The role of communication professionals in fostering a culture of public engagement

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Abstract

This study initially reports on qualitative interviews (n = 17) with scientists at two Long Term Ecological Research (LTER) sites in the Northeastern United States. These interviews suggest the need for greater attention to the role of communication professionals and institutional leadership in fostering high-quality public engagement. The study also reports on a follow-up quantitative survey (n = 68) conducted to better understand the degree to which LTER scientists' views about communication professionals were meaningfully associated with perceptions about the need for robust engagement funding. The project was initially designed based on the Integrated Behavioral Model to assess how individual LTER scientists' engagement-related attitudes, normative beliefs, and efficacy beliefs affected their communication activity. However, the combined results highlight the potential value of additional research and theorization aimed at better understanding the factors that might lead to greater cooperation between scientists and organizational communicators.

Keywords: public engagement, professional communicators, strategy, culture, survey interviews

Introduction

Understanding how scientists think about science communication should help communication researchers provide better guidance to scientists and other science communicators. However, the nascent research on this topic has primarily focused on large or disconnected samples of scientists from specific fields or from large scientific societies (Bennett et al., 2019). The general sense of this work is that, while most scientists have not thought too deeply about communication, most are eager to participate (Besley, Dudo, Yuan, et al., 2018; Rose et al., 2020; Stylinski et al., 2018) and willing to pursue a range of goals (Besley et al., 2020), objectives (Besley, Dudo, & Yuan, 2018; Stylinski et al., 2018), and tactics (Besley et al., 2019). They are especially likely to make communication choices when they see these choices as ethical and likely to be successful (Bennett et al., 2019). In contrast to the previous survey work, the interviews underlying the current study were gathered at the outset of a three-year project aimed at improving the quality of public engagement activities at two specific Long Term Ecological Research (LTER) sites in the northeastern United States. The initial thinking was that the project would help individual scientists at the sites identify public engagement goals for specific stakeholders (and themselves) and then work backwards to set nearer-term communication objectives and associated tactics that would help the scientists achieve their goals (Besley, Dudo, & Yuan, 2018; Hon, 1998). The plan was to work with established trainers to help scientists implement a strategy to achieve their goals and, in so doing, help enhance the culture of engagement at their research site. This plan was based on the suggestion from the surveys that beliefs about engagement ethics, motivation, and self-efficacy are key correlates of scientists communication choices and that science communication often lacks strategic direction

(Bennett et al., 2019). The interviews and follow-up survey data reported here challenged this plan and suggested an alternate path for both the project and future research by other scholars and practitioners.

As will also be discussed, the somewhat unusual format of this paper reflects the fact that the analyses included were not planned at the project's outset. Instead, what is described reflects an attempt to make sense of initial interviews that (as will be discussed) seemed to suggest that scientists at both research sites seemed to believe that their organizations already had strong engagement cultures (as defined below). This, in turn, meant that their vision for the future did not necessarily involve substantially increasing their own engagement activity and that they did not want to put substantial time into improving their own communication skills or strategic thinking. Instead, the initial interviews we analyze here suggested a desire to better partner with trusted communication professionals at their organizations. Further, the interviews seemed to suggest that the culture around engagement at the sites was derived from how leaders and colleagues worked to ensure a communication team that could collaborate in core science efforts.

Further driving our desire to share our experience in shifting focus was our sense that the scientists' desire for a team-based approach to improving communication partially conflicts with some recent discussion in science communication training. Specifically, our sense of this literature is it suggests that current training efforts emphasize enhancing scientists' individual-level communication skills through the training of individual scientists (Besley et al., 2016; Copple et al., 2020; Miller et al., 2009; Rodgers et al., 2018; Rodgers et al., 2020; The Royal Society, 2006; Yeo & Brossard, 2016). In contrast, what emerged through the research that emerged here complements recent calls for increased attention to the role of organizations in science communication (Schäfer & Fähnrich, 2020) and scientists need for support (Borchelt &

Nielsen, 2014). What emerged also seems to complement emerging evidence about the potential value of communication support (Entradas & Bauer, 2016; Entradas et al., 2020). An individual scientist-focus may be reasonable in some cases, but this research seeks to advance the argument that at least some actors in the scientific community are ready to consider more strategic, team-based approaches that help scientists better work with communication professionals (Besley, 2020).

