

# Introduction and Welcome: Building Capacity and Resources for Advancing Research Impacts in Society (ARIS)

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This special issue is the result of a two-year effort to identify, pilot, and publish scholarly research about the National Science Foundation's (NSFs) broader impacts (BI) criterion and its role in community engagement as an integral part of agency-funded research projects (NSF OIA-2140950). NSF's BI requirements reflect its intention to support research that not only pushes the boundaries of scientific knowledge, but also makes meaningful contributions to society.

Participating institutions worked to build capacity in their researchers to better develop BI projects, including those that enhanced their engagement with local communities. This issue highlights the work, outcomes, and recommendations of these institutions as they explored BI resources and frameworks for building the research impact capacity of researchers and institutions.

## Background

Recent trends worldwide in higher education, government, nonprofit, and industry sectors have supported a renewed interest in the mission to serve and benefit society through research, the U.S. being no exception (NSF, 2023a; Mervis, 2024; NSB, 2030; Bauer et al., 2007). This trend is manifesting through a variety of approaches, including broadening participation through an increased emphasis on culturally responsive teaching (Cochrane et al., 2017; Lehtomäki et al., 2017; Nketsia et al., 2017; Kahangwa, 2017), community engagement and service learning (Ducar & Ellerbee, 2023; Bernando et al., 2012; VanWynsberghe & Andruske, 2007), diversity initiatives to increase representation and inclusion of groups underrepresented in STEM (science, technology, engineering, mathematics) including students, faculty, and staff (Ducar & Ellerbee,

2023; Bowen et al., 2023), and commitments to advancing diversity, equity, and inclusion as core values of university institutions. Higher education is indeed shifting toward a more socially responsible and inclusive approach that aims to benefit both individuals and society as a whole (Nicotera et al., 2022).

Likewise, the NSF is increasingly being asked to connect its research investments to the public good. Traditionally, the NSF has two criteria, Intellectual Merit (IM) and Broader Impacts (BI), that are considered the gold standard in the merit review process (NSF, 2023b). The NSF expects researchers' work to have the potential to benefit society and contribute to the achievement of specific desired societal outcomes. This includes, but is not limited to, increasing and including the participation of women, persons with disabilities, and minority groups underrepresented in STEM; improving education and educator development at any level in STEM; developing a more diverse, globally competitive STEM workforce; increasing the economic competitiveness of the U.S.; and improving national security (NSF, 2023a). In its guidance, NSF refrains from providing prescriptive recommendations on how broader impact goals should be achieved, but their guidance lists ten different examples of BI investment areas (NSF, 2024).

However, there is still confusion and inconsistency as to the interpretation and review of BI, as well as persistent challenges across stakeholder groups in realizing the promise of BI (National Alliance for Broader Impacts [NABI], 2018). These challenges include a lack of clarity about the specifics of the BI criterion, the relative weighting between BI and intellectual merit review, whether the academic culture would be willing to incentivize BI activities,

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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>

and how to generate adequate BI resources to support BI (NABI, 2018; Renoe et al., 2023). Consensus emerged that BI could be advanced nationally with further professionalization of the BI community through enhanced individual and institutional capacity achieved through training for researchers, institutions, and other stakeholders (Renoe et al., 2023).

In 2018, ARIS was funded with investment from all NSF directorates to help coordinate the BI community and advance scholarship of BI. ARIS now has an active community of more than 1,000 members worldwide and supports U.S. and international scientists and engagement practitioners in building the capacity of researchers and institutions to engage more deeply with, and orient research efforts in response to, communities and civic society (Association of Public & Land-Grant Universities, 2019; Christopherson et al., 2018; Dahlberg & Beninson, 2020; Saltmarsh & Johnson, 2018). By design, ARIS helps level the playing field for BI professionals and researchers in a range of contexts to have the resources and support needed to develop strong BI plans.

