

New Mexico EPSCoR
Energize New Mexico Museum Exhibitions
Final Report prepared by Selena Connealy

Summary

Three Albuquerque science museums, New Mexico Museum of Natural History and Science (NMMNHS), Explora, and the National Museum of Nuclear Science and History (NMNSH), each developed and mounted an exhibition as part of the outreach and communication efforts of the NSF-funded NM EPSCoR Energize New Mexico project (2013-2018). Concurrently, all three museums were members of the New Mexico Informal Science Education Network (NM ISE Net), also sponsored by NM EPSCoR, which provided training for museum professionals, facilitated networking opportunities, and developed and implemented a teacher professional development institute. This report describes the front-end evaluation activities, exhibition development process undertaken by each museum, and outcomes, challenges, and opportunities.

Front-End Evaluation

Elsa Bailey was contracted as the Energize New Mexico exhibit evaluator. In that role, she conducted three front-end evaluation studies, each with a different audience: museum members, museum visitors/general public, and teachers. NM ISE Net members were recruited and trained to help with data collection. Data were collected at NMMNHS, Explora, NMNSH, and the Farmington Museum over five months (September 2014 to January 2015). Evaluation results ranged from demographic information to the public's knowledge of and interest in energy topics as well as their familiarity with Energize New Mexico research areas (geothermal, solar, bioalgal, osmotic power, uranium transport).

Exhibition Design Coordination

Staff from each of the three museums met over the course of several months in 2015 to develop a style guide, logos, and shared specs for the suite of exhibitions. Rachel Veracka (NMMNHS) collaborated with Jim Walther (NMNSH) to submit a proposal to NM EPSCoR to travel all three exhibitions at the conclusion of the development process. It was not funded, primarily because of the project timing; the NMNSH exhibition would not be completed until late in Year 5 of the Energize New Mexico project, so there was not sufficient time to travel before the end of the award. However, two of the exhibitions were designed to these shared travel specifications and could be traveled as a package if future opportunities arise.

Get Going with Green Goop at NMMNHS, 2016

NMMNHS staff started their exhibition planning process in 2015 with a trip to New Mexico State University (NMSU) to visit Professor Omar Holguin's lab and learn more about the algae cultivation process. The travel was funded by a mini-grant associated with an NSF SENCER award. Rachel Veracka served as the project manager.

In the EPSCoR proposal, the exhibition was initially conceived as an interactive touch table, but it was determined that the funds available would only support the purchase of hardware, not the programming and content development needed to complete the exhibition. The team decided that a traditional exhibition with text panels and interactive elements (videos, computer interactive, algae models) was more feasible given the available budget and staff

expertise. Students from New Mexico Highlands University (NMHU) were engaged to develop the computer interactive, an algae farming game, and Natalie Rogers (NM EPSCoR State Office) produced short videos that featured NM EPSCoR algae research from NMSU, University of New Mexico (UNM), Eastern New Mexico University, Santa Fe Community College, and the New Mexico Consortium.

The exhibition opened in July 2016. It was installed in the Degrees of Change exhibition that was funded as part of a previous NM EPSCoR NSF Track 1 project. The computer interactive was updated in 2018 by contractor Simone Segal in order to fix glitches and enable it to be accessible through web browsers (<http://algae-biofuel.nmnaturalhistory.org/>).

NMMNHS Staff: Charlie Walter, Margie Marino, Ayesha Burdett, Deb Novak, Rachel Veracka, Chris Ellison, Janet Hevey, Mark Kotanchik, Pedro Toledo, Brian Grace

NM EPSCoR Researchers: Omar Holguin, NMSU; Becky Bixby, UNM; John Roesgen, UNM (graduate student)



Energy Future: Solar at Explora, 2017

The idea for the Solar Exhibition emerged from a Portal to the Public (PoP) training that was conducted by Explora and attended by researchers from the solar, bioalgal, geothermal and osmotic power teams (Explora is an original member of the Portal to the Public Network hosted at the Pacific Science Center: <https://popnet.pacificsciencecenter.org>). Professor Mahinda Ranasinghe (NMT) suggested that Grätzel solar cells, which mimic photosynthesis, might make a good topic for the exhibition. Explora staff prototyped making a working solar cell from fruit at a family science event and discovered that the phenomenon was too subtle to work as the basis for a stand-alone exhibition.

