

*Embedding NOAA in a Public Learning Laboratory: Environmental Scientists in Residence at the Exploratorium*  
**Summative Evaluation Report**

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## **Introduction**

A NOAA scientist-in-residence program at the Exploratorium was evaluated to determine impacts on front-line staff (Explainers), visitors, and the scientists involved. A model for hosting scientists at a museum was developed to include a one-week residency that helped scientists understand the museum followed by a two-week residency during which scientists, working with the Explainers, interacted with visitors in a topic-specific installation space. Data for the evaluation was collected using observations along with interviews and surveys with Exploratorium staff, scientists and visitors. Below are the findings from the evaluation, including how the iPad was incorporated into the installation space.

## **Structure of the report**

This summative evaluation focuses on the impacts for Explainers, visitors, and the scientists themselves of embedding NOAA scientists in the museum. Four questions guided the evaluation:

1. How does working with NOAA scientists change the nature of the Explainers program?
2. What are the impacts on NOAA scientists from working with the Explainers program?
3. What factors influence those impacts both positively and negatively?
4. Does the Scientists in Residence program impact public audiences' perceptions of and knowledge about particular areas of ocean and atmospheric sciences, including perceptions about how ocean and atmospheric scientists do their work?

This report begins with a review of the Year 1 evaluation. It then moves towards answering the guiding questions for the second, and final, year of the project. Methodology is explained for each data collection point and is followed by a discussion of the results. The report concludes with recommendations from the Explainers, scientists, and the evaluator. In some cases, the evaluators have particular insights or ideas that go beyond available data. These are included as bracketed comments throughout the document.

## **Summary of Year 1 Evaluation**

### *Impact of the Project on the explainer Program*

It is clear from both interviews and observations that the lead Explainers in particular “relish the opportunity” to interact with the scientists and “enjoy the challenge”

of learning about the scientists' work and creating opportunities for interacting with visitors around that work. Observations of the morning meetings show that scientists quickly become incorporated as both resources and team members by the lead Explainers.

### *Impact of the Project on the Scientists*

In general scientists are very positive in describing their experiences with the residency and the project as a whole. Scientists report that they very much like spending time with the Explainers. They find the opportunities for formal interactions stimulating, but pointed in particular to the value of the informal "chats" with Explainers. Scientists enjoy serving as a resource and the challenge of applying their knowledge and their work to the wide variety of learning contexts the Explainers work in.

It appears that the fall residency experience is an important element of the project as it "gives a feel for the floor", for daily practices, and in general a "feel for the Exploratorium" and how things are done. Even with that experience, however, more emphasis on roles and responsibilities may be necessary.

Both groups of scientists commented on the difficulty of getting visitors into the Webcast Studio space. One group was able to create an educational tool that represented their labs / research and could be used at the Exploratorium along with other educational settings. Their time with the Exploratorium provided them an opportunity to think through such a project. The other group of scientists originally had in mind to develop an exhibit but was unable to do so for this project.

### *Impact of the Project on Exploratorium Visitors*

Through observations and surveys with visitors, it seemed as though artifacts played an important role within the residency. Artifacts often gave the scientists something to start with when talking to visitors. The acoustics group enjoyed having the map of deployed hydrophones and a real hydrophone on display. Likewise, the salmon group utilized the large map in the space and the baby steelhead that were on display. The artifacts not only livened up the space but also provided a visual context for the information and created talking points that scientists could build on.

Interviews with visitors indicate that about 1/3 of visitors enter the space primarily to sit down and rest or to meet someone. Similarly about 1/3 do not interact with any of the exhibits or talk to anyone while they are in the space. However, those who do interact with scientists or staff are able to give relatively coherent and specific examples of what the scientists do and to recall specific things they talked about with scientists.

There is some question about just what aspect of the physical setting and the interaction with scientists might impact visitors' knowledge and perceptions most strongly. Scientists reported (and observations confirmed) that they felt most comfortable in more "formal" presentation. At the same time, visitors appreciated the chance to talk with scientists.

Exploratorium project staff used the first year evaluation and recommendations to make some noteworthy changes to the Scientist-in-Residence program for the second year. These include involving lead Explainers in meetings during the fall residency and in daily debriefs in the spring residency, in-depth conversations between Explainers, explainer managers, scientists, and project staff about how and in what capacity the iPad can be

incorporated into the floor installation, and moving the installation space so that it is more integrated on the museum floor.

## **Year 2 Evaluation**

Observations and field notes were taken during each Explainer training in both the fall and spring, planning meetings during the fall residency, debrief meetings during the spring residency, and staff brown bags led by the visiting scientists. Floor experiences with visitors were observed using an observation protocol (Appendix A) and consenting visitors were surveyed about their experience (Appendix B). There was a total of five NOAA scientists involved in the second year of this project and four completed the post-spring residency survey (Appendix C). The Exploratorium project staff also led debrief calls with the scientists after the spring residency. Conversations during the debrief calls overlapped with evaluation questions and were therefore treated as an interview. Both of the two Field Trip Explainer managers were surveyed (Appendix D) after the final spring residency along with all four of the Lead Explainers from Year 2 and 11 of the Field Trip Explainers (Appendix E). The Lead Explainers were also asked to complete a supplemental survey (Appendix F).

