Collaborative Research: Grounding Institutional Partnerships in Structures for Broader Impact Design

Mid-Way Evaluation Report

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Introduction

The purpose of this report is to provide a mid-way evaluation document. This report serves as a record of project status and a set of recommendations for consideration. It is intended to facilitate reflective and adaptive process so that the BID collaborative can renew the project plan and optimize project success and impact moving forward.

Partnerships for Broader Impacts Design (BID) is a three-year collaborative project envisioned to better understand and support higher-education institutions (HEIs) and informal science education organizations (ISEs) develop robust partnerships through collaborative design of education-based Broader Impacts (BI) experiences. Three significant elements (in addition to HEIs and ISEs) were part of the proposed partnership model. They were: 1) “STEM PIs” originally imagined as a rotating position; 2) “learning scientists” with the role of applying the science of learning and science communication to broader impacts design; and 3) “community partners” to ensure the broader impacts design is responsive to the needs of surrounding communities, especially underserved populations. The project builds on the successful Portal to the Public framework, a national public engagement-training program for scientists.

The project includes a **backbone organization** that serves as the central coordinating structure established in the Pacific Science Center and now residing in the Institute for Learning Innovation. There are three initial **site-based teams** (in New York, Wisconsin, and Washington) with roles to test models for enduring partnerships and develop and improve tools that enable additional teams to develop partnerships across HEIs and ISEs in support of broader impacts design and practice. The teams, composed of a participating HEI and at least one ISE, have a mission to identify what practices and structural elements are needed to ensure the connection between the HEI, the ISE, and additional **local partners** is enduring and robust. The **research team** resides at Oregon State University and has an overarching goal to understand characteristics, culture and best practices of university/science center collaborations to advance broader impacts design and implementation. The people working together across eight funded organizations are referred to as the **BID collaborative** throughout this report. In October of 2018, an additional six site-based teams joined what is collectively referred to as the **BID community**.

Funding from the NSF for the BID project began in March of 2017. The backbone organization and teams decided to begin work in September of 2017. This start date aligned with the academic year at HEIs and occurred after staff-intensive summer

programs at ISEs. This report covers the project from the September 2017 effective start date through December 2018 with a focus on the initial three site-based teams.

There has been inconsistent use of language to describe all the players and roles. The following list is a basic lexicon used throughout this report. This may not be the best language moving forward, or the language that resonates most strongly among all the collaborators. Indeed, one recommendation is for the backbone organization to host an effort to clarify language in the BID community.

- **Site-based teams** is used for all the place-based partnership teams including three initial teams and six additional
- **Backbone organization** is the central coordinating body at Institute for Learning Innovation
- **Research team** is leading the research on the partnership and based at OSU
- **BID collaborative (or just collaborative)** includes everyone funded on the collaborative grants to do this work
- **Local partners** includes other local folks with which site-based teams collaborate such as community organizations
- **BID community** includes everyone involved including six additional site-based teams and partners such as the National Alliance for Broader Impacts and the Association of Science-Technology Centers

Evaluation Overview

Embedded in the overall structure of the project is ongoing evaluation for two reasons. First, the design-based research approach enables the research team to participate in the overall project activity with the express role of studying and observing BI partnership activities among the site-based teams and regularly reflecting on progress with the BID collaborative. Second, embedded evaluation streamlines data collection so that data collected for research purposes also serve evaluative purposes. Because evaluative processes have been developmental in nature (i.e., continuous engagement, collaborative reflection, and mutually supportive adaptation), this mid-way report serves as a written record of work to date and a set of general recommendations, the BID collaborative may consider moving forward. Two distinct planned differences between the first phase of the project (covered in this report) and the next phase are: 1) the BID collaborative will shift focus from development of the toolkit with the initial three site-based teams to evaluation of relevance and refinement of the toolkit as they are used by the additional six site-based teams; and 2) the additional six site-based teams began the project with training and toolkit in hand, but without direct funding support to

implement their partnerships. Thus, the report's aim is not formative evaluation rather part of the developmental processes that accounts for the complex nature of the project and supports re-centering and thoughtful adaptive processes over the remainder of the project.

The below questions guided evaluative processes to date.

1. In what ways does the implementation of site-based team partnerships support PIs in successful broader impacts?
2. What challenges dominate and/or persist for the site-based teams?
3. Do site-based teams communicate internally and productively adapt their structures and practices?
4. In what ways has the process of tool development facilitated partnership for the initial three site-based teams?
5. To what degree is the toolkit relevant and useful for additional site-based teams?
6. What, if any, indicators point to partnership institutionalization?

The rest of this report is organized into two sections. Section 1 includes an overview of progress to date and general recommendations for consideration at this mid-point in the project. These recommendations are based on continuous observation guided by the above questions and consensus of the research team who conducted and reviewed the observations. Section 2 includes early findings of interest and a description of the status of research methods and processes that have contributed. These early findings have generally informed the recommendations but are not directly linked to them.

Section 1: Progress to Date and Recommendations

This section focuses on progress to date and general recommendations for the backbone organization and the site-based teams, as well as planned adaptations for the research team. Each subsection (backbone organization, site-based teams, and research team) includes an overview of relevant activities and significant changes or departures from the project proposal or initial plan during the reporting period.

Overall, the BID collaborative has been communicative and engaged. The in-person kickoff meeting in September of 2017 set the stage for adaptive practice and collaborative approaches. That kick-off meeting enabled the collaborative to review and adapt their plans and to develop shared goals and initial language. The primary footprint of that meeting was a shared commitment to conduct site-based work that is responsive to the institutional, geographic, relational, and dispositional factors that create a unique and complex context for each team.

Backbone Organization

The backbone organization takes primary responsibility for coordination among the three initial site-based teams (each with their own NSF grants) and supporting their development, and for the development of the six additional teams. Facilitated by PI Eve Klein and Co-PI Dennis Schatz, this includes the coordination and facilitation of monthly site-based team calls and the “All-Hands” calls. A primary project deliverable is the BID toolkit for HEI/ISE teams to use in partnership development. The backbone organization curates the toolkit (developed by the initial site-based teams), and other collaborative efforts, such as conference presentations, by taking the big-picture view to prioritize tool development and package tools for use additional site-based teams.

Major activities of the backbone organization for this reporting period have been to:

- plan and lead an initial in-person kickoff meeting for members of the BID collaborative;
- facilitate continuous engagement and communication in the BID collaborative;
- track interest in and capacity to develop specific tools;
- prioritize and assign tools for development and inclusion in the draft toolkit;
- coordinate collaborative efforts to present BID work at various national meetings and connect with organizations likely to be end-users of BID findings;
- generate a BID project website;
- recruit and coordinate selection and onboarding six additional site-based teams;
- reflect on progress and conducted project planning to ensure the BID collaborative work is relevant in a changing landscape; and
- coordinate reporting to NSF.

Significant Changes (Backbone organization)

Two significant changes have occurred for the leadership of the backbone organization. First, a change in leadership at the Pacific Science Center (initially the home of the NSF award) shifted the organization’s focus inward, emphasizing the visitor experience and the facility while de-emphasizing national-scale work to move the informal science-learning field forward. The BID project no longer aligned with the priorities of the Pacific Science Center, so the project and the people, found a new home with the non-profit research organization Institute for Learning Innovation. Second, the initial lead PI (Dennis Schatz) was appointed as the President of the National Science Teachers’ Association. With less time available to lead the BID effort, Eve Klein’s role changed from project coordinator to lead PI. Eve currently oversees the collaborative and coordinates work across the broader BID community.

