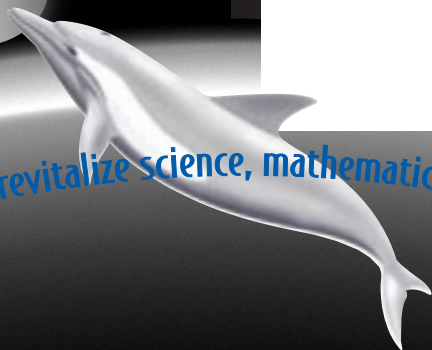
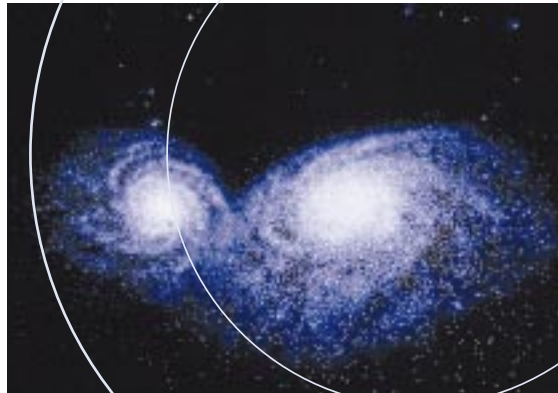




Science



Voyages of the Mind, Informal Learning



“It is our hope that after watching the spectacular beauty, combined

with the breathtaking animation projected in *Cosmic Voyage*, audiences will gaze upon the stars with renewed wonder and amazement and continue on their own voyage of scientific discovery.”

What is our place in the universe? How do birds fly? Why do balls bounce? We are all born curious about the natural and human worlds—about science—but as we grow up, we often come to believe that science is only what scientists do, what we learn about in school, or what happens in a lab. The truth is, science surrounds us—in our kitchens and cars, our music and art, our everything. It can be thought of—in many ways—less as a thing itself, more as our way of deciphering the poetry of the universe. It is a voyage of the mind to infinitely small and incomprehensibly immense worlds. And best of all, the voyage begins within all of us.

GARY TOOKER
VICE CHAIRMAN AND CEO, MOTOROLA
PRESIDENT, MOTOROLA FOUNDATION

ABOUT SYNERGY

Synergy is a publication about programs of the National Science Foundation's Directorate for Education and Human Resources (EHR). Each **Synergy** issue highlights an EHR activity that is demonstrating progress in reforming the teaching and learning of science, mathematics, engineering, or technology, prekindergarten through career entry. The "synergy" derives from NSF working in partnership with organizations throughout the United States and in all sectors of the economy to help foster the positive changes in education to which it is dedicated. The ingredients of these outcomes-based stories are unchanging: access to quality science and mathematics education, high expectations for the success of these efforts, proven excellence of materials and their delivery, and gains in learning by all students.

IN THIS ISSUE...

Synergy examines the Informal Science Education (ISE) program. The program supports the development of projects that—through television, radio, films, museum exhibits, zoos, and community programs—bring science to people of all ages and backgrounds. Synergy is created when participants increase their knowledge, appreciation, and excitement about science, mathematics, and technology by engaging in the rich and stimulating learning experiences that ISE makes possible.

Join us on a voyage of the mind; come aboard, and welcome to Synergy!

Informal Learning

At the forefront of the mission of the National Science Foundation (NSF) is the discovery of new knowledge in service to society. NSF is committed to the principle that scientific discoveries can be understood and enjoyed by all, and it has long recognized that understanding and excitement about science, mathematics, engineering, and technology come from self-directed, voluntary explorations. NSF calls these processes "informal learning."

Since 1984, NSF's Informal Science Education (ISE) program, located in the Directorate for Education and Human Resources, has provided start-up and development support to hundreds of informal learning projects. The program, which is being funded at \$46 million in FY 1999, has been instrumental in launching a vast range of innovative projects, including television series and films—such as *Cosmic Voyage*—on science and mathematics topics; educational programs or exhibits—such as *Raptors*—at science and natural history museums, nature centers,

zoos, botanical gardens, and libraries; and educational programs and activities—such as *Playtime is Science*—at community and youth centers or in the home.

