Engaging Science: Transforming Graduate Education through Public Engagement with Science

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Abstract

Academic scientists are increasingly called upon to engage in public outreach, and an ever-increasing number of graduate degree-holders are finding employment in roles related to public outreach. Graduate programs across the sciences have the potential to address this need, but most programs focus almost exclusively on research. Our team is developing a 3-part curriculum at the University of Cincinnati to provide interdisciplinary instruction in public engagement with science. The curriculum incorporates extensive community partnership, interdisciplinary collaboration, and methods from philosophy of science, and it enrolls students from across the physical, biological, behavioral, and social sciences. In this poster, we describe the three components of the curriculum—workshop, semester-long seminar, and summer fellowship; indicate some initial observations about participation; and summarize the research our team is conducting on this curriculum's transformative potential to equip graduate students to engage public audiences in a more meaningful, robust way; to encourage collaboration across disciplines; and to advance diversity and inclusion in STEM graduate education.

Assessment & Research Methodology

Knowledge-generating research on the short- and long-term impacts of this curriculum on three dimensions:

1. Graduate students' confidence and competence in public engagement with science.

Hypotheses: (1) confidence and competence will improve; (2) graduate students' conception of public engagement is transformed from unidirectional dissemination of research findings to bidirectional communication and deeper engagement.

2. Graduate students' perceptions of and competence in interdisciplinary collaboration.

Hypotheses: (1) students will be better able to articulate the meaning and value of interdisciplinarity not just for science but for society[2]; (2) students will be able to identify contributions from philosophy of science and deploy those methods appropriately in their own outreach; (3) students' interest in and capacity for interdisciplinary collaboration will be strengthened.

3. Strengthening diversity and inclusion in STEM graduate education.

Hypotheses: (1) students from groups traditionally underrepresented in STEM are disproportionately drawn to public engagement with science training; (2) program activities and multidisciplinary peer groups will support students' sense of belonging and reinforce their STEM identities[5] and goal congruity, i.e. fit of STEM education with their other goals[4].

Data Collection: Convergent parallel design, collecting quantitative and qualitative research simultaneously.

Quantitative: Survey questionnaires at Level 1, 2, & 3; Course evaluations at Level 2; Rubrics for projects at Level 2 and Level 3.

Qualitative: Students' written reflections; observation of in-class discussions; in-depth, semi-structured interviews conducted following Level 2; and interviews following Level 3.

Data Analysis: Descriptive statistics for basic patterns in the data, and inferential statistics to test hypotheses.

Quantitative: SPSS software.

Qualitative: MAXQDA. Thematic analysis[3] with multi-phase process involving, (1) identifying textual segments of interest to research questions; (2) generating labels or codes for patterns in the data; (3) classifying and condensing coded segments into thematic categories; and (4) creating narrative descriptions of emergent themes based on their shared properties and the relationships among themes.

Engaging Science Curriculum

This curriculum employs a community-partnered, interdisciplinary approach grounded in philosophy of science to effectively prepare graduate students in a bidirectional approach to public engagement with science. The curriculum has three levels, with the prior level(s) as a prerequisite:

Level 1: Sharing Science Experience 2-day (1-credit) Workshop

Day 1

Sharing Science Workshop & Practicum[1]: a hands-on experience doing outreach and engagement at the Cincinnati Museum Center.

Day 2

Distillation and application of Day 1 content + introduction of a framework for undertaking public engagement with science.

Level 2: Public Engagement with Science Semester-long (3-credit) Graduate Seminar

Course Topics

1. Public Engagement with Science: Theory, Aims, & Goals
   - Variety of aims & goals for public engagement with science.
   - Public talks & science communication basics.
   - Fundamentals of learner-centered (or public-centered) education.
2. Collaboration, People, and Publics
   - Theory and best practices for working with community partner organizations, interdisciplinary teams, and the public.
   - Culturally responsive pedagogies in the context of STEM.
3. Designing and "Doing" Public Engagement
   - Theory and best practices for various modes of public engagement.
   - Developing engagements focused on scientific methodology and the role of values in science.
   - Incorporating question-asking, inquiry, and dialogue skill-building.
4. Assessing Success and conducting assessment of outreach efforts.
5. Careers with Public Engagement with Science.

Weekly Journal Reflections

Five-minute public "talk" on students' area of research, video-recorded, paired with a social media campaign.

Interdisciplinary team project where 3-4 students with varying skill sets and disciplinary expertise collaborate to develop, execute, and assess a public engagement with science project with a partner community organization.

Summarative **Interest Statement** detailing students' approach to and interest in public engagement with science.

Level 3: Engaging Science Summer (10-weeks) Fellowships

Each student is matched with a local community partner organization. The fellows:

- Become familiar with the main projects of their organization;
- Learn and practice public engagement in that setting;
- Plan, implement, and asses one public engagement with science initiative in collaboration with that organization.

Students also meet with PI/Co-PI faculty mentors 5 times to discuss fellowships, compare experiences, deepen learning, and cultivate community within the cohort.

Citations

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