Professor Yang Qin (UNM) was recruited to provide curatorial expertise and the team decided to feature the comparison of silicon-based and organic (polymer) solar cells. They prototyped several versions of the exhibition, and with the support of evaluator Elsa Bailey, Explora staff observed and interviewed visitors interacting with the exhibition. The final version of the exhibition features exhibit text in English and Spanish, an interactive component to compare silicon-based and organic solar cells, and a suite of three videos produced by Natalie Rogers.

Explora Staff: Joe Hastings, Allison Brody, Andres Barrera Guerrero, Tamara Grybko, Shane Montoya, George Moran, Ajasha Silver, Alicia Gonzalez

NM EPSCoR Researchers: Mahinda Ranasinghe, NMT; Yang Qin, UNM



***What's Up with U?* at NMNSH, 2018**

Although the *What's Up with U?* exhibition did not open until 2018, NMNSH began their exhibition development process in 2015. They participated in a number of planning sessions with the Uranium Transport and Site Remediation team, including attending All-Hands Meetings, supporting a public outreach event on uranium research at Laguna Pueblo, and hosting exhibit development meetings.

The final exhibition features text panels, touch screen interactives, two Wenz Scopes, videos, and graduate student research posters. Also on display are 26 historic uranium mining samples never before exhibited publicly. Museum staff have education programming planned around the exhibit, including use of an isotope discovery board and featuring the exhibit during Nuclear Science Week.

NMNSH Staff: Jim Walther, Greg Shuman, Ryan Painter, Joyce Whelchel

NM EPSCoR Researchers: Bonnie Frey and Virginia McLemore, NMT; Jose Cerrato, UNM; see Appendix for a full list of technical advisors.



OUTCOMES

Building Institutional Capacity

Each of the three museums reported increased capacity for mounting exhibitions, particularly those that feature current research. NMNSH developed processes for working with researchers and honing the message for a general public audience. NMNSH Deputy Director Greg Shuman reported that the museum staff learned how to build a team with academics, even though “at first, [the researchers] were talking on a scientific level that no one could understand.”

Explora, for the first time, used evaluation in the exhibit development process to assess defined learning outcomes and took advantage of evaluator Elsa Bailey’s expertise both to conduct evaluation work, and to train staff on evaluation methods. Explora Director Joe Hastings remarked that the EPSCoR exhibition, with the goals of showcasing EPSCoR research and teaching a specific science concept, represented a departure from the traditional Explora exhibition which generally has a goal of visitor engagement without predetermined learning outcomes. He said this was a capacity-building experience for Explora staff, and will help them in designing future exhibitions, particularly those for the museum’s planned teen center. It is also noteworthy that Explora secured its first National Science Foundation grant as the lead institution in late 2017, and the museum’s experience with Energize New Mexico organizational structure, programming, faculty, higher education institutions, and grant administration through this exhibit likely had a role in this achievement.

The team charged with exhibition development at NMMNHS began the project with relatively little exhibition experience which, coupled with a change in museum leadership (Charlie Walter left during the early phases of development), proved challenging. NMMNHS staff reported that they grew their project management and exhibition development skills through this project, learning from staff at the other two museums. Additionally, they were inspired to seek out a project management expert to lead a one-and-a-half-day seminar for NM ISE Net members; David Whitmyer, Director of Experience Design, BPI was engaged for this effort.

NM EPSCoR staff also increased their capacity to communicate science to a public audience. Two of the three exhibitions (NMMNHS and Explora) feature short videos that were filmed and edited by Natalie Rogers, Public Relations Specialist, who reported that the project challenged her to communicate complex research and ideas in 60- to 90-second videos. She appreciated the opportunity to work with scientists, exhibit developers, educators and curators to build a bridge between NM EPSCoR research and the general public.