Its goal is to provide rich and stimulating learning experiences for people of all ages, interests, and backgrounds in order to increase their knowledge, appreciation, and excitement about science, mathematics, and technology and their applications.

ISE defines informal education activities as those in which learning is voluntary, self-directed, and motivated by intrinsic interests, curiosity, exploration, and imagination. Informal education is intended

“We live in a time when artificial distinctions about when, where, and how we learn no longer serve us well; a world where informal education is one destination in our own odyssey of science.”

to stimulate lifelong learning. “People come to or otherwise experience informal learning projects on their own volition, their own schedule,” says Hyman Field, who oversees ISE media efforts. “They stay as long as they feel they are getting some benefit, entertainment, or knowledge—or all three.”

Informal education often actively involves the participant in scientific explorations, and it increases social and learning interaction between youth and adults. “It’s important to keep in mind that informal education projects can be directed toward adults as well as children—they help families, parents, and kids interact,” points out Barbara Butler, a former ISE program officer responsible for museum exhibits. “In our lives, all of us spend more hours learning in this way than we do in formal learning environments.” (Informal education is linked with and supports formal education when possible.) The intended outcomes of such projects include a better understanding of concepts, processes, and thinking in scientific and technical disciplines, as well as increased awareness about careers in those fields.

“Informal education also takes place in community centers where people of all ages come willingly to learn about science and mathematics on

weekends and after school,” says ISE program officer James Oglesby. The youth and community-based component of the program is extremely important, Oglesby points out. It helps to increase the number of young people (particularly members of groups who have been underserved in the sciences, such as African Americans, Latinos, girls, and people with disabilities) who are excited about science and math and want to pursue activities in those fields out of school as well as in the classroom.



A Matter of Fact

A 1997 NSF study¹ of public attitudes toward science and technology revealed widespread interest and strong support for science and scientific literacy.

- Sixty percent of the adult public visited a science museum, zoo, or aquarium one or more times in the last year. And more than half watch one or more science programs on television each month.





Voyages of the Mind, Informal Learning...



- Almost 90 percent of the public feel that science and technology are making our lives healthier, easier, and more comfortable. And three-quarters agree that the benefits of science are greater than any harmful effects.
- Three-quarters of adults feel that it is in some way important for them to know about science in their daily lives. And 90 percent admit they are interested in new scientific discoveries that appear from time to time in the news.

At the same time, the survey revealed astonishingly low levels of scientific knowledge on the part of the adult respondents. While 82 percent of adult Americans knew that the “center of the earth is very hot,” about half believe that earliest humans were around when

dinosaurs roamed the earth, and just one in three believe that the “universe began with a huge explosion.”

And as we embrace a world where science and technology

are paramount in our everyday lives, a world that demands that we think critically about issues in our community, that rewards those who draw creatively on knowledge across boundaries, and where lifelong learning is no longer a platitude, we find ourselves closer and closer to the nucleus of the world of informal science education. We live in a time when artificial distinctions about when, where, and how we learn no longer serve us well; a world where informal education is one destination in our own odyssey of science.

Media Projects

ISE supports the production of television or radio programs and films that are broad in their reach, attracting millions of devoted young

and adult viewers. Says Hyman Field, “television, films, and radio are among the more accessible ways of learning today. These communication technologies are with us virtually everywhere we go.”

The ISE program has played a major role in supporting such enormously popular and highly acclaimed TV series as *Bill Nye the Science Guy*, *The Magic School Bus*, *Reading Rainbow*, and *Nova*. The program has supported the production of a number of film hits, including *Cosmic Voyage*, *Everest*, *Stand and Deliver*, and *Stormchasers*. And a host of innovative radio programs, such as National Public Radio’s *Science Friday* and the Hispanic Radio Network’s *Buscando la Belleza* [Creating Beauty] and *Salvemos Nuestro Planeta* [Saving Our Planet] make their way into homes, offices, and automobiles from coast to coast.

It takes just a few of these projects to demonstrate what is possible when science is brought to popular media:

- *Roman City* is a one-hour television special that led, through live action segments and animated sequences, 2.6 million viewers



on an historic tour of ancient Roman culture and technology when it aired on PBS.