### ***Fall Residency***

The week-long fall residency provided an opportunity for the scientists to get to know the Exploratorium and its staff and for Exploratorium staff to learn about the work the scientists do. From observations and surveys with scientists and Explainers the fall residency seemed to be a powerful experience for groups over both years. During the fall residency scientists presented their work to Explainers and Exploratorium staff, scientists and lead Explainers met to talk about floor activities, spaces, and the incorporation of the iPad into the installation. Scientists also had an opportunity to shadow Explainers on the museum floor. Overall, scientists enjoyed shadowing the Explainers, with one scientist saying it was a “good understanding of what Explainers do.” However, another scientist thought it was a “double-edge sword. It’s imperative to see how they [museum and Explainers] work but I felt like we spent a little too much time [shadowing]. I got the big idea quickly.”

One recommendation from the first year of the project was for participants to be explicit about their goals for the project. Therefore, project staff scheduled time for scientists, lead Explainers, Explainer managers, project coordinator, and the evaluator to share what they thought the goals of the project were and their role within the project.

Goals from the Explainer program included to “have Explainers meet and work with scientists, bring current science to the public, and model hosting scientists in a way that is meaningful for the scientists and the Explainer program,” “understand the work that the scientists do and present it to visitors (who have probably seen the information in some form) in a way that they intuitively understand,” and “teach kids at a young age about climate.”

The scientists stated their goals were “to share experiences and knowledge in order to help the Exploratorium create an exhibit about weather for their new location,” “bring knowledge to the untrained masses,” “see how the Explainers work with the public,” “do more outreach, have people be aware of the work [scientists] do,” and “gain experience that

I can incorporate into other outreach opportunities, mainly working with inner city school kids.”

At the end of the spring residency, scientists, Explainers, and Explainer managers were asked about one thing they would share with a museum hosting a scientist. An Explainer manager said to “talk about goals” (i.e. a larger picture) while the Explainer responses focused more on communicating with scientists at an individual level; for example, “Talk with the scientist as much as you can, not only do you have a lot of things to learn from them, but they have a lot of things they can learn from you” and “take a moment... to bond with your scientist.” Talking about goals during the fall residency set up discussions for floor activities and installation space for the spring residency.

### ***How does working with NOAA scientists change the nature of the Explainers program?***

Observations, field notes, informal interviews, and a formal post-spring residency survey were used to collect data on the impacts of this project on the Explainer program, particularly the Explainer managers, lead Explainers, and Field Trip Explainers. Many questions from Year 1 interviews with lead Explainers were used on the survey. The evaluator worked with an Explainer manager to develop and clarify some of those questions. It was also agreed upon to survey all Explainers instead of just the lead Explainers. A few of the questions were also used in a survey for the Explainer managers.

The scientists ran several of the Field Trip Explainer morning trainings during both the fall and spring residency. The scientists enjoyed the Explainer trainings saying, “it was interesting to see the types of questions asked... and to see how they took the information and put it into their own minds.”

The scientists agree that they “didn’t always know what to do for trainings and what would be useful to talk about.” One scientist said he “could have done a better job of training and engaging the students [Explainers] if I would have known more about the way the Exploratorium staff does their trainings.” However, this scientist also reported that, “by the end of the spring residency I felt good about the trainings for the Field Trip Explainers because I had some days off to see others do trainings.” Therefore, it may be beneficial to spend more time, possibly during the fall residency, having scientists observe trainings instead of leading trainings. This may help them conceptualize what trainings are and that trainings are flexible. An Explainer manager said that she liked “when [scientists and Explainers] were at exhibits together and that it’s hard to make plans for each day.” [The evaluator thinks it is worth noting that the scientists may not recognize the flexibility that is ingrained in the Exploratorium and its staff, especially when they first enter the setting in the fall.]

When asked what they enjoyed most about the trainings, the Explainers reported “mixed types of training (presentations, hands-on, working with senior scientist at Explo),” “the opportunity to ask deeper questions,” “[scientists] showing the instruments they use,” and “[scientist’s] personal experiences in the field.”

One part of the project that changed based on the Year 1 evaluation is the involvement of the lead Explainers in planning meetings during the fall residency. All four lead Explainers from Year 2 liked being involved in those meetings, saying “I really liked the process of planning, designing, implementing, and reflecting on the floor activities process” and “It was good to see them everyday and have a chance to talk to them to follow up what’s going on and how we are doing.”

However, the Explainers at large were fairly neutral (3.73 out of 5) about the amount of time they got to spend with the scientists. Explainers “wish we got to hang out more and shoot the breeze” and would like “more individual time.” These ideas are supported by evidence in the Year 1 evaluation report, where the scientists appreciated more informal time and chats with Explainers.

