

Science Literacy for a Changing Future

Excelling With Atlas of Science Literacy

Scholarships Bring K-16 Educators to Workshop

With funding for professional development limited in many schools and universities, educators must make tough decisions about which programs—if any—to participate in each year. Yet professional development can help teachers enhance their content and pedagogical knowledge, strengthen their professional identity, and learn new ideas and strategies to share with colleagues. Thanks to donations from AAAS members and friends to the AAAS Fund for Excellence, Project 2061 is able to give science and mathematics educators the opportunity to attend a unique professional development workshop at no charge.

Since 2004, Project 2061 has awarded scholarships to its popular "Using *Atlas of Science Literacy*" workshop that cover the full registration fee for recipients. There have been 31 scholarship winners so far: K–12 teachers, teacher educators, university professors, and administrators from all over the United States and abroad. At an *Atlas* workshop in March at AAAS headquarters in Washington, DC, six scholarship winners were among the nearly 50 educators who gathered to learn more about improving science teaching and learning.

A Standards-Based Approach

"We are so grateful for the Fund for Excellence donations, which make it possible to bring such worthy educators to our workshops," said Dr. Jo Ellen Roseman, director of Project 2061. "The dedication of the scholarship recipients has been impressive, and we support them as they put *Atlas* maps to work in standards-based reform in their schools and districts."



The three-day workshop helps participants use *Atlas of Science Literacy* and other Project 2061 tools to enhance their under-

standing of science literacy and to improve curriculum, instruction, and assessment. The conceptual strand maps in *Atlas* show how students' understanding of the ideas and skills that lead to literacy in science, mathematics, and technology might grow over time. Each map depicts how learning goals for a particular topic relate to each other and progress from kindergarten through grade 12.

Workshop participants learn about how strand maps are developed and how the maps can help to clarify national, state, and local standards. They also consider the ways in which strand maps can aid in the evaluation and creation of science curriculum, in the analysis of assessment tasks, and in fostering coherence within and across topics.

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Project 2061 senior program associate Ted Willard (third from left) with the March 2006 scholarship recipients (from left to right): Lynne Hehr, Patricia Stinger-Barnes, Michael Beeth, David Squires, Bangping Ding, and Danae Wirth.

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Jo Ellen Roseman

"The *Atlas* maps inspire all of us to think carefully about the growth of students' understanding from grade to grade."

FROM THE Director The Appeal of Atlas

The connections among key ideas and skills depicted in the strand maps of *Atlas of Science Literacy* have long been a part of Project 2061's thinking and the thinking we foster in the educators who use our tools. From the beginning, we took into account the conceptual steps along the way to science literacy. Deciding on the adult literacy goals in *Science for All Americans* often involved imagining what the conceptual steps would be and whether they were feasible for all students. When we then set out to identify in *Benchmarks for Science Literacy* what students need to learn from K to 12 to achieve those adult literacy goals, attention to connections among the benchmarks was integral to the work.

Even so, the usefulness of the strand maps—and their popularity among teachers—has surpassed our expectations. *Atlas* has sold more than 20,000 copies and our *Atlas* workshop continues to be in demand. The visual appeal of seeing how benchmarks relate to each other on the maps is matched by their conceptual appeal—they give us a new way of thinking about science literacy that goes beyond the acquisition of isolated facts. The ability to appreciate important connections among ideas is crucial to becoming science literate. To help promote this ability, the new *Atlas* maps now in development (see page 4) are more explicit about the relationships among ideas within and across content areas.

As we prepare the second volume of *Atlas* for publication, it is evident how central the process of mapping has become to all of Project 2061's work. In the past few years, we've created specialized maps to analyze the coherence of textbooks' treatment of key science ideas and to support our analysis and development of assessment items aligned to standards. Materials developers with whom we work use maps to guide the design and sequencing of activities. And our digital library collaborations have shown the promise of interactive strand maps for accessing standards-based resources online.

