

Project 2061 American Association for the Advancement of Science

Project 2061's Influence on Reform

"More than 80% of the state leaders we talked with said Project 2061 had played a major role in defining science literacy in their states," says SRI International's Andrew Zucker. An independent applied research firm that is studying systemic education reform nationwide, SRI released its findings on a year-long evaluation of Project 2061's impact and influence this fall. The study

finds that Project 2061 has had a "broad and substantive impact that. . . has changed the terms of the national discussion on science education reform." Zucker also points out that this is the first evaluation of its kind to assess the impact of a long-term reform initiative like Project 2061. The study reveals that Project 2061's efforts at the national, state, and local levels have paid off in many of the ways the project had anticipated. But there were some unexpected benefits as well.

Guiding National Reform Efforts

According to SRI, "Science for All Americans and Benchmarks for Science Literacy [are] broadly recognized as authoritative, timely, and useful steps toward national science education standards." The National Research Council drew on them extensively for its *National Science Education Standards*. One member of the standards development team reports that "Project 2061 served as the NRC's conscience. We knew that whatever we wrote would. . . have to be of the highest quality, focused on equity, and decidedly non-elitist."

SRI cites Project 2061's impact on the National Science Education Standards as "one of its major contributions to date...." Indeed, SFAA and Benchmarks entered the reform debate when the nation was hungry for ambitious national standards, so it is not surprising that educators continued on page 2



Science Literacy for a Changing Future

Mathematics Natural Sciences Social Sciences Technology

Influence on Reform continued

SRI's Methodology

SRI staff used four research questions to guide its evaluation:

- To what extent have national reformers, state science curriculum framework developers, and science curriculum materials developers used *Science for All Americans* and *Benchmarks for Science Literacy*?
- How do these audiences, along with state science supervisors and leaders of state science associations, use Project 2061?
- What are the impacts of Project 2061 workshops on teachers, teacher leaders, and teacher educators?
- How can Project 2061 increase its impact on all audiences?

SRI employed the following data collection strategies to answer these questions:

Expert interviews. SRI interviewed approximately two dozen experts in science education and representatives of some commercial and nonprofit curriculum developers.

Document review. The evaluation team examined a number of state science curriculum frameworks. Experts then assessed a subset of the frameworks, two elementary and two secondary biology textbooks, and other key science education reform publications.

Telephone surveys. Telephone surveys were conducted with state science supervisors, state professional association leaders, and others involved in developing state curriculum frameworks.

Mail surveys. Teachers, teacher leaders, and teacher educators who attended Project 2061 workshops were surveyed by mail.

Case studies. SRI conducted site visits in Colorado, Georgia, New Jersey, New York, South Carolina, and Wyoming to gather information about the impact of Project 2061 at the state and local levels.

For a summary of the SRI evaluation, contact Project 2061, 1333 H Street, NW, P.O. Box 34446, Washington, DC 20005; (202)326-6666; Electronic mail: project2061@aaas.org 2 and leaders across the country turn to these documents to guide their reform efforts.

Project 2061's sway at the national level doesn't end with standards. Two influential federal programs that have embraced standardsbased reform—the Statewide Systemic Initiative program of the National Science Foundation and the U.S. Department of Education's Eisenhower Mathematics and Science Education Program have explicitly identified *Science for All Americans* as a model for state frameworks. SRI reports that both agencies "urged states and local districts to incorporate or demonstrate consistency with Project 2061's vision of science literacy in their proposals for important federal initiatives." This in turn has helped increase the project's impact at the state level.

MAKING HEADWAY IN THE STATES

In interviewing reform leaders from 27 states, SRI found that a "remarkably high percentage (90%) of them currently use or refer to *Benchmarks* in their day-to-day work, and nearly twothirds (64%) of them indicated that they use *Science for All Americans*..." Since 1990, the project has involved systemic initiative site leaders in workshops and in many of its research and development efforts. As a result of this collaboration, many systemic initiative sites—including Georgia, New Jersey, Philadelphia, San Antonio, and San Diego—are using *Science for All Americans* and *Benchmarks* in their reform efforts.

