



The **Art** of  
**SCIENCE**  
*Learning*

**Harvey Seifter**  
Director and  
Principal Investigator



**Globalization**

**Radical change,  
speed and  
unpredictability**

**WHY THE  
ARTS?**

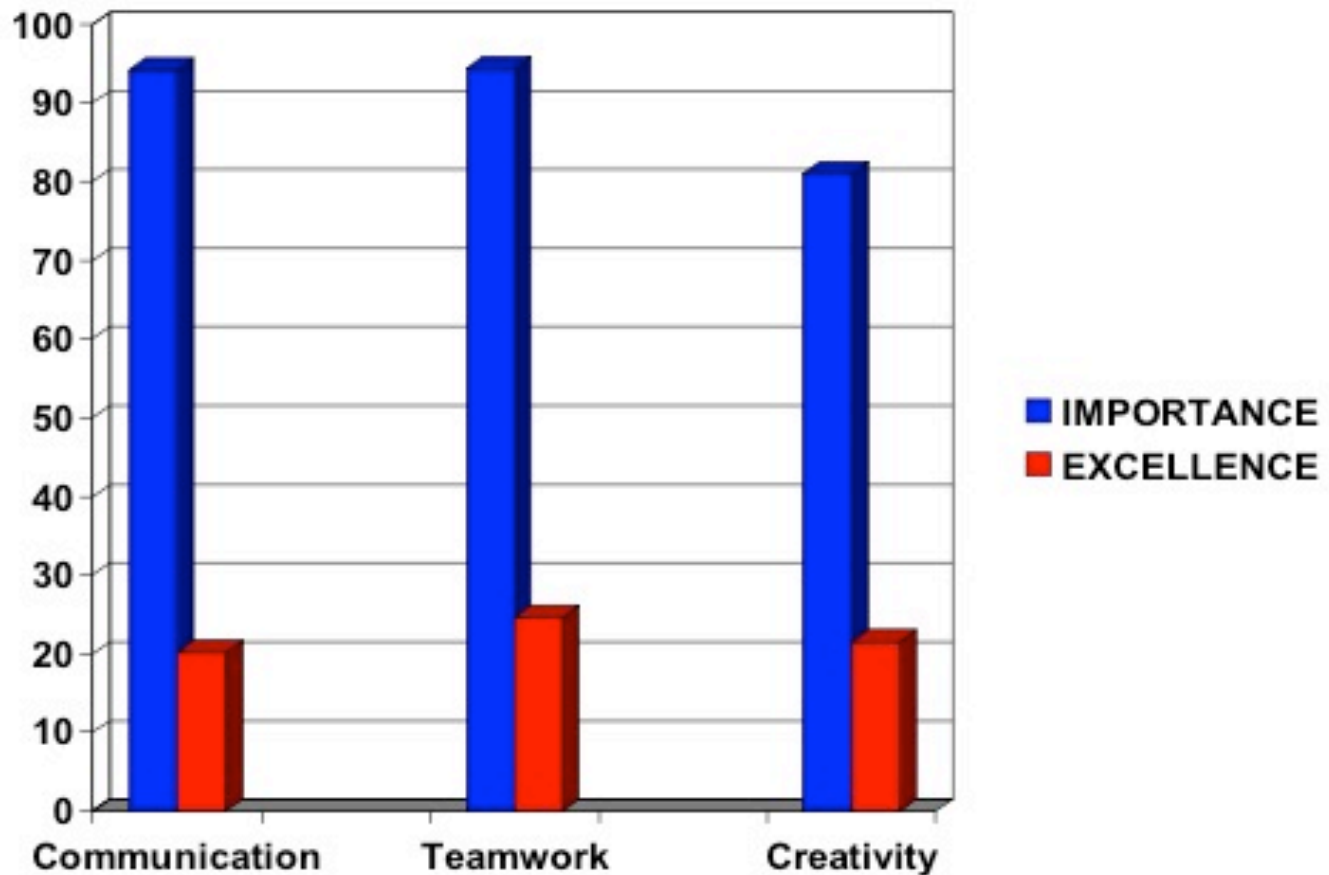
**Innovation as a  
way of life**

**Increased workforce needs for  
creativity, collaboration,  
communication skills**

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# The Innovation Gap



How 400 Major Corporations Assess Workforce Development

*Source: 2006 Conference Board Report, "Are They Really Ready to Work"*