The research community is undergoing a significant transformation in how it conceptualizes and addresses the NSF BI criterion (NSB, 2030). In practice, many academic institutions are providing professional development, training, support, and brokerage services for researchers who want help with their BI plans. For example, ARIS is facilitating the Organizational Research Impacts Capacity (ORIC) program with 27 institutional members who are integrating BI project development with their community engagement work.

However, as noted with many science communication efforts in the U.S., these practices are disjointed among institutions (Bevan & Smith, 2020). ARIS is a unique network that facilitates the development of the human resources necessary for sustained growth and increased diversity of the BI community. ARIS supports cross-institutional collaboration on and dissemination of BI programs, practices, models, materials, and digital resources, such as the ARIS Toolkit (see [Hotaling et al.](#) in this special issue), hereafter referred to as the “Toolkit.” The Toolkit is a growing and evolving collection of digital resources designed to help researchers improve the rigor of their BI activities. These activities include the planned experience or engagement that is conducted for the specific purpose of providing benefit to society associated with funded research.

Over a two-year period, the ARIS BI Toolkit was pilot tested with BI professionals located within ten institutions geographically distributed across the U.S., representing a range of R1 and R2 institutions, Land Grant Institutions, and Minority Serving Institutions, with BI professionals serving in centralized and decentralized capacities within the institutions (McDonnell et al., 2024). Each served as a case study to better understand the range of ways in which the Toolkit can be used and understand the factors that promote and threaten successful implementation across contexts. Together we explored questions such as: What contextual factors do participants (researchers, BI professionals) perceive as influencing their implementation of the Toolkit? How do the collaborators characterize their use of the Toolkit concurrently and over time? To what extent are institutional-level outcomes related to the BI capacity associated with the Toolkit use?

This special issue will present the results of the wide-ranging implementation scenarios, each with different starting and inflection points, and each providing insight into how institutions support the development and facilitation of BI plans, and the tools they use to do so. We explore the range of ways in which the Toolkit can be used and to understand the factors that promote and threaten successful implementation of BI work. We examine associations between Toolkit use and institution level-outcomes, including the degree to which the Toolkit supports capacity building at institutions for BI and engaged scholarship. Case studies reflect BI professionals’ and researchers’ views about the usefulness of the Toolkit, associations between Toolkit use and institution-level outcomes, and how the Toolkit can be adapted to align with institutional needs. These case studies broadly cover four contexts for BI development, including institutional change, program assessment, professional development, and further research in BI conceptualization and BI identity.

**First, the Toolkit can support institutional development and change in the areas of BI promotion, development, and community engagement.** [McNall et al.](#) show us that ARIS resources writ large positively impacted Michigan State University’s (MSU) capabilities in BI work. [McNall et al.](#) highlight the interplay of ARIS’s Organizational Research Impact Capacity (ORIC) program and the Toolkit, and how they address critical aspects of public engagement (see [Gura et al.](#) for more information on the ORIC program). The experiences of BI professionals

at MSU demonstrate that a supportive and well-resourced BI Community of Practice (CoP) at the national and institutional level are essential for BI professionals to make effective use of the Toolkit and assist researchers in developing BI plans that are innovative, inclusive, and impactful.

Similarly, Merchant et al. at the City University of New York (CUNY) conclude that the Toolkit can lower the burden on the Office of Research staff by developing useful training modules for researchers that build capacity at resource-limited institutions. Because many CUNY colleges do not have dedicated research development staff, expanded BI expertise and training through ARIS and the Toolkit magnify the ability of faculty to write successful proposals and thus increase overall research and training capacity.

**The Toolkit can also support project and proposal development and assessment.** Iverson et al. provide a critical review of the BI rubric as one of the key tools in the Toolkit. To understand the potential utility and relevance of the rubric for researchers, a panel of 20 researchers were invited to use the rubric against a set of BI plans and then participate in one of two virtual focus groups. Results show strong content validity and reliability across many of the criteria of the rubric. Users imagine the rubric's use in several different ways—including, but not limited to, writing a BI plan, implementing a plan, assistance when serving on a panel, and helping with professional development at their institution. The range of these uses was strengthened by the involvement of these different communities as part of the development.

