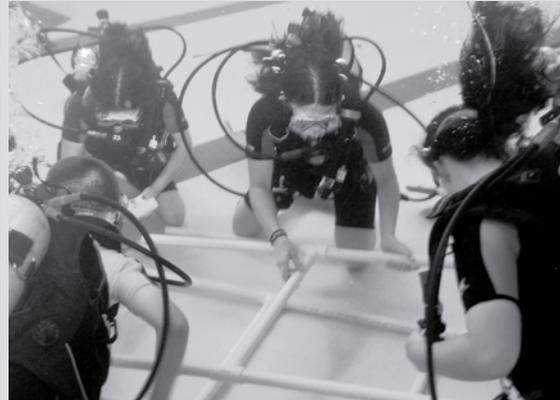


OPENING MINDS TO SCIENCE

The Saint Louis Science Center's Report to the Community



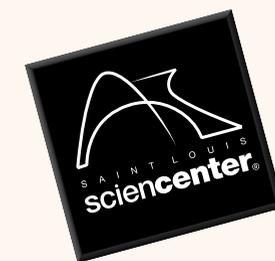
2009-2010



OPENING MINDS TO SCIENCE

The Saint Louis Science Center's Report to the Community

2009-2010



Editor: Jennifer Heim
Publication Design: Jason Cook

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*For a complete list of Education, Exhibits & Programs staff, see the Appendix.

Cover photos (clockwise from top left):

Fossils Around Town; Summer Science Blast; Underwater Explorations Summer Camp (Photo: Challenger Learning Center-St. Louis); *Youth Exploring Science (YES) Learning Lab; Algae Palooza; Teacher Professional Development Workshop*. Unless otherwise noted, all photos by the Saint Louis Science Center.

From the Senior Vice President and Associate Director of the Museum,
Carol Valenta

Dear Partners in Science Education,

I am pleased to present the Science Center's fourth annual report on the experiences of participants in our educational programs, *Opening Minds to Science: The Saint Louis Science Center's Report to the Community, 2009-2010*.

As you receive this report, we are in the midst of celebrating our 25th anniversary! Since our opening in 1985, more than five million people have experienced Science Center educational programs. As we embark on our next 25 years, we will expand both the breadth and the depth of our programs' impact through two exciting initiatives: the *Institute for Science Learning* and the *Center for Science*. Building on our groundbreaking work with the **Youth Exploring Science (YES)** program, the *Institute for Science Learning* will bring together leading education researchers with formal and informal educators to create innovative practice informed by the most current learning research. The *Center for Science* embodies our commitment to engaging adults in lifelong science learning; we want to be **the** place to which the community looks to develop the science literacy skills necessary for life in the 21st century. We look forward to involving you in these two initiatives as they develop.

This report analyzes the experiences of participants in our programs through both quantitative and qualitative methods. In addition to numerical measures, you will hear the voices of our audience; they speak compellingly to the ways in which Science Center programs transform their relationships with science and with their world.

We hope this report will be useful to your work and that you will let us know how it can be even more pertinent. We look forward to working with you to open minds to science.

Sincerely,



Carol J. Valenta
Senior Vice President and Associate Director of the Museum
Saint Louis Science Center



Carol Valenta
Senior Vice President
and Associate Director
of the Museum

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OPEN EVERY MIND TO SCIENCE

The Saint Louis Science Center’s Educational Philosophy and Practice

The Saint Louis Science Center is a free-choice, informal learning environment where people of all ages engage with science – directly and on their own terms. We seek to engage the broadest audience possible through programs designed for: families, school groups, educators, teens, community organizations, adults and the general public visiting the Science Center.

Our mission is to ignite and sustain lifelong science and technology learning.

Opening Minds to Science

Our exhibitions and programs take into account the complete visitor environment – physical, social and personal. We believe that learning is best fostered through programs and exhibitions that encourage visitors to:

- Make personal connections to their knowledge and experiences
- Embrace a spirit of play and discovery
- Act on their own curiosity
- Form and ask questions
- Engage in hands-on exploration and experimentation
- Cultivate science process skills
- Pursue science throughout their lives

Positive experiences with Science Center exhibitions and programs will encourage repeat visits and prompt visitors to interact with science beyond their visit. Ultimately, we hope to motivate our visitors to think differently about science and to empower them to make informed choices in their everyday lives.

Learning in an Informal Environment

Free-choice learning “tends to be non-linear and personally motivated.” (Falk and Dierking, 2000, p.13) In designing our programs and exhibitions, we strive to provide multiple levels of interaction and engagement for diverse audiences. This translates into experiences that are accessible, multi-sensory and meaningful to people with a variety of abilities, cultural backgrounds, experiences with science, learning styles and interests. We also seek to support social learning, experimentation and investigation. We believe visitors should have fun, engaging, relevant and successful experiences with science, whatever their level of knowledge. Science Center staff play a key role in fostering a successful experience.

How We Develop Exhibitions and Programs

In order to develop exemplary exhibitions and programs, we ground our processes in best practices in the field, current science content, current learning theory and audience research. Clearly articulated educational goals and objectives drive the exhibition and program development process. As appropriate, we correlate our offerings to national and state curriculum standards. Through front-end, formative and summative evaluation, we include our audiences and other stakeholders in the program and exhibition development and revision process.

In developing these experiences, we seek to communicate clearly how we envision visitors engaging with them, employing devices such as advance organizers and tools to personalize the experience. We take risks with cutting-edge content, ways to deliver that content and ways of including new audiences. The Science Center supports these processes with adequate time, funding and staff.

Exhibitions at the Saint Louis Science Center capitalize on the power of three-dimensional environments to engage our community with science. Our exhibitions must engage a broad spectrum of visitors. We recognize that every exhibit component cannot meet all the needs of all our audiences, but we seek to create a balance of experiences within the exhibition as a whole.

We commit to developing exhibitions that:

- Provide multiple conceptual entry points and multiple outcomes
- Are current and can be adapted to stay current
- Facilitate conversations and encourage multiple groups to engage with each other

Programs at the Saint Louis Science Center engage our community with science via skilled, well-trained program developers and presenters. Often developed based on the needs of specific audiences, programs both expand on conversations begun in our galleries and incorporate topics and experiences beyond the scope of our galleries. Consequently, programs increase our audiences' engagement with science and broaden the Science Center's impact. Programs also increase the size and diversity of our audience and generate revenue crucial to our ongoing work.

We commit to developing programs that are:

- Learner-centered
- Delivered by knowledgeable and well-trained presenters
- Facilitated in a manner that actively matches content and delivery to the needs of the current audience

Thoughtful planning supports our exhibition and program development process. A focused and fiscally sound plan, based on this learning philosophy, addresses each of our audiences and content areas. A review process allows us to monitor our impact and track our success toward opening minds to science.

METHODOLOGY

Since 1997, the Saint Louis Science Center has collected information about the experience of participants in our programs. At the Science Center, we define programs as, "staff-led interactions scheduled for a specific audience with written educational goals and objectives." From 1997 through 2008, the Science Center used the **Better Education and Revenue Through Tracking (BERTT)** system to assess the experiences of program participants. Beginning in 2008, the Research & Evaluation Department engaged in a systematic evaluation of BERTT with the goal of developing a new system that would more accurately assess the impact of Science Center programs on participants.

In January 2009, after extensive development and testing, the Science Center debuted the **System for Assessing Mission Impact (SAMI)**. SAMI collects and summarizes key performance indicators for Science Center educational programs.

SAMI tracks the following elements related to program performance:

- Average length of a program
- Number of times offered
- Number of interactions (an individual's participation in a program)
- Total hours of interaction
- Average Knowledge, Enjoyment, Interest and Attitude ratings by participants (each on a 4-point scale, with 4 as the highest rating)
- Participants' descriptions of what they got out of the program
- Participants' suggestions for improvement
- Impact Score (16-point scale, with 16 as the highest score)

Defining and Measuring Impact

On an individual level, impact occurs when a Science Center offering enables a participant to make personal connections between the content and experience of the offering and their own knowledge and experiences.

