

Always Evolving

A Framework for the Professional Development
of Exploratorium Field Trip Explainers



By Anne Richardson, Associate Director, Field Trip Explainer Program



a l w a y s e v o l v i n g

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Exploratorium
San Francisco, California

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● CONTENTS

Welcome	6
About the Exploratorium	7
Who Are the Field Trip Explainers and What Do They Do?	8
What Are the Professional Development Strategies?	18
Who Leads Professional Development Sessions?	24
What Do Explainers Study?	30
Try This! Reflect and Consider	37
The Mistake Garden and Other Outcomes.....	40



welcome

Hello,

Managers of education programs at other institutions often ask me if I can share our curriculum for Field Trip Explainer training. This book is the answer to that question.

Because of the dynamic nature of the Explainer program, there is no set curriculum. The professional development plan is flexible and constantly adapts and improves to meet the changing needs of the Explainers and their work. Instead of a curriculum, there is a framework: a set of organizing principles around which the training and professional development are built.

This book outlines the framework for the professional development of the Exploratorium Field Trip Explainers, illustrated with examples from our practice. There are many ways in which professional development for educators can be structured; this is one example. I hope it will serve as a starting point for discussion as you make decisions about your programs in a way that makes sense for your institution, staff, and goals.

One final note: This program is made possible and wonderful by all of the Exploratorium staff, particularly Robyn Higdon, director of Mediated Experiences; Sylvia Algire, assistant manager of Field Trip Explainers; and all the past and present Field Trip Explainers.

Sincerely,

Anne Richardson, PhD

Associate Director of the Field Trip Explainer Program

You can contact me at arichardson@exploratorium.edu. My dissertation, *Explainers' Development of Science-Learner Identities through Participation in a Community of Practice*, can be downloaded here: http://etd.ohiolink.edu/view.cgi?acc_num=antioch1327711877.

The Exploratorium is a hands-on museum of science, art, and human perception located in San Francisco, California. We believe that when people follow their curiosity, it can lead to surprising and wonderful discoveries and learning. It can also increase confidence in their ability to understand how the world works.

We create tools and experiences that help people to become active explorers. These include hundreds of explore-for-yourself exhibits; a website with more than 40,000 pages of content; film screenings; workshops for lifelong learners including day camps for kids and family investigations; evening art and science events for adults—and much more. We also create professional development programs for educators and are at the forefront of changing the way science is taught. We share our exhibits and expertise with museums and science centers around the world.

To learn more about the Exploratorium, go to www.exploratorium.edu.

The Explainer Programs

Exploratorium founder Frank Oppenheimer wanted the Exploratorium to be accessible to everyone, regardless of their familiarity with science. He also wanted enthusiastic guides who could encourage visitors to play with the exhibits and discover their own questions and answers. The Explainer programs grew out of this idea.

Today, there are two programs: the Field Trip Explainer Program, which employs young adult educators, and the High School Explainer Program, which employs students. The two programs share a common purpose: to enhance the experiences of visitors; to provide training in communication, inquiry-based learning, and leadership; and to deepen the science knowledge of the Explainers themselves.

The Field Trip Explainer Program strives to provide a positive, rich experience for visiting school groups, supporting their goals. At the same time, it carefully and constantly strives to provide professional development for the Field Trip Explainers in their growth as museum educators and leaders in their future professions.

about the Exploratorium

● WHO ARE THE FIELD TRIP EXPLAINERS AND WHAT DO THEY DO?



Field Trip Explainers are young adults who lead demonstrations, orient groups of students, and interact with visitors at exhibits. To learn the best ways to do this, they participate in intensive professional development that includes both formal training and reflective practice.

Field Trip Explainers

- support visitors' goals
- inspire visitors to explore the world around them
- empower visitors to take control of their own learning

Explainer Dario Maciel dissects flowers with a field-trip student. He encourages visitors to make and share their own observations.



Explainers are expert explorers, engaging their own—and other people’s—curiosity. They are not experts in the underlying science of each exhibit but are facilitators who explore along with visitors to ensure that the experience is meaningful.

Explainer Khamara Pettus asks a school group at the Angel Columns exhibit whether they noticed the columns or the people first. She encourages students to look at things more closely and to keep in mind that people don’t always see things the same way.



