# Teacher Tune-up

## Quick Content Refresher for Busy Professionals

## *How can students benefit from science fairs?*

The science fair is an opportunity for students to exhibit their skills as scientists while simultaneously developing their reading, writing, and speaking abilities. They engage in scientific practices while participating in a scientific micro-community. Your young scientists may later be able to share work with their peers across larger networks at the district or county level and beyond.

Science fairs can align well with standards, can help acculturate students to challenging academic contexts, and can also be adapted to the needs and interests of particular communities.

**Science Fairs Can Align Well with NGSS and CCSS Standards**


The four phases that make up the life cycle of a science fair—preparation, production, presentation, and reflection—provide the perfect opportunity for students to begin mastering the Next Generation Science Standards' (NGSS) essential science and engineering practices (SEPs). There are eight of these practices:

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

This list reflects the ways that scientists share explanations and engineers share solutions in the "real," professional world. With an emphasis on clear communication, the SEPs align nicely with the Common Core ELA standards' emphases on reading expository text and on using multiple sources of information to do research. Students participating in science fairs practice two fundamental skills from the Common Core in particular: (1) building knowledge through content-rich nonfiction; and (2) reading, writing, and speaking grounded in evidence from the text.

The following chart shows how a science fair project that follows the traditional "scientific method" format may align with the Common Core State Standards (CCSS).

| Common Core State Standards » English Language Arts | | **Science Fair special project** |
|---|---|---|
| **Writing History, Science and Technical Subjects** | Write arguments focused on discipline-specific content. *WHST.6-8.1* | Background |
| | Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. *WHST.6-8.2* | Procedure |
| | Write precise enough descriptions of the step-by-step procedures they use in their investigations or technical work that others can replicate them and (possibly) reach the same results. *WHST.6-8.3* | Procedure |
| **Research to Build and Present Knowledge** | Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. *WHST.6-8.* | Background and Entire Project |
| | Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. *WHST.6-8.* | Background |
| | Draw evidence from informational texts to support analysis, reflection, and research. *WHST.6-8.* | Background and Analysis |
| | Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. *WHST.6-8.* | Lab Journal, Data Collection, Analysis, and Conclusion |
| **Key Ideas & Details** | Cite specific textual evidence to support analysis of science and technical texts. *RST.6-8.1* | References |
| | Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. *RST.6-8.2* | Background |
| | Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. *RST.6-8.3* | Procedure |
| **Craft & Structure** | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics. *RST.6-8.4* | Background Research |
| | Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic. *RST.6-8.5* | Peer Feedback |
| | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text. *RST.6-8.6* | Peer Feedback |
| **Integration of Knowledge & Ideas** | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). *RST.6-8.7* | Presentation |
| | Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. *RST.6-8.8* | Peer Feedback |
| | Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. *RST.6-8.9* | Conclusion / Self-Assessment |
| **Range of Reading & Text Complexity** | By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently. *RST.6-8.10* | Background Research / Peer Feedback |
| **Speaking & Listening: Comprehension and Collaboration** | Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly. *SL.6.1* | Presentation / Q&A / Peer Feedback |
| | Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study. *SL.6.2* | Background Research / Peer Feedback |
| | Delineate a speaker's argument and specific claims, distinguishing claims that are supported by reasons and evidence from claims that are not. *SL.6.3* | Peer Feedback |
| **Speaking & Listening: Presentation of Knowledge and Ideas** | Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes. *SL.6.4* | Presentation |
| | Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details. *SL.8.4* | Presentation |
| | Use appropriate eye contact, adequate volume, and clear pronunciation. *SL.6.4, SL.8.4* | Presentation |
| | Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information. *SL.6.5* | Presentation |
| | Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. *SL.8.5* | Presentation |
| | Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. *SL.6.6* | Presentation |
| | Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. *SL.8.1* | Presentation / Q&A / Peer Feedback |

Beyond meeting the expectations of the NGSS SEPs and the Common Core, devising, developing, and displaying the science fair project gives students a taste of what many scientists and engineers report they spend over half their time actually doing: reading, interpreting, and producing text, both formal (journals, books, presentations, websites) and informal (discussion, email, phone calls, blogs, tweets).