Pendley and Shahid focus on the BI rubric and how faculty's applications might be strengthened with the help of the ARIS rubric. Pendley et al. also explore how the ARIS rubric can be useful in leading faculty to mutually beneficial collaborations that increase community capacity and science literacy. Based on their application of the rubric, they hypothesize that the ARIS Toolkit will increase the potential to develop community-engaged collaborations based on principles of reciprocity: mutually beneficial, co-designed projects with sustainable impact with audiences and partners.

Bosely et al. at the University of Nebraska Lincoln (UNL) provide an analysis of the integration of research and education in NSF Faculty Early Career Development (CAREER) proposals submitted by UNL faculty, using the BI rubric. The CAREER program is NSF's foundation-wide program that offers the most prestigious

awards in support of early-career faculty who have the potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization. Bosely et al. show us how the Toolkit can be used specifically for early career researchers to implement practical strategies that strengthen this aspect of grant proposals.

**The Toolkit can provide support for the professional development of researchers and BI professionals in BI work.** Johnson et al. studied how the Toolkit could be used as a professional development tool for BI professions. Based on the study and the advice of study participants, they advise the BI Toolkit can be used in a formal process of onboarding novice BI professionals. By using these resources, those new to BI develop familiarity with the field through analysis of proposals, are prepared for conducting consultation meetings with researchers, and assist in planning and writing the BI plans of proposals.

Willoughby and Bug similarly applied the Toolkit in their own work as BI professionals and showed us how the toolkit was used to develop and evolve a consulting protocol for their prospective universities. Willoughby, who is at the University of Texas at Dallas, and Bug, who is at North Carolina State University, found that creating a consultation protocol from the Toolkit resources provides a platform for a BI professional to assist researchers with the development of and planning for BI activities.

**Finally, the concept of BI and the ways to effectively support it is still evolving and is context specific. The Toolkit can serve as a framework to support further research on BI work impact, BI identity, and other advancements in the BI field.** Telliell and Chen examined the ways in which BI resources such as the ARIS Toolkit can assist academics to explore BI identity and their personal connection to BI, while increasing critical engagement with diversity and inclusion in research and education, as well as promoting ethical engagement with the local community.

Both Yohalem and Torres and Grant et al. explore the importance of fostering authentic and productive research relationships across the lifecycle of a research project with the help of the BI Toolkit. Both articles provide thoughtful discussion on the importance of augmenting or constructing new tools that reflect the voices and insights directly from community partner representatives—the people researchers would

approach to create collaborations to implement BI activities. These BI tools would serve to help researchers build intentional relationships, which must be at the core of any program or project that aims to create societal impact. Therefore, resources like the Toolkit play a critical role in serving as a primer in research fields dedicated to creating societal impact and as a guide for how to operationalize lessons from those fields. Together, these articles provide a forward-looking lens by multiplying or diversifying contexts and stretching the Toolkit to the point of adaptation or “breaking,” which leads to new ideas and resources.

Shahid’s article perhaps best summarizes the experience of our ARIS Toolkit test sites. As a Pakistani-born woman with a Doctor of Medicine (MD), a Master of Public Health, a Master of Human Resource Administration, and who is currently working on a doctorate in Health Communication and Social Influence, Shahid describes herself as “profoundly inspired” to continue to brainstorm creative BI solutions around research and development for her people back home in Pakistan. Ultimately, the toolkit facilitates and strengthens the ability of the researchers to develop creative and productive plans that benefit society from their research. ARIS provides a supportive network and resources so that researchers and BI professionals in a range of contexts can fully contribute to the broader STEM enterprise.

The JCES focus on community practitioners embodies the principles of the ARIS community and its intention to build the capacity of BI professionals and researchers. Through sharing their work, JCES advances universities’ principles and missions. The Toolkit strives to support researchers in creating BI plans that are integrated with their research, aligned with their personal goals and values, and contribute to their institutional goals and values. As researchers have embraced BI, it has become less of a burden and more of an opportunity for self-expression and fulfillment (Nadkarni et al., 2019; Risien & Storksdieck, 2018).