In the short-term, this is illustrated by a change in knowledge, understanding, attitude, interest or enjoyment. Over the long term (months to years), this is illustrated by an incorporation of these changes into participants' lives. The larger effects of these long-term individual impacts are felt within the Science Center and throughout the broader communities of which the Science Center is a part.

The Impact Score provides a numerical way to represent the impact that participation in a program has on an individual. Program participants rate four questions, which correspond to the four main components of the Impact definition: knowledge/understanding, attitude, interest, enjoyment. The Knowledge, Enjoyment, Interest and Attitude ratings are summed to produce the Impact Score. The lowest possible Impact Score is four and the highest is 16.

Data Collection Process

Program staff distribute comment cards to a sampling of program participants. Respondents are invited to answer four questions, based on the Impact definition, which are rated on a scale from 1 (“No, not at all”) to 4 (“Yes, definitely!”):

- **Knowledge Rating:** Measures a change in knowledge or understanding. “Did you, or others in your group, learn content and/or skills from this program?”
- **Enjoyment Rating:** Measures the degree to which participants enjoyed the program. “Did you enjoy this program?”
- **Interest Rating:** Measures the influence of this experience on future interest in science or technology.
- **Attitude Rating:** Measures the reinforcement or increase of positive attitudes toward science or technology. “Did this program reinforce or increase any positive attitudes you have towards science or technology?”

Participants are also asked to respond to the following open-ended questions:

- “Please describe what you got out of this program.”
- “How could we improve this program?”

The responses to these questions are grouped for analysis.

A version of the response cards with child-friendly language is distributed to participants under the age of 14.

Program staff enter the responses into a shared database. This database allows the Research & Evaluation Department to calculate average length, interactions and participant ratings for specific programs, departments and Science Center program offerings as a whole. This information is analyzed and presented in monthly, quarterly and end-of-year reports, in addition to this annual report to our community stakeholders.

In addition to the ongoing program measures collected and reported on a monthly, quarterly and annual basis, the Science Center also conducts more in-depth evaluation of selected programs. Periodically, the Science Center contracts with external evaluators to conduct front-end, formative and summative evaluations on specific programs. This report contains findings from both internal evaluations conducted by the Science Center’s Research & Evaluation Department as well as evaluation studies conducted by external evaluators. Unless otherwise noted, data and findings originate from the Research & Evaluation Department.

OVERVIEW OF SAINT LOUIS SCIENCE CENTER PROGRAMS

September 2009 to August 2010

Broad View of Program Interaction

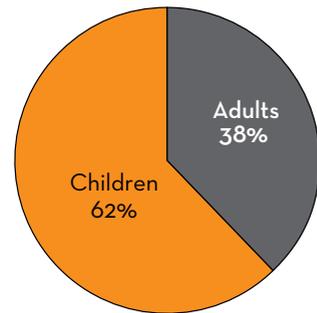
From September 2009 to August 2010, the Saint Louis Science Center offered approximately 127 distinct programs to a wide range of audiences including: children, families, teachers, school groups and adults. These programs ranged from one-time events such as *Minority Scientist Showcase* and *Pi Day* to recurring programs such as *Camp-ins* and *Science Cafés*. Each time a visitor participated in a program offering, this was recorded as an “interaction” for that particular program. “Interactions” varied in length from a 10-minute *Amazing Science Demonstration* to week-long *Paleotrek* expeditions. During the timeframe covered by this report, **378,716 program interactions** took place for a total of **390,219 hours of engagement**. On average, visitors spent approximately one hour participating in a program offering.

During many of the programs, participants were given the opportunity to fill out a comment card and rate their experience. From September 2009 to August 2010, a total of 10,349 comment cards were collected from visitors for an overall return rate of 3%. Respondents gave the following average ratings:

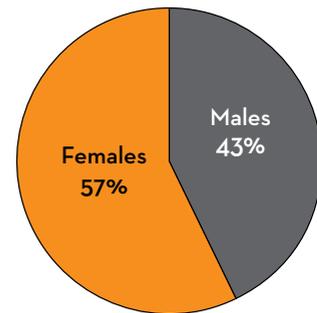
- Impact Score: 13.89 (out of 16)
- Knowledge: 3.45 (out of 4)
- Enjoyment: 3.66 (out of 4)
- Interest: 3.40 (out of 4)
- Attitude: 3.39 (out of 4)

Characteristics of Program Respondents

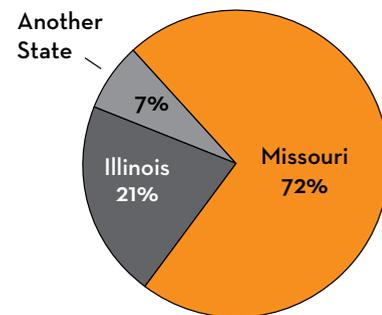
ADULTS & CHILDREN



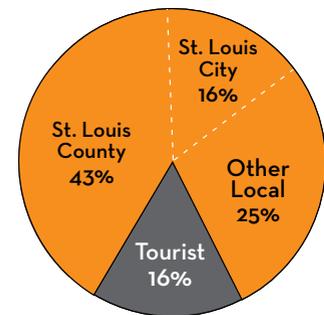
GENDER



RESIDENCY

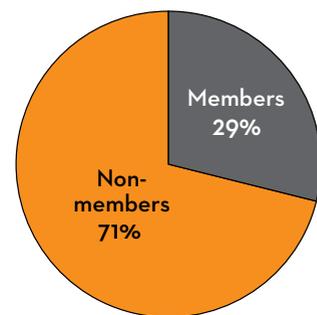


By State



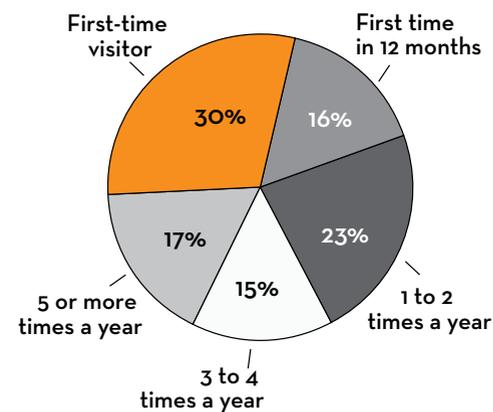
Local* vs. Tourist

MEMBERSHIP STATUS



VISITATION FREQUENCY

Total equals 101% due to rounding.



*Residing within St. Louis City, St. Louis County and fourteen surrounding counties in Missouri and Illinois.

Analysis of Ratings by Age, Gender, Residence, Membership and Visitation Frequency

Overall, Science Center programs seemed to have the greatest impact on adults, tourists and frequent visitors. Unless otherwise noted, all comparisons presented here are statistically significant at $p < 0.05$.*

As illustrated in the table below, adults gave significantly higher ratings than children for three of the four rating questions, with the exception of Enjoyment. Consequently, adults had a significantly higher Impact Score compared to children; 14.24 for adults, compared to 13.67 for children.

Tourist respondents (program participants from outside the St. Louis Metropolitan Area) gave significantly higher ratings for all four questions, when compared to local respondents. The Impact Score for tourists was 14.09, compared to 13.85 for locals. Within the St. Louis Metropolitan Area, residents of local Missouri counties other than St. Louis City and St. Louis County had significantly higher Impact Scores than residents of Illinois, St. Louis City and St. Louis County. The Impact Score for local residents from other Missouri counties was 14.00, compared to 13.98 for local residents from Illinois, 13.85 for St. Louis City residents and 13.77 for St. Louis County residents.

*The p-value is a measure of significance. In general, p-values of 0.05 or less are considered statistically significant.

There were significant differences based on visitation frequency. Those respondents who reported being frequent visitors (three or more visits per year) gave significantly higher ratings on all four questions than regular (one to two visits per year) or infrequent (fewer than one visit per year) visitors. Frequent visitors also had a significantly higher Impact Score (14.12) than regular or infrequent visitors (13.81 and 13.77, respectively).

Overall, the ratings and Impact Scores were not significantly affected by gender or by membership status.

