

OVERVIEW

Role of Science Learning Outside of School Grows**Opportunities are plentiful, from after-school programs to computer simulations to visiting a zoo**By **Erik W. Robele**

When a fresh round of national and international data on student achievement in science came out recently, the results—widely seen as disappointing—prompted familiar hand-wringing from political leaders and education experts about the steps needed to improve science instruction in the public schools.

What's often missing from the national dialogue on the issue is a concerted focus not simply on what happens in the classroom, but also on the opportunities to learn about science—and to inspire a passion for the subject—that come outside the school day and the formal curriculum.

But many leaders in the field often referred to as “informal science education” say that is beginning to change. There are signs that this sector is garnering wider attention and starting to be included in broader discussions on how to improve science learning among young people.

David A. Ucko, a former senior official at the National Science Foundation, said the field now has greater external recognition of its impact on public awareness, understanding, and engagement with science and related subjects.

“There is definitely momentum building,” agreed John H. Falk, a professor of free-choice learning at Oregon State University, in Corvallis. “The good news is that the field is of late being invited to some tables and being taken seriously as important, but it’s still roughly an order of magnitude less than formal education.”

One boost to the cause was the 2009 release of a major National Research Council report, “Learning Science in Informal Environments.” With the prestige of the National Academies behind it, the NRC document served as a clarion call.

“Efforts to enhance scientific capacity typically target schools and focus on such strategies as improving science curriculum and teacher training and strengthening the science pipeline,” the report said. “What is often overlooked or underestimated is the potential for science learning in nonschool settings, where people actually spend the majority of their time.

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Science Learning Outside the Classroom

Role of Science Learning Outside of School Grows

Researchers Play Catch-Up in Gauging Beyond-School Effects

Science-Rich Institutions Provide Venues for Exploration

Science Competitions Integrated Into Curriculum

Games and Simulations Help Children Access Science

Independent Play Fosters

"Beyond the schoolhouse door," it said, "opportunities for science learning abound."

Indeed, they do. Visits to science-rich cultural institutions, such as zoos, aquariums, science centers, and natural-history museums immediately come to mind. But it's really a host of opportunities. Astronomy and robotics clubs. After-school programs and science competitions. Collecting rocks or taking a walk in the woods. Watching television programs such as "MythBusters" or turning to the Internet to learn more about cancer or global warming. The list goes on and on.

President Barack Obama, who has aggressively used his bully pulpit to promote education in the STEM fields of science, technology, engineering, and mathematics, seems to share an appreciation for learning outside the classroom. He hosted an Astronomy Night on the White House lawn in 2009 and, last fall, the first White House science fair, celebrating winners of STEM-focused student competitions.

"In many ways, our future depends on what happens in those contests," Mr. Obama said at the October event. "It's in these pursuits that talents are discovered and passions are lit, and the future scientists, engineers, inventors, and entrepreneurs are born."

No Tests or Grades

In an increasingly data-obsessed education landscape, one challenge is meeting the demand for concrete evidence on how individuals benefit from informal learning opportunities.

The NRC report found "abundant evidence" that people of all ages learn science across a wide range of venues and activities. But that report, and interviews with experts in the field, suggest there's still a long way to go in better evaluating and understanding the impact.

Advocates for informal learning emphasize that it's vital not simply to align measures for out-of-school learning with the focus on standardized achievement tests so prevalent in public education. Instead, the idea is to gauge scientific skills and understanding in ways that are more appropriate to the various settings and activities, as well as to look at interest in science topics and a person's self-identification as someone knowledgeable about science.

"If we allow the things that are easy to measure in school districts as the only definitions of learning we're going to consider, we are leaving off the table an awful lot of things," said Kevin J. Crowley, the director of the University of Pittsburgh's Center for Learning in Out-of-School Environments and an associate professor of education and psychology. "We need to have compelling, theory-based, reliable measures, and we're just beginning to chip away at that right now."

The NRC report said one important feature of informal learning settings is the absence of tests, grades, and other familiar approaches used by schools to document the effect of education.

"Assessments should not be limited to factual recall or other narrow cognitive measures of

Discovery in Youngsters

**National Science Foundation
Deemed Leader in Informal
Learning**

**Environmental Issues Inspire
Children to Dig Into Science**

Web Extras

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**Science Shared on Online
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Digital Edition

**Read the interactive digital edition
of this special report.**

Science Through the TV Screen

By Sarah D. Sparks

In one of the best-remembered TV science experiments, Donald J. Herbert, aka Mr. Wizard, and one of his student-helpers peered over a waist-high acrylic box filled with set mousetraps, representing fissionable material in an atomic bomb. On each perched a pingpong ball, representing the neutrons. When one additional ball dropped into the mix, the entire box went up in an explosion of white plastic.

