ASTC Dimensions

Bimonthly News Journal of the Association of Science-Technology Centers

September/October 2004

Farther Afield:

The Changing School Visit

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Field trips, excursions, school visits—call them what you will, on-site programs for teachers and students remain a key element of science center operations. But a recent change in education policy in the United States, the No Child Left Behind Act of 2001, has put these "bread-and-butter" programs in question. Under the terms of NCLB, the status of each school—and, by extension, its teachers—depends on how well its students score on annual standardized tests in reading and mathematics. In response, many school districts are funneling resources into basic instruction, dropping enrichment programs like art, music, and museum visits. A January report by the National Education Association reveals that field trips have been eliminated statewide in Kentucky and Michigan, while in other states officials have cut back on trips or imposed new fees. In this issue, we look at creative ways science centers are responding to this challenge, and consider some promising new practices.

Features

Departments

Cover: From "virtual voyages" to sophisticated lab sessions, from custom enrichment to videoconferencing, science centers are finding new ways to meet the needs of schools while retaining their informal science approach. *Photos courtesy, clockwise from top, Louisville Science Center, COSI Columbus, the Children's Museum of Indianapolis, and Edgerton Explorit Center*

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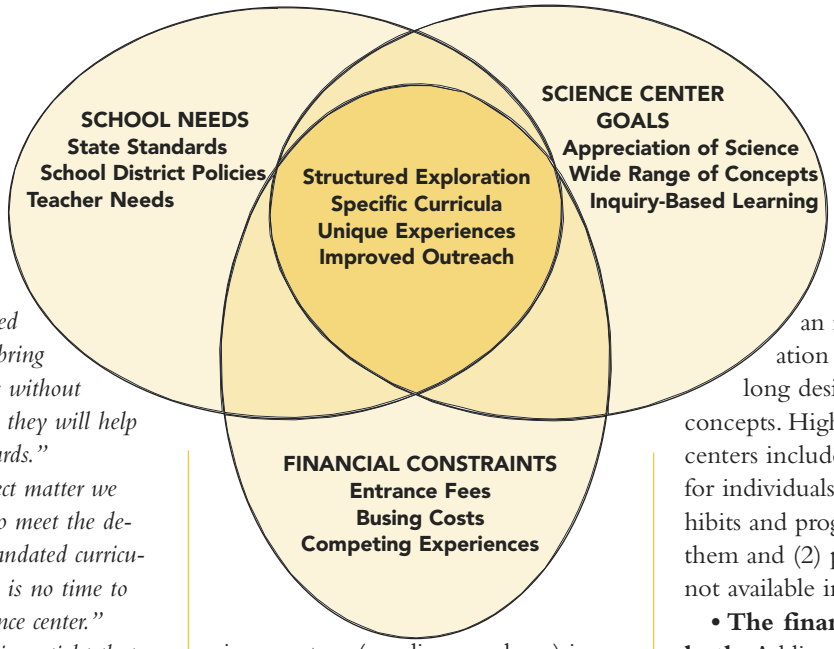
The Field Trip Challenge:
Finding Common Ground

By Dennis Schatz



"We are no longer allowed to schedule field trips or bring programs into our schools without justifying in writing how they will help us meet the stated standards."

"The amount of subject matter we need to teach each year to meet the demands of our school's mandated curriculum is so great that there is no time to schedule visits to the science center."

"The school's budget is so tight that it is nearly impossible to pay for buses to go to the science center or get the PTA to pay for the outreach program to come to the school."

These are the types of comments I hear from teachers, parents, and science center professionals whenever we talk about why, in this world of "No Child Left Behind," it can be so difficult to get school groups to visit science centers. At Pacific Science Center (PSC), as at many other U.S. institutions, school group attendance has plateaued since the beginning of the new millennium.

As a science center professional with 30+ years working in the education arena, I have tried to delve deeper into the underlying causes for these comments. As I considered the sometimes conflicting, sometimes complementary needs, goals, and constraints of schools and science centers, I found myself visualizing a system (see diagram above) in which these factors might overlap to suggest a new approach to the classic "field trip."

• **The needs of schools.** As the standards movement has been implemented across the United States, state departments of education have (1) begun specifying which science concepts need to be learned in which grades and (2) created mandatory tests to document that learning. School districts have responded by aligning their instructional materials to the mandated concepts and requiring teachers to cover them. Teachers, many with their jobs hanging on successful testing results, are thus less willing (or able) to spend a day at the science center simply for the joy of learning; they now demand that the experience relate directly to the curriculum they teach.

•**The goals of science centers.** Historically, the missions of science centers have not been tied to a specific curriculum. We exist to inspire an interest in and appreciation of science and a lifelong desire to explore scientific concepts. High priorities for science centers include (1) making it possible for individuals to freely explore exhibits and programs that appeal to them and (2) providing experiences not available in a school setting.

• **The financial constraints on both.** Adding to the complexity of the issue is the fact that budgets at both schools and science centers are increasingly strained. In schools, the costs of busing students to a science center have increased; principals' discretionary funds are down; and PTA fund-raisers must now pay for a wider range of school expenses. Museums are facing more local competition in the out-of-school science experiences market than they did a decade ago. Since I came to PSC in 1977, for example, Seattle has added a flight museum, an aquarium, a children's museum, and several environmental education centers. So resources are spread more thinly.

The "central triangle"

Is there a place where these diverse needs, goals, and constraints overlap? Can science centers find ways to meet teachers' expectations, keep program costs in check, and still maintain our core identity? Here are

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Connecting with Curriculum:
A Hands-On Biotech Lab

By Michele Schilten

Teachers everywhere are under intense pressure to meet state-mandated academic standards. At the Children's Museum of Indianapolis, we are responding to the needs of Indiana's teachers by building bridges between school curricula and museum programs. Because we keep the Indiana Academic Standards for student learning in mind as we develop our interactive programs, we have been able to extend our reach to the school audience. One example is our new Biotechnology Learning Center (BLC), a facility geared primarily to students aged 10 to 14.

Because most teachers now visit the museum only when they can justify a field trip's contribution to the curriculum, we make it easy for them by identifying and advertising the standards addressed in BLC programs. That way, when they begin a unit on cells or DNA, for example, they know they can plan a correlating visit to the lab. Beyond general admission, there is no additional fee for these programs.

It has been our experience that most upper elementary and middle school science teachers lack the skills of a trained scientist, and many do not have a good working knowledge of the life sciences. The 1,500-square-foot BLC, created with the financial support of Dow AgroSciences LLC and the expertise of Dow scientists, helps to enhance the science curricula mandated in upper elementary and middle school classrooms.

The lab offers students a colorful and friendly atmosphere in which to explore the principles of agricultural biotechnology, a subject that has important implications for their present and future lives. It provides teachers with the space and resources they need to do real science. The hands-on equipment in the BLC, including micropipettes, water baths, incubators, models, and microscopes, is rarely found in the average elementary or middle school.

Middle school students participate in DNA extraction at the Biotechnology Learning Center. *Courtesy Children's Museum of Indianapolis*

During a typical 80-minute lab program, fourth to eighth graders review the parts of the cell, using models and microscopes; isolate DNA from strawberries or wheat germ; and investigate it using models and three-dimensional images. With older students, we discuss the implications of genetic engineering and encourage them to "create" their own new products. In a separate 50-minute program, middle school students look at uses of biotechnology in their own lives and practice micropipetting by making cheese with chymosin, one of the first products of biotechnology found in our food supply.

A class visit to the BLC is only one part of the science enrichment the museum offers. School Services staff have created a variety of resources for teachers to use in supplementing their students' learning:

- The *Biotechnology Learning Center* has its own web site designed for children, families, and teachers. The site contains links, resources, books, activities, and current information for learning more on the topic.
- A *Unit of Study* is a set of lessons organized around fundamental themes and enduring ideas, linking academic standards with museum exhibits and programs. The Agricultural Biotechnology Unit developed for the BLC addresses standards relating to the history and nature of science, plus concepts like cells and genetics.
- New this summer, the *Understanding Agricultural Biotechnology Resource Kit* contains books, videos, posters, pamphlets, and tools (micropipettes, electrophoresis equipment, models) that enhance the Unit of Study. Teachers can check out a kit for two weeks for a minimal fee.
- *Teacher Institute,* a five-day professional development program offered in the summer in the BLC and at partner institutions, such as Dow AgroSciences and Purdue University, gives educators an extended opportunity to get familiar with the lab, the Unit of Study, the kit, and the general topic of agricultural biotechnology. Graduate credit is available. The Institute reinforces the idea that the museum is a place where informal learning connects with school curricula.

