Liz Lerman and the Dance Exchange's

The Matter of Origins

EVALUATION FINDINGS

AN IDEA BOOK

PRESENTED BY

MICHIGAN STATE UNIVERSITY

FALL 2011

MICHIGAN STATE UNIVERSITY | University Outreach and Engagement

ARTISTS

Choreographer Liz Lerman

Artists at the Dance Exchange

FUNDING

The National Science Foundation supported the presentation of The Matter of Origins *and the evaluation research through its Early Concept Grants for Exploratory Research (EAGER) grant program.*

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The Matter of Origins

Choreographed by Liz Lerman and the Dance Exchange, *The Matter of Origins* is a contemporary dance exploring historical perspectives and cutting edge physics about our beginnings.

In Act One, audience members watch as science concepts are translated into images, music, and dance. Dancers portray ideas such as the complexity of measurement, the ways atomic particles interact, and the origins of the universe. Science-themed, multi-media experiences including images from the Hubble space telescope, CERN, and replications of atomic bomb explosions accompany the dancing.

In Act Two, audience members adjourn to a nearby room to enjoy tea, cake, and dialogue facilitated by local scientists and scholars. The tea experience includes dance interruptions and additional science content, to stimulate reflection through public engagement about the nature of science, limits of measurement, and meaning of movements, both big and small.

NSF Evaluation

The National Science Foundation (NSF) funded the presentation of tea and the evaluation of *The Matter of Origins* as an informal science education project. NSF's main learning impacts for informal science education include individual changes in attitude, interest, knowledge, behavior, and skills related to science.

In addition to NSF's research questions, choreographer Liz Lerman, artists at the Dance Exchange, and Michigan State University evaluation researchers were also interested in understanding connections between art and science, emotional engagement with the subject matter, the impact of the tea experience, and impact of the performance on groups historically underrepresented in the sciences.

Research Design

The challenge was to evaluate the impact of Act One, Act Two, and the overall performance in a way that would not take away from the audience members' experience. Together, the MSU evaluators and the Dance Exchange developed research designs, instruments (which we called "measures"), and data collection processes, so that rigor and creativity were maximized.

In general, audience members completed pre-performance, intermission, and post-performance measures. These hard-copy surveys included quantitative (Likert-scale) questions measuring their attitudes, interests, knowledge, behavior about science; directed qualitative measures about their emotions (emotion clouds); open-ended qualitative questions about what struck them, and about science themes they perceived during the performance and tea.

Audience members also provided background and demographic information, including race/ethnicity, gender, age, level of education, science background, dance background, and informal science education background.

Research designs varied from site to site depending on theatre arrangements for Act One and Act Two; particular learning interests at each site; and the evaluation team's evolving understanding of the materials. Data was collected at four sites during the 2010-2011 performance season—The University of Maryland, Wesleyan University, Montclair State University, and Arizona State University.

The research measures and findings presented in this "idea book" are designed to spark thinking about rigorous, creative ways to evaluate informal science education through the arts. Data tables are from specific sites, which are noted in the introductions to each section. This "idea book" is not an exhaustive report of the study's findings. If you would like more comprehensive information, please contact the authors directly.