When Mr. Herbert died in 2007, after more than a half-century in educational entertainment, science television shows had exploded more fully than his ping-pong balls. The National Research Council's 2009 landmark study of informal science highlighted evidence that children's shows such as "Bill Nye the Science Guy" can

learning," it said, but instead "should address the range of intellectual, attitudinal, behavioral, social, and participatory capabilities that informal environments effectively promote."

In fact, tools are now emerging that show the potential to link individuals' learning across a lifetime of different experiences. ("**Researchers Play Catch-Up in Gauging Beyond-School Effects**," April 6, 2011.)

One domain that is seeing a strong push to promote learning and engagement in science is the after-school setting. In fact, 2011 was billed as the "Year of Science in After-School" by several leading groups, including the Afterschool Alliance, the National AfterSchool Association, and the National Summer Learning Association.

"We're all speaking with one voice to say this is important," said Anita Krishnamurthi, the director of STEM policy for the Afterschool Alliance, an advocacy group based in Washington.

Meanwhile, initiatives have recently emerged in California and Missouri to establish sustainable statewide systems that support and promote high-quality after-school programming in the STEM fields. The initiative in Missouri, Project Liftoff, is working to spark similar undertakings in other Midwestern states as well. Among the efforts planned are identifying a menu of first-rate curricular materials in the STEM fields, better preparing after-school program staff members to provide engaging STEM activities, and supporting the evaluation and improvement of such after-school offerings.

The project is getting financial backing from the Noyce Foundation, which also underwrote this special report, and the Charles S. Mott Foundation, which helps underwrite economic-stimulus coverage in *Education Week*.

Some advocates have eyed policy changes at the federal level to gain better leverage for informal science learning. A prime target is the main federal source of after-school aid, the \$1.2 billion 21st Century Community Learning Centers program.

Last year, a White House advisory panel on science and technology—as part of a larger report on improving STEM education—urged the government to create a set-aside in the program for those fields. It suggested that the funding could be pooled with other federal aid to create a new, coordinated initiative across agencies to support high-quality out-of-school activities that "inspire" students in the STEM subjects. Such activities could include after-school and summer school programs, as well as contests, the report said.

The news and entertainment media have long served as powerful vehicles for educating the public about science, from newspapers and magazines to TV and radio programs, documentaries, and IMAX films. Even science-fiction movies have helped inspire young people to learn about

increase not just students' interest in science, but also their understanding of complex scientific concepts.

Here's a look at some of the top science television series through the years.



Watch Mr. Wizard (1951)

The granddaddy of all children's science shows, "Mr. Wizard" first aired on WMAQ, Chicago's NBC station. It spanned more than 600 shows during the 1950s and '60s, and another 78 shows, as the cable-based "Mr. Wizard's World," in the 1980s and '90s, according to Tom Nikosey, the president of Mr. Wizard Studios in West Hills, Calif.

science. The National Science Foundation is a key supporter, having issued an assortment of grants over the years for educational programming, including the science desk at NPR, television programs like DragonFly TV, and giant-screen movies like "Tornado Alley," which premiered in March.

Private foundations have also played a role. In February, for instance, the Howard Hughes Medical Institute, based in Chevy Chase, Md., announced the launch of a \$60 million documentary-film initiative to bring compelling science features to television.

Further, new technologies hold tremendous promise to advance science learning and interest, with the advent of increasingly sophisticated computer games and simulations, among other developments.

'Urban Advantage'

Ensuring access across the U.S. population, especially among low-income and minority families, is seen as an important goal for many informal initiatives and institutions, from after-school programs to science centers and museums, such as Explora, in Albuquerque, N.M. Explora offers free memberships for low-income families and hosts Family Science Nights in partnership with the city school district as a way to better acquaint such families with its offerings.

The Family Science Night idea also illustrates another theme: the value of fostering direct connections between schools and informal learning environments. Around the country, there's no shortage of such collaborations.

Explora, like many other science centers, also offers professional-development programs for teachers. And it offers a menu of more than 200 hourlong experiential programs for students, called "explorations," pegged to the state's academic standards.

In New York City, Urban Advantage, a program led by the American Museum of Natural History, has brought together the city school system and an assortment of science-rich institutions, including the New York Hall of Science, the Queens and Brooklyn botanical gardens, and the Bronx Zoo, to provide rich opportunities to improve middle school students' understanding of scientific inquiry.

The value of such collaborations between schools and informal institutions was brought into clearer focus by a 2010 report from the Center for Advancement of Informal Science Education, a partnership of several organizations that was founded with NSF support.

The report said formal-informal collaborations can enhance students' and teachers' conceptual understanding of science, improve student achievement, strengthen students' disposition toward the field, and help teachers integrate inquiry and new materials into the classroom.



The World of Jacques Cousteau (1966)

Mr. Cousteau, the founder of the French Navy's Undersea Research Group in 1946 and a commander of the research ship Calypso, almost singlehandedly developed underwater wildlife documentaries with multiple cinematic films, television specials, and the series, which was later renamed "The Undersea World of Jacques-Yves Cousteau" and ran through 1976.