How does all this benefit the Children's Museum? Opportunities exist now for older students that we did

not have before. Since the lab opened in March 2003, the museum's reach to upper elementary and middle school audiences has increased from a couple of programs a year to several regularly scheduled programs a month. More importantly, the quality of learning that these students experience when they come to the museum has grown.

Surveys and comments gathered from teachers show that they are beginning to see the BLC as a place to supplement and enrich classroom learning. Several have remarked how well the program matches the standards and how much more focused the students are when they visit the museum. The buzz is spreading—one recent participant from Southern Indiana said she specifically came to the museum for the DNA program.

All of this has been done without compromising the museum's commitment to informal learning. The BLC was designed to allow for discovery, investigation, and free-choice learning within the context of standards-related programming. When isolating DNA, for example, we allow students to extend the process by experimenting with the procedure. What happens if we change the temperature of the water bath? What if we don't use soap in the procedure? And a really important question: How do we really know this is DNA? Encouraging students to ask these kinds of questions gets them thinking like real scientists.

Efforts like the BLC and our new planetarium show "Galileo and the Tale of the Telescope"—also standards-based and aimed at upper elementary students—show how the Children's Museum of Indianapolis has become proactive in helping teachers combine informal science learning with formal learning in the classroom. ■

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(Continued from page 3)

some ideas—gathered from conversations with science center staff from across the United States—for modifications that can help keep our field trip programs attractive to school group audiences in coming years.

1. Offer structured exploration. The new emphasis on aligning with standards and teaching specific concepts requires us to offer something more than opportunities for free exploration. Teachers look to science centers to provide a mechanism to structure students' use of exhibits and programs. Some museums are developing standards-linked worksheets for students to complete during their visit; others may not wish to go this far. But providing open-ended questions for students to answer as they use exhibits can meet schools' needs while still falling within the science center's mission.

2. Connect to specific curricula. Teachers are most familiar with the units they teach. It is not hard to link a science center's exhibits and programs to state or national standards, but we can serve teachers even better by identifying the curriculum units commonly taught in our community and explicitly stating how our exhibits and programs help convey the concepts in those units. A strong approach is to combine exhibit exploration with a related laboratory experience for a specific curriculum unit. PSC now offers all kindergarten classes, for example, a combination of exhibit and laboratory experiences that conveys the concepts covered in the FOSS Wood and Paper module.

3. Emphasize unique experiences. As competition from other informal science attractions increases and teachers are faced with justifying the value of a trip to the science center, we need to offer experiences that cannot be found elsewhere or duplicated in the classroom. Observing the motions of the night sky in a planetarium, doing electrophoresis to examine DNA, exploring the life cycle of a butterfly in a butterfly atrium—all of these are strong reasons for a school group to visit the science center, especially if the experience can be modified to meet the needs of different grade levels and curricula.

4. Improve physical and virtual outreach. With budget constraints making it more difficult for schools to get to the science center, we need to find new ways to take our programs to them. These can include not only the traditional outreach van of exhibits, demonstrations, and laboratory experiences, but also virtual ways to convey unique experiences to the classroom. Institutions like the Liberty Science Center, COSI Columbus [see page 14], and the New York Hall of Science are finding success with videoconferencing, in which schools pay for virtual access to a live science center program keyed to local curricula or to a mediated third-party experience, such as a live surgical procedure.

These are not the only possibilities, of course, and it is important that whatever programs we devise not place added burdens on museum resources. If school groups make up only a small percentage of overall attendance at a given institution, it might be more cost-effective to explore modest ways to align school visits to the state's education reform effort and put remaining resources toward improvements for the general visitor.

One thing is clear, however: In today's climate, science centers must take the lead in developing school programs more intimately connected to what teachers are required to teach in the classroom. ■

Dennis Schatz is vice president for education and exhibits at the Pacific Science Center, Seattle, Washington; www.pacsci.org.

Serving Teachers, Supporting Schools

A Collaborative Solution

By Ann Carter and Fawn Warner

Opened in January 1998, the Discovery Center of Springfield (DCS) is "an interactive, hands-on museum committed to inspiring people of all ages with a lifelong love of learning and an appreciation for the world and our place in it." The museum currently flourishes as an educational resource center not only for its mid-sized, southwestern Missouri urban community (population 150,000), but also for the surrounding four-state Ozarks region.

From an original staff of three, with one programming area and a handful of exhibits, DCS has grown to 17 employees, 30,000 square feet of permanent and temporary gallery space, and a new digital Immersion Cinema. Museum education has gone from a handful of summer workshops to 20 distinct on-site science, health, and environmental field-trip programs; distance learning via videoconferencing; 10 weeks of summer workshops for ages 4 through 13; an award-winning web site; outreach and after-school programs for at-risk youth; and an array of special and educational events.

How have we managed to grow our educational programming at a time when state and school budgets are shrinking and teachers face increasing demands related to standards-based testing? We believe the answer comes down to two key elements: a focus on personal service and leadership in building community collaboration.

At Discovery Center of Springfield, students participate in a field trip activity, part of the museum's *ScienceWorks on the Road* program for children aged 8 to 10. *Photo courtesy Discovery Center of Springfield*

Tailored to specific needs

Collectively, the seven people who make up the DCS education staff—a director, four program coordinators, and two contract teachers—serve more than 50,000 students and teachers annually. As busy as we are, we still make time for a biweekly, face-to-face strategy meeting where we can put our combined talents and energies to work. Whether it's addressing individual project challenges or planning future programs, seven heads are better than one.

This spirit of teamwork has produced some creative ideas for tailoring programs to teacher and student needs. One of our most successful outreach efforts is *ScienceWorks on the Road,* an eight-week program (seven one-hour classroom sessions and a field trip to DCS) that targets children aged 8 to 10 in science and health. Many schools that participate are "at-risk" institutions—i.e., Title I schools where 70 percent or more of students are on free or reduced-fee lunch. Since 2002, Title I schools have received our program for free, thanks to support from the Missouri Department of Economic Development's Youth Opportunities Program and a U.S. Department of Education 21st Century Community Learning Center grant.

From the outset, *ScienceWorks* teachers told us that one of the big challenges they faced was helping students maintain interest and retain content from one session to the next. Our outreach coordinator and web site coordinator worked together to come up with a solution.

Using resources from DCS's *ScienceSource* web site—a museum-library collaboration with the Springfield–Greene County Library System that was funded by a 2001 grant from the Institute for Museum and Library Services—she created complementary "Virtual Voyages." *ScienceSource* is directly aligned with the science curriculum frameworks identified by the Missouri State Department of Education.

Each Virtual Voyage consists of online interactives and links related to the teacher's choice of one of nine possible topics: chemistry, biology, energy and Newton's Laws, earth science, color and light, matter, electricity and magnetism, ecology, and weather. A voyage can be used as a

special assignment, a focus for class discussion, or a free-time activity for students in the computer lab.

Not only do the online components provide vital continuity between outreach visits and increase the students' level of retention; they also demonstrate applications of the topic area in daily life, broaden the students' computer skills, and heighten the comfort level of many teachers with the subject material. Evaluation of *ScienceWorks on the Road* indicates a 25 percent to 30 percent increase in students' content-knowledge retention, as well as improved scores on required state testing and documented evidence of increased interest in science by the children and renewed enthusiasm for science by the teachers.

Another way we reach out to teachers is through a web-site "feedback form" for queries. We promise to respond within 24 hours to any question or need the educator posts here. This service has resulted in numerous successes and can be directly tied to an increase in field trips—including on-site, outreach, and videoconferencing—during our 2004 fiscal year.

A coalition for success

The second key to supporting educational programming is community collaboration. Almost everything we undertake these days is done with a community partner.

Of the 14 programs we currently offer through videoconferencing, for example, five are taught by staff and volunteers from the city's Dickerson Park Zoo. The zoo utilizes our investment in the technology and equipment necessary for electronic field trips while providing opportunities in topic areas for which we have little expertise (animal management and native species, for instance). Starting in the 2004–2005 school year, we will similarly partner with the Missouri Department of Conservation to provide programs on the Lewis and Clark Expedition and with the Watershed Committee on water quality issues.

Perhaps most significant has been our founding membership in the Springfield–Greene County Interpreters Coalition. The Coalition is a regional group of 20 informal education institutions that meet regularly and participate in activities and events for the benefit of the Springfield Public School District's teachers and students. Besides DCS and the zoo, the group includes the Springfield–Greene County Library; Wonders of Wildlife; the Springfield Conservation Nature Center; the Leadership Ranch; the City of Springfield's Art Museum, History Museum, and Public Works Department (specifically the latter's environmental education arm); City Utilities; Wilson's Creek National Battlefield; Fantastic Caverns; and the Air and Military Museum.