Recommendations (Backbone organization)

As the entity that takes the big-picture view of the BID project, the backbone organization will continue to oversee the facilitation and coordination among the site-based teams. Below are the some areas to prioritize in improving the function of the backbone coordination.

1. Continue to Prioritize Interactions & Meetings - Monthly site-based team zoom calls with the backbone organization and a member of the research team (conducting observations) have been valuable to provide feedback to teams, work through challenges and providing data for research and evaluation. These calls also help to maintain consistent workflow across the project.
2. Enhance Communications across the BID Collaborative - One frequently mentioned challenge is scheduling meetings that include the entire collaborative. Such meetings may need to be scheduled two or three months in advance to enable participation and reduce scheduling problems. The three initial site-based teams have noted that it would be beneficial to hear the progress and actions of the six additional teams and to use the other teams (within the original three) as resources and reference to their own development. There is currently no process for communicating and networking across the larger BID collaborative. The addition and use of a digital collaboration platform may enable networking and communication while also providing an archive of discussions, documents, and activities as a record of work and a way to onboard new team members.
3. Clarify and Cultivate Partnerships with National Entities – Collaborative members value the relationships with other NSF projects and entities; these have potential to provide a foundation for sustainability. At this point in the project, the nature of these relationships is unclear, especially with the Center for Advancement of Informal Science Learning (CAISE), Association of Science-Technology Centers (ASTC), National Alliance for Broader Impacts (NABI), Center for Advancing Research Impacts in Society (ARIS), the National Organization of Research Development Professionals (NORDP), and others. Clarifying the nature of those partnerships may contribute to the overall impact of BID in the long-term.
4. Expand Public Information toward Broadening BID Impact - The BID project has two websites accessible through Portal to the Public and Institute for Learning Innovation. These websites do not include enough information for stakeholders and potential users of BID products. They do not convey the status of the project, ways to learn from or become involved in the project, or what products to anticipate as the project develops. It will be important in the coming months to establish an information strategy to set BID up for successful broader impacts. Given all the partners in the BID community there are several organizations that can link to a more complete BID project web presence.

5. Revisit Toolkit Design - The backbone organization should continue to probe the functioning of the toolkit as a resource for each of the site-based teams. The toolkit promises to be a prominent tangible outcome and legacy of the project. However, the field of broader impacts partnerships is quickly evolving, and the current conception of the toolkit may be too static to have a long-term impact. Although BID tools are unique in their focus on general organizational principles as developed in context of the HEI/ISE partnerships, other organizations and universities are developing similar tools. These include: BI menus created at several universities and shared through the NABI listserv; university-based CAREER workshops, NABI/ARIS broader impact identity trainings; broader impact case studies and matching platforms (NSF funded SciLinkr (<https://scilinkr.com>) and ARIS SciComm case study project); and others. The original site-based teams express they experience value in developing tools together, but emphasize that much of the value emerges from the process of co-development that facilitates understanding across the different organizations rather than from the resulting tools. The toolkit concept should be revisited to optimize impact in this quickly developing field. The toolkit remains the underpinning of developing and maintaining robust partnerships, but the major outcome of the BID needs to address the need for a more dynamic legacy.¹
6. Utilize Design-Based Project Planning - The site-based teams reference alignment and realignment of within team goals as an important aspect of the BID collaborative, yet the BID site-based teams reported goals as the least agreed upon item on the pulse checks. To improve goal alignment within site-based teams, the backbone organization should connect regularly with the research team to reflect on feedback from pulse checks and site-based team observations.

Site-Based Teams

Each of the initial site-based teams includes a participating HEI and a participating ISE. The team structures varies across sites in where the BID project is housed within the organization and how many members are on the team. As noted, a major focus during the reporting period was collaboration on the development of the tools for the toolkit in preparation for the workshop in November 2018 with the addition of the six new site-based teams.

¹ There are early indications that the six new teams find value in certain tools and are using them. Pulse Checks moving forward in 2019 ask all nine teams about which aspects of the toolkit are useful. Given the ongoing evaluation of the project, the research team will provide updates from the pulse check responses to the backbone organization on tool usage.

The three initial site-based teams included in the BID collaborative are:

- Wisconsin - Wisconsin Institutes for Discovery (one partner) and University of Wisconsin, Madison;
- Washington - Pacific Science Center and University of Washington, Bothell; and
- New York - Sciencenter and Cornell University, Ithaca.

Major activities of the site-based teams for this reporting period have been to:

- examine their institutional contexts and cultures to improve partnerships;
- work to expand the partnership beyond the HEI and ISE designated team members to include additional local partners;
- collaborate on tools developing and testing to establish systems and workflows that support the goals of their team;
- work directly with PIs on professional development and broader impacts design with an emphasis on broader impacts activities connected to the ISE programs and needs;
- connect with the BID collaborative on a regular to reflect and share experiences and lessons;
- aid in recruitment and selection of the additional six site-based teams;
- participate as mentors and facilitators on the November 2018 kick-off meeting with the additional six site-based teams; and
- participate as research subjects by completing team concept mapping, interviews, and quarterly pulse check surveys.

The additional six site-based teams were selected from 32 applications to join the BID community. All members of the collaborative participated in reviewing the applications and selected the six teams considering diversity of organizational types, geographic distribution, and quality of application materials. The number of prospective teams that applied to join BID far exceeded the expectations of the collaborative, demonstrating the appetite for HEI/ISE partnerships as a promising pathway to strengthen broader impacts design and implementation. The role of the six additional site-based teams is to expand the HEI/ISE partnerships and test the BID toolkit. The additional teams met in person, along with members of the collaborative, for a partnership kick-off meeting hosted at the Pacific Science Center, in November 2018.

The six additional site-based teams included in the broader BID community (but not included in the findings of this report) are:

- Minnesota - Minnesota Zoo and University of Minnesota;
- Colorado - Science Discovery and University of Colorado, Boulder;
- California - Fleet Science Center and University of California, San Diego;
- North Carolina - North Carolina Museum of Natural Sciences and Museum of Life and Science and Duke University;

- New Hampshire/Vermont- Vermont Institute of Natural Science and Dartmouth Guarini School of Graduate and Advanced Studies; and
- New Mexico - Explora and University of New Mexico.

The kick-off event in November 2018 served to mark the progress and learning of the initial three site-based teams. It also further validated early decisions to shift the focus of the project from implementing and testing a specific model to development of a flexible framework and set of guidelines for HEI/ISE partnerships (discussed in more detail in the research team section).

Significant Changes (Site-Based Teams)

Professional position changes are already common among the teams and may have positive and/or negative impacts on partnership endurance. For example, PI Ann McMahon moved positions from the Pacific Science Center to the Research Office at the University of Washington, Bothell after the project proposal was submitted, but prior to the award. Anna Johnson, at the Pacific Science Center, now leads the work for the Washington ISE. In New York, two staffing changes occurred. Michelle Kortenaar, the ISE lead, continues her position on the project after receiving a promotion, but another New York ISE team member left the project for a position elsewhere. All the teams have noted challenges with leadership changes or interim leadership at HEIs. This situation made it difficult to address institutionalization and gain leadership buy-in and support.