	IMPACT SCORE	KNOWLEDGE	ENJOYMENT	INTEREST	ATTITUDE
Adults	14.24	3.56	3.67	3.39	3.52
Children	13.67	3.38	3.65	3.34	3.31
Females	13.90	3.46	3.65	3.40	3.39
Males	13.85	3.42	3.66	3.38	3.38
Tourists	14.09	3.49	3.72	3.43	3.45
Locals	13.85	3.43	3.66	3.39	3.37
Members	14.00	3.47	3.66	3.43	3.45
Non-members	13.88	3.44	3.65	3.40	3.39
Frequent Visitors	14.12	3.48	3.69	3.48	3.48
Regular Visitors	13.81	3.41	3.64	3.38	3.38
Infrequent Visitors	13.77	3.43	3.65	3.36	3.33

“An experience of new ideas and how to easily view complex ideas and equations.”

–Adult participant,
SciFest: What Is Reality?

“I had an opportunity to see first hand what a geologist sees when studying volcanoes and the effects they have on nature. I interacted with a dynamic group of educators and scientists.”

–Adult participant,
Science of National Parks: Hawaii Volcanoes National Park



Participants in *Fossils Around Town* examine a specimen.
(Photo: Saint Louis Science Center)

“I had an absolute blast, working with trained paleontologists and learning while hiking in beautiful countryside and finding dinosaurs! What could be better?”

--Adult participant,
Paleotrek

PROGRAM OVERVIEW BY DEPARTMENT

At the Science Center, programs are divided into six major departments: **Center for Science, Challenger Learning Center-St. Louis, Community Science, Public Programs, School Programs** and **Science & Galleries**. Following is an analysis of program offerings based on these categories. Unless otherwise noted, all comparisons presented here are statistically significant at $p < 0.05$.

Center for Science

The Center for Science showcases the Science Center as a scientific information resource for the community. Programs in this department feature cutting-edge science topics and opportunities to interact with scientists. Many of the programs are designed for adults, while some are offered for middle and high school students. **SciFest**, an annual multi-day, international science festival, engages participants with current science through fun, dynamic presentations by leaders in the field. Travel programs, such as **Ancient Americas, Paleotrek** and **Science of National Parks**, combine breathtaking locations with opportunities for authentic field work. Offering both local and international explorations, these trips explore archaeology, paleontology, ecology and resource management.

Offerings: 7 distinct programs

Reported interactions: 17,202

Total hours of engagement with programs: 16,896

Average length of engagement with programs: 1 hour

Range of program engagement times: 30 minutes to 7 days

Overall ratings (1,012 cards collected from Sept. 09 to Aug. 10; 6% return rate):

- Impact Score: 13.68 (out of 16)
- Knowledge: 3.42 (out of 4)
- Enjoyment: 3.50 (out of 4)
- Interest: 3.37 (out of 4)
- Attitude: 3.40 (out of 4)

Of all respondents, 88% completed adult comment cards and 88% reported living within the St. Louis Metropolitan Area. Respondents participating in these programs gave consistently high ratings regardless of age, gender, residence or Membership status. More frequent visitors to the Science Center gave higher ratings than less frequent visitors. The majority of respondents' comments indicated that participants had highly educational experiences through Center for Science programs. Comments also indicated that the program experience generated a great deal of interest in science.

Challenger Learning Center-St. Louis

Located in Ferguson, Missouri, the Challenger Learning Center provides a variety of space education programs for schools, scouts, community groups, corporations and the general public. The core programming at the Center involves two space simulation environments: a space station and a Mission Control room. The Center is part of the Challenger Center for Space Science Education, an international, not-for-profit organization founded by the families of the astronauts lost in the Challenger space shuttle mission in 1986. In St. Louis, the Center is supported by a regional partnership of the Saint Louis Science Center, the Ferguson-Florissant School District and the Cooperating School Districts. Some of the programs offered in 2009-10 included: **Return to the Moon, Robotic Rovers Camp** and **The Great Rocket Design Challenge**.

Offerings: 13 distinct programs

Reported interactions: 18,088

Total hours of engagement with programs: 39,971

Average length of engagement with programs: 2 hours and 15 minutes

Range of program engagement times: 1 hour to 5 days

Overall ratings (867 cards collected from Sept. 09 – Aug. 10; 5% return rate):

- Impact Score: 13.75 (out of 16)
- Knowledge: 3.43 (out of 4)
- Enjoyment: 3.74 (out of 4)
- Interest: 3.32 (out of 4)
- Attitude: 3.26 (out of 4)

Of all respondents, 93% completed child comment cards and 89% were first-time visitors to the Challenger Learning Center. Fifty-six percent of respondents were female and 44% were male. The largest number of respondents, 53%, were from St. Louis County, followed by 28% from Illinois counties in the St. Louis Metropolitan Area. Overall, participants gave high ratings to Challenger Learning Center programs. There were no significant differences in ratings by age, residence, Membership status or visitation frequency. However, females rated Knowledge significantly higher than did males. Participants frequently commented on knowledge and skills gained through the program and also often mentioned enjoying the experience very much. Participants also noted the authenticity of Challenger Learning Center programs.



Students in *Underwater Expeditions Summer Camp* construct a remotely operated underwater vehicle.
(Photo: Challenger Learning Center - St. Louis)

“I learned what jobs are at NASA and it makes me want to work in mission control because I loved my job so much.”

- Child participant,
Student Mission: Comets

“What I got out of it was that a space station is like a sport, with a lot of teamwork.”

- Child participant,
Student Mission: Comets

“Girls realized all the different jobs they can do - they were very excited!”

- Adult participant,
Scout Programs

Community Science Department

"I learned that a hawk's beak is short and very sharp. I never saw a hawk beak up close."

- Child participant,
Summertime Science

The Community Science Department cultivates relationships with community-based organizations serving families throughout the St. Louis area, including Mathews-Dickey Boys and Girls Club and The Urban League. Programs developed with these partners promote wellness, diversity and education while integrating science, technology, engineering and math concepts and curricula. Partner organizations also contribute to the Science Center through participation in programs such as **Minority Scientists Showcase** and through recruiting teens from their client base for the **Youth Exploring Science (YES)** program.

YES serves youth facing multiple risk factors and works with teens throughout the course of their high school career. **YES** provides a work-based, inquiry-learning environment focusing on science, technology, engineering and mathematics. As part of the program, **YES** teens also take on teaching responsibilities, facilitating hands-on science and math activities at community partner organizations. Overall, the **YES** program allows participants to gain professional, academic and real-world skills that assist in building self-confidence and achieving success. **YES** offers a number of programs, including: **Communicating Climate Change**, **Design Engineering Learning Lab** and **Summertime Science**.

Offerings: 17 distinct programs

Reported interactions: 20,349

Total hours of engagement with programs: 49,148

Average length of engagement with programs: 2 hours

Range of program engagement times: 1 hour to 1 day

Overall ratings (915 cards collected from Sep. 09 - Aug. 10; 4% return rate):

- Impact Score: 13.24 (out of 16)
- Knowledge: 3.32 (out of 4)
- Interest: 3.20 (out of 4)
- Attitude: 3.30 (out of 4)
- Enjoyment: 3.43 (out of 4)

Of all respondents, 56% completed adult comment cards; teen participants often use adult cards, accounting for the high percentage. The largest number of respondents resided in St. Louis City (51%), followed by St. Louis County (39%). Respondents generally fell into two categories of visitation; 44% were frequent visitors (three or more annual visits) and 37% were infrequent visitors (less than one visit annually). Non-members accounted for 52% of respondents and Members for 48%. Non-members had a significantly higher average Impact Score (13.37) than members (12.80). Children gave significantly higher ratings for Enjoyment than adults. Respondents' comments indicated they gained a great deal of knowledge and skills from Community Science programs. Comments also frequently mentioned enjoying the program as well as appreciating personal interaction with other program participants. Of all comments, 25% mentioned skills gained, the highest for any department.

"I got knowledge out of the training. I know how to handle and present myself at the main building and in front of anyone regardless of female/male, child/adult, disabilities."