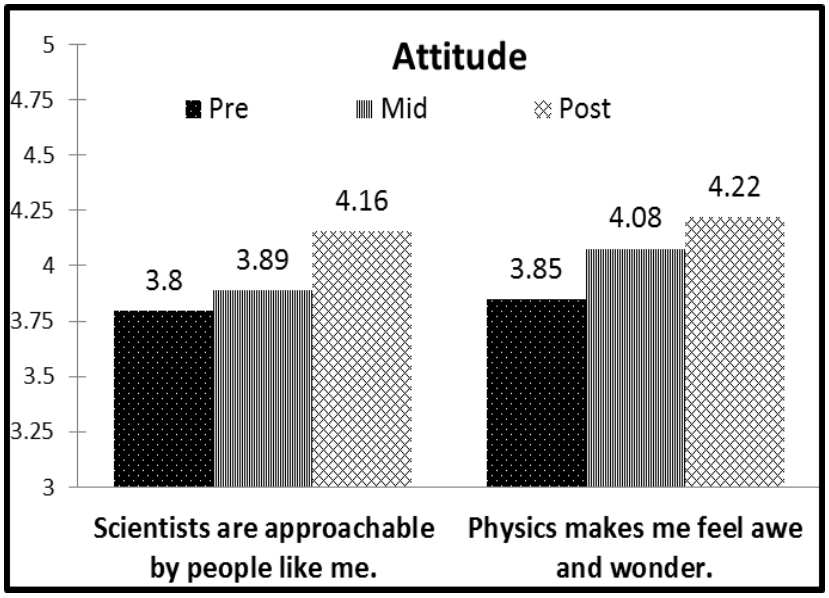
Attitude and Interest

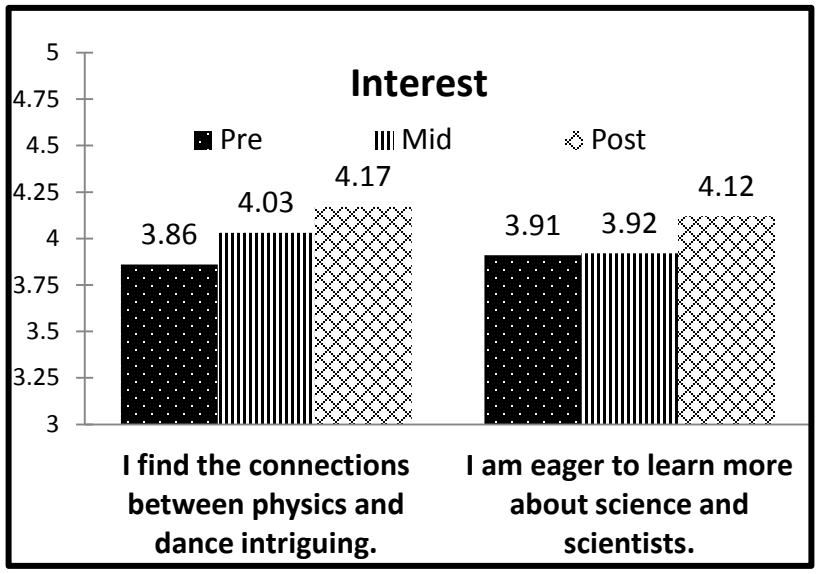
For **Attitude** and **Interest**, we asked Likert-scale questions comparing audience members' responses prior to the performance, at intermission, and after the tea.

Here is a survey example excerpted from **The University of Maryland**.

Measuring the Matter of You

Please tell us where you're coming from...	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	↓Circle your opinion↓				
I find the connections between physics and dance intriguing.	SD	D	N	A	SA
Scientists are approachable by people like me.	SD	D	N	A	SA
Physicists study the origins of matter at small and large scales.	SD	D	N	A	SA
I am eager to know more about science and scientists.	SD	D	N	A	SA
Physics makes me feel awe and wonder.	SD	D	N	A	SA



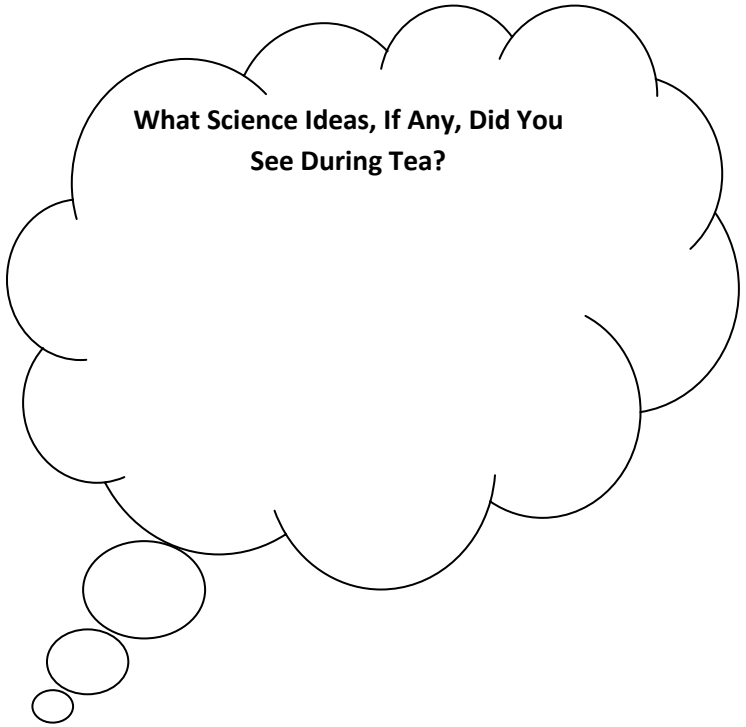


For the analysis, we compared mean scores pre-performance, intermission, and post-tea. For all four Attitude and Interest questions, audience members' showed statistically significant changes in the expected direction.