"After reviewing dozens of documents, the committee responsible for revising our state science guide voted unanimously to use Project 2061 for guidance. Benchmarks was the driving force behind our work," says Kevin Beardmore, Indiana's state science supervisor. His sentiments are echoed throughout SRI's evaluation. The study found that state leaders use Project 2061 most often to design curriculum frameworks and that "[a] background knowledge of Project 2061 infused the writing process and contributed to the overall tone and purposes of the frameworks. The resulting documents include bibliographic references to SFAA and Benchmarks, quotations to help establish visions of science literacy, and organizational schemas similar to that of Project 2061."

Reaching Educators

Of the teacher educators who participated in Project 2061 workshops, 90% use Benchmarks and 92% use Science for All Americans. The project is designing its workshops to help educators use these tools more effectively. Although the workshops that SRI evaluated were part of Project 2061's research and development process, almost 90% of the participants surveyed reported that they were beneficial. Teachers and teacher leaders alike reported changing their classroom practices. Participants appreciated the opportunity to discuss science education reform with colleagues from many backgrounds and to "interact with people from different educational realms." Based on this input, the project will build into future workshops more opportunities for participants to exchange ideas and establish peer networks.

LOOKING AHEAD

Although Project 2061 has not expressly sought to influence textbook content, SRI reports that textbooks are nonetheless beginning to reflect the project's vision. And because Project 2061's curriculum analysis tools may be useful to state and district textbook selection committees, textbooks are likely to show Project 2061's influence to an even greater extent in the future. The project expects to collaborate with publishers more frequently to work toward these changes.

Project 2061 has also influenced textbook selection. All three districts in SRI's case study of Georgia use Project 2061 principles as criteria in selecting science textbooks. One district rates potential texts specifically on their alignment with *Benchmarks*. Serendipitous to be sure, but these impacts offer new opportunities to influence the course of reform.

All of these indicators suggest that Project 2061 has been on the right track. But what about the future? Says Dr. F. James Rutherford, Project 2061's director, "The SRI study highlights our contributions to science education reform in the last decade. To sustain our progress, we will continue to develop reform tools that educators can use to develop curricula, improve teaching, and evaluate student learning in ways that promote science literacy for <u>all</u> students."

Introducing Pinky Nelson

For Dr. George "Pinky" Nelson, the path from astronaut to education reformer was only logical. An astronomy professor, university administrator, and former NASA astronaut, Dr. Nelson spearheaded the University of Washington's efforts to improve K-12 science and mathematics education. Earlier this year, he joined the AAAS National Council on Science and Technology Education, which oversees the work of Project 2061. Last month, he became Project 2061's Deputy Director. Project 2061 staff member Natalie Nielsen interviewed Dr. Nelson to find out more about his perspective on science education.

NN: What drew you to education?

PN: I come from a family of teachers, so I've always been interested in education. I also share H.G. Wells' opinion that "the future is a race between education and catastrophe." When I worked at NASA, I spent time in schools talking to kids, teachers, and principals. That got me interested in what drives K-12 science programs and why they don't seem to be effective for most students. At the university I started thinking about how we train teachers and how we educate the public about science. We don't seem to be doing a very good job of either.

NN: Was your science education different from what you observed in your school visits?

PN: I was in 2nd grade when Sputnik was launched, so I rode that whole wave of science education reform through the late 50's and 60's. I got a superb education in rural Minnesota during a much simpler time. The problems faced by schools, communities, and families today are much more complex.

Schools have always done a pretty good job of educating some kids. For white males who are predisposed to science, we still do a very good job. But what should we be doing for <u>all kids</u>—not just future scientists or engineers? This is a question that Project 2061 has been trying to answer. It's what interested me in the project. **NN:** Tell us about your involvement in science education at the University of Washington.

PN: Although it really wasn't one of my jobs when I began at the university, I have been involved in a number of efforts at the K-12 and the university level. I have an adjunct appointment in the college of education, which allows me to teach classes there. For the last three years I've conducted a seminar in science education. We bring together faculty and graduate students from the sciences, mathematics, engineering, and education, along with classroom teachers from area schools to discuss science literacy and education reform. The first year our primary texts were *Science for All Americans* and *Benchmarks*.

NN: How were your efforts received?

PN: My goals were modest. I knew that many of the scientists at the university would not want to take time away from their own work. But I started with a small core of very good scientists who are also committed to education.