***What are the impacts on NOAA scientists from working with the Explainers program?***

***Backgrounds of scientists make a difference:*** The NOAA scientists involved with the second year of the project were asked about what kinds of experiences they have had with informal audiences in the past. Some examples they provided were facility tours, weather festivals (which include balloon launches), after-school enrichment classes, writing website information and posting to a blog, K-12 teacher professional development, and classroom visits.

While scientists had some experiences interacting with public audiences, the scientist-in-residence program provided a unique experience. One scientist stated, “what was different [from past experiences] was no set plan or script. I would talk to people and see where it went.” Other reasons the scientists reported this experience was unique include “explaining and showing [Explainers] things- it was more in depth than with visitors and that was valuable” and the “casualness of encounters.”

Again this year, it seems that scientists had a great experience in this project. It not only provided scientists time to reflect on their communication, but they also took away ideas for future education and outreach. One scientist reported that the project as a whole provided “time to reflect what it is I as a scientist am doing and it gives you some new ways of thinking and ideas to use in the future” while another scientist said, “now, whenever I go out into the community I want to take more props and things to touch because I think that helps people. I have thought about what questions to ask.”

Explainers and Explainer managers believed the scientist-in-residence experience provided the scientists with an “opportunity to talk about their professions with visitors who may have very limited knowledge about the topic.” and time to “practice ways in which to communicate about their work.”

***Scientists’ communications skills changed:*** Changing scientist communication skills was seen as a possible long-term goal of this project. There was no data for this project that followed the change in scientist’s communication skills directly; however, it was recognized that the scientists did think about and reflect on their communication skills. One scientist noted that, “it was nice to see people interested in what we work on. The process of how to explain things to someone makes you think about what you say and brings out hidden assumptions.” Another scientist said this project helped him feel “more comfortable with asking the right question to see what people know in order to engage them at their level of understanding.”

One example of a scientist reflecting on their communication skills came early in the spring residency. This particular scientist presented his work in a staff brown bag. The presentation had a lot of jargon in it, which was pointed out by one of the staff members attending the presentation. Later, the scientist informally mentioned that the comment grounded him and gave him an idea of the audience. From observation, this scientist

incorporated this experience and changed the way he presented his work. Here is a segment of field notes from the next day's Field Trip Explainer morning training:

The scientist started off talking about his background, why he decided to go to college, and how he got his job. He then went on to his slideshow, which wasn't too long. The Explainers had a lot of questions. He [the scientist] talked about collecting observations and tools for doing that and then showed a weather map for the group to decipher. The first question he asked the group was "what do you notice?" A long conversation occurred around the weather map (mostly relating to symbols). Explainer questions include: "the wind is moving NW but the cold front is moving SE, are the winds at the surface and the front is above?," "what do the double circles mean?," and "how do forecasters know wind is 25 knots with gusts of 40 knots?"

Explainers that responded to the post-spring residency survey agreed (M= 4.70/5.00) that the scientists changed the way they communicated their work over the time they spent at the Exploratorium.

[Note: The scientists' backgrounds in communication can be compared to the experiences they have on the museum floor. Scientists who have had more experience giving tours and lectures tend to stand next to the television monitor using the iPad to flip through pictures, essentially being a "talking head." These scientists often use more of a lecture-style approach to the Field Trip Explainer morning trainings. On the other hand are scientists who have done festivals and more informal table exhibits. These scientists tend to sit lower to the ground and use a dialogic approach during both Field Trip Explainer morning trainings and visitor interactions. Therefore, it is up to the scientist when they come into this program to determine if enhancing their communication skills is going to be a priority or even a goal.]

### ***Spring Residency***

***Floor space:*** Another recommendation from Year 1 that was incorporated into the second year of this project is the careful thought about the space used for the installation on the museum floor. Instead of using the WebCast Studio, Exploratorium project staff and scientists decided to use a space around exhibits that related to their topic. It worked out that both groups of scientists in the second year chose the same space of the museum. Overall, the scientists and the Explainers liked the space they used in Year 2. One scientist "appreciated the desk" used for demo space. Explainers (and Explainer managers) liked being integrated onto the floor. They stated that this location "provided approachable space" and the "space provided flow." Explainers also liked the signage/banners.

Scientists with the severe storms group liked having the mobile mesonet and outdoor cart inside and in the same area, with one scientist noting "I liked having the outdoor cart to connect to the mesonet." On the second day of the severe storms residency, an Explainer manager asked the scientists and the lead Explainers what they felt went well and what they liked about the day's activities. The lead Explainers said "having the outdoor cart and activities" and "having [the scientist] near the van de Graaff so they could ask him questions they didn't know the answer to." The scientists liked "having the iPad and the

AppleTV to show pictures” and “having the balloon and car.” This again shows the importance of photos and videos as a draw for visitors as well as the presence of artifacts in the space for the scientists, Explainers, and their interactions with visitors.