Also worth noting is that this manuscript talks about both science communication and public engagement. Our understanding of public engagement activities is somewhat broad but is limited to planned communication activities where there is a focus on fostering deeper-level cognitive engagement by all participants (including scientists). In other words, we envision engagement-focused communication as communication designed to foster more "systematic" (Chaiken, 1980), "central route" (Petty & Cacioppo, 1986), or "system 2" (Kahneman, 2003) processing rather than communication that tries to use things like "nudges" (Thaler & Sunstein, 2008) meant to capitalize on peoples' "heuristics," "peripheral route," or "system 1" intuitions or biases (Besley et al., 2019). We see this as consistent with the deliberative turn in political philosophy and an interest in opinion quality (Delli Carpini et al., 2004; Price & Neijens, 1997). As is discussed below, we are thus primarily interested in communication where there is an increased likelihood that 'engaged' participants' (again, including scientists) will develop evaluative beliefs, feelings, or frames that might affect their intentional behaviors (e.g., they might change how they manage a forest or research a forest). Specific tools such as dialogue, from this perspective, can be understood as tactics meant to increase the likelihood of participant cognitive engagement. We use the term science communication even more broadly as a subfield of study (as might be published in journals such as this one, *Science Communication, Public*

Understanding of Science, or somewhere else), and as a catch-all description for any activity in which there is a focus on tacit or explicit communication related to science and scientists, whether intentional or unintentional.

As noted, the work described below was conducted through two rural research forests in New England that are part of an American network of "Long Term Ecological Research" (LTER) sites (LTER Network, 2019). Both sites—Hubbard Brook in New Hampshire and Harvard Forest in Massachusetts—are home to a variety of research projects related to forest ecosystems. The Hubbard Brook LTER project occurs at the Hubbard Brook Experimental Forest, a 7,800-acre research forest operated by the U.S. Forest Service, while the Harvard Forest LTER project occurs at the Harvard Forest, a 4,000-acre research site owned by Harvard University. Both have a small number of on-site scientists (~10–15) and communication professionals, with several dozen (~50–70) additional Ph.D.-level researchers who might be on site several times year for specific projects alongside their students. Both sites also have regular meetings that bring together researchers across projects. The U.S. National Science Foundation (NSF), other government agencies, universities, and foundations provide the sites' funding. The NSF is the primary funder of non-medical natural science research in the United States. One additional contextual factor that we will return to in the discussion is that both sites have small (n = ~2–3 at any given time) multi-person teams of communication professionals, including communication leaders with substantial experience.

Literature Review

The project underlying this research seeks to understand how the scientific community could find ways to build more strategic thinking into science-focused public engagement planning and implementation. We understand strategic communication to be purposeful

communication-related activities designed to achieve policy or behavioral goals over an extended period, often in the context of an organization (Hallahan et al., 2007). This is done by identifying communication objectives with the potential to affect goal behaviors, and tactics that might ethically and efficiently affect chosen communication objectives (Besley, Dudo, & Yuan, 2018; Hon, 1998). The most commonly prioritized communication objective likely involves increasing audiences' science knowledge (i.e., filling knowledge deficits) (Besley, Dudo, & Yuan, 2018), but strategic communicators also recognize that communication can affect a range of other evaluative beliefs, feelings, and frames, as well as the beliefs, feelings, and frames of communicators. For example, scientists could communicate in ways that potentially foster trust-related beliefs, such as whether scientists are perceived as caring about stakeholders (i.e., warmth or benevolence), similar to stakeholders, willing to listen to stakeholders, and competent (Besley, Dudo, & Yuan, 2018; Fiske & Dupree, 2014; Hendriks et al., 2015). They might equally choose to communicate in ways designed to affect beliefs often associated with behavior change, including normative beliefs, efficacy beliefs, and risk/benefit beliefs (Armitage & Conner, 2001; Fishbein & Ajzen, 2010; Montano & Kasprzyk, 2015). When focused on updating their own beliefs, science communicators might use engagement activities to try to learn more about what others think about risk and benefit, social, self-efficacy, or the degree to which someone is trustworthy. Beyond beliefs, communicators can make choices that could engender positive or negative affect (Finucane et al., 2000), specific emotions (e.g., disgust, anger, hope, excitement, etc.) (Kühne & Schemer, 2015), or specific psychological processes (e.g., cognitive engagement). A communicator might similarly seek to affect how someone frames an issue in terms of wins or losses, short-term or long-term, or many other potential frames (Nisbet, 2015).

Tactics are understood as the words, tone, behaviors, sources, and channels that communicators can use to achieve objectives (Besley et al., 2019).

A novel aspect of the current project is its focus on trying to increase the likelihood that scientists will carefully choose their goals, objectives, and tactics by embedding a culture of public engagement at the institutional level. Underlying this approach is an assumption that, left to their own devices, untrained science communicators will often simply focus on filling knowledge deficits rather than pursuing a broader range of objectives (Simis et al., 2016). Although the idea of what might constitute a culture of engagement for LTER sites was still being developed as part of the project when this research was conducted, initial thinking was that scientists at sites with stronger engagement cultures would engage more as a function of seeing engagement activities as beneficial, ethical, normatively acceptable, and possible. In other words, consistent with the Integrated Behavioral Model (IBM) (Montano & Kasprzyk, 2015), a research site with a positive engagement culture would have scientists with positive attitudes, norms, and self-efficacy beliefs about participating in engagement activities. The IBM is built on the well-known Theory of Planned Behavior (TPB) (Fishbein & Ajzen, 2010), but adds insights from other behavior change models that include similar variables. Further, given discussions around the value of meaningful public engagement (Stilgoe et al., 2014), this project was particularly interested in fostering engagement activities that prioritized communication objectives associated with building real, substantive relationships between scientists and others, including ensuring that scientists are open to changing their own beliefs, feelings, and framing about research-related topics (i.e., prioritizing trustworthiness-related objectives). More immediately, the hope was to encourage scientists to choose authentic communication tactics (e.g., dialogue-based events, everyday language) that increase the odds that *both* scientists and their public-sphere

interlocutors will be motivated and able to cognitively engage (i.e., elaborate), consistent with the approach to public engagement we describe in the introduction.