In the five years since the group formed, I've seen a difference on campus. There is now an identifiable group that communicates and collaborates on some joint projects in science, math, and engineering education. We are integrating the efforts of some of our strong individual programs, including physics, biology, mathematics, engineering, and biotechnology.

NN: Where have you made the most progress?

PN: The faculty is now much more aware of how to interact effectively with the K-12 community. They understand that we're all part of the same system, and that we need to work together toward the goal of science literacy.

At the K-12 level, the results are harder to measure. More teachers are aware of the standards movement and seem willing to embrace the teaching methods that go along with that. But there is still a lot of work to be done with parents and families. We're bringing them on board by working with museums, science centers, and other community organizations.

NN: What would your advice be to others undertaking similar efforts?

PN: Start working with the folks who are likeminded and don't try to change everybody at once. With the support of a core group, you can then work up into the structure of the university's



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Exhibit Schedule

FALL 1996-Spring 1997

In the coming months, be sure to look for Project 2061 at the following meetings:

Association of Science-Technology

Centers, October 26-29, 1996, Pittsburgh, PA. **Contact:** Valerie Royal, Manager of Meetings and Conferences, 202-783-7200.

Association of Independent Maryland Schools, October 28, 1996, Baltimore, MD.

American Association for Higher Education, November 20-22, 1996, Washington, D.C. Contact: Monica Manes, Conference Coordinator, 202-293-6440.

National Council for the Social Studies November 22-25, 1996, Washington, D.C. Contact: Jaime Hitchcock, Director of Meetings, 202-966-7840.

Association for the Education of

Teachers in Science, January 9-12, 1997, Cincinnati, OH. **Contact:** Joe Peters, Executive Secretary, 904-474-2860.

American Association for the Advancement of Science, February 13-18, 1997, Seattle, WA. Contact: Lester Matlock, Project Administrator, 202-326-6666.

Association for Supervision and Curriculum Development, March 22-25, 1997, Baltimore, MD. Contact: Customer Service Center, 800-933-ASCD.

National Association for Research in Science Teaching, March 21-23, 1997, Oak Brook, IL. Contact: Kathleen Fisher, Program Chair, 619-594-4453.

International Technology Education Association, March 23-25, 1997, Tampa, FL. Contact: Linda Defrances, Convention Coordinator, 703-860-4924.

National Science Teachers Association April 3-6, 1997, New Orleans, LA. Contact: Kevin Bullock, Registration Supervisor, 703-312-9288.

National Council of Teachers of Mathematics, April 17-20, 1997, Minneapolis, MN. Contact: Convention Department, 703-620-9840.

NELSON continued

administration. They are often very interested in these issues.

Science, math, and engineering faculty also need to understand that they can't count on their content knowledge alone to make them effective proponents of education reform. They will also need knowledge and skills relating to teaching, learning, and the education system.

It is important to keep in mind that we are advocating revolutionary changes in the education system K-20, not just K-12 and not just on the margins. There is already a lot of knowledge and expertise in the K-12 school system. Add to that what the university has to offer, and meaningful reform becomes possible.

NN: What do you see as the next steps for making science literacy a reality?

PN: We need to include the general public and the schools as full partners. Everyone in the science community has a stake in this quest. The challenge is to get the professional organizations

to look beyond their disciplines and understand that they have a larger role to play. We also need to work closely with the business community because today's students are the future workforce, and science literacy is key to everyone's success.

NN: What do you see as Project 2061's role?

PN: I see Project 2061 as the sustaining organization for science education reform efforts. As the involvement of other organizations waxes and wanes, the mission of AAAS will continue. Project 2061's long-term commitment to develop the highest quality tools and to work closely with other organizations on behalf of science education bodes well for the future achievement of science literacy for all students.

I'm excited to be able to work with such a talented group and to contribute to Project 2061 and its mission.

NN: Final question: How is it to walk in space?PN: It's terrific. You should try it!

Remembering Mary Budd Rowe

It is with fondness and admiration that we remember Mary Budd Rowe, whose death in June at the age of 71 saddened the science education community. Dr. Rowe was a science education innovator who, as a charter member of AAAS' National Council on Science and Technology Education, helped guide Project 2061 from its start.

A visiting professor at Stanford's School of Education and a professor at the University of Florida, Dr. Rowe was renowned for her research on "wait time," which opened teachers' eyes to the amount of time they should give students to answer questions. She was also in the van-



guard of using technology to teach science.