**iPads:** In the first year of this project scientists and Exploratorium staff struggled with how to use and incorporate the iPad into the installation. While this struggle was recognized by staff, the Year 1 evaluation also suggested that planning meetings during the fall residency be used to talk specifically about the use of the iPad. During the fall residency the scientists met with the Explainer managers and the lead Explainers to talk about the iPad. This turned into a discussion about the affordances and constraints of the tool in relation to how it can be used on the museum floor. Some affordances include: online access, portable/personal, pictures/ high quality screen image, touch screen interaction, microphone, gyroscope, access to scientific data, and can be in the hands of staff and visitors. Some constraints of the iPad are: no GPS, bad audio, and it’s small (can’t get many people around it). Exploratorium staff overcame this last constraint by providing AppleTV’s and large flat-screen televisions linked to the iPad.

Based on survey results from the Explainer managers and Explainers, the iPad was used for apps, to view photos and videos, real-time data, and as a computer/for Internet access not only on the museum floor but also during the Explainer trainings. Connecting to the Internet was observed on several occasions – with both scientists and Explainers using the iPad for this particular reason.

Explainers had mostly positive feelings about the use of the iPad on the museum floor, saying “using the iPad as an additional resource is helpful, but because of the flashy nature of it, it is difficult to not make it the focus of the discussion” and “the iPad came in handy quite a lot- not only was it great to be able to have photos right at our fingertips, but we were also able to look up information quickly if/when guests had questions.” However, Explainers offered mixed recommendations about changing the use of the iPad on the museum floor. For example, “I would simplify the number of things that can be done on the iPad and have it put away until there is a moment where the facilitator wants to show something on it,” “I think it’s good we don’t let the public play with them because I feel playing with it would take something away from the rich interaction that guests can have with the scientists themselves,” and “incorporate it into the activity being done, rather than as a show-and-tell exhibit.”

An example of mixed reactions about using the iPad on the floor also came from field observations:

At the beginning of our time on the floor, I talk to a lead Explainer about using an iPad. She said she wants to use one and would find it helpful to have an iPad “on her hip” to see if she even ever turned to it. She is quite excited by this and says she can probably get one of the Field Trip Explainer iPads to bring out. Not long after this, a High School Explainer manager brings an iPad out to the floor and hands it to this particular lead Explainer. She is talking to a visitor when a scientist comes up and asks if that is the iPad for him [to hook up to the AppleTV]. The lead Explainer hands the iPad to him. She later told me she was a bit disappointed when the scientist took the iPad. Later, she got another iPad and did turn to it a couple of times but told me

that it would be nice to have some of the scientist's pictures on it because all she had was apps.

In the post-Spring residency debrief call scientists reported they "loved using the iPad" and that "it was nice to have the capability to show pictures and videos and having that technology facilitated the discussion."

While iPads were used on the museum floor as a mediating tool, one was also used for evaluation purposes. A survey app was used to collect observation data to answer the question: *How is the iPad used on the museum floor during a scientist-in-residence program?* The evaluator alternated every 30 minutes between iPad data collection and completing visitor surveys so it should be noted this data comes from approximately half the time the scientists were on the floor. iPad observations show that discussions occurred around what was seen on the scientists' iPad/projected onto the AppleTV. A lot of questions, comments, explanations, and answers were observed during both spring residencies. Some examples of visitor questions from the severe storms residency include:

Asking about a specific place ("Can we see Chicago?")

"What do you do in the off season?"

One adult visitor moved from asking about what the scientist does and the implications of the work to more personal questions. ("What do you do?" "What is the end goal?" "How many storms have you chased?" "Where did you grow up?" "When will you be finished [with doctorate]?")

Scientists were also observed asking questions to visitors. Some examples of scientist questions from severe storms group include:

"How do you think [tornados] form?"

"What would you do to protect yourself [from a tornado]?"

"How do you think we measure a storm?"

There were also four counts of affect from visitors when interacting with a scientist. Affects were only *observed* during the severe storms residency and were observed when visitors were looking at the RADAR app, viewing video, viewing the web cam app, and looking at the weather balloon that was on display. Affects observed included "ooh" and "wow." This reinforces how powerful visuals are in these special topic installation.

The following are examples of visitor questions from the climate/weather residency:

"How do satellites stay out [above earth]?"

"Where does this [data] come from?"



Both scientists involved in the climate/weather residency made an effort to ask visitors questions. Some examples of those questions include:

“Do you know the difference between weather and climate?”

“What do you think we use to collect data?”

“If you were a forecaster, what do you think will happen?”

It was observed by the evaluator and supported by both an Explainer manager (post-project survey) and a scientist (post-residency debrief call) that “visitors never directly interacted with the iPad.” It was also noted “the iPad is not the only tool that could’ve done that [hook up to a screen, show photos and videos].” During the severe storms spring residency there was no evidence of an Explainer or visitors holding or working with the iPad. There were two instances of Explainers using the iPad as a mediating tool during the climate/weather residency. Data from observations of how the iPad was used also included what the iPad was used for (Table 1) along with who touched the screen or pointed to something on the screen (Table 2 and Table 3).