Though the Coalition works hard to promote science, art, history, and environmental education, it has no formal officers, nonprofit status, or by-laws. The group exists solely because of the passion felt by its members' representatives. In our discussions of common themes, issues, and problems, we have been able to strategize goals, objectives, and results that ultimately reach and serve local schools more effectively. Over time, this collective voice has gained recognition and respect from the school district, and has at least begun to remove some obstacles shared by all.

Since 2001, the Springfield–Greene County Interpreters Coalition has successfully

• *written and received two grants from our local Community Foundation to fund field trip transportation*. The first year, we got $4,000; in the second, our request was fully funded with $8,000. Available to all classroom teachers, the money is distributed through a simple, first-come, first-served application process. The new grant will provide free busing for approximately 2,500 students.

• *improved communication between the school district and Coalition members.* This includes face-to-face meetings with the district's curriculum coordinators to ensure that field trips to member sites provide opportunities that are directly tied to teacher needs and student testing requirements. Coalition staff members have also been invited to attend teachers' professional development workshops.

• *organized an annual one-day tour for up to 100 educators to visit member sites.* Now in its second year, the "Free-Wheelin' Friday" event, held in early August, features donated transportation on air-conditioned buses; free admission, tours, and activities at designated stops; and a wrap-up session with giveaways targeted to classroom teachers. The first event was free, but this year we implemented a $5 fee to cover continental breakfast, lunch, drinks, and closing reception snacks. We also added, based on a survey from last year's event, an additional "track" with four new stops. Despite limited advertising (a single newsletter, the DCS web site, and word of mouth), we filled 100 spots in two weeks and had 20 teachers on a waiting list.

This summer, DCS is embarking on an expansion that will double the museum's physical space by early 2005. In the education department, we look forward to more exhibit space, a permanent theater, state-of-the-art technology and classrooms, and real offices. But at the same time, we are determined not to lose what we have so carefully built. We know that our success is, and always will be, tied directly to our sense of place in the community, to the collaborations we have built, and to our willingness to remain a true service provider. ■

Ann Carter recently left her position as education director at the Discovery Center of Springfield, in Springfield, Missouri, to become a grants coordinator in Colorado. DCS web site coordinator Fawn Warner succeeded her as education director. To download the 2003–2004 Educator's Field Trip Guide(pdf)*, visit the Education pages at* www.discoverycenter.org.

Science Oasis:
Solving the Distance Problem

By Chad Johnson

A visiting student helps capture time during an Edgerton Explorit Center strobe light demonstration. *Photo courtesy EEC*

A recent school field trip to the Edgerton Explorit Center (EEC), in Aurora, Nebraska, begins, like most, with a phone call. The third grade teachers at Randolph Elementary School in Lincoln, the state capital, are looking for a location for their spring field trip. To please the children, the program has to fit the mold of a fun getaway; to please the educators, it has to deliver academic enrichment. And the caller has a special request: "Can you provide a program on the Six Simple Machines?"

Yes, indeed we can—and what's more, we can help her fill out our online registration form and choose the date, time, and type of activities that best fit her needs. Within minutes, the registration is complete, confirmation letters have been e-mailed, calendars are updated, and a new EEC Enrichment Program is in the works.

"Six Simple Machines" is a term commonly used to refer to six basic tools—the inclined plane, pulley, wheel/axle, wedge, lever, and screw—that have few or no moving parts. Over the next six weeks, science center staff will design and build equipment for the program's activities out of PVC pipe. Experiential scenarios will be developed, along with a priority checklist—incorporating three Nebraska State Academic Standards and eight student objectives—that can help teachers assess their students' experiences. The teachers will receive an outline of a challenge scenario for 60 third graders—complete with activities designed to foster teamwork, problem solving, and scientific inquiry—based on the Six Simple Machines.

Finally, the big day arrives. Leaving the bustle of Lincoln, the bus travels the 70 miles to our small town, population 4,000. Rushing in, the kids start to explore EEC's hands-on activities, but their teachers quickly gather them into the classroom/enrichment area. After a briefing on the mission of the day, the rambunctious crowd magically turns into hard-working teams, tackling their assigned machine projects. Within 90 minutes the teams have designed, built, tested, and competed with contraptions that incorporate all six of the Simple Machines. Students continue to buzz about their projects as they finish their day exploring the museum.

"It is amazing to see these kids accomplishing so much," says one sponsoring teacher. A student asks, "Can I bring my family on Saturday to do this stuff?" Evaluations will show that the Randolph Elementary School field trip has definitely been a success.

Extension through technology

Edgerton Explorit Center is named for "Doc" Harold E. Edgerton, the Nebraska-born 1930s pioneer of stop-motion (stroboscopic) photography, who grew up in Aurora. Inspired by Doc's journey from small beginnings to a professorship at the Massachusetts Institute of Technology, EEC thinks of itself as a "science oasis" in a state that has more resident cattle than people (6.2 million vs. 1.7 million in 2003).

Obviously, a town like Aurora can't provide a steady flow of new visitors. At EEC, our challenge has been to find ways to increase market penetration by meeting the needs of many schools, both rural and urban. We currently reach 7 percent of Nebraska students aged 5 through 18. Our goal is to become—through technology, enrichment programming, and strong emphasis on visit quality—a wellspring of science education for the entire state.

Technology plays a key role in this effort. Recently, we were able to purchase a chromo-screen video game for our Explorit Zone gallery and a digital camera to spice up our Stopping Time science demonstration. But our primary technological enhancement has been a facelift and major behind-the-scenes development for our web site that allow us to take reservations, automatically update our calendar and schedules, and communicate effectively online with current and future visitors.

Database-driven, with an easy-to-use format for handling customer information (see "Ensuring Success with Online Reservation," opposite), the new web site has dramatically decreased the amount of time we spend managing registrations. Teachers feel more comfortable because they can log in and verify their information themselves. And because marketing flyers are now sent automatically via e-mail, the database has saved us at least $12,000 in postage.

Our next step in online technology is distance learning. In a 77,000-square-mile state, where four- or five-hour bus trips for student activities are not uncommon, videoconferencing is a logical way to extend our reach. We have begun developing programs for schools throughout the state; ultimately, we hope to serve students outside Nebraska as well.

Not only do we originate videoconferences at EEC; we also facilitate educational programming from NASA and other U.S. sources, acting as a connectivity converter to open the world of IP protocol to partner schools. We are currently developing programs that will allow students to control our strobe and stop-motion photography equipment via the Internet. Through that, plus a "Virtual Scientists in the Classroom" program featuring professors from MIT, we hope soon to be able to share with the world the legacy of Harold Edgerton.

Value-added customer service

The other key elements of our "science oasis" strategy are programming enrichment and quality control. Although venturing into traditional education wasn't our goal, we thought providing a way for schools to address their standards in an inspirational setting was something that needed to be done. EEC Enrichment Programs are 90-minute sessions that offer challenging opportunities based on Nebraska State Science Standards. Each includes a priority checklist that teachers can use to document individual students' level of achievement for the given standards.

Not only do these programs meet a felt need of the schools; they also bring in more money for the science center. EEC's fee for a traditional field trip (two 30-minute science demonstrations and self-guided exploring time) is $3 per student; for an Enrichment Program, it is $5. Yet after initial setup, the latter is no more difficult to facilitate.

Enrichment Programs also offer an academic reason for a visit earlier in the school year. Field trips at EEC have tended to come in March, April, and May, increasing toward the end of school as teachers look to reward their students for a year of hard work. Our new approach provides an incentive to come in the fall as well.

Success has brought challenges, too. In setting an all-time attendance record of 16,722 visitors in 2003, we felt the quality of our service was sometimes compromised. During this year's spring rush, we attempted to balance numbers and quality. Our new registration/scheduling program helped us eliminate group overlap in the Explorit Zone, spread schools out on different days, and eliminated the dreaded unexpected visit. The 2004 schedule allowed a longer transition from exploring to guided programs, provided more time for science demonstrations, and mostly avoided combined groups.

Although our numbers since implementing these changes are slightly behind last year's, they are still well ahead of previous years—and we have never received so many complimentary reviews in the evaluations. Teachers who have been coming for years tell us they like what they are seeing. And, thanks to the higher Enrichment Program fee, the lower numbers have not translated into lower revenue.

As we continue to work to improve our programs, our efficiency, and our bottom line, it is a joy to see how EEC is touching the lives of the children we serve, both on-site and online. Watching students' eyes light up when they accomplish a challenging task is all the motivation we need to carry on the legacy of "Doc" Edgerton. We want all of our visitors, as they pursue their lifelong learning in science, to look back on our "science oasis" as a source of refreshment and inspiration. ■

Chad Johnson (chad@edgerton.org) is experiential educator at the Edgerton Explorit Center, Aurora, Nebraska. For more information about EEC, visit www.edgerton.org.