Explainers and Tibetan Buddhist monks work together to build their understanding of mirrors and visual perception.

Explainers are as diverse as the students visiting the Exploratorium on school field trips. They come from all over the United States and the world, speak many different languages, have studied a range of subjects, and have a variety of teaching and learning styles, life experiences, interests, and skills. Explainers apply their diverse backgrounds to enrich the work that they do. What they have in common is their dedication to serving the visitors. All of the learning described in this book is intended to better serve the people who visit the Exploratorium.



Explainer Ryoko Matsumoto dissects a cow eye with a group of visiting students.

I love to tap dance.

I am curious about everything.

I speak Punjabi.

I like to make films about community.

I am a writing student.

I play classical piano.

I can hula dance.

I speak Tagalog.

I ride my bike to work every day.

I am a world-champion athlete.

I write educational songs.

I volunteer with the visually impaired.

I am from Peru.

I want to be a journalist.

I know how to drive a school bus.

I make art about the sense of wonder.



During their tenure, Explainers become enhanced learners. They then inspire visitors to engage with the world and empower them to take control of their own learning.

They support students by helping them to

- increase their intrinsic motivation
- practice inquiry skills
- understand natural phenomena



Explainers help develop students' intrinsic motivation for science learning by

- modeling methods of exploring exhibits
- leveraging students' prior knowledge and experiences
- sharing their own excitement for learning

Explainer Lianna Kali and a student visitor explore a five-dollar bill under a microscope. During a training session, Explainers discovered hidden images in money that they eagerly share with visitors. They hope to spark visitors' curiosity about exploring everyday objects.

Explainers support curiosity in students by

- modeling and scaffolding the inquiry process
- encouraging students to examine, discuss, and revise their understandings

Explainer Ann Bartkowski and a group of students use magnets to find true north. Together they make careful observations, ask questions about their observations, and experiment to determine if their results can be replicated.





Explainers support student efforts to understand natural phenomena by

- being aware of student interests, prior knowledge, and experiences
- modeling the learning process
- helping students find exhibits that relate to their questions and interests

Before dissecting a flower, Explainer Sal Alper questions students about their prior knowledge of and experiences with plants.



Explainers demonstrate how the Pedal Generator exhibit can be used for a school group orientation. This orientation, led by Explainer Ann Bartkowski, focuses on using your whole body to explore an exhibit. Chaperones are encouraged to use the exhibits with their students.

Explainers are constantly engaged in learning together . . .



. . . so that they become very good at learning.

Explainers test paper airplanes during a training session about the Bernoulli effect. They get an hour of training every morning before they begin teaching. This inspires them to share their enthusiasm for learning with visitors.

● WHAT ARE THE PROFESSIONAL DEVELOPMENT STRATEGIES?



The Explainers' professional development is organized into five strategies:

- investigate
- collaborate
- practice
- share
- reflect

These topics expose the Explainers to multiple facilitation styles, engage them in various parts of the learning process, and address the group's diverse learning needs.

Explainers investigate the Snake Pendulum exhibit using the "Tools for Exploration" section of Explorotopia, an Exploratorium publication, as a guide. They spend two hours at an exhibit of their choice, making observations, developing and testing their own questions, and sharing their discoveries and process with the group.*

* *Explorotopia*, a publication by Pat Murphy and the Exploratorium, is available online at <http://store.exploratorium.edu>.



INVESTIGATE

Explainers investigate phenomena and work to find answers to their own questions by exploring exhibits, performing hands-on activities, and engaging in the inquiry process. By becoming expert investigators, they are well positioned to assist visitors in improving their investigation skills.

Explainers rotate through a series of activities demonstrating various ways to find north. Explainer Sal Alper finds the North Star using a compass, protractor, and map.



COLLABORATE

Explainers' learning reflects the social learning that happens at the Exploratorium. Most training sessions, as well as interactions with visitors, involve collaborative efforts.

Explainers mentor each other by working as partners during interactions with visitors, directly sharing ideas and techniques through conversation and role modeling. This mentoring process is one of the most important ways in which Explainers learn to work effectively.

Explainers at the Linkages exhibit work together to create a machine that links two surfaces.



PRACTICE

Explainers regularly use the exhibits to facilitate their learning process during training sessions and while working on the floor. Their daily interaction with visitors is constantly refined by their ongoing learning process.