- **3-2-1 CONTACT**, a Children's Television Workshop produced magazine show for kids ages 8 to 12, uses an interdisciplinary, teamwork approach to teach science. Although production of the 12-E Emmy-winning program ended in 1989, it continues to be broadcast on some 200 PBS stations nationwide and in other countries such as China, France, Germany, and Spain. In addition, a CD-ROM has linked the program to classroom activities across the nation.



- **A Science Odyssey**, a series produced

by WGBH of Boston, was greeted with resounding acclaim by viewers and critics alike when it was first broadcast in January 1998. Cast as a history of science and technology and of the people who have changed it, the program presents science, above all, as a human endeavor in which success and failure both play important roles. The project also has made a substantial outreach effort to schools.

RAPTORS, HUNTERS OF THE SKY...



“For thousands of years raptors, the birds of prey, have maintained a hold on the human imagination. Whether revered as divine messengers, celebrated as emblems of majesty and power, prized as hunting companions, or reviled as scavengers and blood-thirsty killers, these birds have lived as much in our imaginations as in the world around us.” So says the introduction to *RAPTORS*—an exhibit created by the Science Museum of Minnesota, in collaboration with the St. Paul school system and the University of Minnesota, with the help of more than \$1 million in ISE funding.

Hawks, eagles, vultures, owls—hooked beaks, strong grasping feet, and excellent vision help define this diverse group of predatory birds known as raptors.

RAPTORS explores the lives of these remarkable creatures, where they live, what they eat, how they navigate and fly, how they nest and rear their young, and how they find and capture their prey. Exploring biodiversity within the natural world, the 6,000-square-foot

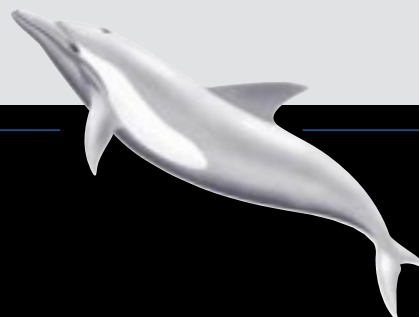
exhibit helps visitors understand these birds as diverse and complex animals whose survival in the wild is threatened. “We wanted to create an exhibit that would challenge visitors to consider their own relationships with the natural world,” says Don Pohlman, who heads the project, “and we chose hawks and other raptors as a vehicle because of the long history of human fascination with birds of prey and the strong recent association of those species with important questions of environmental policy and ecological science. We aimed for an exhibit that would help visitors understand raptors as creatures of culture as well as of nature and would move them to consider for themselves the place of humans in the world. We also hoped the exhibit would help visitors appreciate the value of species other than their own.”

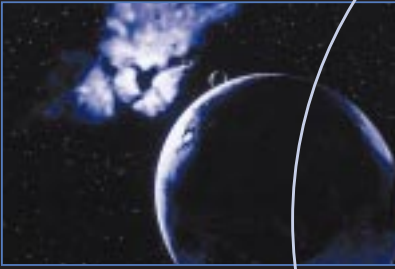
Among the gratifying outcomes of the effort, says Pohlman, has been the response by visitors from the St. Paul area.

“It remains the most highly rated temporary exhibit we’ve done.”

As of November 1997, more than 1.2 million visitors had explored *RAPTORS*.

A traveling version is currently touring museums, nature centers, and zoos around the U.S. through the year 2000.

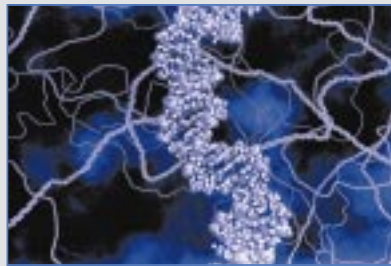




A TRULY COSMIC VOYAGE...

“Things around us aren’t always what they seem. In the everyday world, we use a simple scale—ourselves—to know what’s small and what’s large. But what about the worlds that lie beyond? What is truly large and truly small? To explore, to observe, to understand the wider world we call the universe, is one of the great human adventures. As we look out at the distant horizon, we may ask ourselves... ‘what is our true place in the universe?’” says Morgan Freeman as narrator of this large-format film tour of the universe. Produced with an initial NSF grant of \$600,000, which sparked \$3.5 million in sponsorship from the Motorola Foundation, *COSMIC VOYAGE* opened to critical acclaim in 1996 at the National Air & Space Museum.