Knowledge

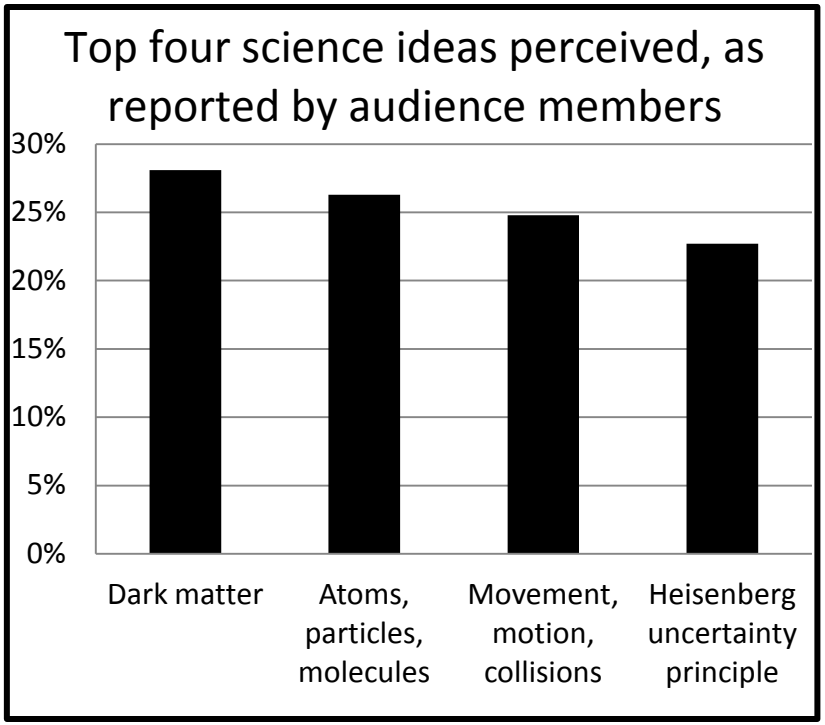
For **Knowledge**, we asked Likert scale questions at all four university sites. We also developed a simple, open-ended question—**What Science Ideas, if any, Did You See During Tea?—**for use at intermission and post-tea.

Here is an example from **Arizona State University**.



For the Arizona State University analysis, we used qualitative, thematic coding to cluster science ideas together.

92% of the audience members reported seeing at least one science idea, with the top four science ideas noted in the table below.



Behavior

For **Behavior**, we developed a survey monkey survey to follow-up with audience members 6 to 9 months after they attended *The Matter of Origins* performance. In the audience member follow-up survey, we asked questions about lasting impressions and about short term and long term behaviors.

Here is an example of the short term behavior questions that were sent to **Montclair State University** audience members.

Since attending The Matter of Origins, I have (check all that apply):

- ☐ Written about my experience at *The Matter of Origins* in an article
- ☐ Talked with someone about the dancing, dancers, or choreography
- ☐ Talked with someone about the physics or science ideas that were part of the performance
- ☐ Blogged, tweeted, facebooked, texted, or emailed about *The Matter of Origins*
- ☐ Started a new project at work or school based on an idea sparked by *The Matter of Origins*

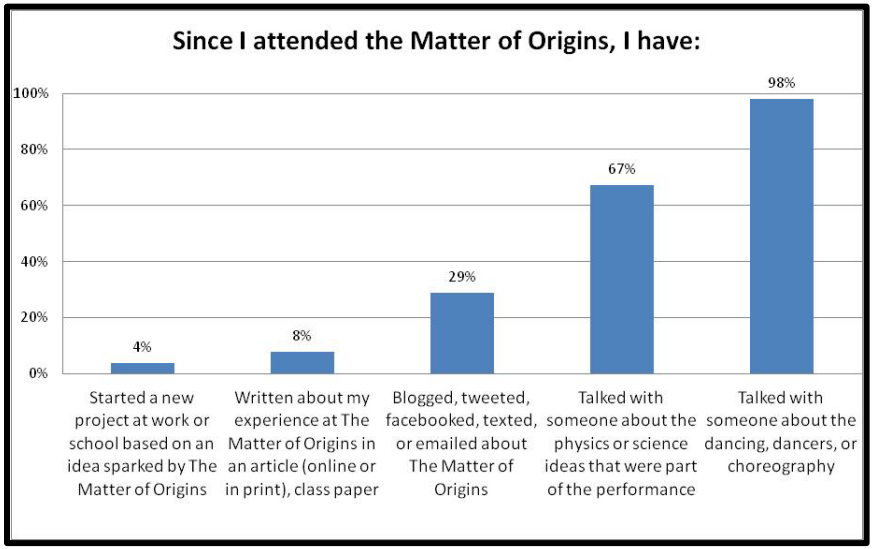
The Matter of Origins may have influenced you to do things normally done. For example, (check all that apply):

- ☐ Notice and pay attention to a news story about a breaking scientific discovery
- ☐ Read a newspaper, article, book, or webpage about science or physics
- ☐ Look for another art/science event to attend
- ☐ Be more creative and imaginative
- ☐ Think more about how science and art are both ways of knowing
- ☐ Consider the personal stories behind big historical or scientific events

For the analysis, we relied on descriptive statistics and reported simple frequencies as percentages.