Explainer Ryan Juan explores the microscopic world with visitors. Doing this demonstration every day gives him opportunities to reflect on his work and test new facilitation strategies.



SHARE

Explainers regularly share their strategies and discoveries with the rest of the group. Peer teaching and leadership development is central to the program.

Explainer Tricia Ong demonstrates the contribution of another Explainer, Dan Scali. Dan led a training on the Goofy Goggles demonstration and suggested that allowing visitors to look through a water bottle is an ideal way to demonstrate refraction. The water bottle is now part of the demonstration and is used by many Explainers.



REFLECT

During training sessions, Explainers take time to process discoveries and to reflect on how their own learning informs their work with visitors. Explainers also regularly reflect on their daily practice through informal conversations, team meetings, retreats, and progress meetings with their managers.



Above left: Explainers reflecting as a group on how the activities they did during training apply to their work with visitors at exhibits.

Above right: Explainers create visual representations of their reflections on their own learning processes.

● WHO LEADS PROFESSIONAL DEVELOPMENT SESSIONS?

Explainer Lianna Kali models facilitation for school groups at the Pin Screen exhibit. She focuses on using all of the senses to explore exhibits and encourages visitors to use the exhibits as creatively as possible.



Daily Explainer training sessions are led by people with a variety of expertise and teaching styles.

Training leaders model facilitation techniques that Explainers can use in their own practice. The Exploratorium's training leaders include the following:

- new and returning Explainers
- exhibit developers
- Explainer managers
- content and process specialists



EXPLAINERS

Throughout the year, new and returning Explainers each lead several training sessions based on their own interests and skills. Explainers increasingly assume greater leadership roles by steering these training sessions and by mentoring and sharing their perspectives.

Explainer Manpreet Randev leads a small group in flower dissection, identifying each part of the flower and imparting her excitement about botany.



EXHIBIT DEVELOPERS

Exhibit developers share their exhibit goals and design processes. They also solicit feedback from Explainers about the visitor experience.

Exhibit developers Erik Thogersen and Nicole Catrett introduce prototypes of their new exhibits.



EXPLAINER MANAGERS

Anne Richardson, associate director of the Field Trip Explainer Program, and Sylvia Algire, manager, develop and lead training sessions throughout the year. These sessions encourage Explainers to make their own discoveries.

Explainers work in pairs, rotating through the stations of Bob Miller's legacy Light Walk. This session concluded with a group reflection about personal discoveries, facilitation techniques, and learning opportunities that integrate art, science, and human perception.