All of this work is indebted to Andrew "Chick" Ahlgren, who passed away this spring. Chick's commitment to thinking through the rich fabric of understanding we expect students to learn found a lasting form in the innovative strand maps he was so instrumental in developing. Chick understood that the enduring value of the strand maps to educators is not in telling teachers exactly what or how to teach. Rather, the maps inspire all of us to think carefully about the growth of students' understanding from grade to grade. Only then can we plan what students can be expected to learn and how best we can help them do so.

DE Ellen Koseman

To contact Project 2061 staff, visit www.project2061.org/about/contact.htm.

AAAS Resources for Educators

New Education Forum in Science

A new science-education section debuted in *Science* magazine in January 2006. *Science*'s Education Forum, published in the last issue of every month, provides a voice for the community interested in the multifaceted world of science education and the science of education. The two-page section partners *Science* with the Howard Hughes Medical Institute (HHMI) and showcases peer-reviewed research, as well as scholarly literature reviews, essays, and other original content on science education. Articles in the Education Forum series have included "Preparing Minority Scientists and Engineers," "Technological Advances in Inquiry Learning," and "Planning Early for Careers in Science."

Science and HHMI work with an advisory committee on this series. Science has full editorial responsibility for the content. For more information about the Education Forum section, including how to submit a manuscript for consideration, visit www.sciencemag.org/sciext/educationforum.





Project 2061's Guide for Teaching Evolution

AAAS Project 2061 has created a new guide to help teachers convey key evolution concepts to their students. Copies were distributed at a special event for St. Louis-area teachers at the 2006 AAAS Annual Meeting in St. Louis. The "Evolution on the Front Line" event brought together several hundred teachers, scientists, students, and others to discuss the challenges confronting science teachers and the resources that teachers can tap as they seek to preserve scientific integrity in the classroom.

- ► To read the Project 2061 evolution guide free online, visit www.project2061.org/ evolutionguide.
- To see more on the St. Louis event, including videos and speaker presentations, visit www.aaas.org/programs/centers/pe/evoline/index.shtml.

Science News for Kids

"Do apes plan ahead?" "A step toward robots with a human touch." "Antarctica's hula hoop of water." You'll find these and many more kid-friendly news stories at *Science* for Kids online. Every week, the page features a new study published in AAAS's *Science* magazine. Visit **www.eurekalert.org/scienceforkids**.



New Atlas Coming Soon

Atlas of Science Literacy includes about half of the learning goals in *Benchmarks for Science Literacy*. The second volume of *Atlas* will map the remaining goals into some 40 new strand maps. Each new map undergoes several rounds of evaluation by Project 2061 staff, followed by reviews from outside scientists and science educators who are experts in the topic covered in the map and are knowledgeable about the relevant research on student learning. Below is a selection of the maps in development for the forthcoming volume of *Atlas*, due out in 2007:

- ► The Scientific Community
- Mathematical Applications
- ► Technology and Science
- ► Weather and Climate
- Electricity and Magnetism
- Diversity of Life
- Human Development
- Global Interdependence
- Energy Sources and Use
- Health Technology
- Shapes
- Copernican Revolution
- Classical Mechanics
- Relativity
- Explaining Evolution
- Models
- Manipulation and Observation
- Critical Response Skills

Visit www.project2061.org/

publications/atlas to find more information about *Atlas of Science Literacy*, including drafts of new maps.





Excelling With Atlas of Science Literacy

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Supporting Teacher Educators

"I wouldn't be here if I didn't have the scholarship. It was absolutely essential," said Patty Stinger-Barnes about the March workshop. An instructor of education at Carson-Newman College in Tennessee, Stinger-Barnes works with pre-service teachers who go on to teach science in rural schools throughout the southeast. With cutbacks on travel funds at her college and mounting expenses as she completes her Ph.D. in teacher education, the AAAS scholarship helped Stinger-Barnes fulfill her goal of attending an *Atlas* workshop.

"The workshop helped me to see how all the tools Project 2061 has to offer fit together so I can apply them to my pre-service teacher education," noted Stinger-Barnes. "Our graduates are looked to as models in the region, so I need to keep the quality of my instruction high and keep up-to-date on curriculum reform."