At Montclair State University, more than 90% of the audience members talked with someone about the dancing, dancers, or choreography.

More than 60% of the audience members reported talking with someone about the physics or science ideas that were part of the performance.



Connections Between Art and Science

For **Connections Between Art and Science**, we asked Likert scale questions at all four university sites. We also developed special questions for sites if *The Matter of Origins* was coupled with a university event, such as a conference, symposium, or festival.

Here is a survey excerpt from **Arizona State University**, where the performance was the culminating event of Science and Culture Festival.

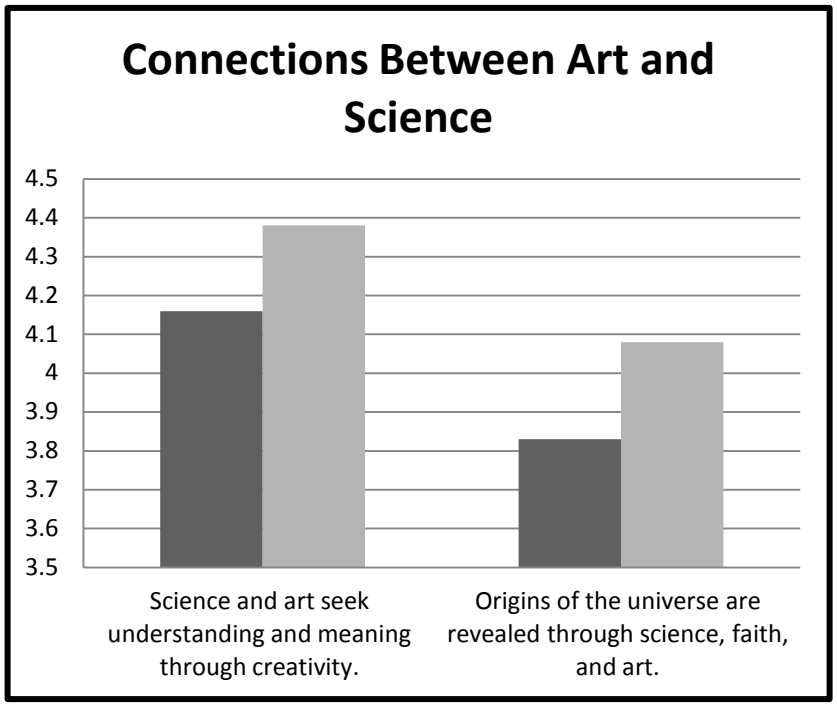
Measuring the Matter of You

Please tell us where you're coming from...

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	↓Circle your opinion↓				
I find the connections between physics and dance intriguing.	SD	D	N	A	SA
"Dark matter" has been directly observed and photographed.	SD	D	N	A	SA
Science and art seek understanding and meaning through creativity.	SD	D	N	A	SA
Bodies in motion stay in motion unless acted upon by another force.	SD	D	N	A	SA
The universe is expanding at an accelerating rate.	SD	D	N	A	SA
Origins of the universe are revealed through science, faith, and art.	SD	D	N	A	SA
Scientists smash tiny particles to recreate the conditions just after the Big Bang.	SD	D	N	A	SA

For the analysis, we compared pre-performance with post-performance data and calculated differences in the means to determine whether there were changes in audience members' perceptions in the connections between art and science.

For both questions, audience members reported seeing more connections between art and science at the end of the performance.

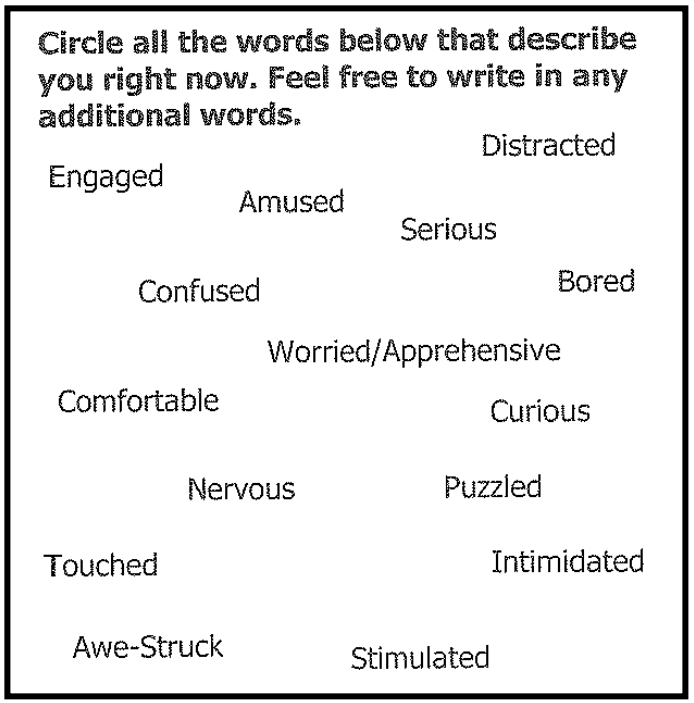


Emotional Engagement

Some scholars believe that **Emotional Engagement** with the subject matter leads to more powerful learning. In order to gauge audience members' emotional engagement, we used a technique developed by the Dance Exchange.