Dissemination of NM EPSCoR Energy Research

The museum exhibitions provide a vehicle for NM EPSCoR research to be shared with the general public on a much larger scale than could be accomplished through traditional outreach activities. In total, more than 400,000 people visit the three museums each year and it is reasonable to expect a large percentage of those visitors to be engaged by the Energize NM exhibitions.

It is of note that these exhibitions are about cutting-edge science research. While it can be challenging to communicate current research in an exhibit format, the content gives museum visitors insights into ongoing science questions, the methods and laboratories dedicated to answering them, and introduces them to scientists from local institutions. This kind of content also adds additional substantive content and scientific legitimacy to informal science education venues.

Coordinating with Active Researchers and Training Faculty in Science Outreach

Working with over-committed academics on activities that don't "count" toward tenure and promotion can be challenging (see "Challenges" section, below). However, the museums engaged in these exhibitions used creative and diverse approaches to access academic expertise and collaborate with researchers who were part of the Energize New Mexico project. Specifically, researchers from four research teams (solar, bioalgal, geothermal, and osmotic power) participated in Explora's PoP training sessions, advancing NSF EPSCoR's mission of engaging the public in current research and inspiring youth toward STEM pathways. It was from this PoP programming that the initial ideas for the Explora solar exhibition were conceived. NMNSH led two half-day workshops with faculty, research staff, graduate students, and undergraduate students from the Uranium Transport and Site Remediation team to focus their scientific message, an experience that both the museum staff and research team have reported as educational. Ultimately, NMNSH utilized the Energize New Mexico uranium team (faculty and students) as the "technical advisory board" for the exhibition, which was a new model for the museum.

CHALLENGES

Complicated Basic Research Topics are Esoteric

NMNSH Director Jim Walther encapsulated this challenge by saying that the museum's goal was to present the science of uranium transport and site remediation as "simple but not inaccurate." The museums mitigated this challenge by focusing on three research areas that seemed understandable and relevant to the general public, as determined via the front-end evaluation: bioalgal energy, solar energy, and uranium transport.

Museum personnel reported that the All-Hands meetings were an imperfect vehicle for building relationships with researchers and learning about research outcomes. NMNSH mitigated this challenge by coordinating with the Uranium Team in two separate half-day meetings dedicated to exhibition development.

Collaboration Between NM EPSCoR Researchers and Museums

In general, NM EPSCoR researchers were interested in engaging with museum staff to develop exhibit ideas and provide content expertise, but at times higher education realities, like tenure and other reward structures, impeded their ability to fully engage from project conception through completion. One example of this challenge happened when a researcher's tenure committee instructed him to cease all outreach activities and the museum had to recruit a new content expert. Some researchers also expressed frustration with the exhibit development process and the challenge of working as an "outsider" with museum teams.

In the end, each of the museums were able to engage researchers to support their exhibit development, although this was based more on the "goodwill" of the researchers (and some encouragement by the NM EPSCoR State Office) rather than the task fitting within their academic job duties or defined NM EPSCoR responsibilities. One museum reported that students were more responsive than faculty, and therefore good members to engage on the technical planning teams.

Collaboration Across Three Museums with Different Institutional Cultures

The exhibit development project began with a highly collaborative vision as stated in the proposal to NSF: "The three museums will work together to create three distinctive exhibitions

that interpret NM EPSCoR research, in Years 3 and 5. Exhibits will be complementary and will be designed so components of them can travel to NM ISE Net members across NM.” Challenges related to traveling the final exhibits are addressed above in Exhibit Design Coordination.

Ultimately, the exhibit development effort across the three museums might be better characterized as “coordinating.” Initial exhibit design specs were developed, but only followed by two of the three museums; similarly, the exhibit scope and curatorial approach was vastly different between the first two exhibitions (NMMNHS and Explora) and the third (NMNSH). This challenge reflects the complexity of cross-disciplinary, multi-organizational/institutional work that is further complicated by a long project timeline of 5 years.