Given this interest, the project's Year 1 interviews aimed to explore how the two sites' scientists thought about communication strategy, operationalized as scientists' views about the goals, objectives, and tactics. Indeed, the project underlying the two studies presented here draws on recent arguments that behavior change theories, as summarized by the IBM, have the potential for broad use in understanding the choices that science communicators make about their tactics, objectives, and goals. Specifically, the idea of "Strategic Communication as Planned Behavior" (Besley et al., 2019) reflects the idea that strategic communication choices should be understood as intentional behaviors and thus driven by the same types of IBM-summarized factors (i.e., evaluative beliefs about related to expected outcomes of communication choices in the form of attitudes, normative beliefs, and self-efficacy beliefs) known to drive other behaviors. For example, if we want scientists to choose to put resources into dialogue aimed at fostering fulsome cognitive engagement by all participants, then we probably need to ensure they believe that putting resources into dialogue is likely to be beneficial, normative, and within their capacity given available resources.

As foregrounded in the introduction, what we saw as unexpected and worth exploring mid-project is that the scientists interviewed in Year 1 of the project (and reported in Study 1, below) often put the focus on their perceptions of professional communicators, rather than their own beliefs about engagement activities. For example, early in one interview a scientist was asked about the current culture around engagement at their site; they gave an answer that focused on activity being done by one of the site's communication professionals as an illustration of the positive direction of the site (Interview 3, HB). In another interview, a scientist asked about their

site's engagement culture pointed to the site's "personnel for engagement" as evidence of a positive culture (Interview 7, HF). In other words, while we intended to explore the value of using behavior change models such the IBM to reshape scientists' engagement beliefs as a way to help them change their communication behavior, the initial interviews showed us that we should put greater attention in our research on understanding how to help scientists to cooperate with professional communicators. This article is one step in this effort at refocusing, and it therefore seems important to include some overview of relevant literature that guided our thinking during the analysis, even though we had not intended to draw on this literature at the outset of the project.

In this regard, we have come to see the argument that science communication researchers should put more attention on scientists' interactions with professional communicators as worth advancing in the science communication research literature for several reasons. Our sense is that much of the research on improving science communication focuses on training individual scientists to speak in clear and vivid ways, including telling stories and participating in two-way conversations (Bennett et al., 2019; Dudo et al., 2021). Similarly, much of the previous research on scientists has focused on their views about communicating (Copple et al., 2020; Rose et al., 2020; Stylinski et al., 2018). The current manuscript could thus be understood as questioning this somewhat limited focus inasmuch as it focuses on the potential need for training that involves working with professional communicators to use strategic thinking to decide when—and with whom—tools such as stories and conversation make sense (Besley, 2020). Such a strategic perspective also might question what specific skills scientists need to devote time to improving as it seems unreasonable for scientists to be experts at everything. For example, some scientists might benefit from devoting time to learning to write better for youth audiences, whereas another

might need to build their capacity to participate in difficult conversations on contentious topics. Further, our sense is that much of the recent academic literature about the role of communication professionals focuses on concerns about how a loss of scientific autonomy may be occurring because those with access to resources (e.g., funders, higher-level administrators) are pushing scientists to do things like seek media coverage in order to bolster organizational reputation (Peters et al., 2008; Rödder, 2020; Weingart & Guenther, 2016). An important corollary of this concern about "medialization" (or "mediatization") is that scientists might sometimes change their research focus or approach in inappropriate ways (e.g., going too fast, over-hyping results) to obtain attention and approval from others (e.g., the media and, through them, funders). More generally, there also appears to be some concern about the potential negative role of "public relations" approaches increasingly being used within the scientific community (Bauer, 2008). On the other hand and consistent with other research investigations (e.g., Koivumäki & Wilkinson, 2020), the interviews described here might put attention on the contrary idea that while some specific public relations activities may be inappropriate for scientists, there is still a need for scientists to draw on the expertise of professional communicators. The expectation in doing so would be that these professionals can help the scientific community develop, implement, and evaluate ethical communication activities that would see scientists and stakeholders mutually engage on topics of shared interest and achieve their respective goals. The view that science community might benefit from leaning on professional communicators is not new (Borchelt & Nielsen, 2014), but we think the current project offers a new opportunity to foreground novel evidence that scientists—at least the scientists studied here—are eager for the support that communication professionals can provide to help them ensure their research has impact, rather than concerned about loss of autonomy. It may even be that the scientists interviewed represent

an unusual test sample inasmuch as they represent a group of scientists who have had the good fortune of working alongside communication professionals.

