)
- Student generally has three minute 'speech'; don't let them go past 3 mins
- Interview student to determine scores for this form; bubble the point values
- At four minute warning: complete score sheet and feedback sheet
- Give oral feedback & feedback sheet to student (lots of encouragement)
- Double check this sheet and give to runner

19 circles to fill on this side

Return this form to a runner when complete.
Other Judging Details

Leaving early
If you as a judge must leave early (any time before your final project is judged), please turn in your schedule at the scoring table in the basement so that we can handle your absence.

Feedback Forms
Judges are the professional authority for the competitors. Please be sure you fill that role properly.

All rounds include written feedback to students given on very free-form full sheets of paper. In the top third, circle a few (one? two? three?) of the areas in which the student’s project excelled.

<table>
<thead>
<tr>
<th>PROJ ID</th>
<th>JUDGE ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______</td>
<td>_______</td>
</tr>
</tbody>
</table>

**JUDGING FEEDBACK**
PIKES PEAK REGIONAL SCIENCE FAIR 2017

**FAVORITE JUDGING AREAS (Circle as many as appropriate)**
- Project Selection
- Project Design
- Variable selection & Evaluation
- Procedure
- Data Measurements
- Notebook
- Data Analysis
- Results
- Backboard
- Verbal Presentation

**GOOD THINGS ABOUT THIS PROJECT:**

**CHALLENGE FOR THE FUTURE:**

In the next area, please try to pick two or three items to emphasize as positive feedback (even if science isn’t in their future, they may well become a politician voting on science!). Consider using simple sentences like these:

- I liked _______ best about your project
- You did a great job on __________
- _______ was really well done
- You did really well on __________ and __________

Some judges put a header (e.g., “Best parts of your project”) and list the parts they enjoyed below that.

It is often appropriate to offer a suggestion or idea for improvement; it is not a requirement. Don’t hesitate to do so – but please confine negative constructive feedback to one thought per judging session. Please avoid nasty words (i.e., don’t be like the mean judge on *American Idol*). Suggestions could be couched like “If
you had more time, you might have ____” or “If you wished to expand on this, you might ____” or even “The best way to improve your score for next time would be ____”.

Try to leave them with something concrete. Avoid: “Your analysis was just not up to par.” in favor of “Calculating the mean and variance for the distribution of your results would have strengthened your analysis.”

Feedback will in all likelihood be shared with both parents and teachers; please write feedback so that it is favorably received by all (and unlikely to generate litigation).

**Chairs**

If you prefer sitting while judging, don’t hesitate to ask the student to share the chair.

**Parallel Judging**

Both “special awards” and “backup” judges are judging the contestants, potentially at the same time as we (the Fair Award judges) are. The backup judges will work with us on the Grand Award winners.

---

### MULTIPLE JUDGES AT A PROJECT

Category judges (like you) have a certain “priority” in judging. You always get to judge a project (potentially with another category judge) on the provided schedule, even if other judges are there. Feel free to watch or to interrupt and explain that your schedule is immutable.

---

**Interviews: Arguing & Politics**

This is really hard! The students who are deeply invested in their projects often have extremely strongly held beliefs that they do not wish to justify or change. Besides the obvious actions to avoid (like being patronizing), please avoid “arguing” with the competitor. If they are sticking by an erroneous assumption or argument, mark the scoresheet and proceed after potentially probing a tiny bit.

Why? Judges don’t have enough time; everyone gets impatient; and a stubborn student will just walk away frustrated. None of these achieves our goals.

It should go without saying that politics has no place in judging a science fair. Please avoid bringing up any political issues (e.g., “You can’t study the number of abortions in Appalachia.”). No one will win; the Science Fair will lose. Besides, it’s really hard to change people’s minds about politics.

**Safety**

Before the judging starts, the PPRSF Safety Team checks all exhibits to make sure they conform to International Science Fair standards. If you as a judge find something questionable, please notify a runner to report this to the scoring table immediately (with the project ID, of course). Proceed to judge the project normally.

**Discretion**

Please ensure that any discussions you have are properly private. Students (competitors) are everywhere – even in bathrooms. Please be discreet. This again caused problems at a recent fair!
**Sensitivity/Harassment**

Please avoid harassment and discrimination/prejudice in its myriad forms: age, race, color, national origin, ancestry, religion, perception of gender, gestures, physical contact, and disabilities (including blindness and deafness). Please avoid improper remarks, gestures, physical contact, anything that might be construed even remotely as offensive.

**Judge This Year’s Research**

Note that only research conducted in the last 12 months is to be judged. Previous efforts can be discussed briefly but should not form a core of this year’s project. Request a runner to fetch the head judge if you think a project does not contain enough current research.

**Feedback no-no’s**

Please do not foretell or predict results. A casual, offhand remark like, “I’m sure you’ll win a prize,” makes headaches for the staff later when the student’s parents ask where the prize is. Students write letters; teachers write letters; it gets quite painful. “Great project; I hope you do well,” is fine. “This is fantastic; I’m sure you’ll go to the State Science Fair,” can ruin a complete science fair for the head judge who must undo the problem.

**Sample Questions**

To get your brain thinking on the sorts of questions to stimulate discussion with the contestant, here are some queries you might consider.

Before we get to the questions, though, let’s not ask: “Why is this project important to you?” I don’t see how that helps.

- You can always ask for the definition of a (presumably technical) word the contestant uses.
- In response to a question, contestant says, “I don’t know.” No problem. Your reply: “How would you figure it out?”
- When it’s time to probe peripheral knowledge, please preface your ever-more-challenging questions with: “I’ve got some questions slightly peripheral to your presentation, don’t be bothered if they are out of your area of expertise” or some students will get extremely nervous. Remember: even a second grader can corner the smartest people just by repeatedly asking, “Why is that?”
- Where did you get the idea for this project?
- What did you enjoy most?
- What problems arose during your investigation?
- How did you overcome them?
- Do your results indicate further study is needed?
- What is the purpose/objective of your study?
- What are some previous studies?
- What are the possible sources of error?
- How accurate are your measurements?
- What is/are your controls?
• Why did you do the statistical analysis the way you did? What does it mean?
• How many times did you repeat your measurements?
• Over what time period did you conduct your study?
• On what did you base your conclusions?
• Are there are any other approaches you might have taken to your research?
• What instruments did you use for your measurements?
• Tell me about the equipment you constructed yourself.
• What would you do differently if you were doing this again?
• Do you think you could continue development of this project?

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