



# Summative Evaluation of the Research+Practice Collaboratory

## *Final Report*

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*Cover photo: STEM Teaching Tools, R+P Collaboratory*

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## Executive Summary

The National Science Foundation (NSF) funded the Research+Practice Collaboratory in 2012 to develop strategies for (1) making educational research more usable for educators, and (2) helping educators and researchers productively collaborate to advance research on educational effectiveness.

The Collaboratory comprised four partnering teams. Three of these teams were research-practice partnerships (RPPs) that functioned as demonstration sites or “local labs.” Together, they pursued a shared commitment to improving quality and equity in STEM education while respectively, they selected different focal issues: implementation of the Next Generation Science Standards (NGSS); technology-based approaches in early mathematics learning; and connecting informal learning experiences with in-school STEM. The fourth team focused on generating tools and resources for RPPs. Together, the four teams developed and tested tools and approaches across contexts, developing an evidence base for the efficacy of RPP work, distilling generalizable principles, and articulating them for the field.

SRI International (SRI) was the Collaboratory’s summative evaluator, partnering with formative evaluator Inverness Research (Inverness). SRI’s evaluation examined the project’s superstructure—the strategy and outcomes of the four-team partnership—whereas Inverness primarily studied the four component teams.<sup>1</sup> SRI’s evaluation questions were:

1. Regarding **strategy**: How do the design and function of the Collaboratory (including its focal themes and activities) collectively result in an innovative mechanism for productive engagements between research and practice?
2. Regarding **outcomes**: To what degree have Collaboratory processes and products been taken up and, (a) affected professional development efforts, models, practices among researchers and practitioners; and, (b) facilitated cultural exchange and transformation within the Collaboratory’s sphere of influence?

## Methods

To examine the Collaboratory’s strategy (question 1), SRI interviewed project leadership and professional association contacts, conducted observations at events, and reviewed documents

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<sup>1</sup> Inverness’s case studies, cross-case analysis, and other formative evaluation products are available at: [https://inverness-research.org/2018/07/30/portfolio-research\\_\\_practice\\_collab/](https://inverness-research.org/2018/07/30/portfolio-research__practice_collab/)



to develop descriptions of strategies, activities, and routines. We later refined these descriptions by checking them against findings from other analysis tasks.

To examine the Collaboratory's outcomes (question 2), we used digital metrics (e.g., Google Analytics) to gauge the project's reach and the uptake of its products, and then benchmarked the results of this analysis against the same metrics from several other similar entities. We also used interviews and surveys to gather the perspectives of people who partnered with the Collaboratory, participated in its events, and used its tools and resources, including professional association leaders, workshop participants, and website users. We also sought to place the Collaboratory in the broader education research-and-practice landscape by investigating the views, priorities, and needs of people involved in RPPs who had not participated in Collaboratory activities (including people who had not heard of it), as well of people who fund RPPs in education. In this way, the evaluation draws on findings regarding views and experience both within and beyond the Collaboratory's sphere of influence.

SRI's evaluation additionally attended to a set of success measures that the Collaboratory devised to assess progress against its theory of action. The Collaboratory team used the success measures to benchmark its work; SRI's evaluation was not designed to address the success measures but we noted which evaluation activities we expected to generate evidence for each (see Appendix A). Lastly, NSF asked SRI to reflect on productive approaches for evaluating center-like organizations such as the Collaboratory that aim to build capacity and cause shifts in approaches.

## **Findings regarding Collaboratory strategy**

The R+P Collaboratory was a unique structure, characterized by more intensive joint work and deeper shared purpose than most collaboratories (or "collaborating laboratories") and differing from Networked Improvement Communities (NICs) in local labs' addressing different STEM education issues rather than jointly working on a common issue. The Collaboratory's structure and associated routines, such as those for fostering partnership, were well-suited to the project goals and contributed to its success.

Strong alignment of values and approaches among Collaboratory leadership, and shared priorities in STEM improvement work, reinforced and supported its joint work. Specifically, SRI found that leaders shared the view that RPPs are design-research endeavors (see Fishman, Penuel, Allen, and Cheng, 2013) that foreground and promote equity, and can lead to

sustainable education improvement and transformation. (One team initially included in the project did not share characteristics and values of the other three and was replaced early on.) In addition, a focus on specific STEM practices (e.g., argumentation, problem-solving, and perseverance) emerged as critical across the local labs' focal topics, an alignment that facilitated the teams' ability to test approaches across contexts. Each lab's deep involvement in educator professional development was another unifying factor.

