Overcoming Obstacles to Broader Impacts Implementation

Alisa Zornig Gura, Gina Svarovsky, Catherine Wagner, Heather Boyd, and Jessica Brookshire

Abstract

Broader Impacts (BI), or the potential for academic research to benefit society, are an important and growing function of higher education. Government agencies and private foundations increasingly expect researchers to clearly articulate BI in addition to intellectual contributions to their fields. In response to these expectations and the University of Notre Dame's (ND) mission, the Center for Broader Impacts was established in 2022 to simultaneously enhance institutional efforts to support competitive research proposal development and contribute to the overall societal impact of ND by collaborating with faculty, campus units, and external partners to design, implement, and evaluate effective BI opportunities for a wide range of audiences. Drawing from expertise across a variety of faculty and staff practitioners, as well as discussions the authors participated in with seven other diverse universities as members of the Center for Advancing Research Impact in Society's (ARIS) Program to Enhance Organizational Research Infrastructure Capacity (ORIC) Cohort 5 training sessions, this article helps inform BI practitioners in higher education of potential obstacles, opportunities, and approaches to supporting researchers across their own campuses and communities, while also highlighting nuances of working with researchers for BI partners. An example model for a sustainable approach to BI programming is also offered in the context of the future of BI.

Federal investment in research universities is a complex and unique model in the U.S. that advances science, engineering, and technology for public health, economic vitality, education, and other societal benefits. This government-academic partnership for catalyzing innovation includes more than 20 federal agencies that use public funds to support scientific research (National Academies of Sciences, Engineering, and Medicine, 2016), making investment of funds for the benefit of the general public a national imperative. We often refer to Broader Impacts (BI) in relation to the National Science Foundation (NSF), the entity created by Congress in 1950 that supports 24% of all federally funded academic fundamental research in colleges and universities in the U.S. (NSF, n.d.). NSF defines BI as "the potential to benefit society and contribute to the achievement of specific, desired societal outcomes" (Office of International and Integrative Activities [OIIA], Office of Legislative and Public Affairs, and the Division of Molecular and Cellular Biosciences, 2014, p. 3). While the NSF established BI as its own review criterion separate from Intellectual Merit for all research proposals in 1997 (OIIA et al., 2014), planting the flag for the concept and coining the terminology, many other federal and private foundations expect researchers to articulate, implement, and evaluate how their research benefits society.

With the aforementioned funding, expectations and the University of Notre Dame's (ND) mission to "create a sense of human solidarity and concern for the common good that will bear fruit as learning becomes service to justice" in mind, the Center for Broader Impacts (CBI) was launched by ND Research in 2022 (University of Notre Dame, n.d.). CBI is part of a strategic effort to simultaneously enhance institutional efforts to support competitive research proposal development and contribute to the overall societal impact of the University. Specifically, CBI focuses on collaborating with ND researchers, campus units, and external partners (e.g., K–12 schools, nonprofit service organizations, local governments, higher education institutions) to design, implement, and evaluate effective BI opportunities for a wide range of audiences. CBI also houses its own K–12 student research

This article is included in a special issue focused on the Implementation and Evaluation of the ARIS Broader Impacts Toolkit project, which is designed to advance the understanding of mechanisms and supports needed to develop effective Broader Impacts (BI) statements. The full issue can be found at https://jces.ua.edu/37/volume/17/issue/2

experiences and K–12 teacher workforce training programs to respond to BI priorities expressed by local community partners.

CBI's process begins by establishing trust with partners and listening to understand how/whether they envision Broader Impacts of research contributing to their organizational objectives. For example, the Robinson Community Learning Center's (RCLC) Summer Youth Programs keep K–12 students from historically marginalized communities in South Bend, IN, mentally and physically active through learning activities, hands-on projects, social interaction, creative expression, and field trips during the summer. CBI and RCLC meet regularly to discuss possibilities for mutually beneficial collaboration. Additionally, several ND researchers have connected with RCLC via CBI to develop week-long summer camp modules related to their research themes as part of NSF BI plans. The idea came from RCLC leadership, and CBI acts as a conduit to engage with researchers whose experience and interests align. CBI also advises researchers in partnership development by sharing best practices, such as implementing a smaller-scale version of proposed BI activities with partners if a proposal is not funded.