Emotion clouds are a collection of feeling words—some positive, some neutral, some negative. Audience members, at different points in time, are asked to circle the words that represent their feelings at that moment.

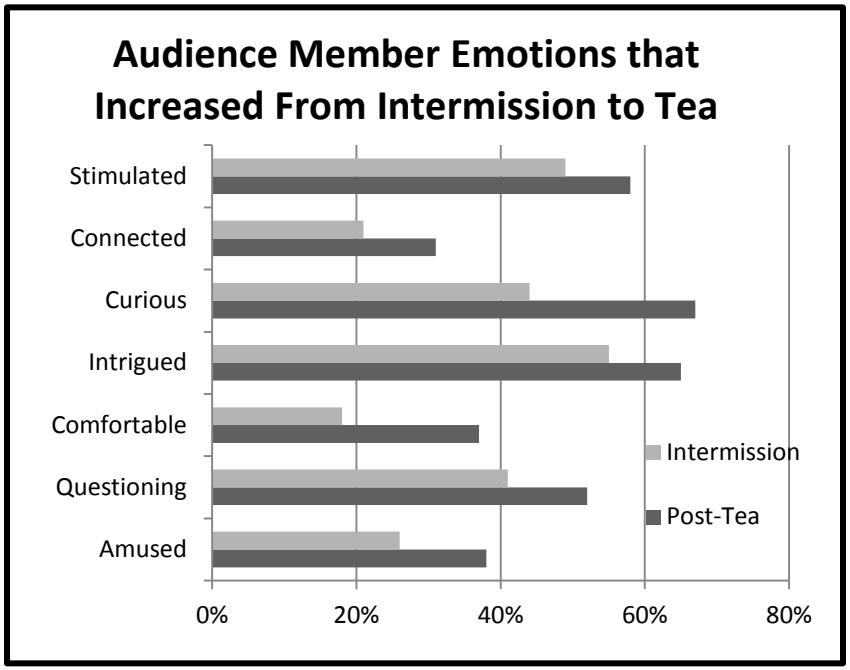
Here is a survey excerpt from **University of Maryland.**



For the analysis, we looked at each emotion word and calculated the percentage of audience members who circled a specific emotion at intermission and at post-tea. Comparisons of percentages showed which emotions increased and which ones decreased.

At **Montclair State University**, we added a few more words to the emotion clouds based on previous data from audience members.

Montclair State University audience members were more stimulated, connected, curious, intrigued, comfortable, questioning, and amused at the end of tea.



Impact of Tea Experience

The National Science Foundation, in particular, is interested in whether the "tea experience" is a way of reinforcing science learning.

In addition to the pre-performance, intermission, and post-tea comparisons (reported on early pages in this idea book), we added some simple, but clear questions about the tea experience for audience members to respond to.

Here is a survey excerpt from **Arizona State University.**

Please tell us more about you.
My background in physics or science is:
☐ Extensive ☐ Moderate ☐ Limited

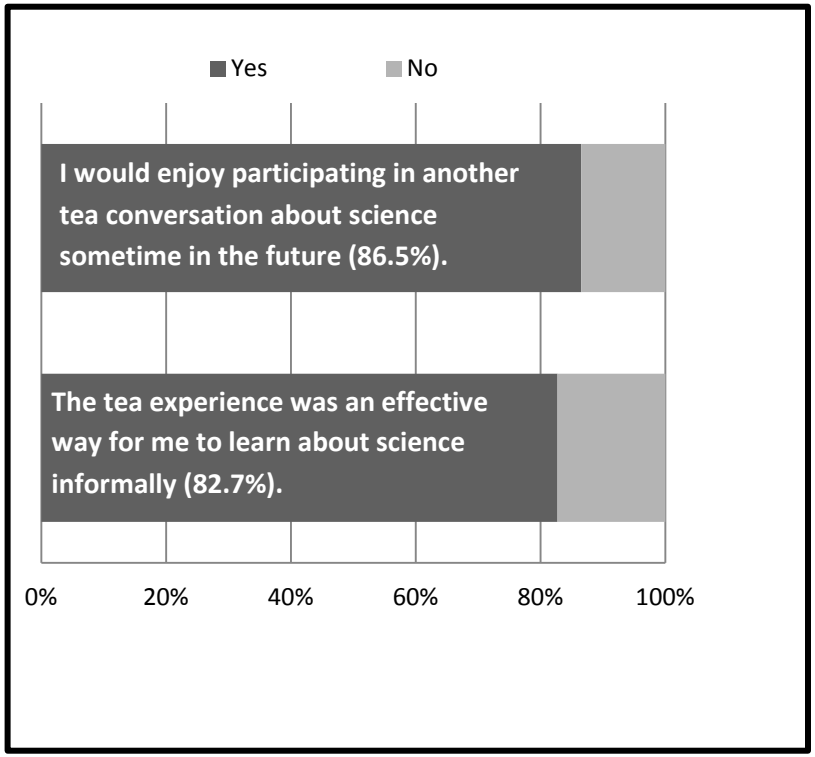
My background in arts and/or humanities is:
☐ Extensive ☐ Moderate ☐ Limited