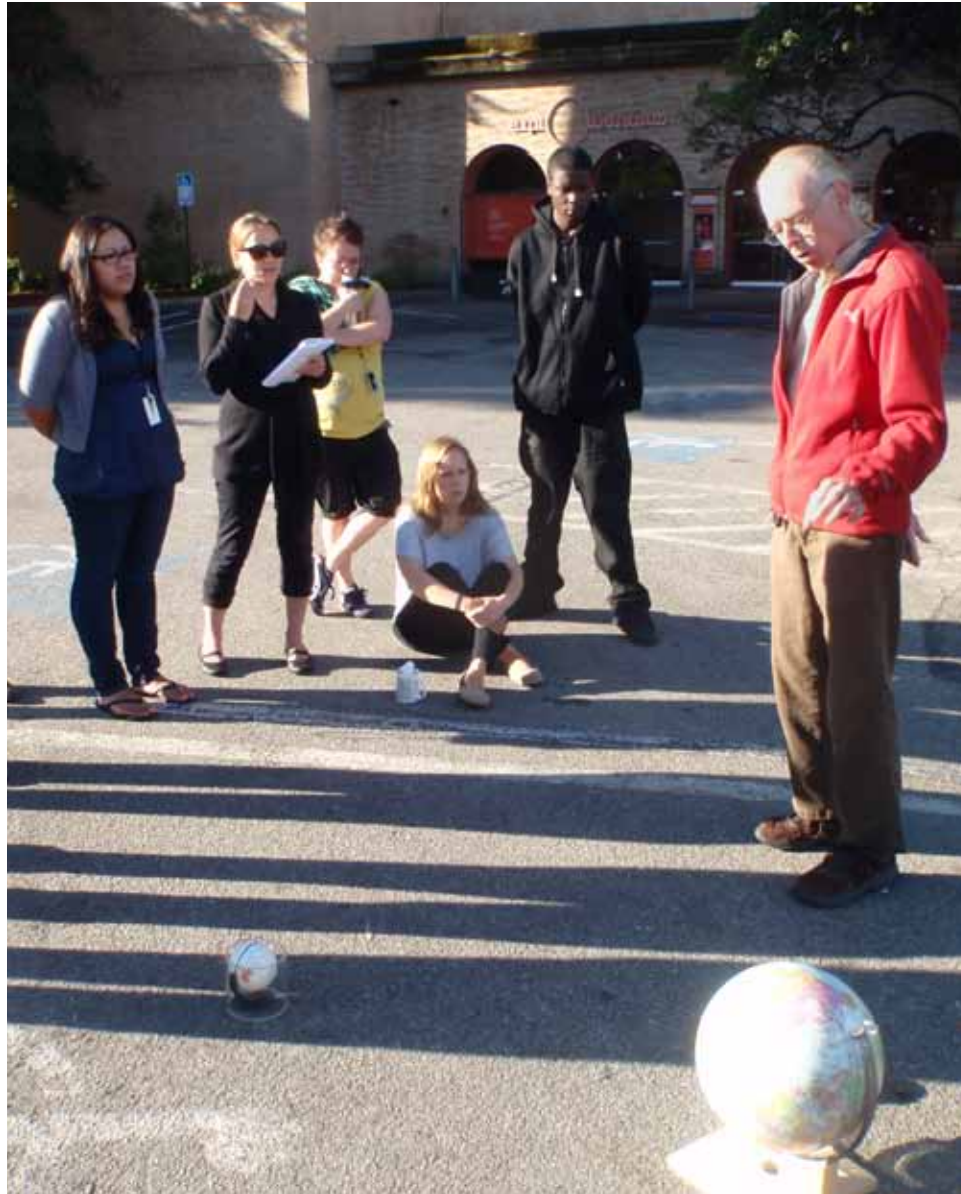


CONTENT AND PROCESS SPECIALISTS

Every question can't be answered through personal investigation; experts are invited to offer guidance. Exploratorium staff scientists lead many of the Explainer training sessions. When possible, specialists in other content areas, such as art and mathematics, also lead training.

Left: Dr. Karen Kalumuck teaches Explainers about plant reproduction by inviting them to investigate fruits and flowers under a microscope and to share their discoveries with the group.

Above: Dr. Luigi Anzivino highlights the connections between the Explainers' magic demonstration and the visual perception exhibits.



The Exploratorium's Teacher Institute, the Institute for Inquiry, and the Learning Studio have each developed specialized processes for teaching science. Educators from these groups lead workshops that expand the Explainers' facilitation tool kits.

Dr. Paul Doherty of the Teacher Institute uses a series of hands-on activities to teach Explainers about the earth's magnetic field and its use in navigation.

● WHAT DO EXPLAINERS STUDY?



Explainers Ryoko Matsumoto and Adam Green explore organisms living in the intertidal zone.

The topics studied in training sessions are driven by the Explainers' questions and relate to their interactions with visitors. Training topics can be divided into two categories:

Deepening the understanding of phenomena

- through art
- through science
- through mathematics

Exploring teaching and learning

- the visitor perspective
- how learning happens
- facilitation strategies

ART



Explainers attach markers to the Relative Motion Pendulum to track the surprisingly beautiful pattern made by the movements of the pendulum.



SCIENCE

From the anatomy of eyes to the period of pendulum swings, Explainers learn a great deal about science. They practice using the tools of scientific inquiry as strategies for building their understanding of phenomena.

Above left: Explainer Dan Scali leads a small group in a cow's eye dissection. After teaching the group to make an incision, he gives them time to make their own observations. Next, he discusses the parts of the eye and strategies for sharing this information with visitors.



Above right: Working with a small group, Explainer Tricia Ong investigates whether she can alter the period of a pendulum swing by using her body to change the distribution of the weight.



MATHEMATICS

Integrating math into exhibit explorations is not only fun but is also a tool that many visitors can use as they observe each exhibit.

Explainers figure out a way to measure and describe the speed of a rotating disk.



