

Systems of success: The George Washington Carver Science Fair

In March 2007, the George Washington Carver Science Fair will celebrate its 28th anniversary. The Carver Fair is a one-of-a-kind urban enrichment program that provides opportunities for students of Philadelphia County to engage in authentic scientific investigations. Over the years, the Carver Fair has provided rewarding experiences for students, teachers, judges, parents, and fair organizers.

The Carver Fair is a year-round endeavor, open to students from public, parochial, charter, and private schools as well as home-schooled participants. The Carver Science Fair Committee, which administers and runs the science fair, is composed primarily of school district personnel, university faculty and staff, museum educators, corporate employees, and community volunteers.

In the fall, teachers, students, and parents attend special orientations presented by committee members to learn about the science fair process. Safety issues are addressed during the orientation, in addition to being included in the printed handbook. Following the same safety rules and guidelines as the Intel International Science and Engineering Fair, Carver Fair participants must have their research plan approved by a teacher or scientist. Throughout the year, teachers and sponsors facilitate students' investigations. Sponsors may be a parent, scientist, afterschool instructor, or caring adult who mentors one or more students when a teacher is unable to do so. In February, judges are confirmed and may attend an orientation on judging criteria and techniques.

The actual competition takes place over the course of two weeks in late February or early March. Each week involves a separate day for display setup, judging, public viewing, and an awards ceremony. Approximately 800 fourth through twelfth graders compete annually for gold, silver, and bronze medals, special awards, and the opportunity to advance to regional, national, and sometimes international fairs. Specific project categories range from Earth science and botany to microbiology, engineering, consumer science, and team projects. Participants frequently return to compete year after year, while some of the participating schools have instituted science fair clubs, or set aside class time to assist students in completing their research. Anecdotal evidence has shown that many of the student participants have pursued science careers after graduation.

At the end of the science fair, all fifth-, sixth-, seventh-, and eighth-grade participants are invited to register for the



PHOTOS COURTESY OF THE AUTHORS

Teams of judges interview students at the 2006 George Washington Carver Science Fair.

Carver Summer Scholars Program. These young scientists spend their summer studying environmental issues and exploring natural science research laboratories.

Systems

When creating new educational programs, longevity is often the key to success. Over 25 years of trial and error, the Carver Fair has developed several effective ways of doing business. Most notably, many components of the Carver Fair have generated their own systems. These systems, or sequential methods repeated year after year, allow Carver Committee members to spend less time running a fair, which generates better results and higher student achievements.

The following are two examples of systems that, over time, have continued to improve the efficiency and quality of the Carver Fair.

Science fair judges

Working with science fair judges is an area in which longevity and developing systems has yielded significant results. In planning the Carver Fair, there are some constants and checkpoints that help keep everything and everyone coordinated. For instance, the secondary portion of the Carver Fair always

Kathleen Fadigan (kxf24@psu.edu) is an assistant professor of science education in the College of Education at Penn State Abington. **Nancy Peter** (npeter@sp2.upenn.edu) is the director of the Out-of-School Time Resource Center at the University of Pennsylvania's Center for Research on Youth and Social Policy in Philadelphia.

coincides with Temple University's spring break. With no classes scheduled all week, gymnasiums and classrooms are more readily available for setting up the project displays. In addition, holding the fair during spring break makes it easier to engage professors from science, math, engineering, and computer departments to assist in judging. Once the dates of spring break have been confirmed, the Carver Committee works backward to schedule the judges' recruitment, correspondence, and training. Members of the committee must understand and commit to their individual roles and responsibilities in the overall process.

Throughout the year, judges are recruited from the professional education and scientific communities, giving the fair an elevated level of importance for students, schools, and the community. Research labs, pharmaceutical companies, museums, universities, and local chapters of professional organizations (such as Association for Women in Science [AWIS] and the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers) often encourage their employees and members to participate. New judges' contact information is immediately added to a database, which facilitates easy communication. Starting early in the school year and adhering to a schedule ensures adequate time to recruit judges and send out confirmation letters and reminders. The internet has become a great time-saver in terms of speeding up communication. New judges are invited to an optional "Judges Orientation" where the history of the fair, the particulars of the judging process, and tips for good judging practices are reviewed and practiced.

The logistics of the judging days become more streamlined each year. When the judges check in on the morning of the science fair, they receive a preassembled folder, which includes all of the forms and information for the day, a nametag, and the category and project numbers they are scheduled to judge. Next, volunteer staff direct judges to a reception area with a continental breakfast and a place to stow their belongings. Approximately 10% of the judges cancel or don't show up, so some assignment shuffling is inevitable unless a surplus number of judges is procured.

Judging tends to run smoothly when the judges are organized into groups of three, and each group is assigned 6–10 projects. It is also beneficial to pair up new judges with those who have had previous science fair experience. The Carver Fair sets aside an entire day for the judges to evaluate the projects, without students present in the morning.

This system allows the judges to thoroughly review the projects, read students' logbooks, and develop questions to ask students during an interview session held later in the day.

Five- to ten-minute interviews allow students to present their projects to the judges and clarify any questions the judges had prior to meeting them. For younger students this can be frightening. Carver Committee members prepare the judges for the interviews by reminding them that their goal is to ensure that participants walk away having had a positive experience—which will hopefully motivate them to continue scientific pursuits in the future. There is nothing worse than a judge who criticizes a student's hard work in a nonconstructive manner. Judges are advised to designate a lead judge who will do most of the talking, so as not to overwhelm students with questions. Judges are told to be mindful of their body language and, if possible, position themselves so that they are eye-level with students.