National Geographic (1964)

The first television specials by the National Geographic Society aired on CBS and have since spawned innumerable documentaries, additional television series like "National Geographic Explorer," and, in 2001, a full cable channel dubbed NatGeo.

"Despite scores of such examples, these collaborations have generally failed to institutionalize: In many communities, they come and go with changes in funding and leadership," it said. "The walls between formal and informal learning professional fields are only beginning to crumble. There is too little transfer of practice, learning, and community."

'A Modest Change'

Even as informal science education is gaining more prominence, people who know the field say insufficient money remains a big barrier to expanding its role.

In a recent essay, Mr. Falk from Oregon State University, along with Lynn D. Dierking, also a professor of free-choice learning at that university, noted that far more funding goes to public schooling in science than informal learning opportunities.

"Even a modest change in this ratio could make a huge difference" to Americans' science literacy, they wrote in the December issue of *American Scientist* magazine, though they emphasized that they were not suggesting lessening support to schools.

Martin Storksdieck, the director of the Board on Science Education at the National Academies, suggests that advocates still have a lot of work to do in convincing policymakers and the public that informal science learning merits increased investment.

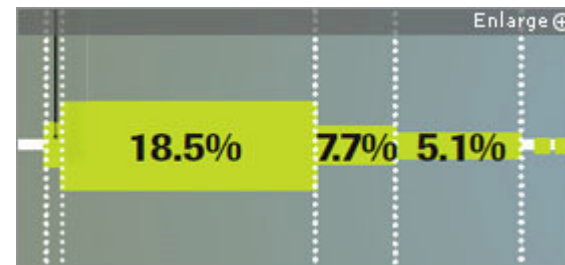
He points to a telling illustration. The federal economic-stimulus legislation enacted in 2009 included on a short list of institutions barred from receiving funds not only casinos, golf courses, and swimming pools, but also zoos and aquariums. (The Senate-passed bill sought to add museums, theaters, and several other categories to the list, but that language was removed.)

"At the end of the day, we haven't made the value proposition in the political arena or to consumers as much as we should," Mr. Storksdieck said, "of just how fundamentally beneficial these learning spaces are, and how much we as a society and as individuals benefit when we take part in what they have to offer us."

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Lifelong Learning

A relatively small percentage of waking hours across the life span are spent in formal educational environments.



SOURCE: Learning in Informal and Formal Environments Center



NOVA (1971)

First launched by WGBH in Boston, the one-hour series won the National Science Foundation's inaugural Public Service Award in 1998. It repeatedly has won honors while spurring debate in Congress for coverage of controversial topics, such as the "Miracle of Life" (1983), which earned Peabody and Emmy awards. It spun off a news show, "NOVA scienceNOW," in 2005.



Cosmos: A Personal Voyage (1980)

The internationally renowned astrophysicist Carl Sagan presented and co-wrote both this 13-episode series and an accompanying book, which PBS first aired. According to its website, it remains the most popular PBS series in the

world.



Children's Television Workshop

3-2-1 Contact (1980)

This science and technology show developed by the Children's Television Workshop ran seven seasons in a magazine format. Its features included interviews with scientists and popular skits with a group of child detectives called the Bloodhound Gang, who used scientific knowledge and procedures to solve mysteries.



Bill Nye the Science Guy (1993)

KING-TV, Seattle's NBC affiliate, first aired the show by the Cornell University engineer while he was moonlighting as a stand-up comic, according to his biography site. The show won 18 Emmys in its five years on air

and has spun off several science shows, such as the Science Channel's "100 Greatest Discoveries," "The Eyes of Nye" on PBS, and Planet Green's "Stuff Happens."



The Crocodile Hunter (1997)

This wildlife documentary hosted by the exuberant Australian naturalist and zoo owner Steve Irwin proved a breakout hit for the cable channel Animal Planet in more than 130 countries before Mr. Irwin died in 2006. It spun off several specials and a children's program, "Bindi, The Jungle Girl," hosted by Mr. Irwin's school-age daughter.



Mythbusters (2003)

The Discovery Channel launched this series, hosted by two Hollywood special-effects designers and their assistants, who test urban legends, Internet rumors, and historical myths through experiments. In 2009,

President Barack Obama asked the team to re-create (and eventually bust) the legend that the ancient Greek Archimedes used a "solar death ray" of mirrors to ignite invading ships in 212 B.C.



Jim Henson Company

Sid the Science Kid (2008)

The Jim Henson Co. and KCET/Los Angeles developed the program for PBS KIDS as the first science show targeted at preschool-age children. In each show, the title character asks a child's typical question, such as "Where did my snowman go?" and discovers the answer in the course of the program.

Photos by AP except where indicated