- YES participant,
YES Teen Training

"I got some good information to share with young students as well as my own children and I learned two experiments to share in the after school programs."

- Adult participant,
Community Partner Meetings

Public Programs Department

The Public Programs Department offers programs both at the Science Center and off-site, through ScienceOFFCenter, for a variety of audiences including: adults, families, Scouts, children and home-school groups. School-age children can participate in hands-on, engaging programs such as badge workshops, overnight camp-in experiences or week-long day camps. Through the **Amazing Challenge**, teams of adults follow clues that take them all over St. Louis City as they try to be the first team to complete all of the challenges. Other programs include: **Girl Scout Days**, **Summer Science Blast** and specialized overnight camps like **Dreaming with Dinos**, which focus on a particular theme. The department also offers customized programming such as team building, programs for older adults and specialized scout badge workshops.

Offerings: 45 distinct programs

Reported interactions: 24,195

Total hours of engagement with programs: 76,324

Average length of engagement with programs: 3 hours and 10 minutes

Range of program engagement times: 30 minutes to 5 days

Overall ratings (2,677 cards collected from Sept. 09 - Aug. 10; 11% return rate):

- Impact Score: 14.00 (out of 16)
- Knowledge: 3.49 (out of 4)
- Enjoyment: 3.70 (out of 4)
- Interest: 3.41 (out of 4)
- Attitude: 3.40 (out of 4)

Overall, 56% of respondents completed a child comment card, 64% were female, 45% were infrequent visitors (less than one visit annually) and 78% were Non-members. Responses on adult cards were associated with significantly higher ratings and consequently significantly higher Impact Scores than those on child cards. The average Impact Score from adult cards was 14.74, compared to 13.42 from child cards. Males gave significantly higher ratings than females for Knowledge, Enjoyment and Attitude and had significantly higher Impact Scores; 14.20 for males and 13.93 for females. Frequent visitors had significantly higher Impact Scores (14.33) than regular (13.87) or infrequent visitors (13.97). Participants' comments about their experience indicated they gained a great deal of knowledge and skills. Participants also frequently mentioned their enjoyment; a higher percentage of respondents (33%) mentioned enjoying their Public Programs experience than was mentioned for any other department.

"It was a fun learning experience. Plus, I proved to myself I could master it! Fun, fun, fun!! Lived here all my life and still learned some things about the park."

- Adult participant,
Segway

"I learned about different animals and leaves. Also what we can do to help the earth."

- Child, Girl Scout Days:
Earth Connections

"I was fascinated by the table conversation as well as the caliber of the speakers. Opened up my mind to art/science connection!"

- Adult participant,
Science Café: Van Gogh



A YES teen dissects a shark.
(Photo: Saint Louis Science Center)



A participant in **Summer Science Blast: Techno-Babble** solders a circuit board to create a digital musical instrument.
(Photo: Saint Louis Science Center)

“My students got to review details about plants. I loved how it was hands-on.”

- Adult participant, Mini-Habitats

“Science is fun - I would like to know more about electricity.”

- Child participant, Physics Phun

“Great modeling for early childhood educators/ children. The speaker did an excellent job reviewing the life cycle process.”

- Adult participant, Life Cycles, Ecology and Living Organisms



Teachers in a professional development workshop use silly putty to test theories about how glaciers move. (Photo: Saint Louis Science Center)

School Programs Department

The School Programs Department offers hands-on, inquiry-based science workshops to area schools. These workshops take place both at the Science Center as well as in school classrooms. The department also offers professional development workshops for teachers and opportunities for parents to develop skills in interacting with their children to facilitate science and mathematics learning in the home. School Programs staff work directly with educators to identify target areas and content focus and design customized programs that encourage both students and educators to take ownership of the experience. All programs conform to Missouri and Illinois state standards. Programs delivered in the 2009-10 year included: **Ecology and Living Organisms, Family Science in Your School, Matter and Energy Investigations and Force and Motion Investigations.**

Offerings: 23 distinct programs

Reported interactions: 24,056

Total hours of engagement with programs: 28,558

Average length of engagement with programs: 1 hour and 15 minutes

Range of program engagement times: 50 minutes - 5 hours

Overall ratings (1,399 cards collected from Sep. 09 - Aug. 10;

6% return rate):

- Impact Score: 13.65 (out of 16)
- Knowledge: 3.43 (out of 4)
- Enjoyment: 3.56 (out of 4)
- Interest: 3.34 (out of 4)
- Attitude: 3.31 (out of 4)

Overall, 94% of respondents completed a child card and 56% were female. Regarding residence, 41% resided in St. Louis City and 41% resided in St. Louis County. Of all respondents, 85% were Non-members. The largest number of respondents were infrequent visitors (41%), followed by frequent (31%) and regular visitors (28%). The more often a participant visited the Science Center, the higher their ratings and Impact Score. Frequent visitors had significantly higher Impact Scores than regular and infrequent visitors. Members also had higher Impact Scores than Non-members. Respondents' comments were positive and the largest number described knowledge and skills gained. A number also described their enjoyment of the program.

Science & Galleries Department

Programs offered through this department primarily occur within the Science Center's permanent galleries and are facilitated by the gallery staff. These programs focus on the Science Center's five main content areas: earth science, emerging technologies, life science, physical science and space science. As appropriate for program content, some programs in this department may be held at off-site locations. These programs are available for visiting school groups as well as the general public. They range from daily, 10-minute **Amazing Science Demonstrations**, such as “Boiling Hot, Boiling Cold” to annual events such as **HealthFest**. This department also offers early childhood programs through the Discovery Room, such as **Growing Up Great**, and opportunities to engage in real science experiments, such as **DNA In-Depth**, in the Life Science Lab Classroom. Other programs within this department include: **Pi Day, Science Goes Splat** and **Public Star Party**.

Offerings: 22 distinct programs

Reported interactions: 274,826

Total hours of engagement with programs: 179,322

Average length of engagement with programs: 45 minutes

Range of program engagement times: 15 minutes to 3 hours

Overall ratings (3,479 cards collected from Sept. 09 - Aug. 10;

1% return rate):

- Impact Score: (14.17 out of 16)
- Knowledge: (3.47 out of 4)
- Enjoyment: (3.74 out of 4)
- Interest: (3.48 out of 4)
- Attitude: (3.48 out of 4)

Of all respondents, 65% completed child cards and 77% were local residents. Respondents were fairly equally divided between males and females; 53% were female and 47% were male. Forty-five percent were infrequent visitors and 28% of all respondents indicated that the program experience was their first Science Center visit. Thirty-three percent of all respondents were Members. On average, males gave higher ratings for Enjoyment, but females gave significantly higher Knowledge, Interest and Attitude ratings and consequently had significantly higher Impact Scores. Members had significantly higher Impact Scores than Non-members and frequent visitors had significantly higher Impact Scores than regular or infrequent visitors. Respondents' comments frequently noted content learned and often described enjoying the program very much.

“I've studied chemistry at school but this was awesome and it's amazing how it made me realize things I've not noticed before.”

- Adult participant, Amazing Science Demonstration: Rainbow Chemistry



At **Algae Palooza**, a member of the St. Louis Renewable Energy Club helps young scientists make biodiesel. (Photo: Saint Louis Science Center)

“I learned about DNA and cells, I learned about bacterial cells & insulin and had fun! It was awesome. I would totally come back.”

- Child participant, Gene Shorts

PROGRAM SPOTLIGHT

This section highlights three of the approximately 127 programs offered during the 2009-10 program year. The selected programs offer participants prolonged engagement, ranging from multiple days to multiple years, with science and technology content and experiences. In 2009-10 we highlight: *Family Med School*, *Science Communication for Brain Scientists* and *SciJourn*.