Leadership Changes

Charlie Walter, the director at NMMNHS and the leader of NM Informal Science Education Network (NM ISE Net), left in Year 2 of the project. The loss of his leadership and vision was keenly felt by NM ISE Net members, as well as by NMMNHS staff and the NMMNH Foundation.

Capacity for Managing Accounting and Following Federal Spending Guidelines

Two of the three museums are relatively small non-profit organizations with only one or two staff members with accounting responsibilities. The third museum is a state agency supported by a small, non-profit foundation with similar accounting staff levels. All were challenged by the complexity of the invoice procedures for direct and cost-share expenses. In particular, meeting and documenting cost-share obligations was tricky. Accounting staff turnover also contributed to this challenge.

OPPORTUNITIES

Staff from all three museums and the State Office met in May 2018 to discuss the Energize New Mexico project and consider ways to sustain the work. Ideas generated included:

- Issue a press release from State Office to inform the public about the Energize New Mexico exhibitions and encourage people to visit.
- Explore opportunities to travel the exhibitions, either individually or as a group. All museums expressed a willingness to lend the exhibitions to other NM ISE Net institutions, or to libraries or higher education institutions in New Mexico.
- Submit conference proposals and publications to share the project lessons learned.
- Maintain NM ISE Net presence on the NM EPSCoR website beyond the period of funding (November 2018) and seek additional ways to sustain the NM ISE Network.

Appendix:
 Technical Advisors for What's Up with U, NMNSH

Abdul-Mehdi Ali	University of New Mexico [Faculty-equivalent]
John Asafo-Akowuah	Rodman & Renshaw [Graduate Student]
Sumant Avasarala	University of California, Riverside [Graduate Student]
Johanna Blake	US Geological Survey [Post Doc]
Reid Brown	Wyoming Department of Environmental Quality [Graduate Student]
Stephen Cabaniss	University of New Mexico [Faculty]
Daniel Cadol	New Mexico Institute of Mining and Technology [Faculty]
Samantha Caldwell	New Mexico Institute of Mining and Technology [Graduate Student]
Matthew Campen	University of New Mexico [Faculty]
José M. Cerrato	University of New Mexico [Faculty]
Olivia Chavez	Boston University [Graduate Student]
William X. Chavez	New Mexico Institute of Mining and Technology [Graduate Student]
Cherie Devore	University of New Mexico [Graduate Student]
Eliane El-Hayek	University of New Mexico [Post Doc]
Bonnie Frey	New Mexico Bureau of Geology and Mineral Resources [Faculty-equivalent]
Liliya Frolova	New Mexico Institute of Mining and Technology [Faculty]
Eshani Hettiarachchi	New Mexico Institute of Mining and Technology [Graduate Student]
Chase Kicker	New Mexico Institute of Mining and Technology [Undergraduate Student]
Thomas Kieft	New Mexico Institute of Mining and Technology [Faculty]
Yitian Li	New Mexico Institute of Mining and Technology [Graduate Student]
Virginia McLemore	New Mexico Bureau of Geology and Mineral Resources [Faculty-equivalent]
Shaylene Paul	Navajo Technical University [Graduate Student]
Alexandra Pearce	New Mexico Institute of Mining and Technology [Graduate Student]
Gayan Rubasinghege	New Mexico Institute of Mining and Technology [Faculty]
Mitchell Schatz	University of New Mexico [Graduate Student]
Marcus Silva	New Mexico Institute of Mining and Technology [Graduate Student]
Bruce Merrill Thomson	University of New Mexico [Faculty]
Dana Ulmer-Scholle	Scholle Petrographic, LLC [Faculty-equivalent]
Carmen A. Velasco Rivera	University of New Mexico [Graduate Student]
Ingar Walder	New Mexico Institute of Mining and Technology [Faculty]
Ashlynn Winton	New Mexico Environment Department [Graduate Student]
William Zutah	New Mexico Institute of Mining and Technology [Graduate Student]