Table 1. How many times the iPad was used to view videos, photos, apps, and connect to the Internet during each of the second year spring residencies.

|                     | Severe Storms | Climate/Weather |
|---------------------|---------------|-----------------|
| View Video          | 8             | 18              |
| View Photo          | 20            | 0               |
| View Apps           | 16            | 9               |
| Connect to Internet | 3             | 8               |

Table2. How often scientists, youth visitors, or adult visitors touched the iPad screen or pointed to something on the iPad screen during the severe storms residency.

|              | Touch Screen | Point |
|--------------|--------------|-------|
| Scientist    | 9            | 17    |
| Youth Male   | 3            | 4     |
| Youth Female | 1            | 4     |
| Adult Male   | 0            | 3     |
| Adult Female | 0            | 4     |

Table 3. How often scientists, youth visitors, adult visitors, or Explainers touched the iPad screen or pointed to something on the iPad screen during the climate/weather residency.

|              | Touch Screen | Point |
|--------------|--------------|-------|
| Scientist    | 13           | 18    |
| Youth Male   | 1            | 6     |
| Youth Female | 1            | 1     |
| Adult Male   | 0            | 7     |
| Adult Female | 0            | 3     |
| Explainer    | 0            | 3     |

### ***What is the impact of NOAA scientists-in-residence on museum visitors?***

Both the Explainers and the scientists were asked what they thought the impact of the project was on Exploratorium visitors. The Explainer program believed this project positively impacted museum visitors because it provided them “access to scientists, a chance to ask them their questions, and understand how their work relates to their everyday lives.”

The scientists provided many ideas as to what they thought visitors got from interacting with the scientists in the installation. One scientist reported that visitors “got that there is more than meteorology they see on television and that there is still a lot we don’t know [about meteorology]” while another reported the he “had times when people were excited to meet a real meteorologist and they use products that we [meteorologists] produce. I think visitors are more familiar with the difference between the NWS [National Weather Service] and other weather media outlets.” Yet another scientist “hoped that [kids] walked away with awareness of what’s going on around them.” One of the climate/weather scientists in residence said that he “[got] people to think about light as energy and how that relates to climate.”

Visitors engaged with the scientists for a very long time. This evaluator, the on-call Exploratorium Visitor Research & Evaluation (VRE) evaluator, and the scientists observed this. Some visitors stayed at the installation for 45 minutes, which is an extraordinary amount of time for a museum.

Visitor data was collected in two ways, with one-on-one interviews where the answers were recorded onto paper and on the iPad through a survey app. The same questions were used in both cases. It was decided during a meeting with VRE staff that the survey would be kept short and focus on only general questions. This methodology fits into the type of surveys regularly carried out by VRE staff with visitors. The visitor survey focused on (1) what the visitors thought the space was about, (2) if visitors talked to someone in and space, and (3) what they talked about.

Anyone over the age of 18 who interacted (this includes standing, feet planted, and looking at the installation for at least 10 seconds, even if they do not interact with an exhibit or someone in the space) with any of the exhibits within the installation space was selected for surveys. VRE staff, VRE on-call staff member helping to collect data, and myself determined the area. The on-call VRE staff member used tradition paper surveys while I tested using the survey app on the iPad.

The number of visitors surveyed in the second year of the project compared to the first year shows how being more integrated on the museum floor makes a difference for visitors to approach and stay at the installation. There were 95 visitors surveyed during the severe storms spring residency and 85 visitors during the climate/weather spring residency compared to 44 visitors during the acoustics residency and 16 for the salmon residency in the first year of the project.

### ***What did visitors think the installation was about?***

Visitors to both installations were able to report the topic of the space. After coding the visitor responses for reoccurring themes, the common themes for what visitors thought the severe storms space was about were: severe storms (n=32), lightning or electricity (n=10), tornadoes (n=7), weather in general (n=14), equipment for weather tracking/ data collection (n=2), meteorology (n=4), storm chasing (n= 3), and clouds (n=1).

Again, visitor responses were coded for reoccurring themes on what visitors thought the climate/weather installation space was about. These themes were: weather (n=40), climate (n= 20), weather forecasting (n=17), predictions (n=8), and modeling (n=2).

*Who did visitors talk to within the installation?*

Of the 95 visitors surveyed during severe storms spring residency, 67 (70%) reported talking to someone within the installation. Likewise, 77 of the 85 (90%) visitors surveyed for the climate/weather residency reported talking to someone. However, most visitors could not directly identify with whom they talked when asked if they talked to a scientist, an Explainer, or a non-Explainer staff member. Many times visitors pointed to the person but could not verbalize that person's role at the museum or within the installation.

Of the 67 visitors who reported talking to someone in the severe storms space, 26 indicated in some way that they talked to a scientist. Only one visitor said "representative of NOAA" while other visitors said "the storm-chaser guy" or "meteorologist." Eighteen visitors from the severe storms installation reported they talked to an Explainer.