Dr. Rowe never lost sight of the human aspect of science education. In her own words, she "spent an entire career trying to impart Einstein's words to adults and children all over the world: science is exploring and exploring is fun." By all accounts she succeeded. Those of us who had the privilege of working with Mary Budd Rowe remember her not only for her contributions to the field, but even more for the great intelligence, dedication, and humanity that she brought to everything she did. We miss her.

Project 2061's Influence on States: A Closer Look

Project 2061's success depends on its impact at the state and local levels. Many state education leaders interviewed for SRI International's study credit Project 2061 with helping to define science literacy, shape reform strategies, and inform important curriculum documents in their states. Some school districts are beginning to draw directly on Project 2061's recommendations for curriculum and instruction. SRI's six case studies of Project 2061's impact in Colorado, Georgia, New Jersey, New York, South Carolina, and Wyoming provide a closer look at how state and local leaders are putting Project 2061 reform tools to use. These case studies also identify some obstacles to reform that require attention.

DIRECT INFLUENCE

In five of the six states studied, Project 2061 had a clear influence:

The preface to Colorado's new state standards for science content acknowledged *Benchmarks* as "particularly useful and influential." With local school districts required to adopt the state standards or develop their own to "meet or exceed" them, ideas from *Benchmarks* will likely also affect local policy and practice.

In Georgia, the Statewide Systemic Initiative (a program funded by the National Science Foundation) based the science portion of its widelysupported Georgia Framework for Learning Mathematics and Science on *Benchmarks for Science Literacy*. Project 2061's chief influence in Georgia, however, has been on local committees deciding on science textbooks for their districts. These committees take notice of which textbooks attempt to incorporate Project 2061 principles, and they even discuss how well textbooks serve particular benchmarks.

The committee drafting New Jersey's new content standards in science used *Benchmarks* extensively, both to settle on content and to assign topics to appropriate grade levels. The committee developing the state's science curriculum framework is also drawing on *Benchmarks*. And New Jersey's professional development partnerships use *Benchmarks* to introduce teachers to notions of long-term reform in science education, familiarize them with grade-appropriate content, or involve them in evaluating curriculum materials. Ideas from Project 2061 influenced New York's recently-completed Mathematics, Science, and Technology Framework. Unlike most state frameworks, this document defines technology as a discipline of equal importance to mathematics and science—much as *Science for All Americans* and *Benchmarks for Science Literacy* recommend.

State leaders in Wyoming maintain that ideas and language from *Benchmarks for Science Literacy* and the standards issued by the National Council for Teachers of Mathematics provide the vision for math and science education in the state. With no official state curriculum guide, but many opportunities for professional development, Wyoming's teachers encounter *Benchmarks* and *Science for All Americans* through national, regional and local conferences.

In contrast, Project 2061's direct influence on education reform in South Carolina was more difficult to trace. The new state science framework does cite Project 2061 as a general reference. In addition, this document is closely aligned with the *National Science Education Standards*, which derived many of its content recommendations from *Benchmarks*. Future collaborations with Project 2061 are feasible, particularly as South Carolina implements new curriculum frameworks and assessments that emphasize academic standards, rather than "basic skills."

More Help

SRI's study also makes clear that state and local leaders feel in need of more help in implementing national learning goals, such as those in *Benchmarks*. Many state frameworks that SRI evaluated capture "the spirit and essence of the national standards and the *Benchmarks* remarkably well," but often omit from their frameworks important *Benchmarks* topics, eliminate ideas within included topics, or restate ideas in terms too general to aid local curriculum committees.

The case studies also suggest the need for more work with assessment. With teachers in many states more attuned to state assessments than to national reform documents, Project 2061 will have to work harder to help states align their assessments with *Benchmarks for Science Literacy*.

About Project 2061

Project 2061 of the American Association for the Advancement of Science is a long-term initiative to reform K-12 education nationwide so that all high-school graduates are science literate. Its first report, Science for All Americans, outlined what all high-school graduates should know and be able to do in science, mathematics, and technology. Project 2061 is now creating a coordinated set of reform tools to help educators meet those goals in their own districts. Working with six school-district teams of teachers and administrators, Project 2061 developed Benchmarks for Science Literacy, a curriculum design tool that translates the literacy goals of Science for All Americans into learning goals for the ends of grades 2, 5, 8, and 12.