Ensuring Success with Online Reservations

At the Edgerton Explorit Center, we launched our database-driven web site in the fall of 2003. Its primary function is to manage our event registration process. We were fortunate to have the resources and staff skills to design and develop our site in-house, but you don't have to have a staff programmer to create a good site (see Tips, below).

Going online was the best thing that could have happened to EEC's registration process; it made 2004 one of our best spring field-trip seasons ever. Here are some details and a few tips on how to take advantage of the Internet for your own registrations:

Vital Statistics: www.edgerton.org

- Template-based web pages for easy editing and page creation
- Microsoft active server pages (ASP)*
- VBScript programming*
- Information stored on a Microsoft SQL Database*
- Interactive calendar, with public, private, and staff access
- Automatic e-mail replies and calendar updates upon registration
- Registrations capable of being submitted and edited by staff or customer

(Note: Items indicated with a star (*) will change as we develop a Unix-based version with Perl, PHP, and mySQL.)

Tips for a Successful Online Registration System

1. Do your research. Ask your staff and regular visitors what they would like to see in the program. Contact people who use similar systems and get their advice. If you are purchasing prepackaged software, ask for demonstrations and evaluation copies.

2. Choose a program that meets your needs; don't change your needs to meet the program. Remember, this system has to be something both staff and visitors are comfortable with—or they won't use it.

3. Go for a database-driven site. E-mail forms are a thing of the past; you have to process them manually, and they don't save time. A database allows you to store and retrieve customer information quickly and automatically.

4. Check out custom programming. Prepackaged software programs can be impressive, but they don't always do what you want them to do. A local web site developer may be able to create a custom program for a reasonable price. (This also lets you develop a good relationship with the person who holds your institution's future in his or her hands.)

5. Budget for upgrades. No matter what your web site registration program costs initially, you will want to alter some elements over time. Making friends with the programmer (see #4) is good, but you will still need to pay for the work.—*Chad Johnson*

Online vs. On-Site:
The 'Burarra Gathering' Experience

By Brenton Honeyman

Both on-site (left) and online exhibits (above) in *Burarra Gathering* are designed to provide visitors with insight into the knowledge and technologies of contemporary Indigenous Australian culture. Here, the subject is firemaking. *Images courtesy Questacon*

One question faced by science centers attempting to serve populations scattered over large areas is whether it is possible to create online, virtual exhibitions that can achieve the same outcomes, in terms of learning impacts, as on-site, gallery-based exhibitions. And if it is possible, should centers then focus attention and resources more on reaching and engaging virtual visitors than on increasing on-site attendance?

To address such questions, Questacon, the National Science and Technology Centre, in partnership with the Burarra ("Bur-ah-dah") people of central-northern Australia and the Investigator Science and Technology Centre, developed a recent exhibition, *Burarra Gathering,* in two stand-alone, interactive formats: a gallery-based exhibition and a web-based experience.

Both on-site and online formats were designed to provide visitors with insight into the knowledge and technologies developed by the Burarra people as an example of contemporary Indigenous Australian culture. The exhibitions focus on

- the interconnected relationships between people, animals and plants, weather systems, and the land;
- the application of their knowledge to the practices of tracking, trapping, making fire, and navigating by the stars;
- the way young Indigenous Australians learn by watching and listening to elders and then trying for themselves; and
- the continuously adapting nature of indigenous knowledge.

Although the on-site and online experiences are based on the same content and are intended to be equivalent in terms of learning outcomes, they are not exact replicas of one another. Each includes different elements that make appropriate use of the advantages of its medium.

An opportunity to compare

Many science centers and museums have a well-established web presence (Questacon's own web site was launched in 1995). Most use their site to promote exhibitions and programs and to provide information that helps people plan or supplement a visit to the museum. But some have extended their online offerings—replicating exhibits found in the museum, providing content independent of an actual visit, or even offering self-contained, "complete" virtual experiences.

Such virtual exhibitions have the potential to reach greater numbers of "visitors" over much greater distances, and for less cost in terms of development and maintenance, than on-site exhibitions. But while there is considerable data available about the impact of web-based content on learning per se, there is limited data on the relative impacts of web-based experiences vs. physical, gallery-based experiences.

In Australia, where potential visitors are spread over large geographical distances, science centers and other cultural organizations take a keen interest in the use of online technologies as a means of extending their reach and impact. At a meeting of the heads of national cultural organizations convened by the Australian Department of Communications, Information Technology, and the Arts in 2002, it was agreed that a study of *Burarra Gathering* be carried out to explore the learning impacts of the two types of exhibition.

Methods and results

The study developed a methodology, using interviews and a time series approach, to compare the extent of cumulative learning by visitors in two age groups—young adults averaging 23 years of age, and children aged 10 to 12—as they engaged with (a) the on-site exhibition; (b) the online exhibition; (c) the on-site exhibition, then

the online exhibition; or (d) the online exhibition, then the on-site exhibition.

The study required participants to
• rate their overall level of understanding of indigenous knowledge and technologies prior to engaging with the exhibition;
• engage in all of the activities offered by the exhibition;
• comment about each activity and any understandings they had gained; and
• rate their overall level of understanding of indigenous knowledge and technologies after engaging with the exhibition.

For young adults and children alike, both online and on-site exhibition experiences generated positive learning impacts, with no observable difference in the extent of their perceived overall learning when comparing one with the other. For individual activities within the exhibitions, verbal reports indicate that both online activities and their on-site counterparts facilitated new understandings and appreciations by both adults and children.

A greater learning impact was noted to accumulate across the two exhibitions for those who engaged with both on-site and online modes. For both adults and children, the order in which they engaged with the exhibition modes made no difference to the overall learning impact. However, when rating their preference of exhibition mode, there was a marked difference between adults and children.

The children consistently expressed a preference for the on-site, gallery-based exhibition, whereas the adults preferred whichever exhibition mode they engaged with last. This is consistent with research conducted by David Schaller, Steven Allison-Bunnell, and others in 2001 (see *www.archimuse.com/mw2002/papers/schaller/schaller.html)*, which demonstrates that children respond more positively to presentations that are largely experiential, while adults prefer presentations that provide opportunities to acquire even more information.

Schools Value Outreach

In Australia, a number of organizations, not just science centers, conduct science education and awareness programs as incursions, or "outreach" programs, into community venues across cities and beyond, to regional, rural, and remote areas. A recent national study mapped the nature and extent of such programs outside the capital cities. Its final report, published as *Reaching All Australians,* is based on data from organizations that offer outreach, as well as from schools that receive the programs. Key findings include the following:
• Incursion programs increase student interest and skill levels.
• Presenters bring much needed new approaches, content, techniques, and resources into classrooms, benefiting students and teachers alike.
• The number of available programs, frequency of visits, and range of experiences provided are insufficient to meet the needs expressed by schools.
• Time, transport, and accommodation costs increase significantly as programs travel further; many providers thus limit their itineraries to less-distant locations.
• Schools and communities in more rural and remote areas, with their lower population base, are unable to afford the higher costs of attracting programs.
• It is more cost- and time-efficient for schools to have science center programs visit them than for students to travel to an urban science center.

The report recommends bringing together national, state, and local resources to address the "educational divide" experienced by regional, rural, and remote areas because of limited access to programs that are readily available in the cities.—*B.H.*

Brenton Honeyman convened the coalition that produced this study. *Reaching All Australians* is available online at *www.questacon.edu.au/html/outreach_report.html.*

Conclusions

To return to the questions we began with, the Burarra study indicates that it is possible to curate an online experience that, when compared with an on-site exhibition, generates similar learning outcomes. Some often-overlooked factors need to be incorporated into the design of online exhibitions first, however. These include the provision of
• appropriate levels of interaction/interactivity to facilitate visitors' preferred learning styles;
• structure to enable visitors to make connections between, and accumulate learning across, related concepts; and
• structured space to reflect upon their understanding.

But the study also leaves some questions unanswered. If positive learning impacts can be demonstrated for online exhibitions, should science centers count virtual visitors in the same way we count on-site visitors? Should we seek additional funds or reassign existing funds to develop virtual online exhibitions in addition to, or instead of, on-site, gallery-based exhibitions? Will virtual museums someday bring online exhibition experiences to people in the same way television has facilitated the mass distribution of leisure entertainment?