Twenty-eight of the 77 visitors who reported talking to someone during the climate/weather residency indicated that they talked to a scientist. Two visitors specified "NOAA scientist" while other visitors said "weather scientist," "climate researcher," and "meteorologist." Eight visitors reported they talked to an Explainer while 6 visitors mentioned the person they talked to "worked here," was a "docent/guide/employee," and "works here but he's not the scientist."

*What did visitors talk about within the installation?*

If visitors responded that they had talked to someone in the installation space, they were then asked what they talked about. Many answers that visitors to the severe storms installation reported mentioned lightning, tornadoes, hail, data collection, and storm chasing. For instance:

"The Explainer talked about how lightning worked, and the scientist talked about tornadoes and storm chasing and the beauty of severe weather (sometimes)."

"The Joplin tornado and response of people to warnings."

"Everything from the cars they use to funding for their projects to the most severe weather situations they've experienced."

"They explained how wind effects tornadoes."

"How he was collecting data... and how long it took to collect data and all the different kinds [of data]."

"Storm chasing, data needed to predict storms and how it's captured."

Visitors to the climate/weather installation reported they talked about weather, climate, weather forecasting, predictions, and models. Some examples include:

“[I’m] from Kansas so we were talking about weather forecast coming up Sunday. They call that forecast modeling. He said it was all done by math.”

“I asked him to explain how weathermen predict weather patterns and how to read the various maps.”

“That clouds low or high affect temperature. He showed us with a temperature gauge using a coffee filter [as the clouds].”

“What data can show and the nature of data. Modeling and how inputs are made.”

“The difference between infrared and ultraviolet rays and what it means for global warming.”

“Global warming, ocean temperature and its influence. [How] Colorado River bends and how that happened. How temperatures were before and future patterns.”

When asked what, if anything, surprised them about the space (installation), visitors gave an array of responses. Some examples of what visitors reported surprised them during the severe storms residency include:

“That they are considering the response of people to warnings in their research or maybe even more so that that factor hasn’t been considered very much in research.”

“The scientists still do not know the exact reason why certain storms produce tornadoes and others don’t.”

“Interesting that only US has severe weather like this – the mountains, valleys, etc. make the perfect conditions.”

Some examples of what visitors reported surprised them during the climate/weather residency are:

“It was fun! I also realized that it was easy to understand the weather symbols and how they make their predictions.”

“Sea level rise in CA is historic – from the ice age and that ice melting in the sea doesn’t change sea level but melting of land ice could.”

“At all the details – measures they take all the time.”

“Level of expertise and the ability to translate into simple terms.”

Both of these survey questions got at the heart of the discussions that were occurring in the installation space. This shows that the scientists, Explainers, and visitors were having in-depth conversations around a wide variety of topics relating to atmospheric sciences.

## **Recommendations**

### ***From Scientists***

When asked about preparing for this project one scientist mentioned it “would have been helpful to have background on the scientist-in-residence program, for instance who has been out, to get context for what we are walking into.” Setting up a mentorship has been mentioned in debrief calls for this project and I would agree that having a mentor would be helpful to scientists before they come to the museum. Another recommendation is to share the video that was produced about each scientists’ experience during the scientist-in-residence project so new scientists have context from fellow scientists.

### ***From Explainers***

Three recommendations came from asking the Explainers what they would change about the morning trainings. Those recommendations are “slightly less or more consolidated lectures,” “talk about the trainings beforehand,” and “make sure the scientists understood that engaging with the Explainers is valuable, even if the trainings are not scientifically rigo[rous].” I, therefore, recommend that conversations around trainings continue and include debrief time to see what worked and what didn’t. Also, encourage scientists to step out of the box of the lecture.

### ***From Evaluator***

On more than one occasion scientists made a comment about non-project staff presence of the floor. Two instances from field observations:

[Staff member] is on the floor with an explainer and scientist at the outdoor cart. I find it to be a bit distracting because the staff member and explainer keep running off to create an activity leaving the scientist alone in the space. It also seems to distract from visitor experiences (i.e. the staff member is asking Susan questions therefore taking away from time spent with visitors). Later, the scientist shares with me that this was a problem for her.

Staff came onto the floor to see and talk to the scientists. This is difficult to manage both as a researcher and for the scientists (as noted by a scientist yesterday [above]). It takes time from the scientists to be able to interact with public audiences. However, staff members are also lifelong learners.

While I wouldn’t recommend telling staff to stay away from the installation space I would recommend setting up an “informal chat” hour off the museum floor where staff could come and have a conversation with a scientist.

While it would be nice to see more personal reflection time built in to this type of program, I realize this might not be practical for the museum. In future projects I would recommend evaluation focus on spending time with the scientists to help them think about and verbalize their change in communication skills. Reflection is a critical component of learning for adults, but reflection needs to be guided to be useful. It may also be useful for an external party to help develop the reflection tools as they may be useful for staff as well.