Science for All Americans and Benchmarks will soon be joined by Resources for Science Literacy, a computer-based tool to help educators improve their own understanding of science literacy and identify and evaluate instructional materials to help students make progress towards it; Designs for Science Literacy, a guide to help educators take a systematic design approach to planning a K-12 curriculum; and Blueprints for Reform which suggests how various aspects of the K-12 education system must change to accommodate necessary curriculum reforms. Eventually, all of these tools will be pulled together by a computer-based, interactive, multimedia curriculum-design and resource system.

Project 2061 is supported by grants from the National Science Foundation, the Carnegie Corporation of New York, the John D. and Catherine T. MacArthur Foundation, the Andrew W. Mellon Foundation, and The Pew Charitable Trusts.

For more information about AAAS /Project 2061 contact:

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Project 2061's print and electronic products are available from Oxford University Press. For ordering information, please call 1-800-451-7556.

Resources for Science Literacy Available Soon

Look for Oxford University Press to release Project 2061's first CD-ROM tool, *Resources for Science Literacy: Professional Development*, early next year. This tool will help teachers improve their own understanding of science literacy so they can help their students achieve Project 2061's science literacy goals. The CD-ROM includes six interconnected components:

Science for All Americans. The entire

text of Science For All Americans

is linked to other components on the disk. These links enable users to identify resources on the CD-ROM that are relevant to specific chapters and sections in *Science for All Americans*.

Science Trade Books. Full bibliographies, reviews, and other descriptive data are provided for more than 120 books for general readers dealing with all areas of science, technology, and mathematics. Each book is linked to specific *Science for All Americans* chapters and sections. This component can be used as a guide for teachers' reading and discussion groups; as an acquisitions aid for teacher resource centers and libraries; as a supplementary reading source for undergraduate courses; and for any in-service professional development program focusing on science content.

Cognitive Research. An introduction to cognitive research literature sheds light on the ability of students of various ages to understand many of the topics in *Science for All Americans* and *Benchmarks for Science Literacy*. This component also includes *Benchmarks*' Chapter 15: The Research Base and its bibliography. Curriculum developers can use this for information on how students learn specific topics and teachers can use it in making decisions about instruction and materials.

College Courses. Descriptions of 15 undergraduate courses suggest guidelines and examples for courses that teach particular concepts from *Sci*-



ence for All Americans. The syllabi are linked to the relevant chapters and sections of Science for All Americans. The framework for analyzing courses for their match to science literacy goals can guide the design of new courses.

Comparisons of Benchmarks to National Standards.

Detailed analyses compare *Benchmarks for Science Literacy* to national content standards for science, mathematics, and social studies. Curriculum and framework developers can use this to compare their own state or district level guide-lines to the national content recommendations; teachers can use it to evaluate how effectively curriculum materials or activities address a particular benchmark or standard.

Project 2061 Workshop Guide. Developed and field-tested by Project 2061 staff, teachers, and education consultants, the *Workshop Guide* includes materials that can be used to design and conduct a Project 2061 workshop. Professional development specialists will find a wealth of material focused on benchmarks- or standards-based teaching and learning for their in-service programs; school districts, individual schools, or even small groups of teachers can produce complete Project 2061 workshops inexpensively and easily; and teachers can use the background readings, presentations, handouts, and activities as the basis for on-going, self-guided study of Project 2061 and its products.

Director's Notes

Keeping Score

If only education were more like baseball. In baseball, each player knows how well he is doing—batting .283, hitting 16 home runs, making 5 errors—and what the collective effort of the team adds up to—it makes the playoffs, or it doesn't; takes the pennant, or it doesn't; wins the world series, or it doesn't.

But in education, we rarely know how well we are doing. We may not even know who is on the team and who isn't, and we have few measures of individual or team performance. In fact, we can't even agree on which "stats" most clearly express our successes and failures. In short—no team, no batting averages, no world series.

Nevertheless, educators need to find out what their work adds up to. That is why they pay attention to the SAT, NAEP, and TIMSS results and the other measures of student performance. Here at Project 2061, we too want to know in what ways, if any, our work is making a difference.