# THE ART OF SCIENCE LEARNING

Shaping the 21<sup>st</sup> Century Workforce

**Washington DC**



The Smithsonian's National  
Museum of American History

**Chicago**



Illinois Institute of  
Technology

**San Diego**

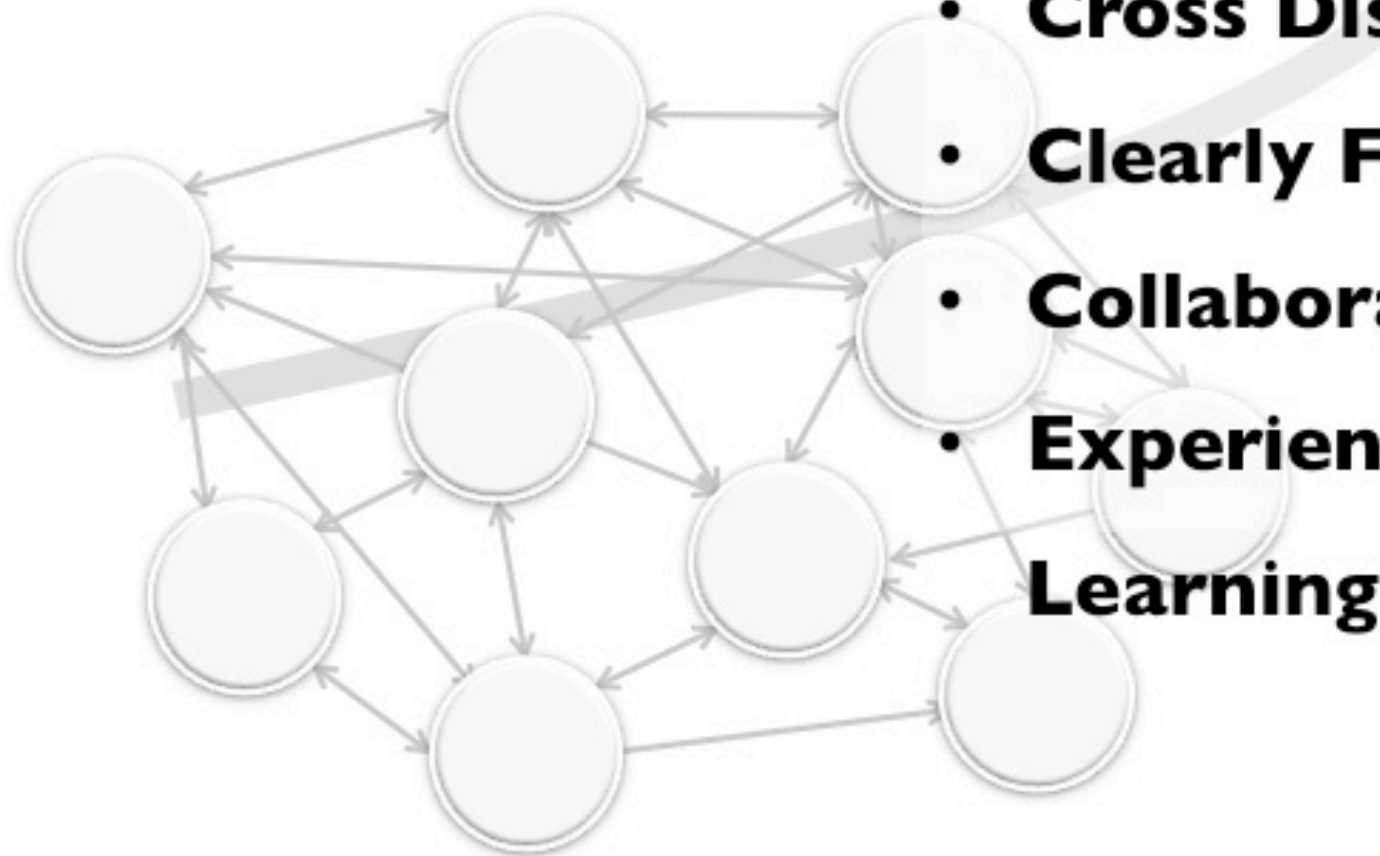


CALIT2 at  
University of California at  
San Diego



# Art of Science Learning Conferences

## **Building a Community of Practice**



- **Cross Disciplinary**
- **Clearly Focused**
- **Collaborative**
- **Experiential Learning**