Termed “a mind-boggling trip” by one newspaper critic, the film—an Academy Award nominee—has since been seen by more than 3 million people at museums and science centers throughout the United States, Canada, and Europe. Bayley Silleck, who directed the film, explains the rationale for the momentous IMAX format, “What excited



me and my collaborators about the idea, was that it was a wonderfully simple device to teach very complex subject matter.”

Silleck, who has been a documentary filmmaker for the past 25 years, says “the goal of *COSMIC VOYAGE* was to construct... a portrait of the entire universe over 42 orders of magnitude. And we wanted to take the audience on an experiential trip from quarks to superclusters of galaxies that would convey a strong sense of the ‘connectedness’ of all matter, including the fact that we humans are made of elements from exploding stars. We also wanted to give audiences an understanding of the vast space and time scales spanned by the universe.”

Furthermore, he says, “we, and NSF as well, felt it was important to stress that while scientists are using the Hubble telescope and other amazing instruments to unlock the secrets of the cosmos, there remain truly profound questions to be addressed by future generations of astronomers, physicists, chemists, and biologists.”

And fortunately for Silleck, future generations are filling the queue: “the film has been especially popular with school groups as young as pre-K,” he adds proudly.

Museum Exhibits

“The ISE program encourages grant applicants to make the visitor, rather than the creator, the focal point of their exhibits. We want exhibit developers to build in elements that will attract new audiences. We encourage them to work collaboratively, to maximize the cost-effectiveness of the projects. And we encourage them to include an experienced group of advisors to assure that the best thinking has gone into the development of their ideas,” says Barbara Butler.

According to Butler, many of the projects that the ISE program has supported have been remarkable in their depth, their imaginativeness, their complexity, and the extent of their reach. A review of grants awarded for the development of science exhibits over the years reveals a seemingly endless stream of fascinating possibilities. Included among them are:

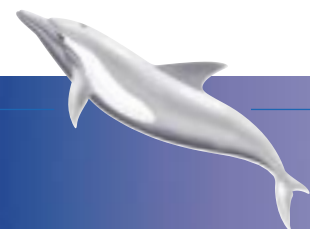
- ***Prehistoric Journey***, the most ambitious exhibit undertaken by the Denver Museum of Natural History in its 97-year history, comprises 20 interactive exhibits including walk-through

enviromas and a paleontology laboratory. Demonstrating the history of life on Earth through 3.5 billion years, the exhibit leads visitors along a “trail” through time, showing them how science and technology contribute to the interpretation of the fossil records, and what is happening now with regard to global environmental concerns.

- ***What Makes Music?***, developed by the Franklin Institute of Philadelphia, is a traveling exhibit for children and adults about the physics of sound and music. The exhibit is organized as an educational playground where visitors engage in open-ended explorations with acoustics, helping them to learn about sound wave amplitude, phase, frequency, reflection, and interference. Since its opening in 1988, the exhibit has traveled to more than 20 major science centers across the United States.
- ***Beyond Numbers***, developed by the Maryland Science Center in Baltimore, is the first traveling museum show in the United States



devoted to mathematics. Through 45 hands-on activities, visitors explore tile patterns, number series, computer animations of flocks of birds, and crystal structures. Three-dimensional models, rather than abstract formulas, are used to illustrate some famous mathematical problems and to show that mathematics can be fun.





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parents, other adults, and teen volunteers directly, in order to increase their comfort and knowledge of basic scientific concepts and to build their capacity to lead children in hands-on discovery.

For example:

- *Volunteer-led Investigations of Neighborhood Ecology—VINE*—engages thousands of inner-city 8- to 12-year-olds and trained volunteers in hands-on investigations of neighborhood plants,

Community Efforts

About ISE's involvement with community and youth programs, Jim Oglesby remarks, "I want to help provide a way for individuals to appreciate science, the richness of nature, and the roles that science, math, and technology play in our daily lives. And I want young people especially, to get a sense of the benefits and satisfaction they can gain from studying those subjects in their classrooms."

Oglesby points out that parents and other adults play a significant role in encouraging their children to study science and mathematics. Many of the ISE youth and community-based projects address

animals, and ecological relationships each year. The program develops observation, communication, and thinking skills while youngsters have fun with activities like "Litter Critters," "Super Soil," and "Plant Hunt." Originally, the project was developed through the Denver Audubon Society. More recently, it has been disseminated nationally—through a kit of materials, videos, and guides—by the North American Association for Environmental Education.