The site-based teams aimed to strengthen the relationship of the two organizations HEI/ISE. The HEI team members positioned themselves as the liaisons with PIs, and the ISE team members have positioned themselves as those with expertise in the learning sciences and in understanding the needs of the surrounding community. This was a departure from the original concept of a partnership model that included positions for representative PIs, learning scientists and community-based local partners.

Recommendations (Site-based Teams)

Site-based teams were provided with a quarterly report of the general trends in partnership health derived from the pulse check data. Below are a few specific recommendations, for each of the initiating three partnerships that have emerged from researcher observations of meetings and review of data from the pulse checks.

1. Acknowledge (and work through) Power Dynamics - There have been complex power dynamics in each site-based team that seemed to emerge from differences in resources, institutional size, position and agency of individuals,

how the grant money is allocated, and the accessibility of PIs and other local partners. Although intense conflict was not observed nor reported, it is important for each team to identify and address these power dynamics to ensure they do not inhibit team progress and health. Articulating, clarifying and adhering to the goals of the team and the respective organizations was indicated as important by the teams and may alleviate miscommunication (arising from power dynamics) and acknowledge the inherent value of the site-based team individuals and their partners.

2. Cultivate Additional Partners - Although the partnership model was conceived with the HEI and ISE as the central connection, three additional roles were envisioned (STEM PIs, learning scientists, and community partners). In practice, these roles are not being filled as part of the partnership. Instead, STEM PIs have been engaged as the consumer of opportunities generated the site-based teams or sometimes as collaborators in BI design. Additionally, ISE staff have taken on the role of the learning scientists with expertise on how people learn in informal environments. While these two alterations may be functional, the role and engagement of other local partners is still a point of concern. It is unclear who is responsible for engaging additional local partners, who the right partners are, and what exactly would be the role of local partners in long-term partnerships. Site-based teams have expressed that the ISE plays the role of a community partner and/or additional local partners will be engaged as the explicit need arises. Thus, the foundation of the partnerships has been two-pronged (HEI and ISE), not three. More consideration of the role and processes for long-term engagement of local community partners, especially those that represent underserved audiences, is warranted. There may exist missed opportunity for the ISEs or the ISE/HEI partnership to leverage the BID project to enhance their role in regional learning ecosystems. It will be important for teams to reflect on the role of additional partners, when and how additional partners should be invited to collaborate, and what are the best practices for co-development of broader impacts with additional partners.
3. Plan for Sustainability - Turnover and variability in the support of BID by leadership at both ISEs and HEIs may inhibit partnerships to endure after the NSF funds are spent. Teams can benefit from reflecting on what information and documentation their potential successors would need to leverage existing support of organizational leadership.

Research Team

The research team is responsible for investigating the practices and structures that impact the quality and endurance of the site-based team partnerships. In addition, the research team plays an evaluative role as described above (and authors this report). The team includes PI Martin Storksdieck, Co-PI Julie Risien, Research Analyst Kelly Hoke, and research consultant Cathlyn Stylinski who also serves as an external reviewer of evaluation processes.

Major activities of the research team for this reporting period have been to:

- develop and refine a detailed design-based research and evaluation plan to guide the work of the team;
- moderate site-based team creation and updates of conceptual partnership maps;
- create and deploy research instruments including the quarterly pulse checks, participating PI intake surveys, interview, and observational protocols;
- conduct iterative and cumulative analysis of quarterly pulse check data and report results to site-based teams;
- conduct interviews with all partnership team members of the initial three site-based teams,
- collect observational data of BID collaborative and check-in meetings; and
- conduct initial qualitative analysis of interview data, open-ended pulse check responses, and observational field notes to establish an initial set of thematic codes.

Significant Changes (Research Team)

The research team changed approach as a result of listening and responding to the initial three site-based teams and collaborating with the backbone organization during the project kick-off meeting in September of 2017. The original approach put forward a specific partnership model as the “treatment” for the initial three teams. The idea was, through design-based research, to test a partnership model, iterate on the model based on findings, apply the model to the six new “control” site-based teams, iterate again and then finalize the model for broad application. It became clear that the original approach did not adequately account for the highly complex and varied nature of the initial three site-based BID teams. The model constrained to the teams and did not allow for substantial innovations and continuous adaptations in each site-based teams’ approach. It also limited teams’ abilities to attend to the needs of their individual institutions and the unique nature of each partnership. Thus, the research focus shifted toward a developing a conceptual framework and set of practice guidelines for robust HEI/ISE partnerships based on the findings from study of the nine teams. This required that the

team collect more observational field notes to capture the depth and detail needed to establish context and to compare across sites. The research team shifted plans and now is oriented around an overarching goal to understand characteristics, culture, and best practices of university/science center collaborations to advance broader impacts design and implementation. Appendix A provides a one-page overview of the current research plan.

Adaptations and Next Steps for Research

Members of the research team prepared this report. Reflections and findings have led the team to make the following adaptations to the research plan.

1. Conduct Data Collection Prioritization - The research team has amassed a significant volume of observational and other data. In the coming months, the research team will assess the value of each type of data to answer the research questions. This assessment will help the research team prioritize and streamline data collection activities for the remainder of the project.
2. Design and Populate an Analysis Platform - The research team will set up a robust analysis database using the Dedoose cloud-based qualitative analysis platform. This database will include a complete record of attributes for individuals, institutions, and institutional types. This platform should enable comparisons and explanations across sites, institution types and a variety of other variables. The research team will also refine the initial qualitative themes through a second round of analysis. From this experience, they will consider how to streamline data collection with the additional six site-based teams and eventually shift focus to analysis and scholarship.
3. Plan for Scholarship - The research team will articulate a scholarship plan that disseminates findings to various scholarly outputs. This plan will include anticipated collaborators, journals and venues, and audiences for each planned piece of scholarship. A significant outcome of the research team will be to develop and share a conceptual framework and set of guidelines for enduring HEI/ISE BID partnerships. The team plans to complete a draft framework in the fall of 2019, enabling engagement of the BID community in a substantive participatory review and member-checking.
4. Extend the Timeline - In order to observe changes over time and significant progress of the additional six site-based teams, the research team plans to extend their analysis work one year beyond that of the site-based teams, taking the research effort into March 2022. This will enable observation of how the teams adapt after NSF funding is complete and institutionalization.

Section 2: Early Findings and Description of Data Collected

This section presents early findings based on the data collected during the first year of the BID project. This report relies on initial analysis of data about the three initial site-based teams. The data presented herein is aggregated to reduce that possibility that individual participant information is identifiable. It is important to note that each site has distinct characteristics that impact how they implement the partnership. These distinctions may not be apparent because of aggregation; however, unique institutional and individual characteristics will factor into deeper analyses conducted as part of the research.

Each of these data collection methods (concept maps, pulse checks, interviews, and observations) are described with early findings below representing and initial analyses of the data collected through December 2018 for this mid-way report. This initial analysis is part of the developing story of the partnerships and is intended to aid reflective practice and reframing efforts.