As Project 2061 entered its tenth year, we asked: What has the work of a decade added up to? The Pew Charitable Trusts funded a yearlong evaluation of the project by SRI International to find out. The SRI study points out some solid achievements, and those are reported elsewhere in this newsletter. But where do we go from here? My reading of the SRI report leads me to the following conclusions:

Stay the course. The Project 2061 commitment to comprehensive, goal-directed reform is having impact enough in the near-term (10 years or less) to justify its long-term strategy (25 years or more). If the study had found that our work was little known, rarely used, or made little difference when used, we could no longer justify continuing the meticulous, time-consuming field research that the project puts into developing reform tools. I see nothing in the report to lead to such a conclusion; instead I see encouragement for the project to continue to look beyond the immediate needs of reformers, however urgent, to help them achieve more far-reaching goals.

Spread the word. Project 2061 receives high marks for its influence on federal agencies, national science standards, state and urban reform initiatives, teacher training institutions, and science education leaders. That's gratifying because those are the audiences we've been aiming for. But the SRI study also reveals that Project 2061 is not nearly as well known by K-12 teachers and administrators as we would like it to be. To some extent, this is because the project does not produce curricula, instructional materials, tests, or other resources that teachers use in the classroom on a day-to-day basis. But now it is time to tell our story to a much broader audience so that Project 2061 and its tools become as well-used by elementary, middle, and high school teachers as they are by state and national reformers.

Our pledge for the next ten years is *both* to keep on track and to get in better touch with the science, mathematics, and technology teachers who are essential to reform. If we do, I have no doubt that the next study (scheduled for the year 2000) will show that the work of Project 2061 adds up to even more than it does now. If we can just hit a few more home runs like *Science for All Americans* and *Benchmarks for Science Literacy*, we might at least make the playoffs. But remember, it's one inning at a time.

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F. James Rutherford Director

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Project 2061 on the World Wide Web

Between newsletters, keep up with Project 2061 by visiting our World Wide Web site at http://www.aaas.org. The Web site eventually will include the full text of *Benchmarks for Science Literacy* in a flexible format useful to curriculum planners. Other new Project 2061 products, as they appear, will also have their own Web sites.

National Council Reconfigured

As Project 2061's focus changes over the years, so too, does the composition of its advisory board, the National Council on Science and Technology Education. This November, a new, smaller Council will meet for the first time. Five new Council members will join 14 current members (down from last year's 35) to form a council which includes more K-12 and university level educators. The new Council members are **Diana Azcoitia**, principal of Kannon Magnet School, Chicago; **Robert Scidmore**, a teacher of technology education, Eau Claire School District, Wisconsin; **Susan Carey**, professor of psychology New York University; **Samuel Ward**, professor of biology, University of Arizona; and **Gary Nakagiri**, county education administrator, San Mateo County, California.

Joining the Council as an ex-officio member is **Marcia Linn**, a fellow of AAAS who researches the teaching and learning of science and technology at the University of California, Berkeley.

Introducing...

Project 2061 welcomes two new staff members. **Kelvin Bennett**, joins the staff as a computer specialist after

serving 16 years in the U.S. Air Force. He is responsible for upgrading and troubleshooting the project's computer systems. **Diane Surati** is Project 2061's new coordinator for the Mathematics Curriculum Analysis Project. A candidate for a master's of secondary education at George Washington University, she will assist in analyzing materials from five NSF-funded middle school curriculum projects and in training teachers to analyze curriculum materials.

Feedback on New Products

This past summer, Project 2061 staff made considerable progress on its products *Blueprints for Reform* and *Designs for Science Literacy*.

A series of *Blueprints* conferences convened the original authors of the dozen Blueprint reports commissioned by Project 2061 along with experts in the areas of the education system addressed by those reports. The areas covered include policy, finance, equity, research, school organization, curriculum connections, assessment, materials and technology, teacher education, higher education, family and community, and business and industry. Participants in each of the three sessions critiqued a set of *Blueprint* chapters, helping staff prepare them for publication.

Meanwhile, three focus groups of educators and education researchers met with project staff to discuss draft sections of *Designs for Science Literacy*. The groups affirmed the need for a publication to guide educators in reforming the curriculum around science literacy goals, and offered suggestions to make it more widely useful.

2061*today*

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