- *ScienceMinders*, created by the YWCA of Annapolis, Maryland, encourages

adolescent babysitters to become involved in science and to use hands-on science activities when babysitting. *ScienceMinders* has published a book of hands-on science activities, a series of training videos, and a guide to early child development. The program conducts training sessions for adolescents at schools, YWCA babysitting classes, and other similar settings.



“I want to help provide a way for individuals to appreciate science, the richness of nature, and the roles that science, math, and technology play in our daily lives.”

PLAYTIME IS SCIENCE...

PLAYTIME IS SCIENCE — created by Educational Equity Concepts, Inc. — involves parents in developing their children’s curiosity about the physical world that surrounds them. The program incorporates science, and scientific thinking, into everyday experiences through inquiry-based activities such as “Building with Wonderful Junk,” “Oobleck: Solid or Liquid,” and “Creating a Mystery Bottle.”

The program, which stresses the use of inexpensive household materials, has been used throughout the country as the result of a \$200,000 NSF grant to support its national dissemination. “The approach to science is so different from when I was in school, which was all textbook. You take some of these concepts plus things you have at home, like beans and socks,” commented one parent participant.

PLAYTIME IS SCIENCE creates partnerships among teachers, administrators, parents, and other caregivers. It encourages children to wonder,

question, and experiment with science in a host of settings: preschool, Head Start, at home, or in after-school programs. *PLAYTIME IS SCIENCE* engages children in creative problem-solving and higher order thinking, and helps to develop cooperative learning skills, language and vocabulary, and large

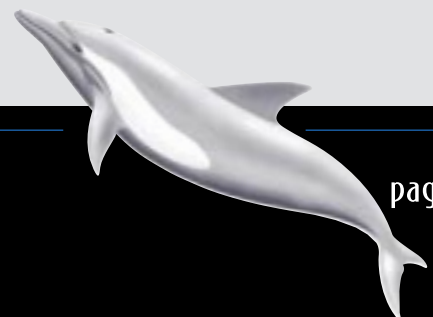


and small motor coordination. In an independent study,² *PLAYTIME IS SCIENCE* was found to have a positive impact on both children’s and adults’ views of science.

Equity is stressed by encouraging the involvement of children and parents of

all backgrounds: “All of the barriers are broken down and people see that all children—whatever their background, whatever their family situation, whether or not they have a disability—get to see themselves as scientists,” says Liz Phillips, an early childhood specialist, who uses the program.

But perhaps most valuable of all, *PLAYTIME IS SCIENCE* renews the intellectual bond between underserved children and their parents through the wonder of scientific discovery. One parent, who used to be “scared to death of science,” said that as the result of *PLAYTIME IS SCIENCE*, “I’ve done more science with my kids, and am more confident about working with kids. Our family is always trying new things and exploring. We’ve even become members of the science museum!”





Voyages of the Mind, Informal Learning...

WHODUNIT?

"We want science to get out into the public," says Charles Walter about his traveling exhibit, *WHODUNIT? THE SCIENCE OF SOLVING CRIME*, which focuses on the scientific methods and technologies used in today's crime laboratories. "We want it to be hands-on and active science. That's what you're going to see here." The 4,000-square-foot exhibit—developed by the Fort Worth Museum of Science and History with the aid of an ISE grant of \$650,000—is circulating to more than eight major U.S. cities.

Walter and his colleagues pioneered a new class of museum exhibits that is being replicated in museums across the country and the world. In *WHODUNIT?* the visitor is placed at center stage, playing the role of crime-solver. "Visitors walk into a cafe and they're immersed in a situation," says Walter. "They hear a detective interviewing somebody and they figure out something has happened but they don't know what yet. They step out into the alley and all of a sudden there's a body."

Taking what they have observed, visitors then browse a series of workstations where they learn how scientists use various techniques and methods, such as fingerprinting, firearms analysis, forensic anthropology, serology, toxicology,



trace evidence, and DNA profiling, to solve crimes. They work with data specific to this case, and, concludes Walter, "[they] figure out that... hmm... this is what my senses told me, but here's a piece of scientific data that says, no that's wrong, and I can see it now that it's been analyzed."