**Academic Acculturation**

Science fair participation opens a gateway for students into the often-unwelcoming setting of an academic conference. This experience proves valuable whether or not the students later choose to pursue a STEM field in college and/or career. As their project progresses, students familiarize themselves with academic terms that they will later encounter in assessments and academia. We've identified dozens of terms from the Academic Word List that teachers and students can expect to use as they prepare for the science fair. Starred terms below are already highlighted as Focus Words in SciGen.

| | | | | | |
|---|---|---|---|---|---|
| abbreviate* | criteria | evidence* | justify | presume | scale* |
| abstract | data | evident | label | principal | sequence |
| accuracy* | deduce | exhibit | length* | principle | significant |
| affect* | define | expert | link | prior | simulate* |
| analyze | degree* | factor* | mass* | procedure* | speed* |
| bias | demonstrate | fair* | mechanism | process* | standard* |
| brief | determine* | format | media | professional | statistic |
| capacity* | develop* | framework | meter* | project | substance* |
| chart | deviate | frequency* | method | protocol | summary |
| claim* | device* | hypothesis* | model* | publication | survey |
| compare* | diagram* | identify* | monitor | publish | system* |
| conclude | displacement* | illustrate | objective* | qualitative* | task |
| conduct* | display | image | outcome | quantitative* | technique |
| confirm | distance* | incidence | pace* | range | technology |
| conflict | document | inference* | paradigm | rate* | testable* |
| consent | draft | initial* | parameter | ratio* | thesis |
| context | duration | innovate | pattern* | reaction* | topic |
| contradict | empirical | input | per* | relationship* | trial* |
| contrast* | equivalent | instruct | percent | represent* | unit* |
| controlling* | error | interpret* | phenomenon | require | variable* |
| convert* | estimate | interval | plausible* | research | visual |
| correlate* | evaluate | investigate* | precision* | resource | volume* |
| | | isolate | predict | result* | weigh |

**Adaptation to Your Community**

To address concerns critics sometimes have about school-based science fairs (such as questions of inequity, or too much parental meddling), try breaking science fair preparation into chunks over several weeks' time and work on it in class only. Some teachers assign individual projects, while others pursue whole-class projects. Both forms involve students brainstorming questions, researching, designing a controlled experiment, and writing.

You may want to ask your students to create projects that follow a traditionally defined "scientific method" and report their results on trifold presentation boards. However, you could also consider explicitly opening up the format of your school or district science fair, inviting students to innovate an approach that best suits them. Awards that recognize unusual categories such as creativity, oral presentation, and collaboration change the nature of the traditional science fair approach.

| **Potential Formats** | **Basics** |
|---|---|
| Standard Scientific Method Posters | *This format is fully fleshed out and backed up with readings and exercises in SERP's SciGen curriculum. Projects are usually presented on a trifold presentation board with accompanying models and other visuals.* |
| Mini-posters | *Similar to the Standard Scientific Method Posters, these are made from two standard file folders stuck together. With less surface area to cover, the stakes are not as high. This first foray into presenting a question and findings presents a lower threshold for teachers and students just wanting to get their feet wet.* |
| Lightning Talks | *Use the Ignite, Pecha Kucha, or TEDx resources to have your students present their findings onstage in a brief and lively form while accompanied by intriguing slides.* |
| School Maker Faire | *Maker Faire exhibits can be from any discipline — from science to art to gardening to engineering to craft. Students display projects or lead a hands-on activity in which they've developed expertise. See school.makerfaire.com for more info.* |
| Kids Inquiry Conference | *KIC replaces the competitive model emphasized in most science fairs and instead patterns itself after professional science conferences. Students share the excitement of their discoveries with students from different schools, critically consider the credibility of their own research, and draw upon the discoveries of other student-scientists. See https://eric.ed.gov/?id=EJ921139* |
| Invention Convention | *In this engineering-focused activity, students identify a need and follow the same research and development steps that inventors follow when patenting inventions. See eduplace.com/science/invention/ for more info.* |
| Bad Science | *Sometimes learning what something is "not" is the best way to understand what something is. With this approach, students lie with statistics and fabricate charts and graphs to persuade others to believe alternative facts. Subtler fabrications are a good way to test the critical thinking skills of peers.* |

***Keywords:*** *Science Fair, NGSS, CCSS, Common Core, standards, disciplinary literacy, exhibition, conference, presentation, student research*