For most gallery-based institutions, including Questacon, the short- to medium-term position is likely to be a continuation of our current practice—providing on-site exhibitions as our primary focus, and using the Internet to provide supplementary or stand-alone learning resources and experiences. In the longer term, with further developments in online technologies generating higher levels of edutainment, interactivity, and, most importantly, accessibility, it is likely that science centers will become more strategic in their use of online media to attract and engage virtual visitors. ■

Brenton Honeyman is executive operations manager at Questacon, the National Science and Technology Centre, Canberra, Australia. He coordinated the study described in this article; the full report, prepared by Phillip Dermody, was published in June 2004. For Burarra Gathering, *go to* http://burarra.questacon.edu.au.

Chaperone-Led Field Trips:

The Road Less Traveled?

By Kimberly M. Burtnyk

In 2002, the California Science Center (CSC)—responding to teacher requests, and motivated by a desire to update its school visit experiences and make them more inclusive—implemented a web-based, self-guided field trip program known as ThinkSCIENCE! Pathways. The program was based on studies of museum field trips done since the mid-1980s (see "Recommended Readings," opposite page) that had identified a variety of elements that contribute to a successful "educational" experience.

Pathways includes pre- and postvisit classroom activities, background information for teachers, in-gallery live demonstrations by museum staff, a focus on artifacts, and worksheets designed to enable adult leaders (i.e., teachers and volunteer chaperones) to guide their groups knowledgeably. Because Los Angeles has a large Hispanic population, the materials were prepared in both English and Spanish.

This approach differed from previous field trip programs at the science center (and other museums) in several ways:

- Pathways is free of charge and available through the museum's web site.
- Staff-facilitated field trip programs can accommodate only a limited number of students; Pathways allows virtually unlimited numbers of students to interact with museum educators.
- Previous field trip programs were held in science center classrooms; Pathways utilizes the exhibit galleries and their live demonstrations to facilitate student learning.
- Chaperones have been recognized in several studies (e.g., Griffin and Symington, and Voris, Sedzielarz, and Blackmon) as valuable field trip resources. Pathways gives these adult leaders the background information they need to become knowledgeable facilitators.
- Unlike the common scavenger-hunt model, the "one-worksheet-per-group" format of Pathways encourages student cooperation.

The main thing that distinguishes Pathways from other field trip programs is the role it assigns to chaperones. The notion of a "knowledgeable adult facilitator" leading field trip discussions appears often in the literature, but the approach has rarely been tested in practice. The launch of Pathways provided an opportunity to do so. The results of that testing are the subject of this article.

The good news and the bad

Evaluation of the role that ThinkSCIENCE! Pathways might play in helping chaperones facilitate students' museum experiences was developed in two phases: a formative evaluation to assess the program's impact on chaperone/student interactions, and a summative evaluation to determine whether students whose chaperones used Pathways would exhibit greater learning outcomes than those whose chaperones did not use the materials.

In both phases, evaluators were to observe chaperones and students from schools that had been recruited to use Pathways (the test groups) or not to use Pathways (the control groups) as they interacted in the *Destination Space* exhibition at the science center's Air & Space Gallery.

Five behaviors were chosen as indicators of active chaperone/student interaction:

Students participate in a liquid nitrogen demonstration in the *Destination Space* exhibition, part of the California Science Center's Air & Space Gallery. *Photo courtesy California Science Center*

- whether chaperones stopped at targeted exhibits,
- how much time they spent with students at a targeted exhibit,
- how many text panels they read to students,
- how often they encouraged closer examination of target artifacts, and
- how often they engaged students in discussion.

Because the duties of a chaperone are not always well defined, teachers and chaperones were to be surveyed in both phases to find out what roles they believe chaperones should play on field trips. Finally, the summative evaluation would include a pre- and post-test to measure student learning.

During the formative evaluation, observations of 25 Pathways test chaperones and 12 non-Pathways control chaperones were conducted. Evaluators found that

- Pathways chaperones exhibited more active interactions with students than non-Pathways chaperones.
- More test chaperones than control chaperones visited targeted exhibits.

• At a target exhibit, Pathways chaperones spent twice as much time with their groups as non-Pathways chaperones; they read more text panels to students; and they more often encouraged students to look closely at artifacts.

The one objective Pathways did not achieve was to increase the frequency of chaperone-led discussions. Despite having access to discussion question sheets, the test chaperones simply did not plunge into an active facilitator role. Nevertheless, students in the Pathways groups did spend more time with adults who helped them interpret exhibits.

From this evidence, Pathways would appear to have been quite successful. But what the above discussion does not reveal is a more sobering result of the study, one that was not anticipated by its designers: Of the 25 school groups recruited to test Pathways, only three groups actually used the program. The 22 groups that had access to Pathways but didn't use it fared no better in the evaluation than the control groups. (An unpaired t-test comparing the groups returned p=0.36.)

Why wasn't Pathways, with its rich assortment of tools, being more widely used? When evaluators queried the test teachers, their answer was that the program was too complex and they had too much difficulty downloading it (most had access only to slow, dial-up modems.) The teachers also said they were unable to talk to chaperones prior to the field trip, so issuing discussion sheets in advance was impossible.

Prior to the summative evaluation, some changes were made. The Pathways in-class activities and chaperone sheets were listed as separate links to minimize their download sizes. To eliminate the need for teachers even to download the materials, all groups recruited for the summative evaluation were sent Pathways packets at least one week prior to the field trip. Pre- and post-tests were administered to both test and control groups to determine whether using Pathways would positively affect student learning outcomes.

Hopes were high that giving teachers Pathways ahead of time would increase its appearance on field trips. Unfortunately, this was not the case. In the summative phase, test group after test group again arrived without the materials. After 26 chaperones from eight schools had been observed with no sign of Pathways use, and 300 pre- and post-tests had been returned representing only students whose chaperones had not used Pathways, the summative evaluation was halted. With nothing but control data in hand, no comparisons were possible.

Searching for reasons

Why weren't the test groups using Pathways? The schools had the materials, so the problem could not have been technical. Further discussion with teachers revealed explanations similar to those of the first study: Teachers felt Pathways was too difficult to implement; the materials were (apparently) still too difficult to download; and teachers did not talk to chaperones before the field trip.

It wasn't until we got to the surveys that a fourth—and probably more significant—reason for Pathways' dismal usage rate emerged. When asked to state the role of a chaperone on a field trip, the two groups disagreed. Nearly 50 percent of chaperones stated that "facilitating learning" was one of their primary duties, while only 14 percent of teachers felt the same way. These findings are corroborated by other surveys completed at California Science Center professional development workshops, strongly suggesting that even when teachers are able to talk to chaperones beforehand, they do not trust these helpers enough to give them the responsibility of facilitating.

For a final explanation, we might also look to the 2002 study of K–7 teachers' field trip planning and implementation processes conducted by Anderson and Zhang in Vancouver, British Columbia. There, the teachers' demand for museums to provide educational components for field trips was

(Continued on page 15)

Related Readings

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• Falk, John, and John D. Balling. "The Field Trip Milieu: Learning and Behavior as a Function of Contextual Events." In *Journal of Educational Research,* Vol. 76, No. 1 (1982).

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Videoconferencing:
Closing the Distance at COSI

By Gail Wheatley with Carolyn Sutterfield

At COSI Columbus, we launched our Electronic Education program in 2000. When we started, there were a few dozen distance-learning providers recognized nationally for their quality science content. Today, there are more than 350. That puts us in competition not only with other museums in Ohio but also with institutions in Texas and California and New York, and makes it even more important to build on what makes us unique.

COSI's first distance-learning offering was *Gadget Works,* a "simple machines" program for grades 2–6. During this one-hour videoconference, students observe the motion of wind-up toys, take the toys apart, and put them back together again. The program includes a kit of hands-on materials for 30 students to use during the show, plus materials for additional hours of in-class activities. We present *Gadget Works* almost every day, January through May. For a single-point hookup (to one classroom), the cost is $190, and teachers will book these shows up to a year in advance.

Gadget Works hits some of the same concepts and standards that COSI teams present in our on-site *Gadgets* gallery, but the programs are complementary rather than identical; we have had school groups do both in the same year. Electronic Education often feeds off what's going on in the building. Because COSI is now doing a lot of weather programming, we are looking at what we can offer in terms of a weather videoconference.

Another program that sells out well in advance is *Surgical Suite* (also available on-site to visiting groups). Participating students in grades 6 and up have an opportunity to interact live with surgeons and medical personnel in the operating room (OR); kit materials include pre- and postexperience activities, an interactive web site, and a guide to OR-based careers.