**A note on scientist interviews:** While I considered the Exploratorium debrief calls with the scientists an interview, I also had several other opportunities for what I would deem informal interviews. I was just as embedded in the museum as the scientists were and this allowed open conversations about what was going well and what was challenging. I would often use time walking to lunch or back to the hotel to ask scientists questions like “how do you think things are going?” One of the scientists even turned to me for reassurance. When she was not feeling like things were going well she asked me what I thought since I had seen the previous residencies.

**A note about using the iPad as a data collection tool:** After each visitor consented to the interview I asked if they were comfortable doing it on the iPad. At any sense of hesitation, or if they outright said “no,” I offered to ask them the questions and fill in the responses. Most visitors I asked, however, were comfortable completing the survey on the iPad, with one visitor saying he’d “prefer it.” After using the iPad for both spring residencies, I spent some time reflecting on the process and decided that using the iPad as a survey instrument has its advantages and disadvantages. While some visitors gave thorough answers to the questions on the survey, others provided short, often time one-word, answers. From observations of the groups while they are in the installation, I know they have had a very long, engaging experience. Therefore, using the iPad for this particular survey for this project may not be reliable or valid. It also causes the researcher to lose the ability to probe for depth. Using the iPad for this type of data collection is, however, convenient. Not only is the iPad easy to hold and use but it also saves time inputting and analyzing data.

## Appendix A – Visitor Observation Protocol

*Example from the Severe Storms Residency*

**Exhibit**                      Tornado                      Van de Graaff                      Outdoor Cart  
Other \_\_\_\_\_

### Basic observation

#### Symbols to use

If you use other symbols, note the symbol and what it means.

|                   |                                  |                          |                          |
|-------------------|----------------------------------|--------------------------|--------------------------|
| <b>M</b> = male   | <b>V</b> = visitor               | <b>TS</b> = touch screen | <b>I</b> = interacts     |
| <b>F</b> = female | <b>NES</b> = non-explainer staff | <b>H</b> = hold          | <b>Q</b> = asks question |
| <b>Y</b> = youth  | <b>Ex</b> = explainer            | <b>G</b> = give to       | <b>E</b> = explanation   |
| <b>A</b> = adult  | <b>Sc</b> = scientist            | <b>P</b> = points        | <b>ANS</b> = answers     |

**VP**= view photo

**VV**= view video

**VD**= view data

**CI**= connect to Internet

**Appendix B – Visitor Survey**

*Example from the Severe Storms Residency*

|        |       |       |                 |       |     |
|--------|-------|-------|-----------------|-------|-----|
| Gender | M     | F     |                 |       |     |
| Age    | 18-29 | 30-39 | 40-49           | 50-59 | 60+ |
| ESL    | N`    | Y     | Yes, but fluent |       |     |

Group size

There is a series of exhibits set up in this area. Which of these did you interact with?

Tornado                      Van de Graaf electrical current globe  
                                    Outdoor cart and weather activity              Weather station/meteorological van

**What would you tell a friend this space was about?**

**Did you talk to someone in this space? (If yes, who [scientist, explainer, other staff member? If they can point to someone but don't know their role, not that.]**

**What made you think the person you talked to was a \_\_\_\_\_?**

**What did you talk about with that person?**

**What, if anything, surprised you about your experience at these exhibits or talking with someone?**



## Appendix C – Scientist Survey

What did you enjoy most about this scientist-in-residence experience?

What do you feel has been the most successful part of this project?

What has been the most challenging part of this project?

Was there anything that surprised you about working with the Exploratorium?

Yes

Please explain.

No

Continues to next question

Did you experience anything during the project that you didn't expect?

Yes

Please explain.

No

Continues to next question

Before the fall residency you were asked about your expectations for this project. On a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree), your expectations were met.

What should change in order for the project to better meet your expectations?

On a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree), the fall residency helped you prepare for the spring residency.

Please provide examples of events/meetings/discussions that occurred during the fall residency that helped you prepare for the spring residency.

[Is there anything you would change about the set-up of the fall residency?

Yes

Please explain.

No

Continues to next question

During your time at the Exploratorium, you had the opportunity to work closely with the Explainers. What is at least one thing you hope the Explainers acquired from working with you?

In the fall, you presented your work to the explainers during the morning training. What about the trainings did you enjoy?

What would you do differently?

Answer the following questions on a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree).

It was exciting...

- ... to work with the explainer program.
- ... to work behind the scenes of the Exploratorium.
- ... to interact with visitors on the floor of the Exploratorium.

The space used on the floor during the spring residency was effective for you to communicate your work.

- What was one thing you liked about the space?
- What was one thing you didn't like about the space?

Answer the following questions on a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree).

The iPad was a successful mediating tool between...

- ... you and the explainers.
- ... you and the visitors.

The iPad...

- ... was easy for you to use.
- ... appeared easy for visitors to use.
- ... appeared easy for the explainers to use.
- ... was available for all parties to use.

Where do you think the iPad was incorporated throughout the project?

Answer the following questions on a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree).

You have a better understanding of how informal science centers communicate science.

What would it take for your understanding to become clearer?

You are comfortable communicating your work to visitors.