In the first 18 months of operations, CBI's team of 1.25 FTE supported 135 research proposals, led the submission of two community-facing research proposals, and participated in the Center for Advancing Research Impact in Society's (ARIS) Program to Enhance Organizational RI Capacity (ORIC) 2023 Cohort training. It is notable that while CBI is a nascent unit, the team involved in its operations have been practicing BI work via an ad hoc approach for more than a decade, including partnership development, designing and evaluating BI programs, and connecting researchers with BI for mutually beneficial outcomes. Practitioners in this space often experience roadblocks to implementing BI, and despite careful program design and thoughtful preparation, even the best plans can derail quickly due to internal and/or external factors. Authors are BI practitioners from ND that have incorporated their experienced perspectives while representing CBI, Community Health and Clinical Partnerships, and Research Development with input from the broader ND academic community, including eight affiliated faculty/staff members representing ND Research, Office of the Provost, Office of Public Affairs, Institute for Educational Initiatives, and multiple departments within the College of Science and the College of Engineering. The authors also drew influence from participation in ORIC Cohort training discussions. The purpose of this article is to maximize the societal benefits of academic research by helping inform BI practitioners in higher education of obstacles, opportunities, and approaches to supporting researchers across their own campuses and communities. While the list of potential obstacles below is not exhaustive, it is intended to provide insight for BI practitioners into what to anticipate and how to adapt to changes that occur between proposal submission and implementation. It is also intended to inform BI partners of some of the nuances of collaborating with researchers for BI.

Obstacles to Broader Impacts

Community Partner Experiences

Drawing from the Carnegie Foundation's Elective Classification definition, community engagement is a "collaboration between institutions of higher education and their larger communities (local, regional/state, national, global) for the mutually beneficial exchange of knowledge and resources in a context of partnership and reciprocity" (American Council on Education, n.d.). Working in the BI space, practitioners learn quickly that not all university-community collaborations lead to reciprocal partnerships and mutually beneficial outcomes. This may rightfully leave partners hesitant to engage with new researchers or other campus representatives. BI practitioners are positioned to think carefully about reciprocity to ensure co-creation of activities that benefit the work of both the researcher(s) and partner(s).

Personnel Changes

It is common for 6–12 months to pass between a research proposal submission and award, and it may be another several months to years before a BI activity is launched, leaving a significant timespan for changes in personnel. While personnel transitions may run smoothly, they may also pose challenges with institutional memory, priorities, skill sets, and interests. It is important for BI practitioners to communicate and build organizational trust across campus and community partners, so when individuals cycle out of positions the work continues.

Timelines

A proposal team may think carefully about their BI implementation timeline only to find their funding agency's timeline does not align.

Additionally, reviews may take more or less time than anticipated; budgets may require negotiation; the government may shut down, and other external factors may delay plans. While postponing BI implementation provides a simple solution, that may negatively impact partner objectives and hinder proposed BI outcomes. BI practitioners may help researchers adapt the scale and scope of their activities when timing is misaligned to preserve relationships and achieve societal impact.

Personnel Time

When new BI activities are proposed, it is often difficult to anticipate precisely how much time will be required for successful implementation. Additionally, without guaranteed funding, both PIs and partners might sign on to multiple proposals and have several awarded at once. In this "feast or famine" environment, it can be arduous to manage personnel time for implementing new efforts without detracting from other responsibilities of team members. BI practitioners are well positioned to understand and communicate the reality of time requirements for BI implementation and advise on personnel solutions for successful implementation.