Anne Douglas, COSI videoconferencing coordinator, conducts the *Ecology* session, which is based on a monitoring program at an Ohio wildlife preserve. *Photo courtesy COSI Columbus*

We offer two tracks: a 90-minute knee surgery program with Mount Carmel East Hospital, and a three-hour open heart surgery program with Mount Carmel Hospital. Not only does *Surgical Suite* meet national and state education standards for health and understanding the role of science in our lives; it also fulfills COSI's mission of motivating the public to pursue "a better understanding of science, industry, health, and history." At the same time, it addresses the hospitals' goal of inspiring more young people to consider health-related careers. In the future, we hope to partner with the Ohio State University Medical Center on an additional *Surgical Suite*.

A three-part program like this is expensive to run, although some efficiencies are starting to kick in as the program grows. We are lucky to have a strong sponsor in Cardinal Health, a Columbus-based national supplier of health care products. But even at a cost of $235 per connection (for the open heart session), sessions for 2004–2005 sold out in one day. The program is definitely self-sustaining.

Experts is a program that offers a little of everything. The presenters are mostly science, math, and technology researchers and instructors from the Ohio State University, a major employer in Columbus. But we also partner with Battelle, a national science think tank with a strong local presence, and Ross Laboratories, a food and nutritional science corporation. This past year, we started branching out, connecting with college and university presenters in California, Florida, and New York, and in Costa Rica and British Columbia.

The premise is that students get to ask questions of an expert in a particular field—anything from black holes to bioengineering, microarrays to polar research. The presenter talks for about 15 minutes, describing his or her current project, showing slides or objects related to the work, and explaining how experiments are designed or records are kept. For the remaining 60 or 75 minutes, we go round-robin with student questions. The cost is $125 for a multipoint connection for up to five classrooms.

Because it is inquiry-based, *Experts* meets a lot of the new science standards. Our advance packet includes lists of books and web sites for further study, as well as a "thought challenge" that allows students to experience, prior to the videoconference, something of what the professional does.

For instance, we have a pathologist who comes in fairly regularly to talk about autopsies and determining cause of death. His thought challenge involves two sets of pictures, each consisting of a normal organ and its corresponding abnormal organ. For each pair, students have to figure out what the organ is, what the abnormality is, and whether it could be considered a cause of death. That prompts a lot of questions for the expert. We also ask students to prepare a list of general questions about the scientist's daily life and work.

Our newest program is *Ecology,* for grades 7–12, based on an ecological monitoring of the Killbuck Wildlife Area in Ohio's Holmes and Wayne counties. We developed this program in response to strong audience feedback. Because people tend to look to zoos or nature centers for that type of content, it is a harder sell. But as more people participate and word gets out, I expect this program to take off, too.

With so much competition in distance learning, how does Electronic Education manage to succeed? One reason is that we offer what our audiences want. I have heard from others in the field that it is hard to break into the high school market, that teachers won't pull their students out of class for videoconferences, but *Surgical Suite* and *Experts* programs are primarily geared to high school students, and they're our most popular programs. The high school teachers seem to be eager for real-world science content. We have been fortunate to have grant funding to cover front-end and summative studies and focus groups, so we have a pretty good idea what our audiences like and need.

Another boost for Electronic Education has come from our *Videoconference Teacher Training.* This 45-minute professional development session, which costs $75 per connection, allows teachers to experience videoconferencing for the first time and see how COSI runs its programs. The teachers get to view the technology, do some activities, and feel what the students would experience during an actual videoconference. A significant portion of our reservations come from teachers who take that training.

Distance learning differs from school field trips in that you have to offer the content at a time that complements the curriculum. Teachers won't buy ecology programming in May, for example, if they taught it in October, whereas they might potentially take a field trip having to do with ecology in the spring. And if it doesn't cover the standards in their lesson plans, they won't buy it at all. You need to pay attention to schedules and curricula.

In terms of marketing, word of mouth is still the best thing. The key to that is your in-house staff. You cannot be the lone voice crying in the wilderness, trying to get something up and running. The whole team has to be on board, talking about your program and getting the word out. At COSI, staff regularly discuss how we can complement and increase each other's programming and business. It's a very supportive environment.

It's also important to have help at the top. Kim Whaley, our current vice president for education, believes strongly in the Electronic Education program. In the year after she came to COSI, the program grew 257 percent.

The final key to success is finding ways to document your outcomes. I was a bit concerned when I began this job because Electronic Education was held to a very high standard for a start-up program. We had to break even or show a small profit within three years, and every decision had to be based on audience research. But now that the museum has been through a financial crunch, I am glad I was held to those standards. There's no question that the program is successful, and it's needed, and we have a strong audience. ■

Gail Wheatley is director of Electronic Education at COSI Columbus, Columbus, Ohio. Carolyn Sutterfield is ASTC's editor. For more details on the program, visit www.cosi.org/programs/ee.htm.

(Continued from page 13)
often motivated, the researchers found, by their need to "sell" a field trip to administrators. Once approval was granted, educational outcomes got cursory consideration.

Conclusions

The lesson of Pathways seems to be that the "chaperone as facilitator" model works well for field trips when it is used, but getting teachers to use the program is difficult at best. The approach differs too much from what they are comfortable with. Obstacles include not only those identified by the evaluations—lack of time to prepare chaperones, out-of-date technology, and disagreement about the chaperones' role—but also things as simple as bus scheduling, which makes it hard to coordinate field trip destinations with curriculum sequences.

One thing that became clear to us in the evaluation process is that we didn't know our teachers very well. In response, the California Science Center is initiating a large-scale, e-mailed teacher survey in greater Los Angeles to help us better understand their field-trip planning processes.

If self-guided, technology-based school visit programs like Think-SCIENCE! Pathways are to be successful, science centers must offer schools a compromise that bridges the new and the familiar. Without such a compromise, we risk alienating teachers and creating programs that only the most organized and/or dedicated few will use. If we venture too quickly and carelessly down this less-trodden path, our "new field trips" will be at best underutilized and at worst ineffective. The roads are diverging; which will we choose? ■

Kimberly M. Burtnyk is manager of evaluation at the Amgen Center for Science Learning, California Science Center, Los Angeles. She can be reached at kburtnyk@cscmail.org.

ASTC Notes

Data, Impact Top Board Priorities

Over the past year, ASTC's Board of Directors has been considering how the association can become even more effective in helping members worldwide fulfill their missions while remaining financially viable. Among the priorities identified in this process have been (1) addressing members' growing need for research that can guide operations, identify and assess new models, and document the impact of science centers, and (2) positioning ASTC and science centers as recognized leaders in public understanding of science.

Two task forces appointed last November—one on Data and Trends, the other on Science Center Impact—undertook to recommend appropriate actions for ASTC to pursue. Based on their May 2004 reports, the following work is under way:

• The annual Member Survey was revised to focus on key aspects of attendance and finance that members need to manage their operations efficiently. It was also shortened to encourage a higher response rate. As of July 31, the response rate was more than 40 percent, with about 90 percent of Governing Members responding. To help identify fieldwide trends, we plan to ask members in future to provide comparable information annually.

• Data from the 2004 survey will be published in book form as usual, but for the first time, we also plan to make key data available on disk for purchase by participating institutions.

• Techniques for using survey data in management and planning will be addressed in an extended 2004 ASTC Annual Conference session, "Developing a Toolkit for Science Centers: Forging Sustainable Business Models," led by Data and Trends Task Force chair Kim Cavendish.

• A monthly attendance reporting service open to Governing Members is entering its fourth year, with regular participation by 35+ museums.

• ASTC SCANS, a monthly electronic publication that helps members track news and trends that have a bearing on the future of the field, was prototyped in 2004. Following a Task Force recommendation, SCANS will be broadened in 2005 to include notice of research reports and resources newly posted on the ASTC web site.

• A new Analyses and Trends Committee will continue to oversee impact research and trend analysis. ASTC is currently contributing financial support and data to an economic impact test study being conducted by Questacon researcher Ilze Groves on behalf of the International Impact Study. Chaired by ASTC president Per-Edvin Persson, this group includes 13 science centers in Europe, Asia/Pacific, and North America.

Our dialogue on new science center models will continue in a 2004 conference session, "Overhauling Our Science Center Model, Part 2," led by Buffalo Museum of Science president David Chesebrough and ASTC president Per-Edvin Persson. The May/June 2004 issue of *ASTC Dimensions* on the same topic offered examples of ways that science centers are reexamining and repurposing their institutions for the future.

In the important area of positioning, the ASTC web site has undergone a comprehensive redesign to upgrade the image of the association and its members. Now featured are dynamic images of science centers worldwide and actively engaged visitors, young and old, from all segments of the community. Our thanks go to web site designer Ideum, of Sausalito, California, and to the many other members who responded to our call for images for the site. Usage of the site is now averaging 70,000+ individual visits monthly. Planned for 2005 are enhancements to the Products and Services area, including logo placement open to members. Be sure to link to *www.astc.org* from your own site.