# METAPHORMING




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# Idea Harvesting

Sparking STEM learning through the arts

- 
- **150+ actionable ideas**
  - **Teaching concepts, methods & practices**
  - **Data**
  - **Policy recommendations**
  - **Partnerships – business, government, academia**
  - **Public awareness**



# The Art of Science Learning Creating a Knowledge Base



**ART SCIENCE MATCHUP**  
Connecting artists, scientists and educators  
to share content and collaborate on  
integrated (STEAM) projects

A project of **The Art of SCIENCE Learning**

Home Categories Blog About ArtScienceMatchup [Post a Lesson, Link, or Project](#)

What are you looking for?  All Categories

**Featured Listings**

- Fibonacci & Biology
- Lesson: Physics of Bubbles
- Biophilia Educational Program
- The Physics of Dance
- The Chemistry of Paint

**Categories**

BY ARTS DISCIPLINE (4)	LESSONS (2)	RESOURCES (2)
<a href="#">Dance (2)</a>		
<a href="#">Music (2)</a>	<a href="#">LOOKING FOR COLLABORATORS (7)</a>	
<a href="#">Painting (2)</a>		
<a href="#">Sculpture (1)</a>	<a href="#">PROJECTS (2)</a>	

**BY STEM DISCIPLINE (4)**

**Welcome to ArtScienceMatchup**  
**Connecting Art, Science, and Learning**

ArtScienceMatchup is a knowledgebase and matching service for projects that integrate the arts and STEM (Science Technology Engineering and Math) skills. We're working on a "soft launch" of the service and will open it shortly to members of the Art of Science Learning Community to begin posting links, lesson ideas, and projects.

[Join Now!](#)

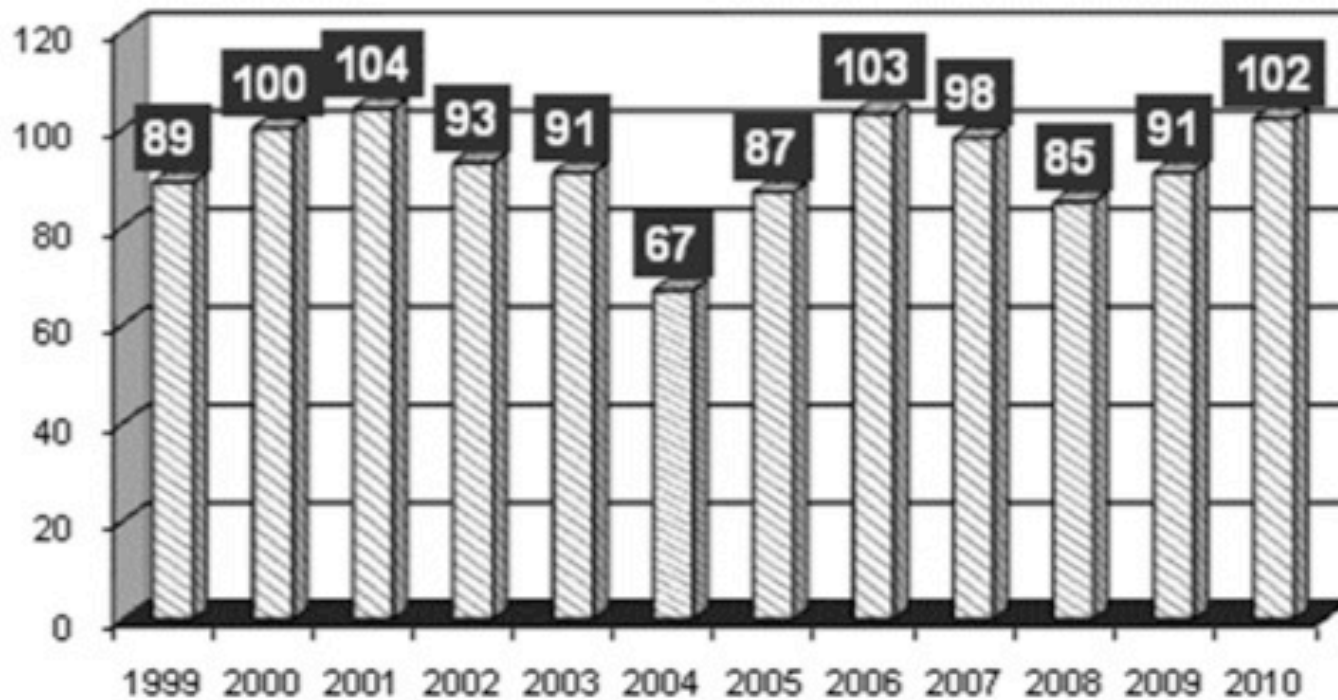
[www.artsciencematchup.org](http://www.artsciencematchup.org)