THE VISITOR PERSPECTIVE

In both practice and structured training sessions, Explainers observe visitor behaviors and work to understand their experiences and perspectives. This understanding enables Explainers to support each visitor's individual learning goals and experiences.

Explainers reflect on a student's experience of completing a worksheet or participating in a demonstration. They also learn to differentiate between visitors who would prefer to engage with Explainers and those who would prefer to learn on their own.

Explainer Lianna Kali interviews students after they experience a new activity that she's piloting. She takes notes that will enable Explainers to determine if the activity is successful.



HOW LEARNING HAPPENS

Explainers reflect on their own learning processes to better understand how to facilitate visitor learning.

An Explainer group works cooperatively to unravel the equation behind the Pendulum Snake exhibit. Explainer Ryan Ames (right) observes the group's process of answering this question and shares his reflections.



FACILITATION TECHNIQUES

Explainers regularly share their favorite exhibit facilitation techniques with each other. By sharing and role modeling, they add new strategies to their tool kits, find ways to connect with a wide variety of visitors, and discover their own voices.

A small group of Explainers models effective facilitation techniques at the Turntable exhibit to measure the speed of the rotating table.

● TRY THIS! REFLECT AND CONSIDER

The activities and practices you design to engage your team in professional development will be guided by the goals and context of your work. Here's an exercise to generate dialogue and reflection about the goals that drive the work you do together. You may find that this exercise is useful for generating reflective dialogue and will serve as a great starting point for making decisions about the direction of your professional development program.

Set Up the Ground Rules

The goal of this exercise is to create a safe time and space to think reflectively and more deeply about the purpose of your group's work. This is a time to share, listen, and consider ideas, but it's not a time to make decisions or come to a consensus.

- **All participants are entitled to their opinions and to change their minds.**
- **The group does not have to agree on one answer.**
- **There is no secret right answer.**
- **Everyone should practice listening to each other.**
- **People who are speaking should be allowed to share their ideas and opinions without interruption. Clarifying questions and responses are OK.**
- **It's OK to play devil's advocate when it's productive.**
- **Have fun with this. Don't get too serious about it.**

Set Up the Ideas

- Brainstorm a list of phrases that complete this statement: The primary purpose of our

(insert: institution/group/team/etc.) should be to

The statement format is rigid on purpose. This highlights when people have strong opinions about a statement and pulls out nuances and dependencies in people's thinking.

- You'll want a long list (at least ten). It's OK, and even useful, if some of these statements seem wild or contradictory. It's also OK if many of them could be true simultaneously.
- Write each of the statements on an index card (one statement per card).

Set Up the Space

- Create a U-shaped line on the ground with masking tape that is long enough for everyone in your group to stand along. Have everyone choose a place to stand—everyone should be able to see each other.
- Explain that the line represents a continuum of opinions; one end of the line is “agree” and the other end is “disagree.” This allows everyone to contribute their opinion without necessarily having to say anything out loud.
- Be prepared to take notes on what participants say during the activity so you can refer to them later.

Discuss

- Choose one card from the set and read the statement aloud.
- Allow fifteen seconds for everyone in the group to silently choose a place to stand on the line. You may be surprised by the range of opinions held by participants.
- **Share:** Ask three participants to share the reason they chose their place in line—one person from each end, and one from the middle. This creates an opportunity for people to voice their ideas and listen to the range of opinions held by people in the group. Alternatively, choose one person and toss them a Koosh ball as a talking stick; this allows the person who's talking to choose who speaks next by tossing them the ball. People tend to choose someone who hasn't had a turn to speak recently, rather than allowing a few people to dominate the conversation.
- **Clarify:** Allow a few minutes for participants to ask and answer clarifying questions about what was just said. This creates an opportunity for people

to make sure they've understood one another. This may lead to a group-wide discussion. It's often productive to allow a few minutes of unstructured dialogue, but then to move on to the next step before becoming bogged down in one idea.

- Tell participants that they can change places in line if their minds were changed (although this is not necessarily the goal).
- **Consider:** Allow a few minutes for three participants to ask probing questions. The purpose of these questions is to provoke people to think about the statement more deeply or from a new angle. These must be asked in a question (not statement) form and should not be answered by anyone, but left as food for thought. The questions people come up with are often surprising and impressive!
- **Repeat:** Draw a new card and repeat the process until you have gone through all of the statements. Participants may want to add new statements to the deck as you go along.