It is our strong commitment to continue to devote ASTC's resources to priorities that help make members successful. Your help is also needed, whether by participating in data collection, contributing news

Welcome to ASTC

The following new members were approved by ASTC's Membership Committee in May 2004. Contact information is available in the Members section of the ASTC web site, www.astc.org.

SCIENCE CENTER AND MUSEUM MEMBERS

• **Lake County Discovery Museum,** Wauconda, Illinois. Operated by the Lake County Forest Preserves since 1976 on the site of a former cattle and grain farm, this small museum celebrates the history and agricultural technology of rural Illinois.

• **Lexington Children's Museum,** Lexington, Kentucky. This 14-year-old museum offers extensive on-site and outreach school programs, plus a new "school readiness" program for 4- and 5-year-olds.

• **ScienceWorks Hands-On Museum,** Ashland, Oregon. This hands-on museum, a resource for southern Oregon, opened in late 2002 in the 26,000-square-foot former Pacific Northwest Museum of Natural History building.

SUSTAINING MEMBERS

• **Claro Creative Studios,** Glendale, California

• **K & K Insurance Group,** Fort Wayne, Indiana

• **Kasian Kennedy Architecture Interior Design & Planning,** Calgary, Alberta, Canada

• **Tom Egan, Artist With Water,** Salina, Kansas.

items to SCANS, or sharing new models and practices with colleagues. Feel free to join in.—*Bonnie VanDorn*

School Programs Featured in San Jose

For more information on how science centers are working with school groups, watch for the following sessions and workshops at the upcoming 2004 ASTC Annual Conference:

- Welcoming Kids with Learning Differences (Saturday, 4:00pm)
- ITEST at Museums: Information Technology Experience Projects for Students and Teachers (Sunday, 9:00am)
- Measuring Success in Museum Youth Programs: Beyond High-Stakes Tests (Sunday, 9:00am)
- Providing Science Professional Development That Teachers Want and Need (Sunday, 1:30pm)
- Toward a More Useful Definition of Formal and Informal Learning (Sunday, 3:15pm)
- Learning Science Through Hands-On Innovation (Monday, 9:00am)
- Inspiring Teachers to Teach Science Through Design and Innovation (Monday, 9:00am)
- From Hands-On to Tender Loving Care: The Personal Touch in Education (Monday, 9:00 am)
- Outreach LIVE! (half-day Monday workshop)
- Down by the Riverside: Environmental Fieldwork for Educators (half-day Monday workshop)
- Keeping It Fresh: Updating Long-Standing Programs (Monday, 10:45am)
- The Museum Learning Collaboratory: Bringing Science Resources to Teachers via the Web (Tuesday, 9:00am)
- Intersections: Where Inquiry and Academic Standards Meet (half-day Tuesday workshop)
- National Education Outreach Network (NEON) workshop (full-day Monday)

For details or to sign up for a workshop, visit *www.astc.org/conference.* ■

Calendar

SEPTEMBER

1 **Math Momentum Workshop.** "Measurement." Hosted by the Museum of Life and Science, Durham, North Carolina. ***Details:*** John Leonard, JohnL@ncmls.org; 919/220-5429 x352

9–12 **GSTA International Conference and Trade Show.** Montréal, Québec, Canada. ***Details:*** www.astc.org/conference

18–21 **ASTC Annual Conference.** 'Sustaining Innovation in an Era of Rapid Change.' Hosted by The Tech Museum of Innovation, San Jose, California. ***Details:*** www.astc.org/conference

22 **Math Momentum Workshop.** "Measurement." Hosted by the Lawrence Hall of Science, University of California, Berkeley. ***Details:*** Helen Raymond, hraymond@uclink.berkeley.edu; 510/643-6525

30 **Math Momentum Workshop.** "Measurement." Hosted by the Buffalo Museum of Science, Buffalo, New York. ***Details:*** Betsy Vazquez, bvazquez@sciencebuff.org; 716/896-5200 x345

OCTOBER

1–2 **ASTC RAP Session.*** "Successful Summer Camp Experiences." Rochester Museum & Science Center, Rochester, New York.

1–2 **ASTC RAP Session.*** "Playing (with) Music in Science Centers." Heureka, the Finnish Science Centre, Vantaa, Finland.

2–3 **Strategies for Collaboration Workshop.** Montshire Museum of Science, Norwich, Vermont. ***Details:*** www.montshire.org/teams

4–9 **Theatre in Museums Workshop.** Science Museum of Minnesota, St. Paul. ***Details:*** Tessa Bridal, 651/221-4560

22 **Math Momentum Workshop.** "Data." Hosted by the Museum of Science, Boston, Massachusetts. ***Details:*** Alana Parkes,aparkes@mos.org; 617/589-0338

NOVEMBER

4–6 **2004 ECSITE Annual Conference.** Barcelona, Spain. ***Details:*** http://ecsite.ballou.be/new

JANUARY 2005

World Year of Physics 2005: Einstein in the 21st Century. A yearlong celebration of the centennial of Albert Einstein's three seminal physics papers. ***Details:*** www.physics2005.org.

APRIL 2005

10–14 **4th Science Centre World Congress.** "Breaking Barriers, Engaging Citizens." Hosted by the Museu da Vida, Rio de Janeiro, Brazil. ***Details:*** www.museudavida.fiocruz.br/4scwc/

OCTOBER 2005

15–18 **ASTC Annual Conference.** Hosted by the Science Museum of Virginia, Richmond. ***Details:*** www.astc.org/conference

* *Information on ASTC RAP sessions is available at* www.astc.org/profdev/. *For updated events listings, click on 'Calendar' at* www.astc.org.

Spotlights

By Carolyn Sutterfield

WORLD OF THE ULTRA-SMALL—Medieval clerics pondered how many angels could dance on the head of a pin. Today's scientists wonder how many molecular computers might fit on that same pinhead. Research and applications at the atomic scale—where the standard measure is the nanometer, 1 one-billionth of a meter—are the subject of *NanoZone,* a new permanent exhibition at the University of California's **Lawrence Hall of Science** (LHS), in Berkeley.

The opening panel of *NanoZone* features videos on an embedded TV screen. *Photo courtesy Lawrence Hall of Science*

NanoZone was conceived, designed, and built by LHS staff, led by principal investigator Marco Molinaro. Major funding for the $1.7 million project came from the National Science Foundation, with additional grants from the Frederick L. Ehrman Foundation and the Hedco Foundation.

When they began, Molinaro recalls, the lead designer called *Nanozone* "the project about things you cannot see that don't exist yet." Fortunately, a variety of nanotechnology-based products, from cloth that does not stain to sophisticated medical diagnostic devices, soon began to appear. "New Applications" is one of three themes of the continually evolving exhibition, along with "Size and Scale" and "Researchers as People."

NanoZone's target audience, visitors aged 8 to 14, can explore the science of the ultra-small through a variety of interactive vehicles. In the Activity Station, visitors encounter nanotechnology applications, including drug-delivering devices and semiconductor circuits, that could be part of everyday life in the future. Size and scale are represented by exhibits like Measure Yourself in Nanometers, What in the World Is This?, and Zoom In.

Computer kiosks feature not only educational games, such as "The Case of the Green Milk," but also stories based on the lives of four nanotechnology researchers. An animated segment on biomedical engineer Tejal Desai, for example, begins with the childhood fall from a tricycle that introduced Desai to the world of medicine and goes on to describe how a family history of diabetes inspired her to try to design micro-electromechanical devices for treating the disease.

Details: Marco Molinaro, molinaro@scienceview.LHS.berkeley.edu; *www.nanozone.org*

WALK AMONG GIANTS—Backed by an advisory board of paleontologists and dinosaur experts, the **Children's Museum of Indianapolis,** Indiana, has created *Dinosphere,* a 33,000-square-foot interactive exhibition aimed at families and designed around the family life of dinosaurs.

Included in this largest U.S. display of genuine juvenile and family dinosaur fossils are "Bucky," a teen-aged *Tyrannosaurus rex* that contains the first recognizable "wishbone" found in a dinosaur skeleton; "Baby Louie," the only articulated dinosaur embryo fossil ever found; a hypacrosaur (duckbill) family, consisting of adult, juvenile, and infant; and "Kelsey," one of the most complete *Triceratops* skeletons extant.

Housed in the museum's former CineDome theater, the three-story, immersive *Dinosphere* environment recreates the daytime and nighttime sights, sounds, and even smells of the Cretaceous Period. Visitors can experiment and explore in eight learning areas—touching real fossils, piecing together dinosaur anatomy, and even sniffing for *T. rex*'s "dinner." In the Paleo Prep Lab, programs allow visitors to interact with preparators as they prepare fossils for display.