Site-Based Team Concept Maps

The site-based team concept maps were not part of the proposed research plan. They emerged from a process at 2017 kick-off meeting designed to facilitate teams to identify their known structures and connections. Map development and reflections included efforts to understand who are the core and peripheral actors, and what additional partners or mechanisms may be needed as they work towards a robust and enduring partnerships. The initial three site-based teams created maps at the 2017 kick-off and revised and updated maps six months later (Appendix B). Each team participated in a Q&A session with a member of the research team and the backbone organization. That session asked three questions:

1. Did you make major changes to the team structure? Why or why not?
2. Was this process useful for your team?
3. Are certain elements of your structure more clear to you than others. Why or why not?

The additional six site-based teams also generate maps at the November 2018 kick-off. Additional maps revisions are planned for all nine teams. The maps will be used to establish context for case-study approach scholarship and to compare and contrast the critical connections across cases. The maps have not yet been analyzed.

Figure 1a. Ithaca Concept Map September 2017

Figure 1b. Ithaca Concept Map April 2018

Figure 1e. Seattle Concept Map September 2017

Figure 1c. Madison Concept Map September 2017

Figure 1d. Madison Concept Map April 2018

Figure 1f. Seattle Concept Map April 2018

Figure 1a-f. Panel of before and after maps for the initial three site-based teams. It illustrates the variety of partnership conceptions between teams and the increasing within-team complexity and detail as partnerships developed site-specific strategies. Appendix B provides a larger scale view of the team concept maps.

Pulse Checks

The pulse check (Appendix C) is an online survey sent quarterly to participants of the original three site-based teams using an individualized link from Qualtrics. The pulse check, developed as a diagnostic tool for team science, has been revised twice from its original; these revision drew from a National Research Council report on the measuring effective science teams (NRC, 2015) and reports on evaluating the strength of the Oregon STEM Hubs (O'Connell, Storksdieck, & Keys, 2017; Storksdieck, O'Connell, & Keys, 2018). The pulse check instrument contains three open-ended questions to monitor the dynamics of the collaboration, as well as 18 Likert rating-based items for five different scales from Koepflefer & Koepflefer, 2011 and Taylor-Powell, Rossing, & Geran, 1998 (Table 1).

The 18 quantitative items in the pulse checks are on a seven-point Likert scale 1) strongly disagree, 2) disagree, 3) somewhat disagree, 4) neither agree or disagree, 5) somewhat agree, 6) agree, or 7) strongly agree. The statements consider the dynamics

of each team at both the individual and group levels. Responses to statements at an individual level reflect the participant's perception of their individual role (e.g., "I feel energized by the current BID partnership activity") within the site-based team. Responses to statements at a group level (e.g., "our BID partnership focuses efforts appropriately to address our goals") reflect the participant's perception of their team as a whole. The quantitative data from the pulse checks were entered into the statistical software, SPSS, to generate descriptive statistics, reliability measures of the scales, and inferential statistics. Scales indicate acceptable or borderline acceptable reliability (Table 1; Appendix D; Cronbach, 1951). The scale with the lowest reliability is communication; deletion of items does not improve reliability. For the scale Institutionalization however, deletion of the item "My engagement in the BID team is supported by my supervisor(s)" improves reliability, possibly reflecting the complex professional structures within the institutions/organizations.

Table 1

Reliability Statistics of the Five Pulse Check Scales (Energy, Goals, Communication, Professional Capacity and Institutionalization).

Scale	Cronbach's Alpha	N of Individual -Level Items	N of Group-Level Items	N of Scale Items
Energy	.823	2	1	3
Goals	.942	1	3	4
Communication	.667	3	1	4
Professional Capacity	.754	3	-	3
Institutionalization ²	.695	4	-	4

Following the quantitative pulse check statements are three open-ended questions designed to better understand the activities of the BID partnership as well as provide an opportunity to capture qualitative data regarding the health of the partnership. The three open-ended questions are: "suggestion of one change or action the BID team should consider," "suggestion of something the [site-based] BID team should absolutely continue," and "is there anything else you would like to share or explain about your answers?"

² Elimination of the item "My engagement in the BID team is supported by my supervisor(s)" improves reliability; $\alpha=.87$ (Appendix D, Table 5).

The data are aggregated from a total of five pulse checks for the mid-way report from the original three teams in the first year (December 2017- December 2018) (Figure 2). Nine individuals across the three teams participated in three of the pulse checks (April 2018, June 2018, and September 2018); for the December 2017 and 2018 pulse checks, only eight individuals participated (one team member was a graduate student who came on after the first pulse check in 2017 and one team member left the ISE before the last pulse check in 2018). Overall, the data are consistent across time, with only slight changes in the average response scores (item or scale). The represented minimal change over time may be indicative of the survey design rather than a true representation of team health. Specifically, for each quarter, the previous survey responses remain in the response fields so that respondents could adjust accordingly; thus this may have resulted in subtle but not significant changes in responses. Over time, decreases in the average agreement occur for goals, energy, and communication, where slight increases are noticed for institutionalization and professional capacity (Figure 2). The scale results are further discussed below.

Figure 2. Pulse Check Responses for all Five Scales. This figure illustrates the aggregated means within each of the five scales (Energy, Goals, Communication, Professional Capacity and Institutionalization) on the quarterly pulse checks for the three site-based teams from December 2017 to December 2018.

From the eighteen items, the item with the highest agreement average ($M=6.17$, $SD=1.19$) was “I have open exchanges with other BID team members” and the item with the lowest agreement average ($M= 4.90$, $SD= 1.27$) was “other BID team members clearly

understand the BID team goals and current status”. Note that here and below, M is mean and SD is standard deviation.

Goal Scale

The Goal scale includes four items from the pulse check (Appendix C). Using aggregated data, a slight decrease in overall mean agreement around goals occurs quarterly beginning with the December 2017 pulse check through the December 2018 pulse check (Figure 3).

Figure 3. Aggregated Means of Goal Scale. Figure 3 illustrates the change in the aggregated mean, for all three site-based teams on the goal scale, from December 2017 until December 2018.

When looking at each of the three items in the Goal scale independently, the item, “other BID team members clearly understand the BID team goals and current status” had the lowest agreement average ($M= 4.90$, $SD= 1.27$) of the four items. The item with the highest agreement mean was “I clearly understand our BID team goals and current status” ($M= 5.33$, $SD= 1.32$). “Our BID team has clear goals” had the greatest range of responses on any of the eighteen items throughout the pulse check, with a minimum response of one (strongly disagrees) and the maximum response of seven (strongly agrees).

We applied a Mann-Whitney test to examine difference between ISEs and HEIs for each item. However, there was no significant difference between ISEs and HEIs for the most items including the one on clearer goals. In fact, “Our BID team focuses efforts appropriately to address our goals” was the only goal item statistically different between

ISEs and HEIs. A Mann-Whitney test indicated that responses agreeing with this statement were greater for HEIs ($Mdn = 6$) than for ISEs ($Mdn = 5$), $U = 137$, $p = 0.02$.

Energy Scale

The Energy scale consists of three items from the pulse check (Appendix C). Using aggregated data, an increase in overall agreement around energy occurs in April 2018; however, a decrease in mean agreement occurs on the subsequent pulse checks. The tool development timeline (June – November 2018) aligns with the mean energy declines reported overall (Figure 4).

