Beyond the Classroom:

*Learning Science in 2030*

University of California, Riverside
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Jeffrey Rudolph, President and CEO
California Science Center
Key Challenges in Science Education

- Inadequate public understanding of science
- Insufficient teaching skills and knowledge of science and mathematics by educators
- More than 50% of science and engineering workforce is approaching retirement
- By 2012, US universities will graduate only 50% of the 1.5 million individuals needed to fill computer and information-related jobs

The Innovative Technology Experiences for Students and Teachers (ITEST) Learning Resource Center (http://itestlrc.edc.org)
Women and minorities remain underrepresented in science, technology, engineering and math (STEM) occupations:

Women constitute just 26% of the STEM workforce, compared to 47% of the overall workforce.

African Americans constitute only 6%, compared to 11% of the overall workforce.

Hispanics constitute little more than 5%, compared to 11% of the overall workforce.

The Innovative Technology Experiences for Students and Teachers (ITEST) Learning Resource Center (http://itestlrc.edc.org)
People of all ages need to understand science as they grapple with science-related issues in their everyday lives.

An expressed interest in science during early adolescence is a strong predictor of science degree attainment.

Non-school science programs can:
- Stimulate the science-specific interests of adults and children
- Positively influence academic achievement for students
- Expand participants’ sense of future science career options
In informal learning environments, learners are:

- Allowed to make their own decisions about their route and pace of learning and are encouraged to move freely around the learning environment.

- Free from the disciplinary constraints applied by a classroom teacher, though remaining under a degree of social control.

- Frequently working together in peer groups or family units to develop their experience, knowledge, and understanding.

The Value of Informal Learning
Informal Learning Environments

Science Centers
Zoos
Aquariums
Children’s and Natural History Museums
Nature Centers
Planetariums
Botanical Gardens
Public Television
Libraries
The Mission
of the California Science Center

Stimulate curiosity and inspire science learning in everyone by creating fun, memorable experiences, because we value science as an indispensable tool for understanding our world, accessibility and inclusiveness, and enriching people’s lives.
Our Strategy

The Science Center confronts these challenges by offering:

• Hands-on, thought-provoking exhibits

• High quality public, community and school youth programs

• Exemplary science inquiry-focused professional development seminars for educators, including teachers, daycare and after school care providers, and parents;

• A K - 5 neighborhood elementary school with a science-focused curriculum that serves as a model and laboratory;

• Broad networks for collaboration and partnerships
California Science Center Master Plan (1993-2018)

- **Wallis Annenberg Building for Science Learning and Innovation**
  - 2004

- **Science Center School**
  - 2004

- **Phase II - Ecosystems**
  - March 2010

- **New Parking Facilities**
  - 2003

- **Phase I**
  - 1998

- **Phase I - World of Life**

- **Phase I - Creative Worlds**

- **Phase I - Worlds Beyond**
The California Science Center’s effectiveness in implementing its mission *to stimulate curiosity and inspire science learning in everyone* was the focus of a 10-year study by the **Dr. John Falk**, Professor, Department of Science and Math Education, Oregon State University and a nationally-recognized expert on museum learning.
Dr. Falk’s Research Questions

- Who does and does not utilize the California Science Center and why?
- What is the nature of visitor’s experiences within the Science Center?
- Does the Science Center facilitate long-term science learning, and if so, what is the nature of this learning?
- How successfully has the Science Center accomplished its mission to enhance the science and technology understanding, attitudes, and behaviors of the Los Angeles general public?
Key Findings of Falk’s Study

• Ten years after opening, **60% of the Los Angeles population** have visited the Science Center.

• Parents unquestionably find the Science Center an **invaluable educational resource**.

• **85% of adults** surveyed reported that their child’s science understanding was increased by a visit to the Science Center.

• **73% of adults** surveyed said it increased their child’s interest and curiosity about science.
Adult’s Reported Changes in Child’s Attitudes, Understanding and Behavior

Visit increased my child’s understanding of science/technology 85%
Visit provided opportunity for me to talk with my child about science/technology 81%
Visit increased my child’s appreciation for science/technology 78%
Visit gave my child an advantage in life 75%

Percent indicating “Agree” or “Strongly Agree”
Adult’s Self-Reported Changes in Attitudes, Understanding and Behavior

<table>
<thead>
<tr>
<th>Statement</th>
<th>Confidence</th>
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<tbody>
<tr>
<td>My understanding of science/technology was strengthened or extended</td>
<td>95%</td>
</tr>
<tr>
<td>I learned at least one thing I did not know</td>
<td>91%</td>
</tr>
<tr>
<td>Greater curiosity about science/technology</td>
<td>81%</td>
</tr>
<tr>
<td>Visits inspired me to learn more</td>
<td>81%</td>
</tr>
<tr>
<td>I thought about science/technology (after visit)</td>
<td>79%</td>
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*Percent indicating “Agree” or “Strongly Agree”*
The Attribution Issue: Homeostasis as a Marker

- 80% of visitors see Tess; 80% able to correctly define homeostasis.
- Percent of LA residents able to correctly define homeostasis:
  - 1998  7%
  - 2000  10%
  - 2009  19%
- 64% say learned in school, only 10% say learned at Science Center (2009)
A significant majority of adults (75%) believed that their child’s Science Center experience enhanced their chances of future success in life.

Low income and minority adults were significantly more likely to have this belief.
Key Findings of Falk’s Study

Dr. Falk concludes his study by noting “if anything, the impact of the Science Center on learning, interest, and behavior might be greater than indicated by the data. It is reasonable to assume that over time, the percentage of the population of L.A. being impacted by the Science Center will continue to grow.”
Summary

- As evidenced by the Falk study, the California Science Center successfully implements its mission. These results likely hold true for most science centers.

- Science centers, along with other informal learning institutions, can complement, reinforce, and in some cases, advance formal learning in classrooms.

- The role of informal learning institutions will become more prominent in the next twenty years in shaping the education of the next generation.
Summary

“Traditionally, museums have supplanted school learning. . . In most cases, supplementation has been subject-based. We, however, recommend that the educational focus be turned away from the subject matter to the learner, from the information to opportunities for individually-centered learning.

We maintain the uniqueness of museums as centers of learning naturally suited for the sort of individualized learning schools need to provide.”

Howard Gardner is the John H. and Elisabeth A. Hobbs Professor of Cognition and Education at the Harvard Graduate School of Education.

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