We thank Dr. Drew Pearl for being so inviting and allowing us to collaborate and share our exploration at the intersection of NSF’s Broader Impacts and community-engaged scholarship. We extend our heartfelt gratitude to all the authors who have generously shared their expertise and findings. Their dedication and scholarship have enriched this special issue and the contributed stories they tell significantly advance knowledge in our fields. We would also

like to express our appreciation to the reviewers and editorial team whose meticulous efforts ensured the quality and integrity of the published work. As you explore the pages of this special issue, we hope you find inspiration, knowledge, and new avenues for thinking about the intersection of BI and community engagement. We hope that the contributions in this issue serve as a catalyst for further exploration and innovation!

## References

- ARIS Toolkit. (2023). *ARIS Broader Impacts Toolkit*. <https://aris.marine.rutgers.edu/index.php>
- Bauer, M.W., Allum, N., & Miller, S. (2007). What can we learn from 25 years of PUS survey research? Liberating and expanding the agenda. *Public Understanding of Science*, 16(1), 79–95. <https://doi.org/10.1177/0963662506071287>
- Bernando, M.A.C., Butcher, J., & Howard, P. (2012). An international comparison of community engagement in higher education. *International Journal of Educational Development*, 32(1), 187–192. <https://doi.org/10.1016/j.ijedudev.2011.04.008>
- Bevan, B., & Smith, B. (2020). United States of America: Science communication in the USA: It’s complicated. In T. Gascoigne, B. Schiele, J. Leach, M. Riedlinger, B.V. Lewenstein, L. Massarani & P. Broks (Eds.), *Communicating science: A global perspective* (pp. 959–982). Australian National University (ANU) Press. <https://doi.org/10.22459/CS.2020>
- Bowen, G.A., Berrien, C.A., & Bennett, R. (2023). Community engagement strategies for responding to sociopolitical and racial challenges facing American society and higher education. In E. Klaw, A. Tully & E.K. Ikeda (Eds.), *Reframing community engagement in higher education* (pp. 11–29). Routledge. <https://doi.org/10.4324/9781003448525>
- Association of Public & Land-Grant Universities. (2019, November). *Public impact research: Engaged universities making the difference*. <https://www.aplu.org/library/public-impact-research-engaged-universities-making-the-difference/file>
- Christopherson, E.G., Scheufele, D.A., & Smith, B. (2018). The civic science imperative. *Stanford Social Innovation Review*, 16(2), 46–52. <https://doi.org/10.48558/6k46-1c68>
- Cochrane, S.V., Chhabra, M., Jones, M. A., & Spragg, D. (2017). Introduction: Cultural literacy, cultural humility, and reflection. In S.V. Cochrane, M. Chhabra, M.A. Jones & D. Spragg (Eds.), *Culturally responsive teaching and reflection in higher education: Promising practices from the Cultural Literacy Curriculum Institute* (pp. 1–10). Routledge. <https://doi.org/10.4324/9781315283333>