Sustainable Funding

Many BI practitioners may relate to the feeling of designing and implementing a meaningful project or program, only to have it sunset at the end of a funded grant effort. While the idea of research proposals seeding sustainable BI efforts is exciting, it may prove difficult for implementation teams to continue these efforts beyond the grant duration. BI practitioners are positioned to build a knowledge base of opportunities where researchers may leverage existing, sustained infrastructure to enhance or expand impact without adversely affecting a program once grant funding sunsets.

Opportunities for Broader Impacts

External Research Funding

In addition to the NSF, many other federal and private foundations that fund academic research are increasingly requiring researchers to clearly define, articulate, and measure how their research will benefit society. By embedding this within the proposal process and allowing costs of BI activities within project budgets, these agencies are signaling that societal benefits are an expectation, not merely an add-on to the research they wish to fund. This provides BI practitioners with the opportunity to think about long-term campus-wide initiatives in addition to traditional case-by-case approaches.

Community Assets

Academic institutions play an important role in their communities, and the current societal landscape calls for increased cross-sector collaboration for mutual benefit. For example, universities depend on well-prepared applicants for enrollment and tuition, and a researcher who partners with a local school teacher to provide research opportunities for K–12 students enhances the communities' assets to the benefit of both of the organizations as well as the individuals involved. Well-established partnerships broaden the impact of academic research by building from the existing assets within their communities.

Researchers' Interests

Researchers are driven by curiosity and inquiry to advance knowledge and contribute to their fields of expertise. In addition, many researchers, whether fundamental or applied, are also driven by their potential to contribute to broader societal needs through their work. By providing support and infrastructure where researchers may contribute to existing efforts to broaden participation, increase societal well-being, strengthen the workforce and economy, and improve education, institutions can aid in both career satisfaction and advancement of their faculty.

Future of Broader Impacts

While challenges to implementing BI of research persist, possibilities to advance the positive impact of research in society will continue to grow. With the increased investment in BI from funding agencies and support for BI practitioners coming from ARIS's ORIC network, universities often can pivot from case-by-case BI approaches to long-term, sustainable, and scalable approaches that leverage their infrastructure, allowing flexibility with BI implementation.

For example, utilizing existing infrastructure and expertise at ND's CBI, Center for STEM Education (CSE), College of Science, and College of Engineering, the STEM Teacher Residency (Residency) program provides a weeklong experience for middle school science, math, and technology/computer science teachers. This program broadens the impact of researchers as their proposals are funded while alleviating the aforementioned obstacles to implementation. From the lens of the BI practitioner, the Residency program contributes to K–12 STEM Education and Workforce Development, but the obstacles often faced when implementing BI

activities are assuaged, namely personnel time commitment, timelines of PIs and partners, mutually beneficial partnerships, and sustainable funding. Community partners are only engaged in the project once funding is secured and teachers are recruited, so relationships are not adversely impacted based on the outcome of proposals. The model allows for flexibility in the timing of the week-long implementation period in research labs between June and August, providing more control over when a project may launch. The in-person time commitment of the researcher is contained to 2.5 days per year, and preparation is completed at their own pace. The personnel involved in the Residency already operate summer programming on campus and can adapt their schedules based on the number of proposals that fund Residency projects. Additionally, in summers where no Residency projects are funded, personnel are not negatively impacted as they are able to redirect their efforts to other projects.

Residency participants are recruited from a pool of educators who have completed the STEM Teaching Fellowship (STF), a sustained program housed within CSE. During the Residency, participants engage with ND faculty and graduate students, who provide an introduction to the cutting-edge STEM topics central to their funded research. Participants then make connections between these experiences in the lab and the STEM content and practices they engage with in their classrooms. They also begin curriculum planning and creation, where they focus intentionally on developing high quality STEM integration experiences for their students. These resources are tested in their classrooms, revised, and then shared with the broader STF community and other national dissemination channels, such as the National Science Teaching Association conference for teachers. The goals of the Residency are to provide middle school teachers with an opportunity to:

- gain exposure to current research and applications being explored by ND faculty
- explore and identify connections between rich, disciplinary research contexts in STEM fields and the educational standards used in K–12 STEM classrooms (e.g., Common Core Mathematics Content/Practice Standards and the Next Generation Science Standards)
- develop and disseminate novel and robust curriculum materials for STEM integration based on these connections.