Program Spotlight: Family Med School (Science & Galleries)

Background

Family Med School is offered by the Science Center in conjunction with the Young Scientist Program at Washington University Medical School and the Adventures in Medicine and Science Program at Saint Louis University Medical School. Now in its fourth year, this partnership seeks to engage families – adults and children in fifth grade or above -- with human anatomy, physiology and health, through a program modeled on medical school training. Led by physicians, researchers, health educators and medical and graduate students, participants delve into hands-on activities to learn about the human body as well as understand the role of genetics and the environment in health and disease. Fostering family interaction is an important goal of the program, which aims to encourage adults and children to work together to explore concepts about healthy lifestyle practices and think about how to implement these practices in their daily lives. The program also offers first-hand knowledge about careers in the medical field.

Program Structure

Program sessions take place in the fall and the spring. The fall series, “Family Med School Basics,” is presented in partnership with Washington University and takes place in the Science Center’s Life Science Lab Classroom. The spring series, “Family Med School Labs,” is presented in partnership with Saint Louis University (SLU) at the Practical Anatomy and Surgical Education (PASE) Learning Center on the SLU campus. Each series consist of four, two-hour sessions.

The 2009-10 program year for *Family Med School* kicked off in the spring of 2009 with “The Incredible Human Body: A 3-D Look into How the Body Works.” This program featured a full body cadaveric dissection, using 3-D view camera technology to focus on how organs and organ systems work in concert with each other. In the fall, “Family Med School Basics” explored systems of the body. In the spring, “Family Med School Labs” sessions focused more specifically on health concerns and medical maladies. Throughout the program, families learned from real human anatomical specimens, medical devices and organ and tissue dissections.

Evaluation Methodology

At the end of each session, adult and child participants completed System for Assessing Mission Impact (SAMI) comment cards. Data was collected for each session, with the exception of “Heart Anatomy and Disease” held in January 2010.

Between April 2009 and April 2010, a total of 179 SAMI cards were collected from 238 participants for a response rate of 75%. In September 2010, a follow-up, online survey was sent to 43 adult participants who provided e-mail addresses. A total of 12 surveys were completed, for a response rate of 28%.

Characteristics of the Samples

Of all respondents completing the SAMI feedback forms, 57% were adults and 43% were children. Of those who reported their gender, 54% were female and 46% were male. Saint Louis Science Center Members comprised 61% of all respondents; 39% of respondents were Non-members. The majority of respondents (93%) resided within the St. Louis Metropolitan Area. Sixty-six percent of respondents reported visiting the Science Center three or more times per year; 19% visited once or twice per year and 15% had visited once in the last twelve months. Of those who completed the online follow-up survey, 80% were female and all were residents of the St. Louis Metropolitan Area.

Short-term Impact on Participants

Based on the data collected via SAMI, the overall Impact Score was 14.50 out of 16. The overall average ratings were: 3.64 for Knowledge, 3.68 for Enjoyment, 3.59 for Interest and 3.60 for Attitude. Adults gave significantly higher ratings than children and thus had significantly higher Impact Scores: 15.13 for adults, 13.69 for children. With the exception of Knowledge, females gave significantly higher ratings and consequently had significantly higher Impact Scores than males: 14.99 for females, 13.95 for males. Ratings were not affected by Membership status, visitation frequency or session attended. The table below describes ratings and Impact Scores by *Family Med School* session.

SESSION TITLE	IMPACT SCORE	KNOWLEDGE	ENJOYMENT	INTEREST	ATTITUDE
“The Incredible Human Body”	15.41	3.71	4.00	3.82	3.88
“Heart and Cardiovascular System”	14.09	3.55	3.50	3.55	3.50
“Lungs and Respiratory System”	14.14	3.52	3.67	3.48	3.48
“Digestive System”	14.08	3.58	3.67	3.42	3.42
“Brain and Nervous System”	14.23	3.59	3.82	3.45	3.36
“Heart Anatomy and Disease”	--	--	--	--	--
“Transplant Surgery”	14.96	3.74	3.65	3.74	3.83
“Brain Anatomy and Head Injury”	15.15	3.89	3.70	3.78	3.78
“Sports Medicine”	14.08	3.52	3.48	3.48	3.61
OVERALL	14.50	3.64	3.68	3.59	3.60

Overall, ratings for this program were high. All sessions received average Knowledge ratings of 3.50 or higher. Seven sessions received average Enjoyment ratings of 3.50 or higher, five received average Interest ratings of 3.50 or higher and six received average Attitude ratings of 3.50 or higher. All sessions had Impact Scores above 14.00.

Immediately after the program, participants were asked to describe what they got out of the **Family Med School** session. The majority of respondents indicated they learned something new or had existing knowledge reinforced.

Comments included:

- *“I learned about a normal heart and a diseased heart. It was extremely fascinating. I loved touching everything and meeting medical students.”*
– Child participant, “Heart and Cardiovascular System”
- *“I learned more about transplants and enjoyed the hands-on experience with organs. Medical person in lab was good at explaining.”*
– Adult participant, “Transplant Surgery”

Respondents also referenced the authentic, hands-on nature of the program:

- *“First time we got an actual look INTO the human body. Was an enlightening experience to see and feel the parts of the body that your family doctor is always talking about in a visit.”*
– Adult participant, “The Incredible Human Body”
- *“The actual hands on dissecting of the brain helped me visualize the brain with better understanding.”*
– Adult participant, “Brain Anatomy and Head Injury”

Long-term Impact on Participants

Participants were surveyed in September 2010, six months after the last session took place. Respondents who completed the follow-up survey were asked to apply the SAMI questions (Knowledge, Enjoyment, Interest, Attitude) to their overall experience in **Family Med School**. The overall average Knowledge and Enjoyment ratings were both 3.25 and the overall average Interest and Attitude ratings were both 3.75. The overall average Impact Score was 14.00.

Respondents were again asked to describe what they got out of the program. The themes echoed those found in responses immediately after completing the program, with respondents describing knowledge gained as well the compelling nature of the authentic, hands-on experience. Even though their participation took place six months to a year earlier, respondents, all adults, vividly recalled their experiences.

- *“Seeing the inside of a human heart.”*
- *“Dissecting the sheep brain was a great hands-on experience.”*
- *“My son was ten years old and for him to be able to experience all of these wonderful activities and to have the hands-on activities was an overall great educational experience for him.”*

Respondents also noted they enjoyed sharing the experience in **Family Med School** with their family:

- *“Going to each area of the classroom... as a family.”*
- *“We loved the fact that it was a learning experience that we could attend with our daughter. We found the lectures, presentations and lab dissections extremely entertaining.”*

The follow-up survey also posed questions about how participating in **Family Med School** affected participants’ lives in a variety of areas. Participants were asked if they had implemented any new, healthier lifestyle practices as a result of their experience in the program. Of those who responded to this question, 50% stated they had made a few changes towards a healthier lifestyle and 20% said they had made a number of changes. Participants were asked to describe science activities in which they engaged at home, since participating in **Family Med School**. All respondents described engaging in some science activities including: reading a science book, doing research, trying experiments at home and visiting another science center.



A mother and daughter dissect a sheep brain during **Family Med School Labs**.
(Photo: Saint Louis Science Center)

Respondents also indicated that discussions of science topics at home had increased as a result of participating in **Family Med School**. Of respondents answering this question, 60% indicated that science discussion had “definitely” increased, 20% indicated it had increased “quite a lot” and 20% noted it had increased “only a little”. In the words of one respondent, *“Overall, it has helped our discussions on science and increased the level of excitement about the topics.”* In addition, 90% of respondents reported an increase in self-confidence in discussing health and medical topics with their children.

When asked how participation in the program had affected their child(ren)’s school performance, 90% reported improvement. One parent said that his child, *“was not interested in school until attending these sessions.”* When asked if the program had increased their child(ren)’s interest in a career in science, 70% said it “definitely” had and 20% said it had “quite a lot”. One parent noted the importance of interacting with medical students in the program saying, *“I think having current med school or pre-med students there is very influential and keeps it fun.”* Overwhelmingly, respondents indicated that participating in **Family Med School** had positively impacted their lives as a family in a variety of ways.

Conclusions

Family Med School received high ratings from participants immediately after experiencing the program; this enthusiasm continued six months to a year after participating. The majority indicated they had a positive, educational experience and often were able to reference specific content. Respondents mentioned enjoying the hands-on laboratory activities as well as appreciating the opportunity to spend time with their families.