Lynne Hehr also plans to apply the workshop experience to her work with teachers. As director of the Center for Math and Science Education and the Arkansas NASA Educator Resource Center at the University of Arkansas, Hehr provides professional development and education outreach to the K–16 science education community. "The workshop will definitely inform my graduate course for K–4 teachers as I ask them to examine what science they are teaching and why, and to think about how the learning in different grades ties together," said Hehr. "There is a real need for teachers to make curricular decisions based not on favorite lessons, but on alignment to standards."

As someone who provides professional development opportunities to others, the *Atlas* workshop was a welcome change of pace for Hehr. "When you're an administrator who works to secure awards for teachers, you don't usually have an avenue to obtain this type of funding for yourself," Hehr said. "But having some professional development of my own challenges me and enriches what I have to offer others in the future."

Practical Applications

The scholarship winners appreciated the workshop's activities and group projects that focused on applying Project 2061's standards-based approach to practical tasks like devel-





Science educators sharing ideas at the March "Using Atlas of Science Literacy" workshop in Washington, DC.

oping standards, improving instruction, and designing a curriculum. "Right now I am helping to develop the science power indicators—the standards—for our local school system," said Danae Wirth, a

"The workshop helped me to see how all the tools Project 2061 has to offer fit together so I can apply them to my pre-service teacher education."

Master Science Teacher for Elkhart Community Schools in Indiana. "*Benchmarks for Science Literacy*, the *Atlas*, and *Science for All Americans* are resources I fall back on to decide which standards are the base-line for each grade level. The workshop pointed me in the right direction in formulating a reasonable scope and sequence for our own indicators."

Such practical uses for Project 2061 resources also resonated with Dr. David Squires, an associate professor of educational leadership at Southern Connecticut State University. "The next time I teach my curriculum course for people training to be principals and superintendents, I will have the students try to create an *Atlas*-like product using our state standards," said Squires. "Then, as we move through a few curriculum development models, I will also have them purchase the *Designs for Science Literacy* book for its practical advice on how to use the standards to develop tasks for units."

Scholarships Available

Like Dr. Squires, all of the scholarship recipients are selected in part for their potential to share with other educators what they learn at the workshop. Awardees are also selected based on their level of interest in science and/or mathematics education at the local, state, national, or international levels and their need for financial support.

Scholarships are available for the following "Using *Atlas of Science Literacy*" workshops in 2006:

- October 16–18, in Washington, DC
- ▶ November 15–17, in Batavia, IL
- December 12–14, in Portland, ME

Project 2061 welcomes applications and seeks participants from diverse backgrounds and geographic areas.

For more information about workshops and scholarships, including application deadlines, visit www.project2061.org/workshops.

The Fund for Excellence: How You Can Help

When you make a gift to Project 2061 through the AAAS Fund for Excellence, your donation is used to provide scholarships for K–12 teachers and teacher educators to attend the "Using *Atlas of Science Literacy*" workshop at no charge. For your convenience, a return envelope has been provided in this newsletter.

The Fund for Excellence generates private support for AAAS through tax-deductible contributions made by members and friends of the Association. All donors of \$100 and above are recognized in the corresponding AAAS Annual Report.

You can also contribute to Project 2061 online at http://www.aaas.org/aboutaaas/ giving. Your support is deeply appreciated.

About AAAS and Project 2061

Publisher of the peer-reviewed journal *Science*, the American Association for the Advancement of Science (AAAS) is the largest general scientific organization in the world. Its education initiative, Project 2061, has been at the forefront of the K–12 reform movement

- Defining science literacy and promoting it as a goal for all Americans;
- Developing K–12 benchmarks for student learning in science, mathematics, and technology;
- Producing a wide range of innovative tools for educators—books,
 CD-ROMs, and online resources to guide their reform efforts; and
- Conducting research on the design and use of curriculum materials, assessment, professional development, and other areas of science teaching and learning.

AAAS gratefully acknowledges the following Project 2061 supporters over the past 20 years: Carnegie Corporation of New York, Hewlett-Packard Company, John D. and Catherine T. MacArthur Foundation, Andrew W. Mellon Foundation, Noyce Foundation, David and Lucile Packard Foundation, Dew Charitable Trusts, Siemens Foundation, and the National Science Foundation.