Figure 4. Aggregated Means of Energy Scale. Figure 4 illustrates the change in the aggregated mean, for all three site-based teams on the energy scale, from December 2017 until December 2018.

When looking at each of the items in the Energy scale independently, the item, “I feel energized by the current BID team activity” had the lowest agreement average ($M = 5.53$, $SD = 1.34$) of the three items. The item with the highest agreement average was “I feel optimistic about the long-term potential of our BID team” ($M = 6.07$, $SD = 1.15$).

When comparing items between ISEs and HEIs, “I feel energized by the current BID team activity” was the only goal item statistically different. A Mann-Whitney test indicated that responses agreeing with this statement were greater for HEIs ($Mdn = 6$) than for ISEs ($Mdn = 5$), $U = 142$, $p = 0.03$.

Communication Scale

The Communication scale consists of four items from the pulse check (Appendix C). Using aggregated data, a slight decrease in overall average agreement around

communication occurs quarterly beginning with the December 2017 pulse check, with a slight increase at the September 2018 pulse check (Figure 5).

Figure 5. Aggregated Means of Communication Scale. Figure 5 illustrates the change in the aggregated mean, for all three site-based teams on the communication scale, from December 2017 until December 2018.

When looking at each of the items in the Communication scale independently, the item, “Our BID team communications and meetings are productive” had the lowest agreement average ($M= 5.72$, $SD= .73$) of the four items. The item with the highest agreement average was “I have open and honest exchanges with other BID team members” ($M= 6.14$, $SD= 1.17$).

When comparing items between ISEs and HEIs, “Our BID team communications and meetings are productive” was the only goal item statistically different. A Mann-Whitney test indicated that responses agreeing with this statement were greater for HEIs ($Mdn = 6$) than for ISEs ($Mdn = 6$), $U= 152$, $p= 0.03$.

Professional Capacity Scale

The Professional Capacity scale includes three items from the pulse check (Appendix C). Using aggregated data, a slight increase in overall average agreement occurs throughout the year, with a slight decrease at the June 2018 pulse check (Figure 6). The June date also aligns with a busy season for ISEs and a likely decrease in the application of, and involvement with, the BID team.

Figure 6. Aggregated Means of Professional Capacity Scale. Figure 6 illustrates the change in the aggregated mean, for all three site-based teams on the professional capacity scale, from December 2017 until December 2018.

When looking at each of the items in the Professional Capacity scale independently, the item, “I am applying new professional practices as a result of participation in the BID team” had the lowest agreement mean ($M= 5.37$, $SD= 1.06$) of the three items. The item with the highest agreement mean was “I am gaining new insights about my work through my involvement in the BID team” ($M= 6$, $SD= 1.01$).

When comparing items between ISEs and HEIs, “I am accessing new tools and resources through participation in the BID team” and “I am applying new professional practices as a result of participation in the BID team” were both statistically different. Mann-Whitney tests indicated that responses agreeing with both of these statements were greater for HEIs ($Mdn = 6$) than for ISEs ($Mdn = 6$), $U= 151$, $p= .03$, HEIs ($Mdn = 6$) and ISEs ($Mdn = 5$), $U= 128$, $p= 0.01$, respectively.

Institutionalization Scale

The Institutionalization scale includes four items from the pulse check (Appendix C). Using aggregated data, this scale has only slight variability. The December 2018 pulse check has a slight increase in the mean agreement across all responses (Figure 7).

Figure 7. Aggregated Means of Institutionalization Scale. Illustrates the change in the aggregated mean, for all three site-based teams on the institutionalization scale, from December 2017 until December 2018.

When looking at each of the items in the Institutionalization scale independently, the item, “BID team activities are gaining recognition at my institution/organization” had the lowest agreement mean ($M= 5.05$, $SD= 1.20$) of the three items. The item with the highest agreement mean was “My institution/organization views me as a resource on broader impacts because of my involvement with BID” ($M= 5.28$, $SD= 1.26$).

When comparing items between ISEs and HEIs, “My institution/organization views me as a resource on broader impacts because of my involvement with BID” was the only Institutional item statistically different. A Mann-Whitney test indicated that responses agreeing with this statement were greater for ISEs ($Mdn = 6$) than for HEIs ($Mdn = 5$), $U= 125$, $p= 0.01$. Overall, a greater number of ISEs (85.7%), compared to small number of HEIs (14.3%), responded that they strongly agreed (response rating=7) with the statement that they were viewed as a resource for BI by their organization.

It may be important to note that, of the five scales, Institutionalization and Professional Capacity both indicate a slight increase in the mean response scores from the initial pulse check to the last one analyzed in this report (December 2018). Both HEIs and ISEs had an increase over the year for the Professional Capacity scale as a whole; however, only ISEs indicated an increase of mean scores for the Institutional scale (Figure 8).

Figure 8. Aggregated Means of Institutionalization Scale by organizational type. Figure 8 illustrates the change in the aggregated mean, for all three site-based teams by organizational type (HEI and ISE) on the institutionalization scale, from December 2017 until December 2018.

An initial analysis of the open-ended questions to the pulse-check provides further insight to site-based team dynamics. The following emerging themes will be further refined, and tested and integrated with additional data sources (e.g., observation notes and semi-structured interviews). Refined themes will be analyzed for frequency, co-occurrence, changes over time, and in relation to the attributes of institutions, individuals, and site-based teams. Emerging themes include:

1. **Partnership activities.** Participant responses reference regular meetings and face-to-face contact as actions taken and actions to continue as means for relationship building through open and honest dialogue. Regular and consistent meetings are referenced often in several responses as being an important action for the BID team, despite the references mentioning the challenges with schedules and time. This theme also includes references to how BID teams work to align goals for within a partnership and how they shared team tasks, also included are references to communication about institutional goals of ISE and/or HEI. There are also references to challenges and breakthroughs while working collaboratively on documents or other tangible aspects of tool development.
2. **Roles.** Participant responses reference the need to establish roles and clearly define the expectations and responsibilities for individuals. Each of the three BID teams has a unique team structure and the navigation of these roles based on their structures is unique (e.g., how many individuals are directly working on the BID partnership, the amount of time allotted to BID per their organization).

Establishing clear goals and timelines were referenced as actions taken and important to continue. Revisiting the initial team concept map was also referenced as a useful action to clarify the roles and responsibilities during the course of the BID partnership.

3. **Institutional/Organizational.** Participant responses reference leadership changes at their institutions/organizations and concerns over new directions, goals, missions for their institutions/organizations and how this could impact future BID partnership work.
4. **PI intake/process.** Participant responses reference ways to streamline how teams communicate with PIs, including references to meeting face-to-face and building relationships with the PIs, keeping track of PIs, “passing PIs back and forth” (e.g., not just recruiting PIs but moving towards implementation by supporting the PI), and creating timelines so expectations are clearer. There were also references to the intentionality of the choices made for the partnership. BI legacy for PIs is also referenced as an aspect of the BI process to consider, including how to help PIs in the creation of their BI legacy, which can be defined as the intentional integration of scholarship with broader impacts by a faculty member over the course of their career.
5. **Network/Resources.** Participant responses reference a curiosity in knowing what the other site-based teams are doing and what their partnerships are doing. References include wanting to use the other teams as a resource and sharing resources.
6. **Sustainability.** Participant responses reference sustainability of the BID team. References include wanting to take proactive measures to ensure the sustainability of the BID team after the grant. This includes references to discussing BI goals beyond this project.
7. **Challenges.** Participant responses reference challenges in making decisions as a team, including where to start the process of building the partnership, and struggles in goal alignment understanding or priority of their BID team partner.