Participants also described long-term benefits of their **Family Med School** experience including healthier habits, an increase in and improvement in the quality of science discussions, improved academic performance for their children, and increased interest in science careers. One respondent summed up the overall impact saying, *“You helped break down the barriers to understanding science.”* **Family Med School** suggests a promising model for bringing adults and children together around authentic experiences with science.

Program Spotlight: Science Communication for Brain Scientists (Science & Galleries)

Background

Science Communication for Brain Scientists is the product of a partnership, now in its fifth year, between the Science Center and Washington University in St. Louis (WUSTL). Developed and overseen by Science Center staff, the program provides unique training in public science outreach to PhD students in WUSTL's Cognitive, Computational and Systems Neuroscience Pathway (CCSN). The CCSN Pathway prepares graduate students to conduct integrative brain science research. CCSN, including the *Science Communication for Brain Scientists* program, is funded by the National Science Foundation's Integrative Graduate Education and Research Traineeship (IGERT) program. The first cohort of seven students began training in 2008. Nine students comprised the second cohort in 2009 and the third cohort of seven students began in summer 2010. Data presented here focuses on the first and second cohorts, who have completed the year-long cycle of training and program delivery.

Program Structure

Key elements of *Science Communication for Brain Scientists* are:

- 1) a series of workshops developed and facilitated by Science Center staff;
- 2) student-led development of a suite of hands-on activities about the brain and brain science; and
- 3) the delivery of the activities at two marquee Science Center programs, *SciFest* and *NeuroDay*. After *NeuroDay*, students can choose to continue their involvement by serving as mentors to future cohorts.



YES teens look at human brains with Yu Sun Chung, Washington University CCSN graduate student. (Photo: Saint Louis Science Center)

The workshops are held over three or four sessions during the summer and cover topics such as "Audience," "Language" and "Presentation Tools." Through exposure to audience research techniques, students learn first-hand about the general public's understanding of the brain and brain science research. Students practice and hone their writing skills, learning techniques to translate technical terminology into everyday language. They also use the workshops to develop ideas for their program - a suite of hands-on activities for the general public offered at *SciFest* and at *NeuroDay*. Science Center staff provide guidance and mentoring in the refinement of the activities and supporting materials.

In 2008, Cohort 1 developed the concept *Real World: Neuroscience (RWN)* as the connecting theme for their activities. Building on the television show, *The Real World*, the students crafted "confessional" videos that showcased themselves and their research labs in an approachable way. Their activities each tied into a different room in the "house," such as an activity about the olfactory system happening in the kitchen. The suite of activities covered basic information about the brain and how it functions as well as demonstrations of techniques scientists

use to study the brain. At *SciFest 08* and *NeuroDay 2009*, *RWN* attracted approximately 600 visitors each time.

In 2009, Cohort 2 developed the concept *Amazing Brain Carnival (ABC)* as the unifying theme for their suite of activities. They modified some of the activities used by Cohort 1 and developed new activities based on their areas of research. They also established clear learning objectives for their program:

- 1) the brain has different parts that do different things,
- 2) the brain changes and
- 3) the brain can be studied in a variety of ways.

ABC attracted approximately 400 visitors at *SciFest 09*. Reprised for *NeuroDay 2010*, *ABC* attracted more than 1200 visitors.

Evaluation Questions and Methodology

Evaluation activities address the training's impact on student participants as well as their programs' effectiveness for Science Center visitors. Key questions are:

- What are the students' incoming levels of familiarity with informal science education? How does this change over the course of the training?
- What are the students' incoming comfort levels with presenting current science to non-science audiences? How does this change?
- Given the optional nature of this component of the grant, what are the students' motivations for choosing to participate?
- What new skills do the students successfully apply in the development and delivery of their educational program(s)? How do they envision applying them in their professional careers?
- How effective are students in communicating to Science Center visitors?

Participating students completed pre- and post-workshop surveys, were interviewed immediately following delivery of their program at *SciFest* and *NeuroDay* and completed follow-up surveys at the conclusion of the full year. Additionally, during *SciFest* and *NeuroDay* Research & Evaluation staff conducted focused observations of student interactions with visitors.

At both *SciFest* and *NeuroDay*, visitors to *RWN* (2008/09) and *ABC* (2009/10) were invited to complete surveys as they exited the room. The visitor surveys incorporated the System for Assessing Mission Impact (SAMI) questions in addition to questions specific to the program activities. Sample sizes for each of the four offerings were: *SciFest 08*: n=55, *NeuroDay 09*: n=36, *SciFest 09*: n=68 and *NeuroDay 2010*: n=116.

Impact on Graduate Students

Through the first two years of the program, students exhibited growth in communication skills and increased comfort with presenting science to the public.

- Students chose to participate in the program because they were motivated to both enhance existing communication skills and learn new ones:

- o “I wanted to develop my skills in translating what I do in the lab into activities and information for the general public.” - Student, Cohort 1
- o “To translate some of the interesting ideas and concepts that stimulate research in my field to the general public in the hope that in doing so brain science will be better understood and more accessible.” - Student, Cohort 2

- Impact Scores for the full training experience (workshops, SciFest and NeuroDay) from the students in both cohorts were high.

The mean Impact Score for Cohort 1 was 14.00 and for Cohort 2 was 13.17, for a combined Impact Score of 13.62 out of 16.

- Students’ self-rated familiarity with informal science education increased over the course of the training. Mean ratings on a 4-point scale:

	COHORT 1 (2008-09)	COHORT 2 (2008-09)
Before the workshops	2.3	2.3
After NeuroDay Program	3.3	3.3
One Year After NeuroDay	3.4	Not Yet Available

- Students’ self-rated comfort with presenting science to non-science audiences increased over the course of the training. Mean ratings on a 4-point scale:

	COHORT 1 (2008-09)	COHORT 2 (2008-09)
Before the workshops	2.1	2.5
After NeuroDay Program	3.3	3.7
One Year After NeuroDay	3.7	Not Yet Available

- Students described improved communication skills and increased comfort with science communication:

- o “I am now more aware of the jargon that I use when I describe science. I try to define new words with examples or describe concepts in simpler terms.” - Student, Cohort 1
- o “I’ve tried to become more aware of the background knowledge that I have compared to that which my audience brings.” - Student, Cohort 2
- o “Focusing on how to give a concrete message that is easy to follow, is a strategy that I try to use when writing abstracts, papers and designing posters.” - Student, Cohort 2
- o “I found out I really enjoy communicating about science and it helped me become more confident while doing it.” - Student, Cohort 1

Impact on Visitors

Visitor feedback about RWN and ABC was positive. Visitors were engaged with activities and with the students and came away from the experience able to describe what they learned about the brain.

- Visitor Impact Scores were high.

The overall mean Impact Score for all offerings of RWN (Cohort 1) and ABC (Cohort 2) was 14.03 out of 16. The scores for the individual offerings are presented in the following table:

COHORT 1: Real World: Neuroscience		COHORT 2: Amazing Brain Carnival	
SciFest 08	NeuroDay 2009	Scifest 09	NeuroDay 2010
14.27	15.05	13.30	14.17

- The student-developed programs were effective at communicating about the brain to Science Center visitors.

Visitors to Cohort 1’s RWN at NeuroDay 09 were asked to describe what they got out of the program. In total, 73% of the respondents could describe what they learned about the brain. Participants in Cohort 2’s ABC, which was presented at both SciFest 09 and NeuroDay 2010, were asked what they learned about the brain. Comments from 37% of respondents specifically addressed at least one of the learning objectives specified by Cohort 2. Another 40% of respondents provided more general comments about the brain.

- Visitors had positive engagements with the students

At NeuroDay 09, visitors to Cohort 1’s RWN were asked to describe how well they understood the students’ research. The mean rating was 3.4 out of 4, with 47% selecting the highest rating. In response to a question asking whether the student presenters were engaging, visitors to Cohort 2’s ABC, at both SciFest 09 and NeuroDay 2010, gave a mean rating of 3.4 out of 4 with 49% selecting the highest rating.