What do you think helped you feel more comfortable?

Involvement in the project changed the way you communicate your work.

How did your communication skills change?

What was one thing you gained from being involved in the scientist-in-residency project?

What do you think the visitors got out of the experience during your time on the floor in the spring?

What would you like to see happen with this project after your residency is over?

What do you see as your involvement with the Exploratorium after the project ends?

## Appendix D – Field Trip Explainer Manager Survey

What did you enjoy most about the scientist-in-residence experience?

What do you feel has been the most successful part of this project?

What has been the most challenging part of this project?

On a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree), you were satisfied with the amount of communication between the Explainer program and the scientists.

[What, if anything, would you change about the communication process between you and the scientists?

One part of the project that has changed from year one to year two is the involvement of the lead Explainers in planning meetings during the fall residency. What do you think worked with their involvement in those meetings?

What, if anything, would you change about lead Explainer involvement in the fall planning meetings?

Describe how you would you change the lead Explainer role for future projects.

What is at least one thing you like about the floor space used during the spring residency?

What, if anything, would you change about the space.

Where and how to you think the iPad was incorporated throughout the project?

What do you see as the impacts of this project...

- ...on the Exploratorium.
- ...on the individual Explainers.
- ...on the Explainer program.
- ...on the scientists.
- ...on the visitors.

What is at least one thing you would tell someone hosting a scientist in a museum to do?

What role do you see NOAA scientists having at the Exploratorium after this project is complete?

Please leave any other comments about the scientist-in-residence project that should be considered in the evaluation.

## Appendix E – Field Trip Explainer Survey

What did you enjoy most about this scientist-in-residence experience?

What do you feel has been the most successful part of this project?

What has been the most challenging part of this project?

Was there anything that surprised you about working with the scientists?

Yes

Please explain.

No

Continues to next question

Did you experience anything during the project that you didn't expect?

Yes

Please explain.

No

Continues to next question

On a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree), you were satisfied with the amount of time you had to spend with the scientists.

Please explain your response.

In both the fall and the spring, the scientists presented their work to you during the morning training. What about the trainings did you enjoy?

What, if anything, would you like to see change?

On a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree), you think the scientists changed the way they communicated their work to you over the time they were at the Exploratorium.

On a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree) it was exciting...

...for you to meet NOAA scientists.

...to work with NOAA scientists behind the scenes of the Exploratorium.

...to help the NOAA scientists interact with visitors on the floor of the Exploratorium.

On a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree) **this project** helped you learn...

...how to interact with scientists.

...how to use NOAA scientists as a resource.

What about the project do you think helped you enhance these skills? (i.e. morning training, spending time with them on the floor, meeting with them personally, etc.)

On a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree), the space used on the floor during the spring residency was effective for communicating severe weather/climate change to public audiences.

What is one thing you liked about the space?

What was one thing you didn't like about the space?

On a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree), the iPad was a successful mediating tool between...

... you and the scientists.

... you and the visitors.

On a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree), the iPad...

... was easy for you to use.

... appeared easy for visitors to use.

... appeared easy for the scientists to use.

... was available for all parties to use.

Where do you think the iPad was incorporated throughout the project?

On a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree), you have a better understanding of what it would take to host a scientist on a museum floor.

What would it take for your understanding to become clearer?

What atmospheric science content do you feel you learned about during this experience?  
[List as many specific examples as you desire.]

On a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree), you feel more comfortable talking to visitors about atmospheric sciences after this project?

Was there a specific aspect (morning trainings, personal time with the scientists, etc.) that helped you feel more comfortable?

In general, what do you think visitors got out of the spring residency/ scientists' time on the floor?

What do you think the scientists got out of the experience?

What is at least one thing you would tell someone hosting a scientist in a museum to do?

What would you like to see happen with the NOAA scientists after the project is complete?

## Appendix F – Lead Explainer Supplemental Survey

What about the scientist-in-residence project made you want to work on the project as lead Explainers?

You designed a floor walk that related to atmospheric science content (severe storms). How was the experience of creating and leading a floor walk?

[On a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree), the floor walk was a success in communicating atmospheric science (severe storms) to visitors.

What did you see as the role of the scientists in the floor walk?

On a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree), the scientists fulfilled that role.

One part of the project that has changed from year one to year two is the involvement of the lead Explainers in planning meetings during the fall residency. What did you like about being involved in those meetings?

What, if anything, would you change about your involvement in the fall planning meetings?

Is there anything about the lead Explainer role you would like to see change in future partnerships?

You were asked to work extra hours to help the HS explainers work with the scientists on the floor. What was that experience like for you?

On a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree)...  
... the high school Explainers were engaged with the scientists on the floor.  
... the high school Explainers helped the scientists communicate their work to visitors.

What, if anything, would you change about your involvement with the high school Explainers?

On a scale of 1 to 10 (where 1 is do not agree and 10 is very strongly agree), you were satisfied with the amount of communication you had with the scientists.

What would you change about the communication process between you and the scientists?