Semi-Structured Interviews

Semi-structured interviews (Appendix E) were conducted in October and November of 2018 with the nine participants from the initial site-based teams. Each of the interviews lasted approximately 30 minutes and were composed to better understand the participant's roles within their institutions and the BID project, and the overlap or intersection of those roles, as well as the development of the partnership between the institutions, including challenges and successes during the development of the BID toolkit.

The interview protocol focused on understanding the site-based team dynamics and experiences in terms of challenges and successes. The below themes emerged from an initial analysis of those interview transcripts. These themes can be considered a summary of the semi-structured interview results, and can be used to comprehensively describe the results. They will be further refined and tested with additional data sources (e.g., observation notes and open-ended pulse check data). Refined themes will be analyzed for frequency, co-occurrence, changes over time, and in relation to institutional, individual, and site-based teams attributes.

1. **Understanding each other.** Participant accounts of learning something about other team members, PIs, or additional partners that deepened understanding. Includes accounts of feeling as if others understand them. Also accounts of working together to learn and understand the needs and context of others. Comments that highlight the importance of relationship across roles and organizational types in governing success are also included.
2. **Not understanding each other.** Participant accounts of feeling like others do not understand one's capabilities, meaning, situation, or realities. Antithetical to "understanding each other" as described above; includes reference to surprise that others do not understand you.
3. **Knowledge/skills development and sharing.** Participant accounts of learning or sharing skills, practices or information that enables partnership development or BI support. This includes efforts to share knowledge with other site-based teams, or with the broader HEI and ISE communities.
4. **Reflection and adaptations.** Participant indication that the team is engaging in reflective and adaptive practice. This includes efforts for continuous improvement, reframing, redirection, and intentional changes in partnership practice. Also includes ideas about evolution of primary activities as the partnerships build over time (e.g., moving from focus on building partnership relationships to supporting BI development with PIs).
5. **Culture and language code-switching.** Participant references to the cognitive load of working across different organizational types and potential or actual misunderstandings related to differences in structure, culture, and language of different types of partners. Code-switching includes references to difficulties moving between contexts and the underlying differences in practices and language used can create barriers in communication and understanding (e.g., how different participants refer to and understand the concept of "audience").
6. **Time and timing challenges.** Participant references to out of sync timing such as the prominence of ISE summer programs and HEI academic years. Also included are comments about lack of time and balancing too many demands on time.

7. **Roles and positionality.** Participant accounts of challenges or opportunities that arise from partners balancing and negotiating multiple roles, responsibilities and tensions. This also includes references to positionality (i.e., where one sits in an organization and the amount of authority and agency they feel they have as a result).
8. **Indicators of institutionalization.** Participant cited indicators of BID work becoming institutionalized through engagement of leadership, additional staff, succession planning, and new policies, procedures or routines that support sustained partnership.
9. **Opportunities and limitations of individualized approaches.** Participants' expression of concerns or challenges associated with relationships and activities being carried out by individuals rather than institutions. This includes references to the personal nature of relationships and reliance on personalities, friendship and trust between individuals as opposed to institutions. Also included are references to issues that arise from job changes and turnover. Participants' comments about sustainability in the context of relationships, roles, and individual capacities or dispositions.
10. **Magnification effects.** Participant accounts of BID as a mechanism for individuals to have magnifying effect in their own organization, including BID as a reason to connect with those whom they may not otherwise. Also includes references to leveraging existing relationships to expand the reach of BI within an organization and about one person or action expanding to many.
11. **Backbone organization practices.** Participant references to the central organization of the BID collaboration, including the roles of Eve/Dennis/ILI in coordinating across sites and connecting people.
12. **Grant funding.** Participant references to sustainability of the partnership after NSF grant funding; includes activities that are possible because of the grant that would otherwise not occur. Also includes references to seeking or needing additional NSF funding and/or constraints of NSF funding.
13. **NSF and "Broader Impacts".** Participant mentions to the language of BI, including how NSF defines or fails to clarify BI. Includes references to PIs' understanding (or lack of) about NSF policy, guidelines or expectations.
14. **Elevating BI practice.** Participants noticing that their work is, or is intended to, elevate BI practices within HEI, ISE, or by PIs. This also includes elevating practice at the intersections of BI partnerships (across the two organizations) and elevating PI understanding of BI activities and practice (including evaluation).
15. **Tool and toolkit development and use.** Participant experiences developing, using or testing tools use. This includes specific recommendations for tool development or use in practice and/or discussion to find clarity about the tools and why BID is focused on the tools.

16. **Scope expansion.** Accounts of challenges with, or efforts to breach the boundaries and scope of BID, may include HEIs using BID to generate or support other types of (non-ISE) partnerships, or ISEs working with additional organizations. Included references to pushing the boundaries or goals of the project, and being or not being trapped by them.
17. **BID project communication.** Participant accounts of specific communication activities, or references to the importance of communication, tracking information, transparency, and communication as a means for relationship building to support BID projects. This includes references to frequency and productivity of meetings within or across teams.
18. **Finding clarity.** Participant accounts of efforts to find clarity of roles, relationships, expectations, shared purpose, boundaries, and processes. This includes references to the importance of clarity, common goals, and/or purpose.
19. **Connection, relationships, and trust across organizations.** Participant references to instances that strengthened the specific connection across ISE and HEI organizational types, cultures, and practices. This includes references to building trust and relationships.
20. **Energizing interactions and practices.** Participant references to activities, interactions, or ideas that energized their thinking or participation in the BID partnership. This includes accounts of excitement, interest, positive surprise, and aha moments.
21. **Working with PIs.** Participant accounts of successes, challenges, anecdotes, etc. of working with PIs. This includes references to communicating across difference with PIs, helping PIs learn or improve practice (some overlap with “elevating BI practice”, but more PI specific).
22. **Geo-structural conditions.** Participant references to something unique about a partnership or team based on geography (e.g., small town, co-location, distance between locations, etc.). Reserved for comments about something that may be true for one BID group because of geo-structural conditions.
23. **Measurement of BI outcomes.** Participants noting the need for or movement towards measurable outcomes of BI work. This includes challenges with evaluation, articulating value, making the return on investment (ROI) case, and getting buy-in from those who can allocate resources.
24. **Partnership power dynamics.** Participant references to or noticing of, power dynamics across HEIs and ISEs or within an individual institution. This includes power imbalances related to money (e.g. to hire help, dedicate time, general resources, or from NSF), organizational size, privilege, and/or positionality. Power also refers to expressions of territorialism or tribalism.

Observations

Observational field notes were recorded during nine All-Hands calls that took place between October 2017 and October 2018 and eight site-based team monthly check-in calls, all in 2018 (Table 2). All of these calls were observed during planned Zoom meeting calls with video and audio.