The current study

Below we present two related exploratory studies on these issues. We describe these studies as exploratory for two reasons that underlie the largely descriptive approach we took. First, the underlying project was designed to focus on individual scientists' views about science communication as public engagement, rather than views about communication professionals. Second, our initial intent was to focus narrowly on using the 'strategic communication as planned behavior' approach and not to address broader debates about the appropriate role of communication professionals in communicating about science. The descriptive format, in particular, represents an attempt to further signal the central role that we, as researchers, likely played in trying to make sense of what we heard in the interviews (Kvale & Brinkmann, 2015) and then inserting additional questions on the topic of professionals into a survey we had previously planned related to our original research questions.

For Study 1, the research question we seek to answer is: How do LTER scientists think about the role of communication professionals in the context of their sites' efforts to engage their publics (RQ1)? This was the initial interview study that prompted the follow-up survey focused on trying to quantitively understand how our population of LTER scientists think about communication professionals, and how these perceptions might be associated with support for ensuring adequate resources for engagement activities.

For Study 2, building on the interviews, we provide descriptive data about one population of scientists' views about how the role of communication professionals, as well as correlational data on focusing the relationship between scientists' perceptions of communication professionals

and their views about appropriate engagement funding levels. In this case, the research questions are simply: Where do LTER scientists think funding for science communication should originate (RQ2)?; What roles do scientists want communication professionals to play at LTERs (RQ3)?; How much funding from various sources should go to public engagement activities (RQ4)?; and How do LTER scientists perceive communication professionals (RQ5)?

The relevant perceptual variables are drawn from both the trust literature (competence and various aspects of warmth) and the IBM literature, including attitudes about the benefits of relying on communication professionals and normative beliefs related to working with such individuals. These are further described in the introduction to Study 2 and operationalized in that study's methods section. Based on the IBM, we also hypothesize that trustworthiness beliefs (H1a), benefit beliefs (H1b), and normative beliefs (H1c) will be associated with scientists' engagement funding beliefs.

Study 1 Methods

Semi-structured interviews (n = 17) were conducted by telephone between February and April of 2018. The interviews were done following an initial survey of scientists (not presented here) and in the first year of a three-year project (late-2017 to late-2020) involving multiple rounds of interviews and surveys. Respondents for the purposive sample were suggested by on-site project members based on their various levels within the two LTER projects, including both senior and more junior scientists to ensure a variety in level of site involvement, such that the sample includes both scientists who worked primarily at the site and affiliated scientists based elsewhere. Students were not interviewed.

Informed consent was obtained through an online survey. The interviewer (first author) was not affiliated with either site beyond the current project. The interview started with a

reminder of federal human subject protection rules and then moved to a discussion of the interviewees' perceptions about the culture of engagement at their site. Follow-up questions addressed perceptions of their site's focus and use of communication resources, strategy, and what they believe constitutes engagement quality. The interviews ended with a discussion of respondents' sense of communication efficacy (skill and perceived impact).

Ten interviews were from Harvard Forest and seven were at Hubbard Brook. The average age of the 16 respondents who provided demographic information was approximately 52 (SD = 9), ten identified as men, and none identified as non-white. The interviews are numbered to protect confidentiality, and demographic information beyond site (HF for Harvard Forest, and HB for Hubbard Brook) is not provided because the population of the scientists at the sites is small enough that providing even limited demographic information might enable subject identification.

Transcripts were coded in NVivo over a series of multiple readings with a focus on identifying themes that related to both concepts derived from past research (i.e., attitudes towards engagement, normative beliefs, efficacy beliefs, and goals/objectives in the context of strategy). Additional codes were developed iteratively based on post-interview notes, and through the reading and re-reading of interviews. In this way, coding followed a relatively straight-forward form of thematic analysis (Guest et al., 2012) and a quasi-grounded process inasmuch as an effort was made to remain open to the types of emergent themes (Strauss & Corbin, 1998) that are at the core of the current manuscript. The focus on describing key themes that might be relevant to future theory building is similar to recent research on science communication trainers' activities (e.g., Copple et al., 2020; Yuan et al., 2017).

Communication leaders at the sites reviewed the initial interview protocol and manuscript drafts to ensure the plausibility of the arguments. They joined as co-authors based on their contribution to the design and framing of key questions. The co-authors were not involved in the analysis of the raw data or the selection of themes to preserve confidentiality.

Study 1 Results

As is discussed in more detail below, there appeared to be three central themes (capitalized, below) in how respondents talked about the role of communication professionals at the LTER sites (RQ1). These included a theme focused on (1) how useful it was to have skilled PEOPLE TO HELP scientists think through the process of identifying and engaging audiences throughout their scientific research processes, as well as (2) appreciation for how communication professionals are often the PEOPLE TO LEAD such work on behalf the sites. A final theme sat between these two themes and reflected an idea that (3) the true value communication professionals derived from a recognition that QUALITY MATTERS in any discussion of engagement.