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Translating Research Into Practice

An Interview With Page Keeley



Page Keeley is senior program director, K–12 science, at the Maine Mathematics and Science Alliance (MMSA), a nonprofit organization that works to improve science and mathematics education in Maine and northern New England. A longtime collaborator with Project 2061, Keeley works primarily in the areas of teacher leadership, science professional development, standards, mentoring, and formative assessment. Prior to joining MMSA in 1996, she taught middle and high school science for 15 years. Susan Shuttleworth of Project 2061 recently interviewed Keeley by e-mail about her latest endeavors.

SS: When did you first become involved with Project 2061 and how did that influence your work at MMSA?

PK: My first experience with Project 2061 was attending a presentation at a National Science Teachers Association regional convention before *Benchmarks for Science Literacy* came out. I

had read *Science for All Americans* and wanted to learn more about Project 2061's goals for K–12 science. I bought a copy of *Benchmarks* as soon as the first edition came off the press. I still have my cherished, dog-eared first copy.

Project 2061 has been ahead of the curve in its focus on goal-oriented teaching—emphasizing the need to first identify and clarify the meaning and intent of a learning goal and understand how it fits into a web of interconnected ideas. I brought this focus into my work with Maine schools in order to change their thinking from short-term, quick fixes that do little to improve teacher practice and student learning, to "Using Project 2061's textbook analysis procedure, adapted for Web resources, is going to be important as more and more educators turn to digital means for selecting instructional content."

long-term, hard work that pays off in knowledgeable teachers and students.

SS: You are currently collaborating with Project 2061 on the project "Phenomena and Representations for the Instruction of Science in Middle Schools" (PRISMS). Tell us about this project and how it will help middle school science teachers.

PK: Maine is currently the only state that provides laptop computers to every middle school teacher and student. Likewise, digital resources are replacing textbooks in Maine science classrooms. However, the quality of the resources that exist on the Web is questionable. The PRISMS project, with support from the National Science Foundation (NSF), will build a collection of digitally based phenomena and representations aligned to *Benchmarks* and describe the quality of their instructional support. This collection will be accessible through the National Science, Technology, Engineering, and Mathematics Education Digital Library (NSDL). I think this use of Project 2061's textbook analysis procedure, adapted for Web resources, is going to be important as more and more educators turn to digital means for selecting instructional content.

SS: You have recently completed the NSF-funded project "Northern New England Co-Mentoring Network" (NNECN), which involved teachers from Maine, New Hampshire, and Vermont. What did you accomplish with this project and how did you use Project 2061's tools? PK: NNECN was a four-year program to develop leadership through mentoring with 80 middle and high school science and mathematics mentor teachers and 240 new teachers. Unlike most district induction programs that provide generic mentoring in survival skills, general pedagogy, and school procedures, our project took a content-focused approach to ensure that new teachers focused on learning goals, were aware of research on student ideas, and could select appropriate strategies for the content they were teaching. We provided every mentor and new teacher with a "toolkit" that included Project 2061's tools as well as other national standards documents. The mentor teachers received a three-year program of professional development in using the tools in their mentoring role.

One of our key findings was that new teachers were energized by the deep, intellectual conversations that came from engaging in mentoring activities with Project 2061's tools. The assumption that new teachers couldn't handle learning about standards and research in their first two years because of all the pressures they faced was dispelled.

SS: Tell us about the two books you have recently published, *Science Curriculum Topic Study: Bridging the Gap between Standards and Practice* and *Uncovering Student Ideas in Science: 25 Formative Assessment Probes (Volume 1).*

PK: The curriculum topic study book, another NSF project, began as a tool we used in our NNECN project. I was looking for a way to expand Project 2061's study of a benchmark so that it could be used in a broader context. Essentially, the book is a collection of vetted readings, organized by curricular topic (147 topics in science, 92 in math), with a process for guiding teachers to apply the teachings in a curricular, instructional, or assessment context.



