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Should science communication become part of a discipline of integration and implementation sciences (i2S)?

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Abstract

Science communication is essential for inter- and trans-disciplinary research on complex societal and environmental problems. Two aspects are explored as examples: 1) helping teams understand the systemic nature of such problems and 2) helping collaborations run effectively. Integration and implementation sciences (i2S) is a new discipline that addresses such aspects of dealing with complex problems that, notably, are not covered by existing disciplines. By becoming part of i2S, science communication will be linked with other communities of practice, resulting in an overall improvement in the ability of research to effectively contribute to tackling complex societal and environmental problems.

Keywords

Professionalism, professional development and training in science communication; Science and policy-making

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Science communication skills are essential for inter- and trans-disciplinary research on complex societal and environmental problems to:

- Provide an understanding of what different disciplines and stakeholders bring to the research
- Allow the intricacies of the problem to be appreciated
- Grease the collaborative wheels when disciplines and stakeholders work together, especially to ensure that diversity is productively harnessed rather than becoming a trigger for conflict
- Effectively use the evidence generated by the research to support policy and practice change

– Foster appreciation, especially by research policy makers, funders and the general public of the benefits and limitations of inter- and trans-disciplinary research.

Science communication is already actively addressing the second last of these, but is less focused on the others. Let's therefore explore two in more detail — the intricacies of the problem and collaboration.

Complex societal and environmental problems are systems problems. Many researchers trained in a discipline are unfamiliar with the core elements of systems thinking, which means that effective science communication is required to ensure that a team researching a complex societal or environmental problem understands these intricacies. Such understanding requires appreciation of:

– the artificial nature of boundaries. In an open system everything is connected, but it is not possible to try to understand and act on the whole system. The problem researchers choose to work on is carved out by setting boundaries and where boundaries are set is determined by multiple factors including the researchers' knowledge, values, world views and context. A different group of researchers would probably set different boundaries and study a different aspect of the system.
– the dynamic nature of relationships. There are many types of relationships in a system; of particular interest are direct and indirect causal relationships leading to positive and negative feedback loops. Tracking causal relationships often pushes against the boundaries that have been established. Furthermore, it is usually not possible to identify all of the causal relationships.
– differences in perspectives. Everyone researching, affected by, or in a position to influence a problem defines and views the problem differently. An agreed problem definition and approach is almost always a compromise.
– the need to keep the whole in mind. Even though it is not possible to deal with the whole system, it is important to keep in mind the compromises made by setting boundaries, defining key relationships and agreeing on a problem definition. This allows for an alertness to the possibilities of adverse unintended consequences and nasty surprises [Adapted from Cabrera and Cabrera, 2018].

Good communication also underpins effective collaboration. Collaboration can be considered as a process of harnessing the differences among researchers and stakeholders that provide the rationale for the collaboration and managing those that get in the way of working together [Bammer, 2008]. Bennett and colleagues [2018] list "communication" as one of the ten top requirements for effective collaboration suggesting that "*Effective communication within and outside a research team contributes to effective group functioning. It depends on a safe environment where team members can openly share and discuss new scientific ideas and take research into new, previously unconsidered directions as well as ensure that difficult conversations can take place*" (p. 3).

Communication also underpins eight of the other nine requirements:

- establishing trust
- developing a strong vision
- providing the ability to demonstrate leadership to all
- developing the skills of others through mentoring
- understanding and negotiating team evolution and dynamics
- recognizing contributions and sharing success
- productively managing conflict and disagreement
- navigating and leveraging networks and systems.

Given the importance of science communication, how, then, can we ensure that these skills become an integral part of inter- and trans- disciplinary research? There are three potential options:

1. All researchers who engage in inter- and trans-disciplinary projects are taught science communication skills. While it is useful for everyone to have some basic science communication skills, it is unrealistic to expect everyone to become proficient in this in addition to their core disciplinary expertise.
2. Experts in science communication are included as key members of inter- and trans- disciplinary teams. This is certainly an option, but unless the science communication experts are familiar with key elements of inter- and trans-disciplinary research, such as systems thinking and collaboration, their contributions may be minimal.
3. Science communication is recognized as an integral part of integration and implementation sciences (i2S), which has been proposed as a new discipline that provides the essential expertise for working on complex problems, including in inter-and trans-disciplinary ways. Such expertise is not provided by existing disciplines.

I briefly expand the case for the third of these options. For more detail see Bammer [2013] and Bammer et al. [2020]. In brief, research dealing with any complex societal or environmental problem has two overlapping dimensions:

1. developing a more comprehensive understanding of the problem
2. supporting improved policy and practice responses to the problem.

Integration and implementation sciences (i2S) provides the expertise to integrate multiple and varied perspectives about the problem and insights into acting on it, all the while not losing sight of unknowns and outliers that do not fit neatly into a synthesized package, especially as these can be the sources of adverse unintended consequences and nasty surprises. It also provides expertise for research

implementation, especially for decision support, to underpin policy and practice change.

Expertise in i2S involves the ability to take a systems perspective, incorporate context, seek out diversity in participants, ideas, mental models, epistemologies, values and more. It requires being able to organise and manage various forms of participation by academics from various disciplines and a range of stakeholders, both those affected by the problem and those in a position to do something about it. Underpinning all of this are science communication skills.

The set of knowledge and skills identified above is what Collins and Evans [2007] refer to as contributory expertise, which is the expertise required to make a substantive contribution to a field. It can be usefully thought of as knowing-that and knowing-how [Gobet, 2015]. In addition, integration and implementation sciences in general and science communication in particular require interactional expertise, which is the ability to understand disciplines, professional practice and community experience without being trained in those disciplines or professions or having lived in those communities [Collins and Evans, 2007].

The relevant contributory and interactional expertise required to deal with complex societal and environmental problems is fragmented across communities of practice and research teams that have minimal interaction [Bammer et al., 2020]. Integration and implementation sciences aims to connect them making the sharing of theories, concepts, methods, processes and other forms of expertise possible. It also aims to make the contributory and interactional expertise recognised and valued.

By becoming part of integration and implementation sciences, science communication will be linked with a range of communities of practice, not only systems thinking and science of team science, but also action research, integrated assessment, post-normal science, implementation science, decision sciences, design thinking and many more [see Bammer et al., 2020, for details]. The new i2S discipline does not seek to diminish science communication or override its identity, but aims to form productive linkages that strengthen it and each of the other relevant communities of practice. The net result is to enhance the ability of research to effectively contribute to tackling complex societal and environmental problems.

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Gabriele Bammer Ph.D. is developing the new discipline of Integration and Implementation Sciences (i2S) to improve research strengths for tackling complex real-world problems through synthesis of disciplinary and stakeholder knowledge, understanding and managing diverse unknowns and providing integrated research support for policy and practice change (see https://i2s.anu.edu.au/ and https://i2Insights.org). She looks at applications in population health, environment and security. She is a professor in the Research School of Population Health at The Australian National University.
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