Two complementary themes related to the importance of perceived norms around engagement are also discussed. Interviewees indicated that prioritization of resources for things such as expert communication professionals was a function of both LEADERSHIP PULL alongside COLLEAGUES' EXPECTATIONS for quality engagement.

There's PEOPLE TO HELP

One consistent theme that emerged was scientists' appreciation for having colleagues dedicated to making communication efforts easier and more impactful. The central idea was a recognition that LTER scientists wanted to engage people such as land managers, policymakers, and others with a perceived stake in the research at the site, but did not always feel they had the

time or expertise to engage effectively. One interviewee, for example, described how integral communication had become to their team.

> *They're always at the table when … we are talking science so that the engagement is embedded within that, if that makes sense… I think what's great about their approach is that they take the burden off of the scientist really. … So they're helping us do that engagement whereas we don't have to try to figure that out ourselves. (Interview 16, HF)*

Similarly, another scientist said that the value of the communication role was becoming increasingly clear to her as demands on the site increased.

> *I'm feeling a lot of pressure to do more of this and to show how our research provides meaningful results to the general public and to the taxpayers. … [They have] just been fantastic in kind of setting up these pub nights and other things that we just probably wouldn't do on our own. (Interview 7, HB)*

What is important to recognize around this theme is that the scientists were not saying that they wanted to hand off all responsibility to professionals, but rather that the communication professionals were enabling them both to implement and strategize engagement.

Most respondents indicated that they were generally happy with the amount of resources going into public engagement efforts, but there was also a recognition that additional resources might be useful.

There's PEOPLE TO LEAD

When asked to describe the culture around engagement at a site, one typical respondent immediately highlighted the role of professionals. "How would I characterize it? We're a very engaged place. We have an Outreach Manager." She then mentioned a regional research project that involves great deal of communication in terms that suggested the interviewee felt it was 'owned' by a communication professional rather than a scientist (Interview 3). In other words, while many scientists talked about the value of having PEOPLE TO HELP, it was equally common to hear scientists say something suggesting they were happy to see public engagement

experts as the PEOPLE TO LEAD engagement efforts, including engagement aimed at framing potential research questions.

> *A large part of [our public engagement activity] is done through people who are on staff where that is sort of their job … [W]hen they say they need something from you, 'can you provide some data' or provide 'some feedback' … I'm happy to say 'oh sure, yeah, let me have a look at that and I'll send you what you need.' (Interview 9, HF).*

Several of the scientists interviewed were fairly directly on this point.

> *[We're] spoiled because we have [a person] here who … kind of knows when to deploy whom, and I am very, very willing to take [this person's] expertise as gospel on that, you know. (Interview 8, HF)*

QUALITY MATTERS

A final theme worth calling out seemed to straddle between communicators as PEOPLE TO HELP and PEOPLE TO LEAD. This third theme seemed to reflect a recognition that having professional communicators help with public engagement was about increasing the quality of activities, not just shifting a burden off scientists. Several scientists also pointed to the expertise they felt their communication leads had developed over the years relative to other communicators they may have worked with. It was this trust in the competence of the communication professionals that seemed to allow a scientist to rely on their guidance.

> *We have someone who really understands communication [and] … who really is able to treat communication science policy as a science, which I don't think anyone here has done before that. … So, yeah, I think, you know, bring[s]a more rigorous and scientific approach to how we communicate science…. Whereas I think more typical would be… is, ooh, I guess we'll write a press release or, you know, come up with something but not really think through a custom, a customized strategy … (Interview 1, HF)*

LEADERSHP PULL

In addition to the emphasis on the role of communication professionals, there appeared to be a related emphasis on the role of formal leaders and fellow scientists in fostering a culture that values public engagement, thus enabling scientists to work with communication professionals.

The LEADERSHIP PULL theme partly emerged in how scientists described how those in leadership roles were communicating the value of engagement through their own actions.

> *The thing about [the] director of the place and how he spends his time and sort of where he puts his energy. And I think the fact that he does things like… with science policy exchange and with … scenarios work that outreach components to it … the writing that he does for general audiences … The fact that that is all that is meaningful to him I think says a lot about the priorities of the place. (Interview 17, HF)*

This appeared to be true whether the respondent was thinking of an individual leader or a leadership team.

> *There's this leadership group of about eight other people. And if two of those people decided, you know, I'm tired of talking to society, the rest of the group would continue to do it. So it, you know, having that kind of distribution of controls gives you more resilience. (Interview 12, HB)*

An additional important aspect of this theme evident in this quotation is that the tradition of collaboration around engagement had reached a point where the scientists interviewed fully expected the emphasis on engagement would survive any change in leadership because of the culture that had been created. This was expressed by one interview in arguing that the focus on engagement activity had created a sense of community between different kinds of researchers.