- Dahlberg, M.L., & Beninson, L. (2020). *Re-envisioning promotion and advancement for STEM faculty: Proceedings of a workshop in brief*. National Academies Press. <https://nap.nationalacademies.org/catalog/25742/re-envisioning-promotion-and-advancement-for-stem-faculty-proceedings-of>
- Ducar, J., & Ellerbee, D. (2023). Community-engaged partnerships when healthy relationships are the priority. In E. Klaw, A. Tully & E.K. Ikeda (Eds.), *Reframing community engagement in higher education* (pp. 213–232). Routledge. <https://doi.org/10.4324/9781003448525>
- Kahangwa, G.L. (2017). Cultural strategy for developing a knowledge-based economy in the Global South: The case of Tanzanian higher education. In E. Lehtomäki, H. Janhonen-Abruquah & G.L. Kahangwa (Eds.), *Culturally responsive education: Reflections from the Global South and North* (pp. 52–67). Routledge. <https://doi.org/10.4324/9781315201900>
- Lehtomäki, E., Janhonen-Abruquah, H., & Kahangwa, G.L. (2017). Introduction: Culturally responsive education: From vision to practice. In E. Lehtomäki, H. Janhonen-Abruquah & G.L. Kahangwa (Eds.), *Culturally responsive education: Reflections from the Global South and North* (pp. 1–14). Routledge. <https://doi.org/10.4324/9781315201900>
- McDonnell, J., Lichtenwalner, C.S., Renoe, S., Hotaling, L., Iverson, E., & O'Connell, K. (2024). Explore the ARIS Toolkit and its application across universities. *ARIS Summit Proceedings*.
- Mervis, J. (2024, February 23). National Science Foundation grant reviewers urged to think more about 'societal benefits'. *Science*. <https://doi.org/10.1126/science.zu7er78>
- Nadkarni, N.M., Weber, C.Q., Goldman, S. V., Schatz, D.L., Allen, S., & Menlove, R. (2019). Beyond the deficit model: The ambassador approach to public engagement. *BioScience*, 69(4), 305–313. <https://doi.org/10.1093/biosci/biz018>
- National Alliance for Broader Impacts (NABI). (2018, January). *The current state of broader impacts: Advancing science and benefiting society*. <https://researchinsociety.org/wp-content/uploads/2021/02/NabiCurrentStateOfBI-011118.pdf>
- National Science Foundation (NSF). (2023a, January). *Proposal and award policies and procedures guide, NSF 23-1*. [https://nsf-gov-resources.nsf.gov/2022-10/nsf23\\_1.pdf](https://nsf-gov-resources.nsf.gov/2022-10/nsf23_1.pdf)
- National Science Foundation (NSF). (2023b, June). *Merit review process: Fiscal year 2021 Merit Review Digest*. [https://nsf-gov-resources.nsf.gov/2023-06/FY\\_2021\\_Merit\\_Review\\_Digest.pdf](https://nsf-gov-resources.nsf.gov/2023-06/FY_2021_Merit_Review_Digest.pdf)
- National Science Foundation (NSF). (2024). *Broader Impacts*. <https://new.nsf.gov/funding/learn/broader-impacts>
- Nicotera, N., Cutforth, N., Fretz, E., & Thompson, S. S. (2022). Dedication to community engagement: A higher education conundrum? *Journal of Community Engagement and Scholarship*, 4(1), 37–49. <https://doi.org/10.54656/SPEA6513>
- Nketsia, W., Juma, S.K., Malle, A.Y., Pirttimaa, R., & Lehtomäki, E. (2017). Dialogues on culture(s) of inclusion between African and Finnish educators. In E. Lehtomäki, H. Janhonen-Abruquah & G.L. Kahangwa (Eds.), *Culturally responsive education: Reflections from the Global South and North* (pp. 163–173). Routledge. <https://doi.org/10.4324/9781315201900>
- Renoe, S., Adetunji, O., Aurbach, E., Fields, J., Gilbreth, T., Heitmann, M., Johnson, M., Kidwell, B., Nelson, C., Pratt, A., Risien, J., Rover, D., Van Egeren, L., Vassmer, S., & Weintraub, J. (2023). *Evolution of Broader Impacts*. ARIS. <https://doi.org/10.32469/10355/95863>
- Risien, J., & Storksdieck, M. (2018). Unveiling impact identities: A path for connecting science and society. *Integrative and Comparative Biology*, 58(1), 58–66. <https://doi.org/10.1093/icb/icy011>
- Saltmarsh, J., & Johnson, M.B. (Eds.). (2018). *The Elective Carnegie Community Engagement Classification: Constructing a successful application for first-time and re-classification applicants*. Campus Compact, Stylus Publishing.
- VanWynsberghe, R., & Andruske, C.L. (2007). Research in the service of co-learning: Sustainability and community engagement. *Canadian Journal of Education*, 30(1), 349, 376. <https://doi.org/10.2307/20466638>

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