Conclusions

Through the first two years, the Science Communication for Brain Scientists program has yielded positive results for both the students and the visitors who experienced the students’ programs. The graduate students have grown in their comfort with presenting current science to non-science audiences and visitors came away from their engagements with the students able to describe key points about the brain.

Program Spotlight: *SciJourn: Science Literacy through Science Journalism (Community Programs)*

Background

SciJourn: Science Literacy through Science Journalism (www.scijournal.org) seeks to train high school students to participate in science journalism as a way to develop lifelong skills in engaging with science. Funded through a four-year National Science Foundation (NSF) grant, the program is based at the University of Missouri-St. Louis (UMSL) College of Education, and involves collaboration between UMSL, the Saint Louis Science Center and the Normandy School District. This research project explores the question: Does the teaching of science journalism improve high school students' understanding of and engagement in science?



A recent issue of *SciJourn*.

Unlike many science education research projects, which focus on teaching students how to think like scientists, *SciJourn* teaches students how to think like science journalists. Joseph Polman, principal investigator and chair of the College of Education's Teaching and Learning Division at UMSL, describes the innovative nature of the project saying, "We are developing and researching how to educate scientifically literate citizens in a way that has never been done before. The expert thinking of good journalists is a very promising model for how a scientifically literate citizen should think in a world where science and technology information routinely impacts important individual and societal decisions. A

good science journalist articulates an issue of contemporary interest; researches it using multiple, credible sources; digests and makes sense of often complex and technical information; constructs an evidence-based story; and communicates it so that multiple people can understand." Ultimately, the project team hopes to create a replicable model and curriculum for cultivating science literacy through science journalism.

Program Description

Using an apprenticeship model, *SciJourn* trains both students and teachers in the fundamentals of science journalism. Teachers attend a two-week professional development course on the curriculum during the summer and implementation meetings throughout the school year. Participating teachers come from a variety of subject areas, including biology, chemistry, physics, English and journalism. During the course of the school year, students turn their classroom into a newsroom and become science journalists. They submit story ideas, research, write and publish original news stories. The project also has an informal learning

component; teens in the Science Center's *Youth Exploring Science (YES)* program set up a newsroom and work as science reporters and editors.

Students publish their work via two outlets: www.scijournal.org, an online science magazine, and *SciJourn*, a print publication. The website presents articles, videos, podcasts and book reviews. Articles from the website are then selected for publication in *SciJourn* which is distributed broadly throughout the St. Louis region to schools, parents of participating students and community members. Student journalists gear their articles toward a public audience, with a special focus on science and technology news that will interest other teens. Past articles include: "Baseball Bats Become Weapons," "Emergency Medicine from a Teen's View" and "Video Game Offers Real Science."

SciJourn began in fall 2008, with a test group of students in a physics class at Normandy High School. The first group of teachers attended the professional development course in the summer of 2009; *YES* teens also joined the program in summer 2009. The program was piloted during the 2009-10 school year in nine schools and with the *YES* teens. During the first two years of the project, more than 1000 students have participated in writing science news stories. The first full year of implementation takes place during the 2010-11 school year. Over the grant's four-year lifespan, the project will involve approximately 40 teachers from more than 25 St. Louis-area schools, including rural, suburban and urban districts.

Evaluation Methodology

The project uses a range of quantitative and qualitative methods to determine if and how the teaching of science journalism improves high school students' understanding of and engagement in science. Data collection methods include: student and teacher interviews, interviews with scientists and science journalists, student focus groups, pre- and post-tests, surveys and field observation notes, supported by audio and video taping of training sessions and student newsrooms in action. The project team also analyzes student articles and other products and is conducting case studies of selected students.

During the first two years of the project, the team developed assessment tools that will be used during Year 3 and Year 4. The team produced a well-researched set of science writing standards, *Science Literacy through Science Journalism Standards*, which articulate the salient features of good science reading and writing that can be achieved in a school setting. In addition to being used to analyze student work for research purposes, these standards support the teaching of science journalism and help students evaluate their own articles.

In addition, the team piloted science literacy assessment tasks during Year 2, to be used by both teachers and project researchers to assess student work in Years 3 and 4. The assessment tasks are grounded in the science writing standards and focus on aspects of science literacy the team believes may be improved through engaging with science as a journalist. These aspects include:

searching and evaluating information; understanding the importance of multiple, credible, attributed sources; contextualizing scientific and technical information; appreciating the relevance of science information to them and others; and checking the factual accuracy of the information.

The team also developed a survey that assesses engagement with science and technology, providing a more valid measure of engagement than is currently available. The *Youth Engagement with Science and Technology (YEST)* survey will help educators better understand how youth are engaged with these realms in their daily lives. The *YEST* survey will be used to measure the impact of **SciJourn** through pre- and post-tests with students participating in the program as well as with control groups.

Impact of SciJourn

During Year 1 and Year 2, the **SciJourn** team has made preliminary findings and identified issues that will be further investigated during the remaining years of the grant. The primary finding is that high school students, both in classrooms and the informal learning environment of the Science Center, can produce science news writing that represents encouraging levels of science literacy. Pilot results show that students in the program are engaging with science information more frequently on the web, or as one teacher put it, *"they are for the first time learning to use the Internet as a tool, not a toy."*

The project team noticed improvement in student writing after just a few months of participation in **SciJourn**. According to co-principal investigator Alan Newman, a research professor in Teaching and Learning at UMSL, *"Students are thinking a lot more about what the source of the information they are gathering is and how credible it is. They throw around the words 'credibility' and 'attribution' more than most teenagers."* Newman also noticed **SciJourn** students engaging in regular discussion about how science and technology are relevant to their own, their peers' and their families' lives.

The program also impacts teachers. A high school science teacher in the Fort Zumwalt school district notes that the program has improved her own practice; *"Being exposed to the dynamics of science journalism, learning how to chase down the who, what, where, when and why of current events in science news, has improved my own ability to find good science articles,"* which she and the students then critically analyze together in class. She adds, *"It has also made my own students much more aware of the science around them."*

Perhaps because of the program's focus on authentic science journalism practice, student participants become extremely engaged in the process of researching and producing science articles. Participating teachers describe great enthusiasm and initiative among their students. An English teacher at Incarnate Word Academy says that her students initially questioned writing science stories for English class, but their attitudes changed when **SciJourn** got underway. The

teacher notes, *"They are now curious and excited about learning. They now understand that science is everywhere and that things that affect them, their friends and family, can always relate back to science."* The pilot surveys indicate that participating students more frequently formulate opinions about science information that they share with others than they did prior to the program.

A high school science teacher in the Fort Zumwalt school district also observed a high level of engagement describing how, *"From the pitch to the finished article, there has been a great deal of open discourse between the students about their topics under construction. Many students were interested in what their peers were researching and would inquire about the progress of their story."* She relates with great pleasure that, *"My students were actually talking about science because they wanted to!"*

The team piloted the *YEST* survey with **YES** teens and noted that, in terms of student interest and engagement, the program has also been very successful in an informal setting. Based on their responses, the **YES** teens are enjoying the program and are very satisfied with their experience. Many describe a positive impact on their school performance and an improvement in their ability to learn science concepts. Teens also describe liking science better as they spend more time exploring topics of personal interest. A highlight of the summer program for most of the **YES** SciJourners was using their skills gained in the program to assist senior residents at nearby McCormack Place to search for and identify credible sources of health information on the Internet.

YES teens, giving feedback on the program through the Science Center's SAMI comment cards, describe specific skills they have gained, including: *"The ability to write thoroughly and more effectively"* and *"How to interview and stay focused."* According to the project team, the teens are taking increasing ownership of the project; two teens have become editors, accepting responsibility for reviewing and selecting articles for publication. It seems that, like their peers in high school classrooms, **YES** teens are creating a growing journalism culture through **SciJourn**.

