Scientists Expand Professional Vision Through Outreach With People Underrepresented in Science

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Abstract: Scientists have commitments to impact the public's perceptions of science. How do they learn how to accomplish successful outreach in different communities? The research examined a multi-faceted engagement program between scientists and communities underrepresented in science. Research examined the practices forged, finding that scientists evolved their professional vision to adapt practices such as developing reciprocity of perspectives, building from empathy, adapting language, and changing teaching practices.

Introduction

Many in society could benefit from interactions with scientists, yet they have little or no access. While formal and informal science institutions do a great amount of science engagement, science experiences remain out of reach for many. They include people who have little or no access to science in their daily lives such as the elderly, those incarcerated, the homebound, and those who are unable to access science facilities. Access can be limited by physical distance and social barriers, such as for refugees and those from communities underserved by educating institutions. Yet, interactions with scientists show positive outcomes.

The STEM Ambassador Program (STEMAP) is a public engagement project that integrates features of three informal science education models: Research Ambassador Program (Nadkarni & Stasch, 2013), Portal to the Public (Storksdieck et al., 2017), and Design Thinking (Goldman, 2017). These models combine, aiming to facilitate multi-level connections between the scientific community and the public. Participating scientists undergo training and continued support for accessing and understanding communities and for tailoring science engagements. Scientists participate to foster curiosity, generate excitement, make the case for science to the public, and improve their outreach skills. We also see them add skills in translation and adaptation as they tailor public engagements to the needs and interests of specific communities. Forty scientists at an R1 university in the United States, from doctoral students to Associate Professors, were in the program in 2016 and 2017, completing 84 events for 1600 pople at venues such as jails and senior centers.

Methods

Research focused on how, if at all, scientists' identities and professional vision were expanded. Professional vision entails the "socially organized ways of seeing and understanding events that are answerable to the distinctive interests of a particular social group" (Goodwin, 1994, p. 606). Through training in and uptake of practices related to public engagement in STEM, scientists experienced opportunities to understand the objects of their professional practice in expanded terms, with implications for the conception and enactment of their identities as scientists. We illustrate and discuss several cases (Stake, 1995; Yin, 1989) developed from data collected on a subset of 17 scientists. The case studies analyzed scientists' responses on pre and post surveys and interviews, field notes from observations of their community engagements, and evaluations from community participants in events. Coding of interviews proceeded from open coding to a more refined set of codes. Codes focused on identity addressed evaluations of self-change (e.g., becoming more empathic or improving as a science communicator) and new ways of thinking (about, for example, public engagement or their future careers and research endeavors). Surveys in year two of the project addressed identity by asking participants to rate a number of practices according to the extent to which they enact them, how important they think they are, and how confident they are to enact them. Example practices included "Seek out opportunities for public engagement experiences with people or communities who may not engage actively in STEM" and "Make public engagement in STEM part of your research projects or the classes you teach." In these ways, our approach to identity included not only one's ideas about oneself, but also connection to practices and social relations (Nasir & Cooks, 2009).

Results and significance

Through case studies we saw scientists expand their professional vision while making connections to new communities. They found ways to adapt their inscriptions, share science topics and practices, and translate their

work for understanding, without "dummying down", while relating to the concerns of the people they engaged. For example, one scientist met with the head of university facilities to propose an engagement. She then designed the interaction to learn how the electricians conceptualize circuitry and use terminology to solve problems in their work. In a lunch meeting with over 20 staff in facilities, she asked questions and there was much discussion about how cancer cells and electrical circuits work. This was a mutually beneficial border-crossing engagement made possible through efforts to understand across communities of practice. Another scientist who met with senior citizens showed examples of how the study of deadly poisionous snails leads to new diabetes drugs. This engagement was designed based on the direct concerns of seniors. Results indicate that no versions of professional vision shifts were alike, yet archetypes of adapting professional practices were revealed as scientists foregrounded certain aspects of their work in community settings. The case studies revealed defining adapted practices that scientists took as they transacted science beyond their labs and peer publications and with people in a variety of community settings (see Table 1).

Table 1: Practicess of scientists emerged showing professional vision adaptations

Vision Expansion	Definition	Example
Reciprocity	Both scientist and community members advance their learning	Scientist meets with electrical systems operators to learn terms & whether circuits work like cancer cells
Empathy	Scientist develops empathy insights about the needs and abilities of people for learning science	Scientist visits youth treatment center to observe and talks with gatekeepers before planning
Citizen Science	Scientist establishes ways for people to contribute to data	Website can take entries of species seen by hikers in local foothills
Multimodal Communicator	Scientist sheds reliance on lectures, creates hands-on/interactive activities	Scientist brings beautiful shells of deadly snails to presentation
Collaborative Consociates	Scientists team with colleagues to meet the needs of a community, even when off-topic	Three scientists team up to support garden science at local jail
Adaptive Expertise	Scientist uses local and context cues with flexibility *en passant*	Scientist finds fossils to examine while on a hike with children
Teaching	Scientist plans to incorporate program approaches and ideals in courses they teach	New faculty will incorporate outreach while teaching

The archetypes of practices in scientist expansion and adaptation of their professional visions are informative for those who work to increase public engagement. The scientists expressed the importance of bringing science to the larger underrepresented public as a professional goal, even when it meant crossing borders and the comfort of existing professional vision. With science becoming a national debate rather than a given national priority, the ability for scientists to help the public understand science through expanded vision may be crucial.

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