WHODUNIT? engages visitors of all ages and backgrounds in scientific processes, problem-solving, and deductive reasoning by challenging them to solve

a crime mystery. A teacher's resource guide, designed to promote in-depth classroom investigations of forensics before and after students interact with

the exhibit, helps tie the exhibit into what students learn in school. As one young crime-solver explains, "We're actually learning something on a field trip; usually we don't learn anything.... It's awesome."

WHODUNIT? which opened in Fort Worth, Texas, in 1993, continues to tour the country. To date, it has engaged over 2.5 million visitors.



Assessing Results

What lasting impact does informal education have on the participant? What is learned through the experience? What connections are made? What dreams are inspired? Experts often portray informal learning as having a cumulative effect on the individual: greater understanding helps to connect science to daily life, and the learning experience itself shapes the participant's attitude and appetite for yet more learning. In essence, it can be seen as one of many, unending learning inputs that continuously feed one's interest and knowledge of science over a lifetime.

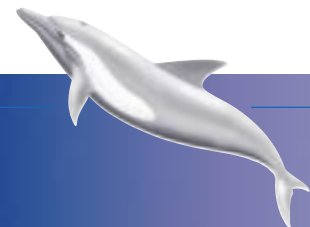
It is within this context that an independent research organization—Cosmos Corporation of Bethesda, Maryland—was commissioned by NSF to evaluate the program. “Informal experiences reinforce one another and serve to make a lot of what is described in the media a bit more real for people. Many of the projects, for example, demonstrate scientific concepts and processes as they relate to daily life, which seems to develop more

“Many of the projects... demonstrate scientific concepts and processes as they relate to daily life, which seems to develop more appreciation and understanding.”

appreciation and understanding,” says Kathy Zantal-Wiener, who directed the study. In its report,

stimulating additional financial investment from a wide range of public and private sources.

Cosmos concludes that the ISE program is, in fact, achieving its major goals. ISE projects are successfully and effectively reaching large audiences—often huge audiences—from all ethnic groups and economic strata. The program is inspiring excitement and interest among audiences of all ages—parents and other adults, as well as youngsters. The start-up funding supplied by NSF is





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And the projects increasingly are functioning interactively with and in support of formal education efforts in science and mathematics throughout the country.

“We found that the diversity of informal learning environments that ISE supports, its requirement that projects include evaluations and input from outside advisors, its leveraging of funds, and its attention to underserved audiences are particular strengths,” notes Zantal-Wiener. In fact, all ISE projects must include outside advisory committees and must undergo rigorous evaluation, based on

comprehensive quantitative and qualitative information. The opportunities for input from diverse groups such as evaluators, parents, scientists, museum visitors, and teachers provide a dynamic partnership that contributes to the program. “Drawing on all of these sources of information not only ensures quality, but helps keep the program flexible

and responsive,” concludes former program officer Barbara Butler.

Looking Ahead

As we end one millennium and begin another, the ISE program is perhaps more vital than ever in assisting the public in its discovery of science, mathematics, engineering, and technology in all its forms and applications. The program will continue to support the development of projects that serve as models of informal learning, as it continues to stimulate

innovation and shape the definition of *learning* in this new age. Like any dynamic body, it will evolve and grow in parallel with the changing times.

Among the questions the ISE program will address in the future are these:

- How can ISE projects use multimedia and advanced technologies to further learning objectives and revolutionize the informal education experience?
- What mental processes are at the base of informal learning and how can we improve informal learning productivity? How can we measure the long-term outcomes of informal learning?
- What are the societal entities that will serve as the purveyors of informal learning of tomorrow and who are the new audiences of learners they will need to reach? What boundaries will they cross and with whom will they forge partnerships?
- How can the program continue to stimulate innovation and creativity that can help informal learning evolve and adapt for the future?

(continued on page 15)





dress, raindrop belt, faucet shoes, and umbrella earrings. This day's field trip takes her students aboard the magically transformable bus, into a water gauge, and from liquid to vapor to liquid again.