I attended other events at ASU's Science & Culture Festival:
☐ Yes ☐ No

I would enjoy participating in another tea conversation about science sometime in the future:
☐ Yes ☐ No ☐

The tea experience was an effective way for me to learn about science informally:
☐ Yes ☐ No ☐

For the analysis, we used descriptive statistics, calculated frequencies and reported the audience members' responses as percentages.



These two questions were a reminder that sometimes it's best to simply ask the audience members what it is you want to know.

Groups Historically Underrepresented in the Sciences

We were interested in whether the "tea experience" was an effective way to reinforce science learning, especially for groups historically underrepresented in the sciences (e.g., women, minorities, etc.).

At three of the study sites, we collected background and demographic data about audience members. The demographic data included gender, race, age, and level of education. We also asked audience members about their background in physics or sciences; participation in athletics, dance, or other body/movement arts; and attendance at educational events such as zoos, museums, aquariums, and/or science centers.

Here is a survey excerpt from the **University of Maryland**.

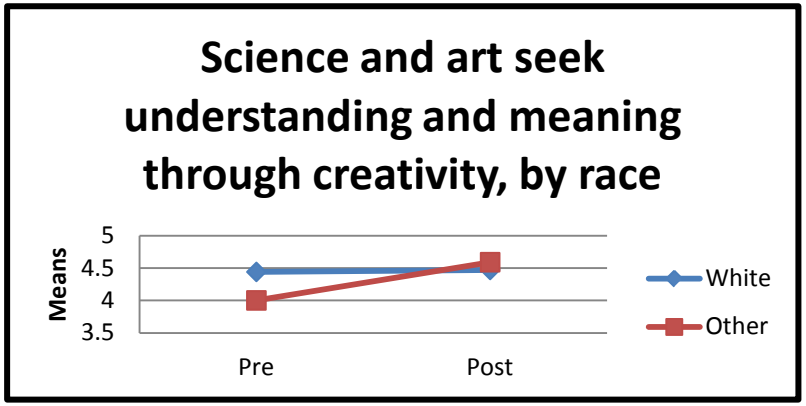
Please tell us more about you.

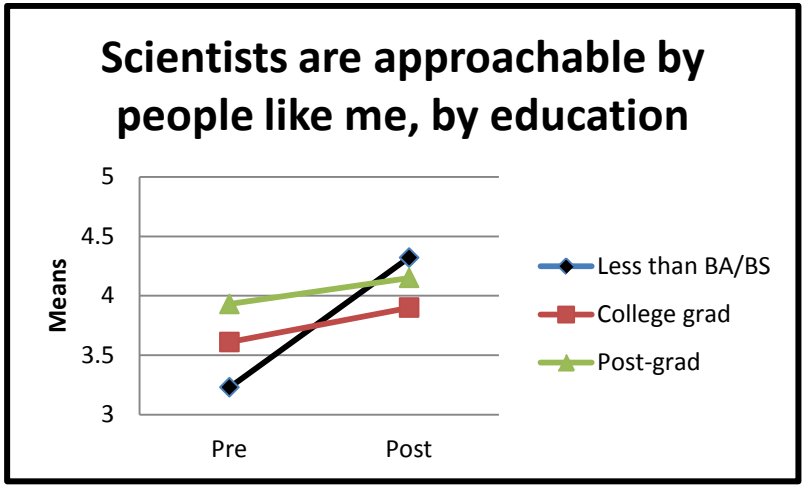
My background in physics or science is:
☐ Extensive ☐ Moderate ☐ Limited

My participation in athletics, dance, or other body/movement art is:
☐ Extensive ☐ Moderate ☐ Limited

I attend education events at museums, zoos, aquariums and/or science centers:
☐ Frequently ☐ Occasionally ☐ Rarely

For analysis, we ran crosstabs to compare means to see if there were any differences based on demographics or background. At Montclair State University, for example, we found that





Dialogue Resources

Bohm, D. (1996). On dialogue. New York, NY: Routledge.

