Learning Scientific Practices Through Participation as a Volunteer Community Scientist

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Abstract: An ethnographic study of community scientist volunteers in a museum-embedded genetics lab clarifies how participants are afforded or constrained in opportunities to learn scientific practices through an apprenticeship-model program. Guided participation in the lab results in participatory appropriation of scientific practices by volunteers. Community scientists enter as newcomers, then gain experience through opportunities to observe and engage in a range of scientific practices associated with studies on genetics of taste and everyday lab support tasks.

Keywords: community science, citizen science, apprenticeship learning, informal learning

Introduction

Over the last two decades, there has been an increased focus on the participation of members of the general public in aspects of scientific research, commonly referred to as citizen science. These types of volunteer programs, also referred to as Public Participation in Scientific Research (PPSR, Shirk et al., 2012) or "community science," generally provide opportunities for volunteers to contribute to various aspects of scientific research. While the availability of volunteers to collect data is of clear benefit to science researchers, there is an ongoing question as to the benefit of such participation to the volunteers themselves. Too often, volunteers can be relegated to the role of "databots" guided in collecting rigorous data following protocols, without an understanding of the scientific issues that render it meaningful (Pea, et al., 1997). What benefit do the community scientists themselves derive from their participation in such practices and others designed into community science programs? We examine one program in detail to answer the question: How do individuals volunteering as community scientists in a museum-embedded genetics lab learn scientific practices through their participation in ongoing studies of the genetics of taste?

Theoretical framework

We draw on Rogoff's (1995) framework of learning through participation on three planes of sociocultural activity: apprenticeship, guided participation, and participatory appropriation. The broadest plane is the community level of activity, which Rogoff refers to as *apprenticeship*, as newcomers to the community learn new skills through first-hand participation (Lave & Wenger, 1991). The next plane of activity focuses on the interpersonal level of participation – *guided participation* – which describes how multiple individuals interact within the context of the mutual activity. The final plane of activity narrows the focus to an individual's process of learning new tasks and using new skills to participate in activities in more knowledgeable ways. Rogoff refers to this plane as *participatory appropriation*. Community scientists are positioned as novices within the community, embedded within existing institutional systems that proscribe engagement in the activity, with tasks directed by more experienced individuals. In this way, we identify learning as a change in participation in practices, looking for evidence of learning within and through the three planes of analysis.

Methods

This study took place inside a genetics lab embedded within an exhibit on the human body in a large natural history museum in the Western U. S. The work of the community scientists who volunteer in this lab is directed on a day-to-day basis by a lab manager and three museum staff members. The community scientists in the lab are responsible for daily maintenance tasks related to the exhibit-associated experiment area as well as enrolling museum guests in ongoing genetics studies and other study-related tasks.

We took an ethnographic approach, engaging the first and second author in participant observations of lab operations. The researchers participated in the normal onboarding process for all museum volunteers. Over the course of 16 months, they completed 52 observations (>156 hours) across all 14 volunteer shifts. All community scientist volunteers were asked to consent to being observed while working in the lab, with a purposive sub-sample asked to participate in interviews. For analytic purposes, based on our observations of learning opportunities, we partitioned community scientists into one of three groups based on career phase: pre-professional, early/mid-career, or late-career/retired.

Primary sources of data included detailed observation notes of all consented community scientists (N=35), interviews of a subset of participating community scientists (N=13), exit interviews of five departing community scientists, demographic survey results, and associated artifacts. Observation notes and interview transcripts were coded using both inductive and deductive codes (Miles, Huberman, & Saldana, 2013).

Findings

On the community and institutional plane, the volunteer program represents a small community of volunteers whose formation is supported by the larger volunteer program in which it is embedded. This natural history museum has over 1800 volunteers each year, representing 230,000 person-hours or 114 full-time positions. The volunteers are treated by the institution as valuable and necessary to the successful operation of the museum.

On the interpersonal level of participation, novice volunteers in the genetics lab are apprenticed into the community, supported and mentored by both lab staff and more experienced community scientists as they engage first-hand in the everyday tasks of the lab through a process of guided participation. One frequently observed example is how novice community scientists learn how to micropipette, a scientific skill requisite for activities such as DNA extraction and analysis, by being shown how to use a micropipette, then being observed by a skilled lab member while practicing, followed by opportunity to practice independently with a follow-up.

On the final plane of activity, novice community scientists demonstrate participatory appropriation through use of learned scientific practices both in and out of this particular lab. For example, we observed Kaitlyn [early/mid career] using her micropipette skills to extract DNA from the previous genetics of taste study, and Aiden [pre-professional] reported using his new micropipetting skills during a lab at his high school.

However, despite ample observations of community scientists engaging in the learning of new scientific practices, we identified patterns of participation that were often mediated by the career phase of the participants in ways that afforded or constrained their participation. For example, pre-professional community scientists such as Aiden were not able to enroll participants because they were not yet 18 years old, so they were relegated to non-study related lab tasks. Early/Mid career community scientists were often focused on acquiring new marketable science skills and as such, were often offered more opportunities to learn such skills. Late-career/retired community scientists frequently identified the purpose of their participation as more socially-oriented and were mainly happy to complete rote tasks rather than engage in learning new scientific practices.

Conclusions and implications

Overall, we found that ample opportunities to learn about scientific practices are embedded as part of regular participation in the ongoing activities in this genetics lab. Community scientist programs need to be designed to provide meaningful opportunities with enough flexibility to support the goals of diverse individual participants. This is a challenging balance to strike, particularly within the context of institutional guidelines and while maintaining rigorous protocol standards.

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