THE MAGIC SCHOOL BUS, produced by Scholastic Foundations, Inc., of New York, was ranked the favorite television show of 2- to 5-year-olds

in 1995 and was carried by 300 of 345 PBS stations nationwide, reaching an estimated 85 million viewers. A complementary award to a collaborative of science museums and community organizations enabled *THE MAGIC SCHOOL BUS* to travel far beyond the television screen into museums, youth centers, libraries, and schools across the country through its interactive exhibits, book series, magazines for students and teachers, and activity guides for teachers and youth group leaders.

"SEATBELTS, EVERYONE!"

THE MAGIC SCHOOL BUS—a long-running, Emmy Award-winning series, supported from its inception by ISE—motivates children ages 6 through 9 to further their curiosity and knowledge of science. The animated program features the eccentric but lovable teacher, Ms. Frizzle (voice by Lily Tomlin), who leads her students on a series of fantastic voyages of exploration aboard the Magic School Bus. They take imaginary trips through the human digestive system, into outer space, inside a baking cake, among the vibrations that make sound, and around and around in the water cycle. "Take chances!" she exhorts her class, "Get messy! Make mistakes!"

In the water episode, Ms. Frizzle rides into class on a wave; discards her wet-suit, revealing her waterworks-themed



ARNOLD: "Oh, no, we're evaporating again!"

WANDA: "I love this part!"

MS. FRIZZLE: "Who knows what happens next?"

WANDA
[shivering]: "We c-c-condense into water droplets."

ARNOLD: "But we've b-b-been there! D-done that!"

MS. FRIZZLE: "And it won't be the last time, Arnold! What happens next?"

PHOEBE: "We become clouds!"

TIM: "Then we get blown who-knows-where by the wind."

MS. FRIZZLE: "And next?"

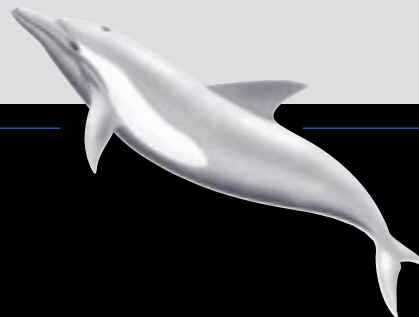
WANDA: "And fall somewhere else as rain again."

ARNOLD: "Are you suggesting that water never, ever stops moving? EVER??!"

MS. FRIZZLE: "In the words of my Great Aunt Mathilda... NOOOOOO!"

PHOEBE: "You mean, water just keeps evaporating – condensing – raining – collecting... FOREVER???"

MS. FRIZZLE: "Bingo! That's why its movement is called the water CYCLE!"





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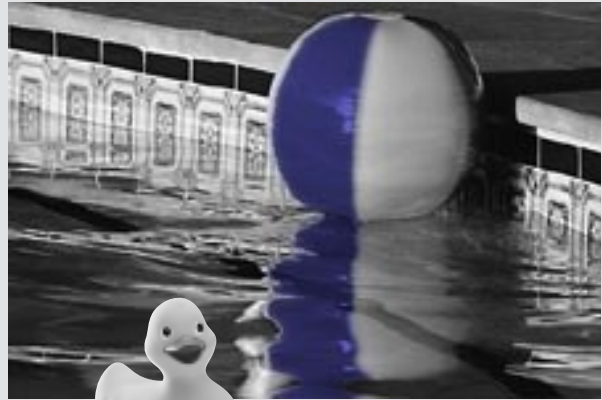
ASK MOTHER GOOSE...

Young children are learning about science in their gardens and in their bathtubs. They are learning about why some things grow, others fly, and still others float. These lessons are being provided by the children's parents, who are learning how to conduct them through the *MOTHER GOOSE ASKS "WHY?"* program of the Vermont Center for the Book.

Families in the program receive eight books for free. The books are classic stories for preschool age children. The families also receive a science activity kit and simple lessons about how to use the stories to help their children become interested in science. Most lessons involve only common household objects. They present science as an everyday event. Scientific processes are emphasized rather than theories. "Our goal is to introduce parents to the process skills of science: observing, predicting, communicating, hypothesizing, basic learning skills that are particularly applied to science," says principal investigator, Sally Anderson. "We want to get families talking about science in their homes every day."