Another part of the judging system directly benefits students. After selecting winners, a final task for the judges is to provide students with a written evaluation. An easy-to-complete form is included in the folder the judges receive at check-in. Students are very eager to read the judges' comments. Judges complete at least one form for every student, and provide constructive criticism and advice for continuing their research.

It is impossible to over-thank the judges for their time and energy. The Carver Fair employs verbal appreciation, certificates of participation, and thank-you letters.

The Summer Scholars Program

The Carver Summer Scholars Program operates with many similar systems in place. Again, setting dates early allows plenty of time for recruiting students. The only advertising that is done is a two-page flyer/registration form. For the past several years, all 60 available slots in this research-oriented camp have been filled long before the registration deadline.

In each of the two, three-week sessions, campers develop a research project from scratch. On the last day of the summer program, students present their research findings in a mini-science-fair format. Judges are recruited and oriented using the same systems for the larger fair. All of the students not only receive prizes for their efforts, but also leave the camp with a research topic that they can expand and improve upon when the entire process begins again in the fall.

The Carver Medal awarded to science fair winners was designed by Edythe Kegrize, the first place winner in 1976.



Conclusion

The George Washington Carver Science Fair has been administered by an informal group of dedicated volunteers for over a quarter of a century. Because there is no salaried director, and because committee members change from year to year, effective systems have taken a long time to coalesce. As the fair continues its next 25 years of operation, systems for communicating with diverse schools and

school systems, effectively engaging teachers and families, implementing effective fundraising strategies, promoting the fair locally and nationally, recruiting and maintaining committee members, and other important responsibilities will, hopefully, continue to develop successfully.

Individuals and groups interested in conducting their own competition are encouraged to visit the websites listed below. The Carver Committee is willing to share

FIGURE 1 Student project feedback form and judge's comments

Project number _____

Date _____

Dear Student:

We would like to explain in detail the comments we have concerning your project, but time does not permit us to do this in person. We have collected our comments and listed them for your project below to help give you some idea of our evaluation.

We appreciate the hard work and effort you put into this project and commend your efforts. We encourage you to continue your interest in science and engineering and your work in research. Thank you for participating in the George Washington Carver Science Fair. We wish you the very best in all your future work in science.

Strengths of project		Areas for improvement	
Originality of topic		Quality of display board	
Originality of methodology		Rethink procedures	
Size of data sample/number of trials conducted		Reduce the number of variables	
Careful and thorough data analysis		Improve graphs/charts analysis	
Conclusions follow data		Use more graphs/charts	
Use of scientific processes		Follow scientific processes	
Graphs/tables presented clearly		Use of control/control group	
Use of laboratory skills/techniques		Increase sample size	
Use of statistics/math skills/calculations		Clarify project's statement of problem	
Application of project (relevance to real-world issues)		Clarify hypothesis	
Background research		Use additional statistical analysis	
Thorough and current bibliography		Expand research	
Excellent interview skills		Update/expand bibliography	
Good understanding of scientific principles		Interview/communication skills	
Attractive/well-prepared display board		Originality of topic	
Understanding of technical terms		Understanding of technical terms	
Statement and fulfillment of engineering goals (<i>engineering category only</i>)		Statement and fulfillment of engineering goals (<i>engineering category only</i>)	
Teamwork/cooperation (<i>team projects only</i>)		Teamwork/cooperation (<i>team projects only</i>)	

Additional comments:

its expertise and will continue to improve the resources available through its website. The authors have recently developed a web page linked to the Carver Fair website listed below for teachers to share their own science fair resources.

Resources

The Delaware Valley Science Fair—www.drexel.edu/dvsf.
 The George Washington Carver Science Fair—www.temple.edu/carversciencefair.
 Intel International Science and Engineering Fair—www.sciserv.org/isef.

FIGURE 2 2006 George Washington Carver Science Fair judges' registration form

Your Name: _____ Organization: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone (day): _____ Phone (eve): _____ E-mail: _____

Have you been a judge at the Carver Fair before? yes no If so, how many years? _____

Have you judged at science fairs other than Carver ? yes no If so, which? _____

Name and address of another individual to contact about being a judge (list additional names on back):

His/Her Name: _____

Address (or e-mail): _____

City: _____ State: _____ Zip: _____

Please indicate in which fair(s) you will participate. If you can judge at only one of the two fairs, your participation in the secondary (grades 7–12) fair would be preferable.

Grades 4 through 6: Tuesday, February 28, at The Academy of Natural Sciences. Please rank your three preferred judging categories. This will allow the Carver Committee to estimate judges' distribution across subject areas. PLEASE note that you will formally select your judging category when you arrive at the fair.

- Life Science
- Earth Science
- Physical Science
- Consumer Science

Grades 7 through 12: Tuesday, March 7, at Temple University. Please rank your three preferred judging categories. This will allow the Carver Committee to estimate judges' distribution across subject areas. PLEASE note that you will formally select your judging category when you arrive at the fair.

- Behavioral/Social Sciences
- Chemistry
- Medicine & Health
- Zoology
- Biochemistry
- Computer Science
- Microbiology
- Consumer Science
(for seventh and eighth grades only)
- Botany
- Earth/Space Sciences
- Environmental Science
- Mathematics
- Physics
- Team Projects

Please mail, fax, or email this form/information, no later than FRIDAY, FEBRUARY 24, 2006, to:

Sharon Angus-Smith, Judges Coordinator
 George Washington Carver Science Fair Committee
 The Academy of Natural Sciences
 1900 Benjamin Franklin Parkway
 Philadelphia, PA 19103-1195
 Email: angussmith@acnatsci.org
 Phone: 215-299-1057