SciJourn students, both in high school classrooms and the **YES** newsroom, have written and published an impressive number of articles. As of fall 2010, more than 400 articles have been submitted to *SciJourn* for consideration. Through October 2010, seven editions of the print publication *SciJourn* have been published. The 76 articles published in the online *SciJourn* have received considerable traffic, with one article receiving more than 5,700 hits and 29 articles more than 500 hits. The **YES** teens have also expanded from print journalism to other media; they have published science news podcasts, video stories and an interactive map on the website. It is anticipated that this prolific



SciJourn teen, Adeola Adewale interviews Ira Flatow, host of National Public Radio's *Science Friday*. (Photo: Saint Louis Science Center)

output will continue as more schools and students join the program during the implementation phase. The students' articles will provide further performance-based indicators of participating students' gains in science literacy.

Conclusions

At the conclusion of the pilot phase of the project, the team has a promising pedagogical model based on using science journalism to cultivate lifelong skills in understanding and engaging with science. During the implementation phase, the team will use the science writing standards, science literacy assessment tasks and survey they have developed to test and refine this model. Both the model and the assessment instruments have great potential for broader impact on the field.

The science writing standards have the potential to inform the science education community about opportunities for integrating the reading and writing of nonfiction within science classrooms. The science literacy assessment tasks and the *YEST* survey will be applicable to other in-school and out-of-school programs. Findings from the implementation phase of the grant will inform the development of instructional practice that better and more effectively integrates science and technology learning into the lives of today's youth.

LOOKING TO THE FUTURE

As we issue our fourth *Report to the Community*, the Science Center is implementing a new, five-year strategic plan. This plan results from more than two years of work on the part of our Board, staff and community partners. We convened workshops and focus groups, seeking input from our community about how the Science Center can best contribute in the future.

Based on those conversations, we developed a vision for the role the Science Center must play in our next 25 years and beyond.

To be successful and effective citizens in a rapidly changing world, all people must have a fundamental understanding of science and technology and a credible resource from which they can seek scientific guidance. To address these critical needs, the future of the Saint Louis Science Center will be dedicated to three mutually supportive, but distinct priorities:

- 1) Renewing and sustaining our *World-Class Science Museum*,
- 2) Institutionalizing our educational programs into a sustainable *Institute for Science Learning* and
- 3) Becoming the St. Louis community's *Center for Science*.

Over the last 25 years we have worked to create exhibitions and programs that provide a world-class experience for our visitors. We have been recognized nationally and internationally for excellence by our peers and will continue to provide this world-class experience as we expand our facilities through a new exhibition hall. In addition, we will implement two new initiatives: the *Institute for Science Learning* and the *Center for Science*. Both provide opportunities to deepen our work with current audiences and partners as well as to expand our impact in new areas.

The *Institute for Science Learning* will be a physical place that will provide a bridge between learning research and practice. Bringing together education researchers with formal and informal education practitioners, the *Institute* will be a learning laboratory open to all who seek to make education more accessible, engaging, meaningful and effective. Serving researchers, formal and informal educators, school districts, community organizations and science centers, the *Institute* will be a place where individuals can engage in an ongoing process to improve their practice. The *Institute* will have an on-site faculty as well as a board of nationally recognized educators and researchers. Programs developed through the *Institute* will serve a wide range of audiences, from students to those developing educational policy. Evaluation will be crucial to the work of the *Institute*, as we determine how to most effectively bring together research and practice.

NOTES

The *Center for Science* is not a physical place; it is a philosophy. This philosophy puts science literacy at the forefront of people's lives as we commit to engaging adults with lifelong science learning. Through the *Center for Science* we will advocate for science as integral to every aspect of daily life and demonstrate how vital science and technology are to our region. We seek to become the visitor center for scientific enterprise in the St. Louis region, helping St. Louisans to be more aware of the region's role as a leading science and technology community.

We have begun this work by increasing our programming for adults. Through offerings such as our travel programs, **Science Cafés** and **SciFest**, we give adults opportunities to follow their interests and engage with science in a way that is meaningful to them. We are currently developing a long-term plan for serving adults that will firmly establish the Science Center as **the** place where adults can learn about cutting-edge science topics that affect their lives. Integral to our plan for the *Center for Science* will be identifying our measures of success, the metrics we will use to determine how well we are achieving our goals.

We are also expanding *Science Beyond the BoundariesSM*, an international network of 135 museums and science centers, reaching more than 56 million visitors annually and still growing. The Science Center founded this network in 2006 to connect a wider universe of museum visitors with the advancing frontiers of science and facilitate the connection between scientific research and their lives. Through *Science Beyond the BoundariesSM*, the Science Center plays a leadership role in facilitating the development of educational materials, providing a conduit for sharing best practices, evaluating impact and coordinating activities.

As we begin to enact these new initiatives, the Science Center continues our commitment to providing an inviting, accessible environment in which people of all ages and levels of experience can engage with science. We are committed to evaluating our process in a systematic way. We look forward to reporting our progress in next year's, *Opening Minds to Science*.

APPENDIX

Saint Louis Science Center Education, Exhibits & Programs Staff As of August 31, 2010

Derrick Adams, Jr.*	Shawntella Caruthers*	Daphne Emrick*	Daisonara Gurley*	Janiece Johns*	LaDaisha Miller*	Siinya Riley-Dulaney	Latrina Vance*
Adeola Adewale*	Jessica Castiglioni	Brooke Emshoff	Eric Gustafson	Damonte Johnson*	Lamar Miller*	Robert Rinehart*	Donna Vidas
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Marlow Allen, Jr.*	Marguerite Choquette	Demetrice Fisher*	Natalie Harrell	Brandon Jones*	Anthony Moore*	Evin Russell	Suzanne Walton
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Joel Anderson	Jenny Cimino	Aaron Ford*	Mia Harsley	Laron Jones*	Kaelan Moorehead*	Michael Schoenewies	Kevin Washington*
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Brenda Appleby	Kimberly Collins-Bey*	David Francis	Andreaunna Hawkins*	Ronald Jones	Raja-Niah Morrison*	Joe Seidler	Joseph Welling
Jamiah Austin*	Isaiah Conner*	Dalila Franklin	Andreille Hawkins*	Sarah Jordan*	Koran Muhammad*	Vontel Silinzy*	Jasmine Welsh*
Jasmine Bailey*	Kathryn Connor	Ligaya Franklin*	Jennifer Heim	William Kazban*	Shaquil Muhammad*	Lonnie Smith, Jr.*	Anna Werner
Thomas Bailey*	Deion Cook*	Jillian Franks*	Lea Heintz	Sherrisse Keeper	Timothy Mulhall	Arielle Smith*	Hannah Wetzel
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Dionne Barge*	Sydney Cowins*	Andre Fuqua	Christopher Hicks*	Betsy King	Bre'Yanna Nicholson*	Kafele Smith	Melvin Williams, Jr.*
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Hal Bierman	Hurlie Cozart	Heather Gallagher	Courtney Hilliard*	Nicholas Klotz	Malinda Nwobodo	Phillip Sortino	DeNeshia Williams*
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				Elizabeth Merriman	Desiree Redus*	Nautica Turner*	Darius Young*
				Tavis Merriman*	Ashley Reekie	Nephreteri Tutwiler*	Jeannie Young
				Diane Miller	Janice Richard*	Carol Valenta	
				Karalynn Miller	Charles Richardson*	Marcella Vamboi*	

***Youth Exploring Science (YES) Teen**

SOURCES

Hand, B. Jang J. and Benus, M. 2010. *Science Literacy through Science Journalism: Evaluation Report, Year 2*. Unpublished manuscript, The University of Iowa, Iowa City, Iowa.

Hatton, J. 2010, February. *UMSL Scholars Engage Students Through Journalism*. UMSL news release. Available at <http://blogs.umsl.edu/news/2010/02/09/umsl-scholars-engage-students-through-journalism/>

Falk, J. and Dierking, L. 2000. *Learning from Museums: Visitor Experiences and the Making of Meaning*. Walnut Creek, CA: Altamira Press.

Polman, J.; Saul, W.; Newman, A. and Farrar, C. 2010. *Activities in Years 1 and 2, Science Literacy through Science Journalism*. Annual Report to the National Science Foundation.

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