> *I can't say I, at any other places I've been, you, there's that level of interdisciplinary researchers together that feel like they're part of a community. And some of that, and part of that community is actually engagement" (Interview 2, HF).*

Beyond the immediate leadership of the site, some scientists also noted they felt broader pressure coming down from overall organizational leadership and into their site.

COLLEAGUES' EXPECTATIONS

The idea that time had imbued the sites' cultures with a shared commitment to public engagement was also a prevalent theme that existed beyond the role of leadership. This theme

was labeled COLLEAGUES' EXPECTATIONS because of a sense that scientists were describing norms they felt from fellow scientists while working at the sites.

> *[T]here was always a sense that we wanted the experiments that were going to produce information that was useful for the management of forests in the northeast. And, I mean, something that the founders of the [site] were very proud of and something that … we're still proud of… (Interview 12, HB)*

At the same time, while it may make sense to identify specific themes in the responses, the overall sense was that the culture around engagement had developed such that it is now hard to identify the degree to which of the different actors are driving discussion.

> *"I think we've all drunk the Kool-Aid. … I think part of it is the director is very into this and part of it is that we all see that, when we do engage, that it can actually make a difference and can actually have impact and people actually, you know, non-specialists, actually pay attention." (Interview 3, HF)*

Study 1 Discussion

As suggested above in providing a rationale for our approach, the current results suggest to us that scientists at the two sites have bought into engagement but see the best way of identifying and achieving their communication goals may be to improve their access to communication professionals, rather than just focusing on building scientists' individual-level skills (e.g., Rodgers et al., 2020) or trying to improve scientists' overall attitudes and normative beliefs about engagement (Bennett et al., 2019). Our sense is that this approach is often overlooked in many current discussions around science communication training that emphasize motivating individual scientists to engage more often and with more tactical skill (e.g., less jargon) (Dudo et al., 2021). Individual skills and beliefs will always be important, but the scientists at the two sites studied here—who may have unusual access to such support—also clearly appreciated the expertise of communication-focused colleagues and working collaboratively (RQ1). An alternative perspective might be that the scientists were simply eager

to have someone else manage the messy and time-consuming aspects of dealing with stakeholders, but this was not the impression received by the first author when coding. Instead, as argued, the interviewed scientists genuinely seemed to appreciate the expertise of their communication experts. On the other hand, one thing we did not hear—and did not specifically set out to learn in the initial interviews—was the degree to which scientists' appreciation was matched by a desire to allocate scarce funding to communication activities. Going forward, we therefore intend to learn more about how scientists at these research sites and elsewhere think about communication professionals from a financial viewpoint. This will include using surveys and interviews to further explore questions about what might make scientists more or less likely to choose to rely (and financially support) professional communication help and collaborate across an organization.

An additional limitation for Study 1 is that the communication professionals at the two sites may be more experienced than the average. This means that scientists interviewed may have been more likely than scientists in other contexts to express a willingness to rely upon their services because of previous positive experiences. A working hypothesis would be that perceived quality of communication professionals drives willingness to rely upon their guidance, as well as a willingness to ensure such professionals have access to adequate funding. It is noteworthy, in this regard, how little systematic knowledge we have about the people hired to do communication work for scientists (see, however: Entradas et al., 2020). If we want "excellence" in science communication, it makes sense to shift our focus away from individual scientists' communications skills and think more about team-based competence. A second obvious limitation is that the two sites are just that, two sites. On this point, recall that the goal of the current manuscript is thus simply to provide data to support a shift away from an individual

scientist-focused emphasis in research and training. Nevertheless, we did want to further explore views about engagement professionals at the two sites before broadening the research to additional populations of scientists.

Introduction to Study 2

The Year 1 interviews prompted the addition of a module on the project's second-annual tracking survey of scientists at the two sites. The hope was to be able to get a quantitative understanding of the LTER scientists' views about communication professionals, as well as associated views about how public engagement support should be funded (i.e., the cost of having access to professionals). Some of the added questions also allowed us to begin answering our descriptive research questions about where scientists think communication funding should originate (RQ2), the role that LTER scientists want communication professionals to play in public engagement activities (RQ3), the amount of communication funding that scientists think should come from various sources as a proportion of overall research funding (RQ4), and overall perceptions about communication professionals (RQ5). The questions relevant to RQ4 and RQ5 also allow us to further test the "Strategic Science Communication as Planned Behavior" approach (Besley et al., 2019), namely that variables (i.e., attitudes, normative beliefs, and self-efficacy) commonly used to study behaviors related to health and the environment (Montano & Kasprzyk, 2015) can also be used to statistically predict potential science communicators' communication choices. The specific variables used in Study 2 are described in the methods section below.