"Who Sank the Boat"

is one of the books that parents will be reading with their children. Parents will then ask their children to pick three objects that they can drop into a bowl of water or into their bath water. The children will be asked to predict which objects will float and which will sink, based on what was presented in the book. Other hands-on science activities related to *"Who Sank the Boat"* might include building an aluminum foil boat and showing how oil floats on water. Through these activities, parents gain



experiences, skills, and confidence to introduce science to their children.

More than 1,200 Vermont families have already participated in the program, which is being expanded to 12 other states, the District of Columbia, and the U.S. Virgin Islands, under a \$1.5 million three-year NSF grant. The program is especially reaching out to low-income parents and those who are least likely to read to their children, let alone work on science activities with them.

The Vermont Center will provide instruction to library and science center professionals in the content and process of the program and provide technical support as the new sites begin implementation of the program. These professionals will in turn work with the parents and give them confidence in their ability to explore science with their children.



(continued from page 12)

- How can the ISE program continue to advance interdisciplinary and multidisciplinary learning—learning that is truly reflective of our natural and human worlds?

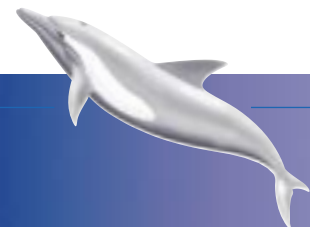
Through its diversity of projects, its creativity, and its high standards for quality, the ISE program has both had a profound effect on the informal learning community and—throughout the years—provided enjoyable and meaningful learning experiences to generations of children and adults. One such adult, Carl Sagan, had the vision to set new paradigms for learning. He worked tirelessly in support of the same ends as the ISE program. “The job is by no means done,” Sagan once remarked. “We will look for the boundary between the solar system and the interstellar medium and then we’ll voyage on forever... between the stars.” Consistent with this vision, the ISE program will continue to excel and will continue enabling people to traverse orders of magnitude in their voyage of the mind.

¹Jon D. Miller and Linda Kimmel. (1997). *Public attitudes toward science and technology, 1979-1997, integrated codebook*. Chicago: Chicago Academy of Sciences, International Center for the Advancement of Scientific Literacy; and unpublished tabulations.

²Patricia B. Campbell, Kathryn Acerbo, and Jennifer Storo. (1994). *Playtime is science: 1994 evaluation report summary*. Groton, MA: Campbell-Kibler Associates.



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and the interstellar medium
and then we’ll voyage on forever...
between the stars.”



Cosmic Voyage

National Air and Space Museum, Washington, D.C.
202/357-2700, 202/357-1729TTY, www.nasm.edu/GALLERIES/GAL115

Raptors

Science Museum of Minnesota, St. Paul, Minnesota
651/221-9488, www.smm.org

Playtime is Science

Educational Equity Concepts, New York, New York
212/725-1803, mdac.educ.ksu.edu/MDAC/services/programs/playtime.html

Roman City, Unicorn Projects, Inc., Washington, D.C.
202/543-6656

3-2-1 CONTACT, Children's Television Workshop, New York, New York
www.ctw.org

A Science Odyssey

WGBH Boston, Boston, Massachusetts
617/492-2777, www.pbs.org/wgbh/aso

Prehistoric Journey

Denver Museum of Natural History, Denver, Colorado
303/322-7009 or 800/925-2250, www.dmnh.org/prejour.htm

What Makes Music?

Franklin Institute, Philadelphia, Pennsylvania
215/448-1129, <http://physics.hallym.ac.kr/education/wave/music>

Beyond Numbers

Maryland Science Center, Baltimore, Maryland
410/545-5901, www.mdsci.org/exhibit.html

Volunteer-led Investigations of Neighborhood Ecology-VINE

North American Association for Environmental Education, Troy, Ohio
937/676-2514, <http://naaee.org/html/vine.html>

ScienceMinders

YWCA of Annapolis, Maryland
410/626-7800, www.sitestar.com/scienceminders/project.html

Whodunit?

Fort Worth Museum of Science and History, Fort Worth, Texas
817/255-9300 or 888/255-9300, www.fwmuseum.org/whoinfo.html

The Magic School Bus

Scholastic Foundations, New York, New York
800/724-6527, www.scholastic.com/magicschoolbus

Mother Goose Asks "Why"

Vermont Center for the Book, Chester, Vermont
800/763-BOOK, www.vermontbook.org

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