Dinosaurs of the Cretaceous Period defend their territory in the immersive, real-bone exhibition *Dinosphere.* *Photo courtesy Children's Museum of Indianapolis*

Major funding for *Dinosphere* was provided by the Lilly Endowment, the Scott A. Jones Foundation, and the Enid Goodrich Educational Initiatives Fund of the Children's Museum. Additional funds came from local, national, and international donors.

Details: Jennifer Robinson, exhibits director, jennifer@childrensmusem.org; *www.dinosphere.org*

MUSEUM METAMORPHOSIS—Just over a year ago, the Sunrise Museum, Charleston, West Virginia, completed a dramatic transformation. Formerly housed in two historic mansions, the 40-year-old institution reopened on July 12, 2003, as the **Avampato Discovery Museum,** a showpiece of the state capital's new Clay Center for the Arts and Sciences. The $130 million complex also houses the West Virginia Symphony and a performing arts theater.

As Sunrise, the museum was a marriage of a small art gallery with a children's museum. The $43 million Avampato complex comprises a series of sophisticated learning spaces: the 9,000-square-foot Juliet Museum of Art, housing a permanent collection of 19th- and 20th-century American works on paper; the ElectricSky Theater, a combined large-format film theater and planetarium with a 60-foot dome; and 12,300 square feet of interactive science exhibits in four galleries on two floors.

Designed and produced by Ohio's Roto Studio (formerly COSI Studio), the science galleries include

- *Gizmo Factory,* a collection of physical science interactives, including the Octorotosphere, an eight-wheeled contraption based on the work of Buckminster Fuller, and the Laminar Tri-Arch Fountain.
- *Kidspace*, a fanciful, nature-

The Gizmo Factory, home to classic physics exhibits, can also accommodate traveling science exhibitions. *Photo courtesy Avampato Discovery Museum*

themed, immersive environment for children under age 6.

• *Health Royale,* delivering messages about smoking, heart disease, obesity, and general wellness with a humorous touch.

• *Milton Gardener's Earth City,* a 1950s-style "roadside attraction" that tells the story of the forces of nature with a special focus on West Virginia.

Funding for Avampato's science floors was provided by the Charleston Area Medical Center, Dow Chemical Company Foundation, Columbia Natural Resources, and Columbia Gas Transmission.

Details: Ruthana McNeel, rmcneel@theclaycenter.org; *www.avampatodiscoverymuseum.com*

PRESS 'PLAY'—Introduced this year by **La Cité des Sciences et de l'Industrie,** Paris, a new series of multimedia "Expo-dossiers" on current science topics promises to include the equivalent of a 50- to 80-square-meter exhibition on a single DVD-ROM. The disks are intended for use by science centers and museums, libraries, universities, and other cultural institutions. The first in the series, *Chronicles of the Martian Years,* includes 15 display panels on Mars exploration and science, three films, eight audio interviews with space science researchers, and a multimedia quiz. A second disk, *From AIDS to SARS: the New Plagues,* follows a similar format. Scheduled for release in October is *Cannabis under the Eye of the Scientist,* with *Are the Apes Disappearing?* planned for January 2005. The programs, which work in Windows 98, 2000, and XP, are bilingual (French/English or French/Spanish). Disks can be purchased individually or by subscription.

Details: Etienne Prevost, *e.prevost@cite-sciences.fr,* or Dominique Jouxtel, *d.jouxtel@cite-sciences.fr*

TECHNOLOGY OF ILLUSION—How do you build a city street on a studio set? What is the role of music in the movie experience? A new exhibition developed by the **Museum of Science and Industry,** Chicago, in cooperation with Paramount Pictures, explores questions like these as it examines the art and technology of the filmmaking process.

Action! An Adventure in Moviemaking opened at MSI on May 28. The 12,000-square-foot temporary exhibition includes over 100 artifacts and features two interactive environments. In "Meet the Moviemakers," writers, directors, performers, and special-effects designers describe through video clips the behind-the-scenes details of their work. Hands-on experiences include operating a movie camera, trying on original costumes, and using a computer to experience a driving stunt or arrange the key scenes of a movie.

In "The Sound Stage Experience," visitors go "on location" to one of three live movie sets, where they can participate in a shoot, either behind or in front of the camera, and visit an editing room to see the final product.

***Action!* visitors participate in movie-making on the Hawaiian Soundstage set.** *Photo courtesy Museum of Science and Industry*

On weekends, a live "Meet the Credits" program features cinematographers, makeup artists, directors, and other film industry professionals.

Details: *www.actionexhibit.org/* ■

Grants & Awards

Port City Web, a full-service web solutions provider in Portsmouth, New Hampshire, has donated web design, web hosting, and other services worth approximately $20,000 to help the **Children's Museum of Portsmouth** redesign and maintain its web site.

The Institute of Museum and Library Services, in Washington, D.C., has awarded a 2004 National Leadership Grant to Ohio's **COSI Toledo.** The $320,987 grant, awarded in the Museums in the Community category, will allow the science center—in partnership with the Toledo Public Schools and the Lucas County Schools—to provide new teachers with professional development in state-of-the-art science education.

The National Science Foundation's Informal Science Education program has awarded $891,243 over three years to the **Fort Worth Museum of Science and History**, Fort Worth, Texas, for *Design IT Studio.* The project will allow the museum to provide intensive and creative information-technology design experiences to 160 youths from the Boys & Girls Clubs of Greater Fort Worth and the Fort Worth Independent School District's Applied Learning Academy.

Britain's Office of Science and Technology, part of the U.K. Ministry of Trade and Industry, has extended its commitment to fund core operations of **ECSITE-UK,** Britain's Science and Discovery Centre Network, through March 2006.

The New Jersey Economic Development Authority has issued bonds in the amount of $14.2 million to support the first phase of the expansion and renovation of the **Liberty Science Center,** Jersey City. Private, corporate, and foundation donors have already committed $27 million to the project, leaving a total of just over $27 million still to be raised. The science center, which will move into temporary quarters in Jersey City early next year, expects to reopen in its nearly 300,000-square-foot renovated facility in 2007.

People

The new director of the Birla Industrial & Technological Museum, Kolkata, India, is **Jayanta Sthanapati.** A former principal coordinator in the development of four new science centers and a winner of the A.N. Chatterjee Memorial Award for innovative exhibit development, Sthanapati replaces **Samaresh Goswamy,** who retired at the end of March 2004.

ASTC Board of Directors member **Douglas R. King,** president and CEO of Missouri's St. Louis Science Center, has been appointed to NASA's new Education Advisory Committee. The 15-member committee will review recommendations of subcommittees and other groups and advise the NASA Administrator of Education on agency programs related to education.

Great Lakes Science Center, Cleveland, Ohio, announces the appointment of **Linda Abraham Silver** as president and executive director, effective August 1. Most recently vice president of education and guest relations at the Natural History Museum of Los Angeles County, California, Silver was instrumental in attracting $5.6 million in grants to the museum over the past four years. She replaces retiring GLSC director **Richard Coyne.**

Liberty Science Center, in Jersey City, New Jersey, announces two senior appointments. **Jeff Osowski,** a former director of education policy for the N.J. Department of Education, joins the staff as vice president for education, and **Ellen Wahl,** most recently director of Youth, Family, and Community Programs at the American Museum of Natural History, New York, is the new senior director for program development and delivery. The two will shape programs and outreach for Liberty's new Center for Science Learning and Teaching.

The Museum of Life and Science, Durham, North Carolina, announces the appointment of **Barry Van Deman** as president/CEO. Formerly section head of the Informal Science Education (ISE) program at the National Science Foundation, in Arlington, Virginia, Van Deman is well known to U.S. ASTC members. As of October 1, he replaces longtime museum director **Tom Krakauer,** who retired in 2003.

The North Museum of Natural History & Science, Lancaster, Pennsylvania, announces the appointment of **Margie Marino** as executive director, effective August 1. Most recently manager of ASTC's Exhibition Services department, Marino previously served as manager of exhibits at the Denver Museum of Nature & Science. She replaces the late **Clare Intress** (see People, *ASTC Dimensions,* May/June 2004).

ASTC welcomes two new staff members to our Exhibition Services department. Replacing Margie Marino (see above) and **Meg Goetz,** who left to pursue a Master of Arts in Teaching, are new manager **Wendy Hancock,** a former gallery manager and education coordinator at the Smithsonian Institution's National Museum of American History, and assistant manager **Erin Hunsaker,** a recent graduate of the Museum Studies program at the George Washington University, Washington, D.C. ■

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