Study 2 Methods

We conducted online surveys of LTER scientists during January and February of 2019. In total, 68 usable responses were collected from the two populations (N = 128), including 35

scientists from Hubbard Brook and 33 scientists from Harvard Forest (i.e., a 53% completion rate). Our use of an attempted population census means that non-response error and measurement error—and not sampling error—are the main sources of potential bias in the data. The lack of sampling error makes standard statistical tests inappropriate, because all relationships found in the data could be understood as descriptions of the actual population, not estimates. For this reason, the analyses below focus on providing a description of the data with an emphasis on the substantive size of differences and patterns, not the statistical significance of differences or correlations.

The full wording of the questions used to address the research questions and the hypothesis are provided in Tables 1 through 4. The questions were designed in collaboration with the onsite co-authors (Tables 1 and 2), as well as theory (Table 3), as described below. Tables 1 and 3 (both RQ2) are based on two different ways of describing the range of funding sources available to support communication activities (including professionals' salaries), and Table 2 (RQ3) is based on the simple range of activities that communication professionals are involved in at LTERs. Table 2's inclusion of content focused on both communication strategy and tactics also reflects the importance of this distinction in public relations theory (Grunig & Grunig, 2008). The inclusion of dialogue is similarly key to any contemporary discussion of strategic communication and public engagement in science communication (Lee et al., 2018). The inclusion of evaluation in Table 2 further reflects the importance of evaluation in any discussion of strategic communication (Watson, 2012).

INSERT TABLE 1

INSERT TABLE 2

The data in Table 3 about the percentage of budget that LTER scientists think should be devoted to communication activities also serves as the primary outcome variable in the correlation analyses used to assess H1a-c. We focus on this outcome because our sense is that scientists' choices about communication funding are both behaviors—thus suitable for studying using models such as the IBM—and primary barriers that prevent communication teams from having the resources needed to design, implement, and evaluate strategic communication activities. We do not use the questions about 'desired role' in Table 2 for correlational analysis because higher responses (i.e., more perceived role for communication professionals) are not inherently desirable. In some cases, the ideal response might be somewhere in the middle. It is also noteworthy that, in the absence of established scales, we used ad-hoc individual labels for each response option, but our expectation is respondents could infer order from the presentation. Further, providing item-specific response options is generally preferable to generic response options (e.g., Likert scales) (Saris et al., 2010).

INSERT TABLE 3

The questions in Table 4 (RQ5 and H1a-c) derive from research on trust-related beliefs and the IBM. Specifically, the trust-related questions reflect a multi-dimensional approach to trust beliefs (Besley et al., 2021; Fiske & Dupree, 2014; Hendriks et al., 2015), including belief about communicators' competence (i.e., ability) and warmth (i.e., benevolence/caring, and integrity/honesty/shared values). The warmth-focused questions focused on openness and respect are also central to discussions on procedural fairness as 'voice' (i.e., perceived willingness to listen) (Besley, 2010). Trust-related belief variables are not typically included in behavior change research using IBM variables, but we would argue that fostering trust is a central element of science communication and strategic communication (Bennett et al., 2019). In practice,

trustworthiness beliefs could also be considered a type of attitude that might underly decisions that people like LTER scientists make about issues, such as whether to devote resources to public engagement.

INSERT TABLE 4

Table 4 also includes more traditional behavioral model questions focused on the potential to obtain benefits from working with communication professionals (i.e., the response efficacy of working with communication professionals), as well as questions about the injunctive (i.e., subjective) norms associated with devoting resources to engagement. Injunctive norms, in this regard, represent beliefs about what important colleagues/friends expect when it comes to a target behavior (Bergquist et al., 2019). The current study did not focus on descriptive norms or self-efficacy (i.e., behavioral control) beliefs as these seemed less relevant and because of a need to limit the length of the survey. Self-efficacy beliefs, in particular, were not included based on the logic that funding priority is not an issue of skill. Scientists might not feel they are able to devote resources to communication (rather than science), but at least some of this perception should be captured by normative beliefs; it would not make sense for a scientist to say they think they do not have the ability to put resources into something that a funder, leader, or colleague expects. In other words, our expectation was that a primary barrier to perceived control was perceived injunctive norms, not respondent skill/behavioral control.

The analyses conducted to assess H1a-c were limited to univariate Pearson correlations (Table 4) rather than multivariate analyses for two main reasons. First, it was possible to create defensible multi-item scales for the criterion variable focused on funding amounts (see Table 3), and the predictor variables related to benefit beliefs (H1b) and normative beliefs (H1c) (both Table 4). However, the trust-focused questions did not correlate in the expected ways with

competence and non-competence questions, failing to form clear dimensions in an Exploratory Factor Analysis context (oblique rotation). This meant that any multi-variate model would need to have a large number of variables included (i.e., all of the trust-related variables would need to be entered separately). Second, the small population size also limits the ability to make substantial distinctions between variables in a multivariate context. It therefore seemed both parsimonious and appropriate for the current exploratory purposes to look at simple correlation patterns to assess whether the data are consistent with the idea that scientists' communicator perceptions are associated with their views about communication funding needs. All results are provided individually for both sites as well as combined. Visual inspection of all relationships was conducted prior to the correlation analyses to ensure that the underlying relationships were linear.

