Broader Impacts and Evidence-Based Models

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While there are many perspectives on broader impacts—what they are, what they mean, and how they are best characterized and classified—one certainty remains for those writing proposals to NSF or supporting those who do: success depends upon addressing the broader impacts (BI) criteria specific to the solicitation.

Somewhat like quarks, BI activities come in multiple flavors, but for those writing research proposals to NSF, BI activities often equate to STEM educational activities at one or more points along what NSF describes as the "*pre-K to Ph.D. continuum*." Of course, BI activities are a function of the award size of any research proposal, typically representing some much smaller proportion of the overall research budget. However, on center proposals, such as an ERC or STC, that smaller portion can be significant due to the size of the grant itself.

That said, keep in mind when planning, developing, and proposing broader impacts activities in the research narrative that these activities benefit enormously from being described in the (1) logical context of the proposed research; (2) in the context of *evidence-based models, best practices, literature, and theory*; and (3) in the context of the *evaluation metrics* that will convince reviewers and program officers of the value of the proposed BI activities.

Moreover, keep in mind that NSF often looks for scalable, inquiry-based BI models, particularly in the domain of K-12 STEM outreach and education. Of course, in the case of K-12 outreach and education, the PI of any research proposal, regardless of size, will need significant support from someone knowledgeable in this domain. The uninitiated PI will face many challenges related to evidence-based models for STEM collaboration with K-12 teachers and student engagement, scale and scope of K-12 outreach activities within budget and time constraints, the interface of proposed BI activities with governing science standards and curricula in the schools, etc. For most PIs on research proposals, K-12 outreach is uncharted territory and they will need a guide to go there. (See *Achieving Broader Impacts in the National Science Foundation, Division of Environmental Biology*).

Also, metrics at NSF are not merely a factor in the review of the proposal but in the annual review of many funded projects, particularly at the center level. Moreover, when it comes to BI, *NSF is not a monolithic agency where one BI model fits all NSF directorates*, divisions, and programs. NSF is an agency of multiple cultures, each of which may *view, review, and reward BI components of the research narrative differently*. Keep in mind as well that NSF favors BI educational models that are replicable at other institutions rather than institutionally specific models that resist dissemination. As an agency, NSF is all about funding new models with widespread relevance to other institutional domains and settings rather than funding institutionally-specific projects that they would essentially consider a "BI one off."

This tight coupling of broader impacts activities with evidence-based models, best practices, and evaluation metrics imposes a very important initial condition on writing the BI components of a project narrative *whose goal is to be underlined funded by NSF*. **Bottom Line**: NSF wants to invest in what works. NSF program officers and reviewers will not buy "*a pig in a poke,*" no

matter how beautiful the seller may claim the pig to be. NSF is all about evidence-based STEM teaching and learning models and proven best practices, and for research that improves evidence-based practices in STEM education. Moreover, NSF clearly favors and rewards BI and education models that draw upon the existing literature and, in turn, contribute to it in some important way. Keep this in mind when considering how to write a BI component to a research grant, including NSF grants in which STEM learning itself is the research.

While there are many perspectives on BI from many disciplinary or even philosophical vantage points, if you are yourself or assisting others to write a proposal to NSF, you need to understand BI as NSF sees it *and not as you may want it to be*. For the grant writer, a decidedly applied and strategic skill, *continuously calibrate what you propose to do with what the agency asks you to do*. In the case of BI, do not forget what NSF defines as the five core elements to be considered in its review of your BI narrative (Chapter III - NSF Proposal Processing and Review), especially element 3: "Is the plan for carrying out the proposed [BI] activities well-reasoned, well-organized and **based on a sound rationale**? *Does the plan incorporate a mechanism to <u>assess success</u>*?" How you interpret "*sound rationale*" and "*mechanism to assess success*" will determine the effectiveness of your proposal's BI narrative section. A prudent reading of element 3 would suggest you equate "*based on sound rationale*" with **evidence-based activities** and best practices, and that you equate "*mechanism to assess success*" with evaluation **metrics**. Of course, these two definitions in practice intertwine and depend upon one another. But in all cases, **metrics matter at NSF**.

The evidence-based BI activity model requires evaluation metrics. Fortunately, most of the core NSF goals underpinning BI activities allow quantitative descriptions of the impact of BI activities, e.g., improved teaching and learning, demographics, retention, curricula, engaging underrepresented groups and communities, etc. Moreover, BI models that meet the NSF expectations for innovation, effectiveness, and dissemination to other domains will require strong and compelling evidence. *There is no getting around the fact that, at NSF, evidence-based models and metrics matter*.

So when you propose a BI activity, you must also be able convincingly to evaluate its success. Therefore, keep the need for evidence-based models and metrics in mind when you start planning, developing, and writing a BI component(s) to the research narrative. By doing so, you will ensure that reviewers and program officers easily recognize how the proposed activities, outputs, and outcomes will be evaluated (See *Logic Models for Program Design, Implementation, and Evaluation: Workshop Toolkit*).

Federal agencies are placing an increasing emphasis on evidence and the need to build the evidence base that supports research programs in the congressional appropriations process. String theorists may get a pass at NSF and be funded, regardless of the fact that no one has yet, presumably, figured out an evidence-based way to test the theory. *But if you are proposing broader impacts activities in an NSF research proposal in which your BI activities and rationale are informed neither by the evidence-based literature nor by metrics, do not expect such a consideration to be extended to you*.