The formative assessment probe book also took root in the NNECN project. I developed a set of probing assessments that could be used by mentors and new teachers to examine student thinking. The research from chapter 15 of *Benchmarks* and the key ideas in *Benchmarks* were used to inform the development of the probes.

SS: As someone who has worked with Project 2061's tools and as a collaborator, how do you think the project can best support science education in the future?

PK: One of the things I most admire about Project 2061 is that it always stays the course. Other organizations change their focus and strategies depending on the prevailing wind. Project 2061 should stay true to its original vision of long-term reform.

I am also very concerned right now about what is happening to elementary science. Because of the pressures of testing in mathematics and reading, elementary schools are dropping science altogether. Anyone who has studied Project 2061's *Atlas of Science Literacy* knows that science literacy comes from a progression of K–12 learning. The ill-informed decision to put off science until middle school is going to have a huge ripple effect. I would like to see Project 2061 help educators understand the importance of elementary science and recognize that science literacy and language literacy can complement each other through a coherent K–12 science program.

SS: What is ahead for you?

PK: Project 2061 has done an incredible job of translating research into practice for science educators. Working with Project 2061 as a practitioner has deepened my respect for the work researchers do to develop tools that help educators. I think I would like to get my doctorate in science education so that I can contribute to education research and teach in a university.

To learn more about the Maine Mathematics and Science Alliance and its current projects, visit www.mmsa.org.

Online Update

Project 2061 staff have contributed two chapters to *The Impact of State and National Standards on K–12 Science Teaching*, a new book edited by Dennis W. Sunal and Emmett L. Wright. To read the chapters and learn more about the book, visit **www.project2061.org/impact**.

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Address Correction Requested

Announcements & Events

Golden Fund Awards

Project 2061 has begun two new projects funded by AAAS's William T. Golden Fund for Program Innovation. Both projects build on Atlas of Science Literacy, Project 2061's popular collection of strand maps that show how K-12 learning goals for particular topics relate to each other and progress from one grade level to the next. "Exploring the Nature of Science with AAAS's Atlas of Science Literacy" will create a booklet that introduces Atlas to the informal science community, parents, and other members of the public. The booklet will present a set of Atlas maps that describe some of the basic assumptions that make up the scientific worldview, how scientists go about their work, and the general culture of the scientific enterprise. "Developing a Unified Interface for Accessing K-12 Teaching Resources: Interactive Strand Maps" will produce a prototype for interactive digital Atlas maps that provide educators with free and easy access to carefully selected instructional resources linked to national and state learning goals.

Honors for CCMS

The work of two researchers affiliated with the Project 2061-led Center for Curriculum Materials in Science (CCMS) was honored at the 2006 annual meetings of the National Association for Research in Science Teaching (NARST) and the American Educational Research Association (AERA). CCMS doctoral student **Leema Kuhm** of Northwestern University won the award for the best paper presented at NARST's 2005 annual meeting. Kuhn's paper focused on her research conducted in Chicago classrooms on middle school students' argumentation. CCMS Early Career Research Associate **Iris Tabak** won the AERA's 2006 Jan Hawkins Award for early career contributions to humanistic research and scholarship in learning technologies. Tabak, an assistant professor in the education department at Ben Gurion University of the Negev in Israel, researches cognitive and sociocultural theory and draws on this theory to design advanced tools for learning. Learn more about CCMS at **www.ScienceMaterialsCenter.org**.

Introducing...

Abigail Burrows joins the staff as a senior project coordinator for Project 2061's assessment work. Most recently, Burrows was a field instructor at IslandWood Outdoor Education Center on Bainbridge Island, WA, where she extended her science education background by using the environment as a classroom for elementary and middle school students. She holds a B.A. in geography with a physics minor from Syracuse University and a Graduate Certificate of Education for Environment and Community from the University of Washington. Kristen Lennon is a new research associate for assessment. Previously, she was a research consultant specializing in plant biology. Her experience also includes postdoctoral research at Purdue University in the Department of Biological Sciences and at Iowa State University in the Department of Plant Pathology. Dr. Lennon earned a Ph.D. in cell, molecular, and developmental biology from the University of California, Riverside, and a B.A. in botany from Connecticut College.

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