Ellinor, L. & Gerard, G. (1998). Dialogue: Rediscovering the transformative power of conversation. New York, NY: John Wiley and Sons, Inc.

Heierbacher, S. (2007). Dialogue and deliberation. In P. Holman, T. Devane, & S. Cady. (Eds.). The change handbook: The definitive resource on today's best methods for engaging whole systems change, pp. 102-117. San Francisco, CA: Berrett-Koehler.

Isaacs, W. (1999). Dialogue and the art of thinking together. New York, NY: Currency.

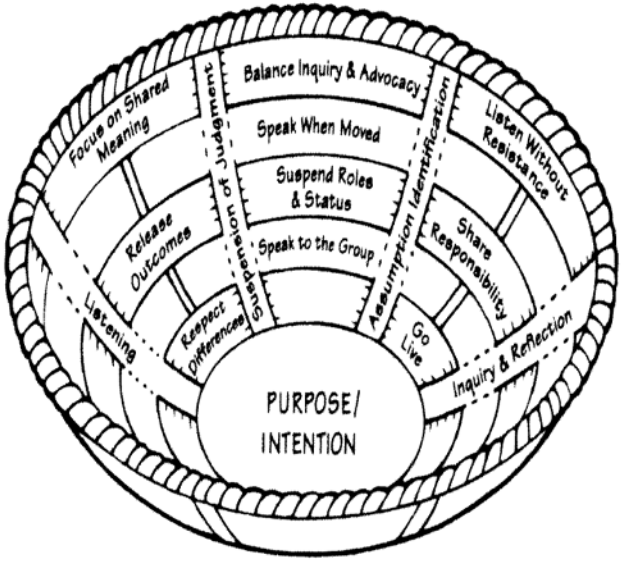
Kaner, S., Lind, L., Toldi, C., Fisk, S. & Berger, D. (1996). Facilitator's guide to participatory decision-making. Gabriola Island, BC: New Society Publishers.

Neal, C., & Neal, P. (2011). The art of convening authentic engagement in meetings, gatherings, and conversations. San Francisco, CA: Berrett-Koehler Publishers.

Schirch, L., & Campt, D. (2007). The little book of dialogue for difficult subjects: A practical hands-on guide. Intercourse, PA: Good Books.

Wheatley, M. (2002). turning to one another: simple conversations to restore hope to the future. San Francisco, CA: Berrett-Koehler.

Adapted from Ellinor, L. & Gerard, G. (1998). Guides for Creating and Sustaining Dialogues, pp. 142-153. Dialogue: Rediscovering the transformative power of conversation. New York, NY: John Wiley and Sons.



Invite everyone's full presence

Suspend Judgment

Identify and suspend assumptions

Listen without Resistance

Focus on Shared Meaning and Learning

Release the Need for Specific Outcomes

Respect Differences

Suspend Role and Status

Allow for Silences and Reflection

Share Responsibility and Leadership

Speak When the Spirit Moves You

Speak to the Group

"Tea" Resources

Atlee, T., & Zubizarreta, R. (2003). The tao of democracy: Using co-intelligence to create a world that works for all. Cranston, RI: The Writers' Collective.

Brown, J., Isaacs, D., & The World Café Community. (2005). The world café: Shaping our futures through conversations that matter. San Francisco, CA: Berrett-Koehler.

Café Scientifique, http://www.cafescientifique.org/

Owens, H. (1997). Open space technology: A user's guide, 2nd edition. San Francisco, CA: Berrett-Koehler.

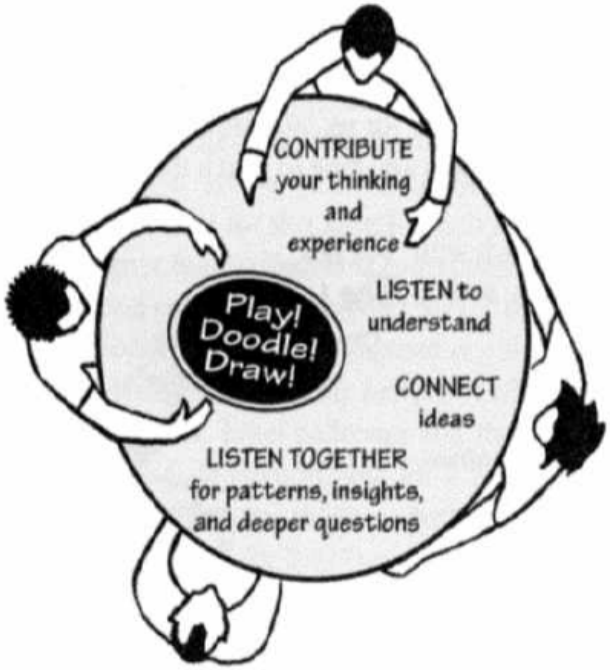
Patterson, K., Grenny, J., McMillan, R., Switzler, A. & Covey, S. (2002). Critical conversations: Tools for talking when the stakes are high. Columbus, OH: McGraw-Hill.