In terms of outcomes, in 2019, seven teachers participated in the pilot Residency focused on the content areas of chemistry and computer science. In 2022, three teachers participated in the Residency that focused on nanoscience in chemistry. Internal evaluation data from both years suggests that the 10 participants found the experience extremely valuable and impactful, with all reporting sizable gains in confidence around multiple content areas in both chemistry and computer science. The 2019 participants produced three high-quality STEM integration curriculum packages, and the 2022 participants produced a suite of lessons across disciplines in a curriculum package for students on the topic of nanoparticles. In 2022, participants collected student data following the implementation of their nanoscience lessons as part of their standard lesson assessments. These student responses indicated positive engagement and interest in science. Two additional teachers are participating in the Residency in 2024 as part of a funded NSF BI plan, and two additional ND researchers have embedded the Residency within BI plans of pending NSF proposals. This model will continue to scale-up to meet the K–12 teacher workforce development needs within our community via BI of academic research efforts at ND.

Conclusions

This is an exciting time for CBI as momentum with research funding continues to push toward measurable societal impacts. BI practitioners play a pivotal role in understanding the needs and opportunities of both researchers and BI partners and developing mutually beneficial BI plans that positively impact society. Resources such as ARIS's network of expert BI practitioners and their growing platform for dissemination of BI knowledge via ORIC provide an avenue for best practice and overcoming obstacles for successful BI implementation. Looking toward the future as experts continue to engage in this important work, exciting opportunities are developing to advance BI scholarship through innovative approaches and models for sustainability.

Acknowledgements

We thank Dr. Patricia L. Clark, Associate Vice President for Research at the University of Notre Dame; Dr. Jeffrey F. Rhoads, Vice President for Research at the University of Notre Dame; all of our faculty and staff affiliates, and campus and

community partners for their ongoing support of our efforts to amplify the impact of our University's research endeavors.

Funding Information

The STEM Teacher Residency teachers were funded by the National Science Foundation Award Numbers 1609394, 1709566, and 2108330. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Authors' Contributions

Alisa Zornig Gura led the conceptualization and writing of the submission. Gina Svarovsky and Catherine Wagner contributed the STEM Teacher Residency program overview and data. All authors contributed to the ideas articulated in the paper and final paper edits.

About the Authors

All authors are affiliated with Notre Dame Research. Alisa Zornig Gura is the associate director of the Center for Broader Impacts. Gina Svarovsky is the faculty director of the Center for Broader Impacts. Catherine Wagner is the education and workforce development program director in the Center for Broader Impacts. Heather Boyd is the research development program director. Jessica Brookshire is the senior program director of community health and clinical partnerships.

References

American Council on Education. (n.d.). *The Elective Classification for Community Engagement*. Carnegie Classification of Institutions of Higher Education. Retrieved June 18, 2024, from https://carnegieclassifications.acenet.edu/elective-classifications/community-engagement/

Office of International and Integrative Activities, Office of Legislative and Public Affairs, & the Division of Molecular and Cellular Biosciences. (2014). *Perspectives on Broader Impacts*. (National Science Foundation Publication No. 15-008). Office of the Director, Directorate for Biological Sciences, National Science Foundation. https://nsf-gov-resources.nsf.gov/2022-09/Broader_Impacts_0.pdf

National Academies of Sciences, Engineering, and Medicine. (2016). *Optimizing the nation's investment in academic research: A new regulatory framework for the 21st century*. The National Academies Press. https://doi.org/10.17226/21824

National Science Foundation. (n.d.). *NSF By the Numbers* [Fact sheet]. Retrieved March 21, 2024, from https://www.nsf.gov/news/factsheets/Factsheet_By%20the%20Numbers_05_21_V02.pdf

University of Notre Dame. (n.d.). *Mission*. Retrieved March 1, 2024, from https://www.nd.edu/about/mission/