Reflect on Your Own

- **What did you notice about the ideas?** You may have noticed interesting trends or divisions in what the participants in your group value. Can you group any of the ideas into categories that are useful to refer to in future discussions? Are there any questions that came up that will be useful to address later? As you design your professional development program, refer back to these notes to make sure the exercises support the goals of your group's work.
- **What did you notice about the process?** You may have noticed patterns in the way participants communicate with one another. What constructive communication techniques or skills did you notice that you could reinforce or celebrate? What destructive communication techniques did you notice that will need to be redirected in future discussions? What facilitation strategies from this activity provided a useful structure for your group to use in communicating, and how could you use

them again in future discussions? As you design your professional development program, refer back to these notes so that you can design the process in a way that supports everyone.

- **What did you notice about your assumptions?** You may have heard ideas and questions that provoked you to think more deeply about your own assumptions. Don't ignore those thoughts! Refine your thinking and your professional development plans continually so that you're always creating room for good, new ideas!

the mistake garden and other outcomes

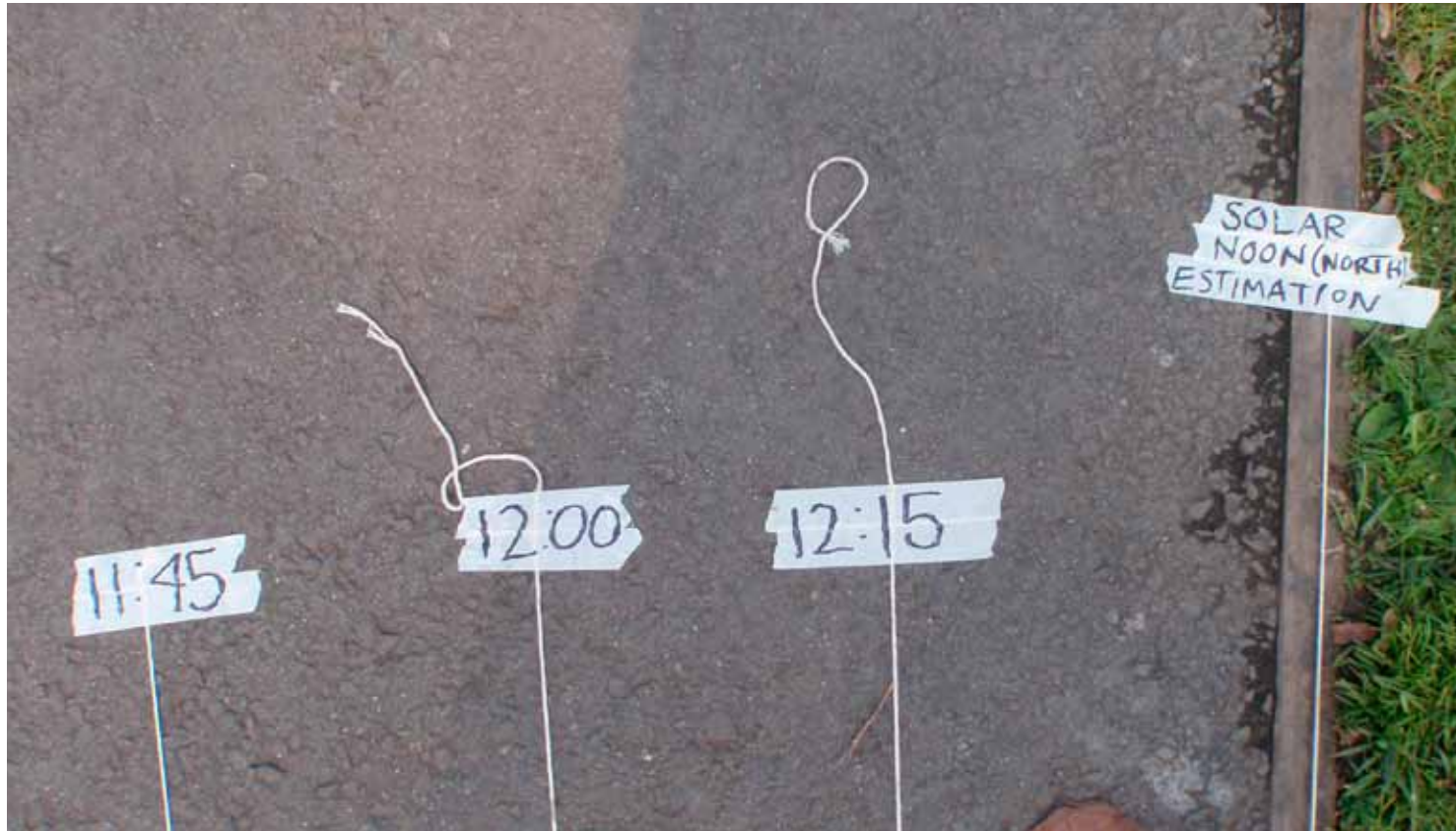


Last week a friend of mine came to visit, and I showed him my garden. “It doesn’t look like much,” I said, “because I don’t know anything about gardening, so I decided to do whatever made sense to me and learn from my mistakes.” He looked at me with utter shock and said, “But you used to be the one who never made mistakes.”

When I was the one who never made mistakes, I didn’t have a garden and wouldn’t have planted one unless I was sure that I could keep everything alive. This conversation reminded me of something very important that I learned from being an explainer: The deepest learning happens when you try something without being sure of the outcome. If you live this way, you have to be okay with your plants not always surviving, your bread not always rising, and making a lot of mistakes sometimes. It took me a while for my ego to be okay with that, but now it seems so second nature that I forgot for a moment that I used to be otherwise.

Thank you, Explainers, for teaching me how to mess up.

— *Aiona Bones*
Explainer Blog Post



“Being an Explainer has given me the confidence to know that I can succeed in any situation. I may not have the answer, but I have the tools to figure out how to accomplish my goal.”

—An Explainer