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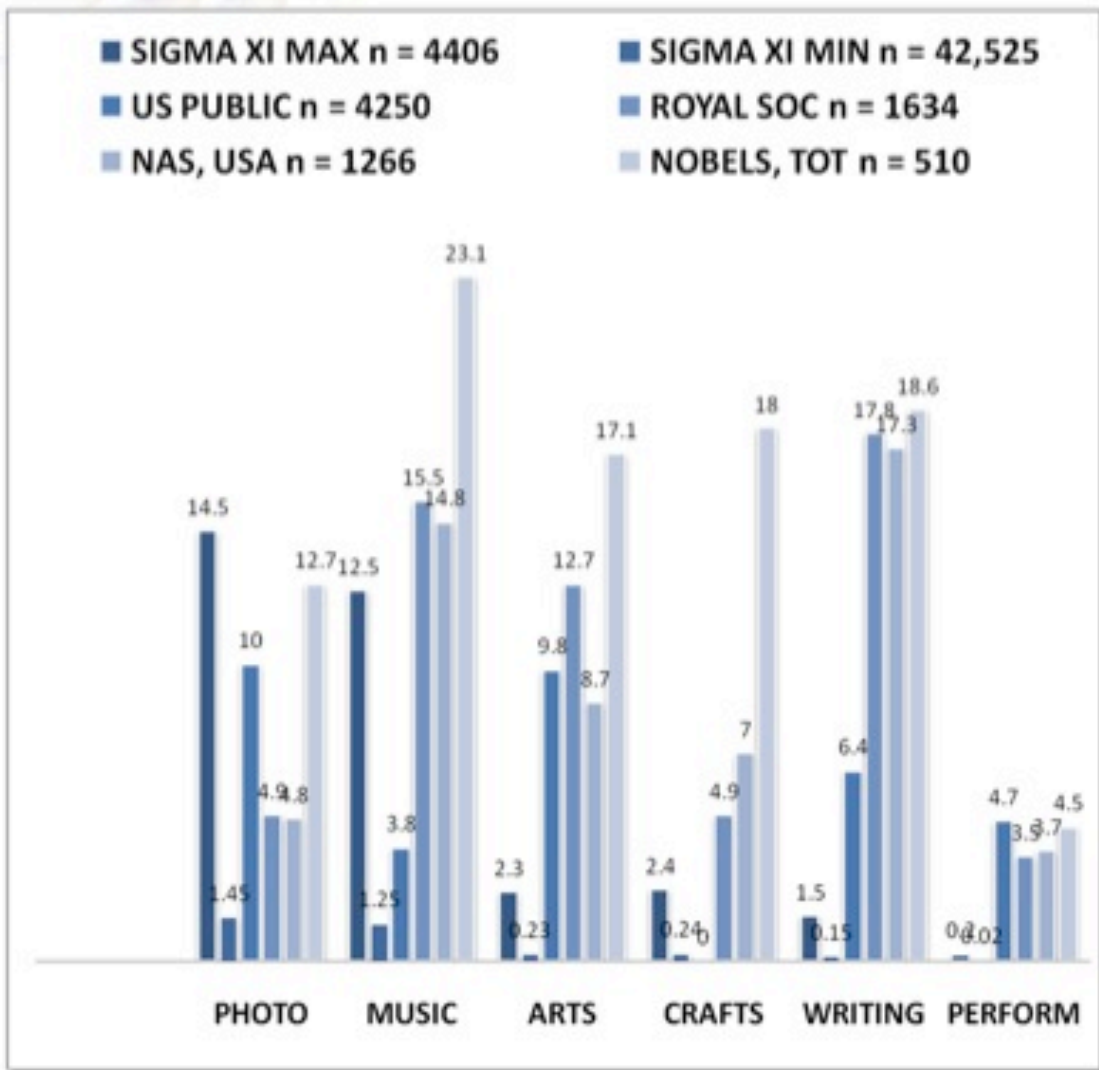
# Students who study the arts outperform students who don't



