SciPEP
Science Public Engagement Partnership

Public Engagement with Basic Science: A Systematic Review

By: Todd Newman, Dominique Brossard, Dietram Scheufele, Kaiping Chen, Yachao Qian, Ashley Cate, Lindsey Middleton

Department of Life Sciences Communication University of Wisconsin-Madison

We present a landscape assessment of a) what research exists on public engagement with basic science research in the STEM peer-reviewed literature, b) trends in US public opinion related to basic science research, and c) an in-depth review of public engagement activities in three specific fields: chemistry, biotechnology, and nanoscience. Our assessment offers a broad overview of the existing scholarship in these areas to understand the extent to which a literature of public engagement with basic science exists, and a context that those interested in communication and engagement can use to establish a research and practice agenda moving forward.

To begin, we analyzed various secondary public opinion data sources to gauge how public attitudes and opinions of basic science and related concepts are measured, and what insight they can provide for the context of public engagement with basic science. One of the key trends that emerged was – overall– strong support among the US public for federal funding of basic science research. Between 1985 – 2018, nearly 85% of the US public "strongly agree" or "agree" that "scientific research that advances the frontiers of knowledge is necessary and should be supported by the federal government." However, there is a lack of public opinion data measuring directly how the public thinks and feels about basic science research and applied science research. Only one existing measure from a survey in 2015 measured public sentiment regarding "basic scientific research" and "applied scientific research." While fewer than one in 20 Americans (below 4%) had a "negative" association with these terms, solid majorities indicated "positive" associations of "basic scientific research" (58%) and "applied scientific research" (54%). Nearly 40%, however, had a "neutral" association with either term, potentially indicating a lack of familiarity among many Americans with these labels.

In our review of the existing STEM literature on public engagement with basic science, we analyzed how often articles on public engagement appear across journals in five fields (chemistry, physics, neuroscience, nanoscience, astronomy & astrophysics, and psychology), and among those that focus on public engagement the extent to which the focus is on basic science. We extracted all articles published between 2015-2019 in all journals appearing in Web of Science for each field. In total, we extracted 1,540,963 articles across 2,132 journals. Using the article title and abstract as our unit of analysis, we iteratively developed, tested, and refined a lexicon to identify articles for instances where keywords appeared. Our results indicate that titles and/or abstracts that reference public engagement appear very infrequently, with fewer than one in 10,000 articles ($\leq$.01%) in chemistry, physics, neuroscience, nanoscience, and astronomy & physics returning a positive match (n = 22,148). We then took another subset from these 22,148 abstracts where the article's title must contain our search string (n=700). This helped to reduce the number of false positives as titles, compared to abstracts, provides a more direct signal for if an article focuses on public engagement with basic science. Four researchers on the team conducted manual content analysis of these 700 articles to code whether an article indeed talks about public engagement with basic science. We found that 70% of articles (n = 489) returned false-positives, and 30% (n= 211) did focus on public engagement. Further analysis revealed that among the 30% of articles that have a clear focus on public engagement, only 20% (n = 43) included a focus on concepts related to basic science. The majority of these 43 articles appeared in chemistry education journals, witha focus on understanding and interest in basic science concepts. Other examples of engagement come from astronomy & astrophysics and document ways in which citizen science (e.g., crowdsourcing of images) help researchers observe and document different phenomena.

THE KAVLI FOUNDATION
U.S. DEPARTMENT OF ENERGY | Office of Science

Our findings suggest that public engagement work doesn't appear frequently in field-specific STEM journals, and actually, its footprint might be even smaller than we report due to the number of false- positives our manual coding revealed. Nonetheless, we do find that examples do appear sporadically, but mainly in journals that focus specifically on education contexts. Likewise, among those examples that have a public engagement focus, the focus is less on basic science than it is on more applied concepts.

To further understand the context of public engagement with basic science, we conducted three case studies on the context of public engagement related to chemistry, nanoscience, and biotechnology. For each field, we examine a) what started the need for public engagement on the topic and what public engagement activities currently look like, and b) what type of public engagement occurred, including the foci of activities and the funding structure supporting the activities. We find that overall public engagement activities across these three fields are initiated and supported by funding source and focus on incorporating the public early in the development of specific technologies. In the context of nanoscience and biotechnology, the focus almost immediately shifted to public engagement around applications.

Based on our systematic assessment, we suggest several opportunities for moving forward with public engagement on basic science. First, more research is needed to understand how the public thinks about basic science (even if they might not use the same label), and if a distinction exists in the mind of the public compared to applied science. Second, very little research exists on public engagement, broadly, and basic science, specifically, in the discipline specific STEM journals. Finally, moving forward, the scientific community needs to be much more transparent with participants and the broader public about their motivations and goals for public engagement with basic science. Simply building support for or excitement about science that might produce applications with disproportionate impacts on vulnerable populations is shortsighted at best and unethical at worst. As our analysis of trends in public opinion suggest, support for basic research funding remains strong and consistent, and the public has an overall positive sentiment towards basic science research, although sentiment is no different than applied research. Public engagement efforts therefore need to consider the outcomes of public engagement activities, and not only how these activities lead to changes in attitude, opinion, and behavior among the public, but also among the scientists and the work that they do.

CONTACT

Department of Life Sciences Communication College of Agricultural and Life Sciences University of Wisconsin-Madison
Madison, WI 53706
+1.608.262.0482
tpnewman@wisc.edu

scimep
science, media & the public

THE KAVLI FOUNDATION
U.S. DEPARTMENT OF ENERGY | Office of Science