Robin, V. (2007). Conversation café. In P. Holman, T. Devane, & S. Cady. (Eds.). The change handbook: The definitive resource on today's best methods for engaging whole systems, pp. 218-222. San Francisco, CA: Berrett-Koehler.

Surowiecki, J. (2004). The wisdom of the crowds: Why the many are smarter than the few and how collective wisdom shapes business, economies, societies, and nations. New York, NY: Doubleday.

Wheatley, M. (2002). turning to one another: simple conversations to restore hope to the future. San Francisco, CA: Berrett-Koehler.

Williams, T. T. (2004). The open space of democracy. Barrington, MA: The Orion Society.



Set the Context

Create Hospitable Space

Explore Questions That Matter

Encourage Everyone's Contributions

Connect Diverse Perspectives

Listen Together For Insights

Share and Harvest Collective Discoveries

Adapted from Brown, J., Isaacs, D., & The World Café Community. (2005). The world café: Shaping our futures through conversations that matter. San Francisco, CA: Berrett-Koehler. *p. 40 & p. 64.*

Provocateur Resources

Bens, I. (2005). Advanced facilitation strategies: Tools and techniques to master difficult situations. New York, NY: Jossey Bass.

Bens, I. (2005). Facilitating with Ease!: Core skills for facilitators, team leaders and members, managers, consultants, and trainers. New York, NY: Jossey-Bass.

Bens, I. (2008). Facilitation at a glance: A pocket guide for tools and techniques for effective meeting facilitation, 2nd edition. Salem, NH: Goal QPC.

Ellinor, L., & Gerard, G. (1998). Guides for creating and sustaining dialogue, pp. 142-153. Dialogue: Rediscover the transforming power of conversation. New York, NY: John Wiley and Sons.

Kaner, S., Lind, L., Toldi, C., Fisk, S. & Berger, D. (1996). Facilitator's guide to participatory decision-making. Gabriola Island, BC: New Society Publishers.

Schwarz, R. (2002). The skilled facilitator guide: A comprehensive resource for consultants, facilitators, managers, trainers, and coaches, 2nd edition. New York, NY: Jossey Bass.

Schwarz, R., Davidson, A., Carlson, P., & McKinney, S. (2005). The skilled facilitator fieldbook: Tips, tools, and tested methods for consultants, facilitators, managers, trainers and coaches. New York, NY: Jossey-Bass.

Wheatley, M. (2005). Finding our way: Leadership for an uncertain time. San Francisco, CA: Berrett-Koehler.

Lessons Learned

Recruit provocateurs from a wide variety of backgrounds (e.g., university scholars, community leaders, artists).

Recognize that they will have a range of comfort levels (or degrees of nervousness) in being a provocateur.

Hold an orientation session for them (e.g., have them become familiar with their role, give them a printed guide, answer their questions).

Remind them that the "provocateur role" is about convening a conversation, which may go in a number of directions and that the "guide" is simply a guide and not set in stone.

Let them become familiar with the topic or project (e.g., view Act 1's performance during dress rehearsal).

Allow them to practice being a provocateur during dress rehearsal or with one another. Encourage sharing of techniques within the group.

Remind them that tables will emphasize different topics and that is OK. Audience members' experiences, ages, and comfort levels in talking with strangers will all influence table conversations.

Provide a "HELP" mechanism for provocateurs to signal that the need some help answer questions at their table.

Debrief the provocateurs for 5-10 minutes after their sessions for reflections on their experience and ideas for improvement for future teas. Consider a survey to collect ideas efficiently.

References

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Dance Exchange. Retrieved from http://danceexchange.org/projects/the-matter-of-origins/

Fenichel, M., Schweingruber, H. A., & National Research Council (2010). *Surrounded by science: Learning science in informal settings*. Washington, DC: National Academies Press.

Friedman, A. (Ed). (2008). *Framework for evaluating impacts of informal science education projects*. Washington, DC: National Science Foundation. Available at http://insci.org/resources/Eval_Framework.pdf.

Lerman, L. (2011). *Hiking the horizontal: Field notes from a choreographer*. Middletown, CT: Wesleyan University Press.

Patton, M. Q. (2010). *Developmental evaluation: Apply complexity concepts to enhance innovation and use*. New York, NY: The Guilford Press.

An Invitation…

We welcome your ideas, comments, and feedback about hosting tea experiences, findings from the NSF-funded study, or learning science in informal settings or through the arts.

Please feel free to contact us!

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