Table 2

Log of Observation Field Notes for Site-Based Team Calls in 2018

SITE-BASED TEAM	MONTH IN 2018			
NY	June	August	October	-
WI	-	August	-	-
WA	June	August	October	December

Notes. A missed log of observational field notes for a team does not mean that the team did not have a monthly team call, rather it may mean the research team did not observe that particular meeting.

During site-based team calls, researchers often observed without video connection in an attempt to avoid influencing the conversation. Project coordination for the call was led by the backbone organization and included at least one representative for the HEI and one representative for the ISE. The evaluation questions guided the analysis of the observational field notes. Themes, listed below, categorize the notes taken from these observations.

1. **Goals of Broader Impact Design.** References to how the partnership implementation supports broader impacts include increased communication with faculty and community partners, intentional efforts to streamline the processes of working with PIs and community partners, including clarity around roles. There are also references to a growing awareness of partner needs and resources and how this can lead to “goodness of fit” for PIs and support BIs.
2. **Challenges for the site-based teams.** Challenges referenced throughout the observational field notes include a difficulty understanding the structure of the site-based team’s institutions/organizations, as well as how to navigate the various structures. This challenge occurs for both the partner of a site-based team and at times the individuals within their own institution. Challenges also included demonstrating return on investments (e.g., the time spent on the BID project and the return for this effort) and the support from institutions/organizations because of the real or perceived obligation for products or funding. Other challenges that seemed to persist included references to goal

setting and establishing clear roles or expectations. These same challenges also came up when discussing tool development, as well as PI partnership activity.

3. **Team adaptability.** References indicating a team's ability to adapt and communicate to overcome challenges included institutions/organizations communication regarding capacity and how to leverage the partnership given available capacity, as well as during different developmental stages of the partnership.
4. **Tool development as a facilitator for the growing partnership.** References to how the tool development has facilitated the partnership included overarching realizations for the teams on where possible gaps might be. This includes creation of self-inventories, a means for tracking PIs, and taking the perspective of the PI to aid the tool development rather than just develop tools through the individual HEI or ISE perspective, which is also an indicator of moving towards partnership institutionalization.
5. **Use of the BI menu.** Usability of the tools referenced less often, given that development of the tools occurred over a large portion of the time represented in this report, rather than implementation of the tools. There were however, references to the usability of the BI menu, especially as support for the PIs.
6. **Sustainability of partnerships.** Reference to indicators of partnership institutionalization included sustainability of the site-based team partnerships beyond the BID project. The development and history of the teams are each unique, these nuances come through at times during the team calls. These nuances often elude to a continuing collaboration in some form or another.

This report documents the BID project at this mid-way inflection point. Designed to aid the BID collaborative in re-centering and productively moving the project forward. The aim is to optimize towards meaningful outcomes (i.e. robust and enduring HEI/ISE partnerships and tools to support future partnerships across the country) and to cultivate in-depth and scholarly understanding of characteristics, culture, and best practices of such partnerships. The research team will continue developmental evaluative processes as described in the introduction (i.e. continuous engagement, collaborative reflection, and mutually supportive adaptation) culminating in a final project report.

Appendices

- A. Research Plan**
- B. Site-Based Team Concept Maps**
- C. Pulse Check**
- D. Inter-Item Correlation Tables for all Five Scales**
- E. Interview guides**

Appendix A. Research Plan

Research map process and design adapted from Maxwell, Joseph A. Qualitative research design: An interactive approach 3rd Edition. Sage Publications, 2013.

Appendix B. Site-Based Team Concept Maps

Figure 1. Ithaca Concept Map, September 2017

Figure 2. Madison Concept Map, September 2017

Figure 3. Seattle Concept Map, September 2017

Figure 4. Ithaca Concept Map, April 2018

BID Taking Flight April 2018 UW-Madison & Discovery

Figure 5. Madison Concept Map, April 2018

PSC/USB System Process Diagram
Revised 03-26-18

ISE = Informal Science Education PSC = Pacific Science Center
HEI = Higher Education Institution USB = University of Washington Bothell
PI - Principal Investigator BI = Broader Impact

Figure 6. Seattle Concept Map, April 2018

Appendix C. Pulse Check

11/14/2018

Qualtrics Survey Software

Default Question Block

Thank you for your participation in the quarterly BID team questionnaire. **This version of the survey should display your answers from the last questionnaire and allow you to update your responses where needed.**

If you have not already done so, please review the [Explanation of Research](#) and click below to start the survey when you are ready.

Scale questions

Considering your Broader Impacts Design team, please select the appropriate level of agreement for the following statements.

The pre-selected response options display your answer from the last check-in. Please update each response as needed based on your current situation.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I feel energized by the current BID team activity.	☐	☐	☐	☐	☐	☐	☐
I feel optimistic about the long-term potential of our BID team.	☐	☐	☐	☐	☐	☐	☐
Other BID team members seem energized by the current BID team activity.	☐	☐	☐	☐	☐	☐	☐
Our BID team has clear goals.	☐	☐	☐	☐	☐	☐	☐
I clearly understand our BID team goals and current status.	☐	☐	☐	☐	☐	☐	☐
Other BID team members clearly understand the BID team goals and current status.	☐	☐	☐	☐	☐	☐	☐
Our BID team focuses efforts appropriately to address our goals.	☐	☐	☐	☐	☐	☐	☐

Considering your Broader Impacts Design team, please select the appropriate level of agreement for the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
	☐	☐	☐	☐	☐	☐	☐

<https://oregonstate.ca1.qualtrics.com/ControlPanel/Ajax.php?action=GetSurveyPrintPreview>

1/4

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I make productive contributions to the BID team.	☐	☐	☐	☐	☐	☐	☐
I have open and honest exchanges with other BID team members.	☐	☐	☐	☐	☐	☐	☐
Our BID team communications and meetings are productive.	☐	☐	☐	☐	☐	☐	☐
My contributions to the BID team are appreciated by others on the team.	☐	☐	☐	☐	☐	☐	☐
I am accessing new tools and resources through participation in the BID team.	☐	☐	☐	☐	☐	☐	☐

Considering your Broader Impacts Design team, please select the appropriate level of agreement for the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I am applying new professional practices as a result of participation in the BID team.	☐	☐	☐	☐	☐	☐	☐
I am gaining new insights about my work through my involvement in the BID team.	☐	☐	☐	☐	☐	☐	☐
My engagement in the BID team is supported by my supervisor(s).	☐	☐	☐	☐	☐	☐	☐
BID team activities are gaining recognition at my institution/organization.	☐	☐	☐	☐	☐	☐	☐
I have opportunities to share what I have learned through BID with others at my institution.	☐	☐	☐	☐	☐	☐	☐
My institution/organization views me as a resource on broader impacts because of my involvement with BID.	☐	☐	☐	☐	☐	☐	☐

Open ended

Please complete the following statements.

On the last check-in, we asked you about one **change or action** our BID team should consider. Your answer should display below.

Do you have any updates about the change or action you suggested? You may delete or edit the answer below.

*If you did not complete the last check-in, you may provide **one change or action** you think the BID team should consider.*

On the last check-in, we asked you about one thing your BID team should **absolutely continue**.

Do you have any updates about the suggestion you provided? You may delete or edit the answer below.

*If you did not complete the last check-in, you may provide one **suggestion of something the BID team should absolutely continue**.*

Is there anything else you would like to share or explain about your answers?