Explainers developed a demonstration in which visitors find true and magnetic north using a variety of tools. In this example, Explainers used the sun to navigate, marking the shadow of a post every fifteen minutes.



“My experience as an Explainer made me determined never to be complacent—to continually make things better, gain more knowledge, and improve.”

—An Explainer

Explainers work with National Oceanic and Atmospheric Administration (NOAA) scientists to codevelop interactive experiences for visitors.



“As an Explainer, I have gained the ability to see the world as a playground of knowledge, and to assist others in learning about and enjoying that world.”

—An Explainer

During a training session, Explainer Associate Director Anne Richardson attempts to use a hula hoop while wearing Goofy Goggles that distort light.



“As an Explainer, I gained a willingness and a passion to stretch myself beyond my boundaries and limitations, and challenge myself.”

—An Explainer

Using a globe and paper clips, Explainer Kate Stir observes how shadows move in the Northern and Southern hemispheres.



after words

As I sit here in front of a computer at the Boys & Girls Club, between graduations, it starts to sink in. I am no longer an Explainer. Never again will I be able to put on that orange vest and tell students to walk into the museum, check out the cool demos, or explain the purpose of the Lariat Chain (anyone know?).

I can still remember my first day as an Explainer. We all sat in a circle in the skylight area of the museum and talked about why we wanted to work at the Exploratorium. We were people from all walks of life: teachers, artists, musicians, youth developers, science nerds, tech geeks. We all had different reasons, but we all believed that the science of hands-on learning is important. I can't believe that was three years ago.

After three years of service in the Field Trip Explainer Program, I graduated. Today, as I make my rounds to various schools to see the young people that I work with graduate, it makes me think about what I learned during my tenure at the Exploratorium. Three years ago, I wouldn't have been able to tell you why we have different color eyes, or why water spins as it goes down a drain rather than just straight down, or how the Drawing Board works. (I still don't know what the deal is with the Drawing Board.) I have learned a lot about science, but as I tell the students, "Don't overwhelm yourself with science, just think about things in simple terms, and it will be easier to understand."

What I've learned at the Exploratorium is that learning doesn't have to happen in a classroom, nor does teaching. Both can happen anywhere—in a classroom, a museum, an after-school program, or on a bus. I have been blessed to have had the opportunity to be an Explainer, and although my time is up, the chance to teach, to learn, and to influence a young person's views on science and learning is not.

— Phanna Phay
Explainer Blog Post