**SAT DIFFERENTIAL BY YEAR**

Source: The College Board, College Bound Seniors 2009

# High achieving scientists are more likely practice art than other scientists



Compared with typical scientist, Nobel laureates are at least:

- 2X photographers
- 4X musicians
- 17X artists
- 15X craftsmen
- 25X writers
- 22X performers

Root-Bernstein, et al., 2008



# Studying the performing arts helps engineers become better communicators

## Assessments of Communication Skills Performed by Corporate Recruiters Blind controlled study, Cooper Union



Control Group,  
No Arts-Based Learning



Arts-Based Learning  
Theater & Music Only



Arts-Based Learning  
Dance, Theater & Music



# Research Agenda

## KEY HYPOTHESIS

Arts-based learning enhances “creativity skills” and innovation outcomes among ...

- **STEM learners**
- **Educators**
- **Professionals**
- **Workforce**

## MEASUREMENT

Based on a variety of research strategies, possibly including ...

- **Skills testing**
- **Workplace assessment of individual innovation performances**
- **Workplace assessment of innovation team outcomes**
- **Neurobiology**



## WORKFORCE DEVELOPMENT:

Creativity is more than problem solving


Which best demonstrates creativity?		
	(#1=most popular choice)	
	Business/ Employers	School Superintendents
<b>Problem-identification or articulation</b>	<b>1</b>	9
Ability to identify new patterns of behavior or new combination of actions	2	3
Integration of knowledge across different disciplines	3	2
Ability to originate new ideas	4	6
Comfort with the notion of "no right answer"	5	11
Fundamental curiosity	6	10
Originality and inventiveness in work	7	4
<b>Problem-solving</b>	8	<b>1</b>

Source: "Ready to Innovate" / 2008  
Conference Board and Americans for the Arts



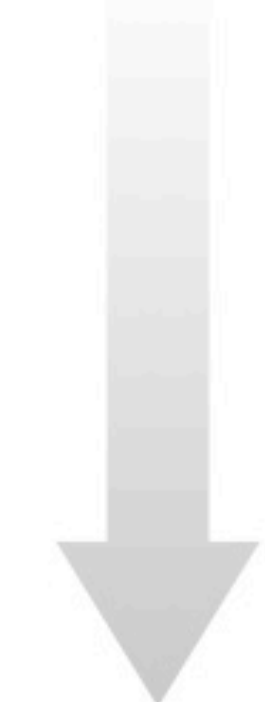
# Conference Evaluation

## Preliminary Conclusions



**Data shows that conference participants consolidated their thinking about the integration of art and STEM learning.**

**They were:**

- 
- Less likely after the conference to approach the topic from the point of view of one particular discipline (e.g. arts or science)
  - More likely to think holistically about the art-science-learning connections
  - More likely to articulate shared processes between art and science
  - Participants' post-conference elaborations of their thinking were richer and more detailed



# Arts-Based Learning for STEM Innovation

GROWING AND  
STRENGTHENING THE  
COMMUNITY OF PRACTICE



FOCUS ON  
WORKFORCE  
DEVELOPMENT



The **Art** of  
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ADVANCING THE  
RESEARCH AGENDA



FOSTERING CROSS-  
DISCIPLINARY PARTNERSHIPS





**“ I actually think there's very little distinction between an artist and a scientist...**

...to me, they're people who pursue different paths headed to the same goal, which is to express what they perceive to be the truth around them so that others can benefit.”

**Steve Jobs, 1995**

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A National Science Foundation-funded initiative