You may delete or edit the answer below.

Appendix D. Inter-Item Correlation Tables for all Five Scales

Table 1

Reliability and Descriptives for Energy Scale Items in the Pulse Check

	<i>M (SD)</i>	<i>1.</i>	<i>2.</i>
<i>1. I feel energized by the current BID team activity.</i>	5.55(1.36)	-	
<i>2. I feel optimistic about the long-term potential of our BID team.</i>	6.05(1.17)	.55	
<i>3. Other BID team members seem energized by the current BID team activity.</i>	5.76(1.03)	.65	.68

$\alpha = .82$

Table 2

Reliability and Descriptives for Goal Scale Items in the Pulse Check

	<i>M (SD)</i>	<i>1.</i>	<i>2.</i>	<i>3.</i>
<i>1. Our BID team has clear goals.</i>	5.26(1.55)	-		
<i>2. I clearly understand our BID team goals and current status.</i>	5.33(1.36)	.90		
<i>3. Other BID team members clearly understand the BID team goals and current status.</i>	4.90(1.27)	.86	.84	
<i>4. Our BID team focuses efforts appropriately to address our goals.</i>	5.24(1.25)	.70	.78	.77

$\alpha=.94$

Table 3

Reliability and Descriptives for Communication Scale Items in the Pulse Check

	<i>M (SD)</i>	<i>1.</i>	<i>2.</i>	<i>3.</i>
<i>1. I make productive contributions to the BID team.</i>	5.93(.78)	-		
<i>2. I have open and honest exchanges with other BID team members.</i>	6.17(1.19)	.44		
<i>3. Our BID team communications and meetings are productive.</i>	5.71(.74)	.26	.50	
<i>4. My contributions to the BID team are appreciated by others on the team.</i>	6.00(.54)	.58	.08	.37

$\alpha=.67$

Table 4

Reliability and Descriptives for Professional Capacity Scale Items in the Pulse Check

	<i>M (SD)</i>	<i>1.</i>	<i>2.</i>
<i>1. I am accessing new tools and resources through participation in the BID team.</i>	5.71(.71)	-	
<i>2. I am applying new professional practices as a result of participation in the BID team.</i>	5.33(1.05)	.43	
<i>3. I am gaining new insights about my work through my involvement in the BID team.</i>	5.98(1.02)	.43	.67

$\alpha=.75$

Table 5

Reliability and Descriptives for Institutionalization Scale Items in the Pulse Check

	M (SD)	1.	2.	3.
<i>*1. My engagement in the BID team is supported by my supervisor(s).</i>	5.69(1.22)	-		
<i>2. BID team activities are gaining recognition at my institution/organization.</i>	5.05(1.23)	.11		
<i>3. I have opportunities to share what I have learned through BID with others at my institution.</i>	5.12(1.40)	-.02	.71	
<i>4. My institution/organization views me as a resource on broader impacts because of my involvement with BID.</i>	5.33(1.24)	-.03	.50	.85
$\alpha=.70$				
*If deleted, $\alpha=.87$				

Appendix E. Interview guides

Prior to each interview, review pulse checks for site and for individual insights

Prior to each interview, send out the Explanation of Study document

GUIDE FOR OPENING INTERVIEW

This interview will inform us on your perspectives and experiences while working with your BID team [NY, WI, WA]. This interview is confidential and will only be used for research purposes. I have six questions for you each with some follow-ups; we will try to complete this in the 30 min.

Do you have any (more) questions for me before we get started?

Did you have a chance to review the Explanation of Study? Do you have any questions about that?

Is it OK with you if I record our conversation from this point forward?

(Repeat that you have permission to record once the recording begins)

Guiding Research Questions:

1. What is the nature of the different team partnerships?

a. Comparative across all teams - all questions

2. What are the experiences of the partnership?

. Questions 1, 2, and 3

3. What is the value of the partnership?

. Question 4 (and 5), observations and focus groups?

4. How do the partnership teams adapt, reframe, and progress?

. Question 3, 5, and 6, and focus groups

5. What are the critical practices that contribute to partnership success?

. Question 6, pulse checks and observational data

6. How are PIs and community partners experiencing value in the system?

. Get this data from PIs themselves (36 intakes so far)

Relevant Frameworks

1. Durable/sustained partnerships/measure of BI-Value Creation

2. Activity/Identity/Boundaries/Practice - Landscapes of Practice

3. Cross- institutional capacity framework?

Interviewers: ask top-level questions, use follow ups (under each question) to prompt more detail and keep interviewees on topic.

-
1. Describe for me your broader role at your [university or science center]?
 - a. What might your partners not realize about what you do, and the capacities you have?
 - b. Does this create any challenges or misunderstandings?
 - c. In what ways do you feel you are successful in your institutional role? Challenges?
 - d. How do these successes and challenges affect into the BID partnership?
 2. Describe your role within the [WI, NY, WA] BID team?
 - a. Is your current role different from what you expected at the beginning of the project?
 3. How has co-development of tools gone for your BID team?
 - a. Which tool or aspect of tool development was easiest to collaboratively create? Why?
 - b. What was the most challenging tool or aspect of tool development to collaborate on?
 - c. Has the process enabled you to build understanding and partnership?
 - d. What have been strengths of the [WI, NY, WA] partnership?
 - e. What have been challenges?
 4. How has your level of commitment changed/fluctuated since the joining the project? What has affected those changes?
 - a. What will keep you involved in the partnership after the grant ends?
 - b. Are there ways that your two institutions can expand and sustain partnership beyond the relationships built in the current BID team?
 - c. What might hinder your sustained involvement? What about [your institution's] broader involvement?
 5. What advice would you/will you give the six new BID teams to help them be successful in their partnership over the first year?

Closing questions: Is there anything you wish I had asked, but didn't? Do you have any questions for me at this time? If any come up, please don't hesitate to contact me.

References

- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297–334.
- Koepfler & Koepfler. (2011). STEPS Summative Evaluation Report. University of Colorado, Denver: UXR Consulting. Retrieved on April 18, 2019 from http://www.informalscience.org/sites/default/files/STEPS_Summative_Evaluation_Report_FINAL.pdf
- National Research Council. 2015. Enhancing the Effectiveness of Team Science. Washington, DC: The National Academies Press. <https://doi.org/10.17226/19007>
- O'Connell, K., Keys, B., Storksdieck, M. (2017). Taking Stock of Oregon STEM Hubs: Accomplishments and Challenges. Technical Evaluation Report. Corvallis, OR: Center for Research on Lifelong STEM Learning. Retrieved on April 18, 2019 from <https://ir.library.oregonstate.edu/downloads/g445ck09r>
- Storksdieck, M., O'Connell, K. & Keys, B. (2018). Taking Stock of Oregon STEM Hubs: Accomplishments and Challenges. NARST 2018 Annual International Conference, Atlanta, GA, USA, March 10-13, 2018.
- Taylor-Powell, E., Rossing, B. and Geran, J. (1998). Evaluating Collaboratives: Reaching the Potential. Madison, WI: University of Wisconsin–Extension, Cooperative Extension, Program Development and Evaluation. Retrieved on April 18, 2019 from: <https://learningstore.uwex.edu/Assets/pdfs/G3658-08.pdf>