Study 2 Results

For RQ2, Table 1 shows more than half of scientists at both sites indicated they thought natural science grants should include funding for public engagement activities. The remaining respondents indicated they thought funding should come from the sites' core budgets (which come from other federal and state-level funds and endowments) or from stand-alone communication-focused grants. The only substantial difference is that Harvard Forest scientists saw more potential for funding through core budgets. This may reflect the broader budget base of the Harvard University-owned site.

For RQ3, the surveyed scientists at both sites again clearly indicated that they saw a substantial role for communication professionals for the standard communication tasks (Table 2). This was especially true for evaluation, strategy development, and content production. The respondents seemed to see interaction with stakeholders as a shared task. In contrast, they

seemed to see setting research priorities as the primary domain of scientists, with only a limited role for communication professionals.

For RQ4, the initial variable was recoded from a simple percentage into a 5-point scale to normalize the distribution. The response pattern suggests that LTER scientists think communication funding should be just a little more than 10% of research budgets, with the modal response being '3' (representing 10%-14%) for the core budget and regular natural science grants and '2' (representing 5-9%) for the LTER-specific grants from the U.S. National Science Foundation, with a slightly higher numbers given by Harvard Forest scientists. A little more than 10% is also the mean score for all three variables prior to recoding, again with somewhat higher scores at Harvard Forest.

For RQ5, the survey data (Table 4) suggest that LTER scientists hold a range of positive trust-related beliefs about communication professionals, with most scores above four on five-point scales. They were especially likely to see communication professionals as respectful of others, informed about key issues, and skilled at managing public engagement activities. The lowest scores were for listening to scientists, but even these were still high relative to the mid-point of the response scale. Beyond trust-related beliefs, LTER scientists from the two sites also indicated they thought communication professionals provide substantial benefits to the sites. In contrast, the scientists were somewhat neutral as to whether they felt normative pressure to work with communication professionals.

For H1a-c, the results suggest that many of the trust-related beliefs (H1a) and both the benefit (H1b) and normative beliefs (H1c) are somewhat correlated with higher desired budgets for public engagement activities. For trust-related beliefs (H1a), several competence-related beliefs seemed to be relatively more correlated with funding views, along with beliefs about the

degree to which communication professionals listen to scientists. Perceived benefits are also substantially (if somewhat weakly) correlated with funding views, especially at Hubbard Brook. The pattern is less clear for normative beliefs, where there is a meaningful correlation in the Harvard scientist population but not the Hubbard Brook population.

Study 2 Discussion

Adding to Study 1, the survey data further support the idea that the scientists at the two sites have positive views about communication professionals (RQ1-5) and provides evidence that individual-level positive views about such professionals are associated with a desire to see more funding for public engagement activities (H1a-c). It is noteworthy that many of the results across the two sites are similar but that there are also some substantial differences, especially when looking at the pattern of correlations. This suggests a need for additional research with additional LTER sites or similar types of organizations to see how much variance there is across contexts and, if such variance exists, to try to explain any patterns. Ideally, such research would include sites where there is a broader range of views about communication professionals (i.e., more variance). This might mean finding sites where scientists have fewer positive views about communication professionals. Alternatively, it may also be necessary to see if it is possible to user longer (i.e., 7- or 9-point) or unbalanced scales (i.e., the mid-point is not neutral) to see if it is possible to capture meaningful variance within scientists who have varying degrees of positive perceptions of communication professionals. Five-point measures with item-specific response options were used here based on the past research into survey best-practices (Saris et al., 2010), but alternative approaches may be necessary given the context (Revilla et al., 2013). Measures with more variance and a broader sample would also allow for substantive testing of the

relationships between scientists' beliefs and feelings, and communication and their communication behaviors.

Overall Discussion

This descriptive research grew out of a perceived need to switch some of the focus of an ongoing effort to improve the impact of public engagement activities at two specific research sites in the United States. The nature of the proposed refocusing, however, may speak to a broader issue in how we talk to scientists about improving communication. The interviews reported here indicated to the project team that we (and others) might benefit from finding ways to improve scientists' motivation and ability to work with existing communication professionals. Similarly, within the current research context, the follow-up survey suggests to us both a high willingness to work with such professionals and the potential value of ensuring scientists perceive cooperation in a positive light. The specific perceptions we explore here include those about the trustworthiness of communicators (i.e., warmth and competence), as well as perceptions related to the benefits and norms associated with cooperation. This perspective is consistent with the "Strategic Science Communication as Planned Behavior" approach that we can study communication-related behaviors like funding prioritization by looking at associated attitudes (as salient evaluative beliefs), normative beliefs, and efficacy beliefs (Besley et al., 2019). Going forward, we look forward to continuing this line of research with a focus on both small, context-specific samples as described in the current study (ideally including sites with additional variance in terms of their experience with communication professionals and their views about communication professions), as well as samples aimed at providing a broader overview of the scientific community.

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