The composition of Collaboratory leadership supported broad uptake of the project's work. The PI and three co-PIs are nationally known leaders in education improvement; people who used Collaboratory tools and resources viewed the Collaboratory as a trusted source, noting the reputations of its leadership give its products "instant credibility." Funders viewed the Collaboratory as a vital complement to their efforts to promote and sustain research-and-practice (R/P) in education and called on it to support uses of RPPs to accomplish sustainable change.

The Collaboratory used its design-research approach in three layers of testing and improvement across its work, not only regarding (1) the focal STEM improvement topics and (2) supports for RPP work, but also (3) communications strategies for targeting and reaching broad audiences. The team conducted front-end, exploratory work, for example convening stakeholders to affirm its selection of priority STEM education issues and refine its understanding of needs related to each. Similarly, the team laid groundwork for a key part of its communications strategy, disseminating tools and resources via professional association networks, by first investigating the research-and-practice needs of various associations. The team also refined formats to help increase the usefulness and uptake of its tools. The design-research approach required risk and experimentation, as well as the flexibility to change approaches as needed. At several points in the project, such flexibility ultimately supported far greater success—for example, in shifting from centralized to distributed responsibility for partnering with professional associations and for managing a coordinated communications strategy that combined digital engagement with in-person events.

## Findings regarding Collaboratory outcomes

The Collaboratory successfully demonstrated that **research-practice partnerships** can be a productive approach to sustainable education improvement. Education leaders in Collaboratory RPPs report that the work transformed how they approach improvement. They report being empowered to take on new leadership roles, including in professional associations, and to co-

present at research conferences. Some report plans to use Collaboratory tools and approaches in other projects. Nearly all participants in Collaboratory workshops on RPPs reported gaining a better understanding of RPPs and how they function. Participants in an RPP workshop for early-career researchers were still engaged in RPP work two years later and optimistic regarding future involvement in RPPs.

The Collaboratory was successful in foregrounding and advancing **equity**, both in its approach to and support of RPPs and in its STEM education improvement work. Within the partnerships, intentionally developed shared language and goals to position both researchers and practitioners to co-create the work. Partnering practitioners report their voices were valued. In the contexts of the local labs' respective STEM education issues, Collaboratory team members reported seeing progress overall and particularly among struggling students. Users of Collaboratory resources valued those that address improving equity and reported using them to train education leaders and teachers in equity-centered practices.

The Collaboratory is widely viewed as providing **much-needed tools, resources, and approaches available from no other source**. Funders and those who benefited from the Collaboratory's work—including PAN contacts, workshop participants, and website users—value the Collaboratory's work and view it as providing unique benefits. They find the tools accessible and useful, value that they draw on both researcher and practitioner perspectives, and report sharing them widely.

The Collaboratory **reached a remarkably large audience** using an innovative, integrated communication and engagement strategy that involved sharing tools and resources via a family of project websites and social media channels, in combination with in-person events such as workshops and conferences.

- Per Google analytics, over 25,000 users have downloaded tools and resources over 7200 times from the Collaboratory's main website, Researchandpractice.org. Over 140,000 users have downloaded tools and resources over 25,000 times from STEMTeachingTools.org, another Collaboratory website.
- Researchandpractice.org has fewer but more active users as compared to a set of other similar organizations' websites, with higher pageviews and downloads per user. It also has a targeted, engaged newsletter audience, with an open rate among the high end of the range in our comparison.

- Use of the tools and resources goes far beyond the website user community. People report using the resources to train others—to work with other state or district leaders or teachers on STEM improvement, or to build capacity in RPPs.
- Approximately half of researchers and practitioners engaged in RPP work but who have not been involved in Collaboratory activities know of the Collaboratory, have visited one of its websites, and can describe its purpose accurately.

The Collaboratory demonstrated the value of **partnering with professional associations** to substantially amplify the impacts of its work. Association leaders value relationships with Collaboratory leaders, and value sharing Collaboratory tools and resources with their member networks. One association partnership developed into a new RPP involving researchers and leaders from 13 states. SRI found, in its survey of the broader education R/P community, that 37% of researchers and 88% of practitioners identified professional associations as one of their three top sources for useful resources for partnership work.

## I. Introduction

The National Science Foundation (NSF) funded the Research+Practice Collaboratory (the Collaboratory) to (1) make education research more usable for practitioners, by synthesizing it in meaningful ways and using innovative approaches to disseminate it, and (2) foster connections among and provide approaches for researchers and practitioners to jointly advance research on educational effectiveness, and identify areas of mutual interest for further research.<sup>2</sup>

The Collaboratory took shape as a collaboration among four locally partnering teams. Three of the teams were research-practice partnerships (RPPs) that each designed and tested solutions to a specific STEM education challenge (Exhibit 1). The fourth team, led by William Penuel at the University of Colorado, Boulder, developed tools and guidance to support RPP work<sup>3</sup>. Partnering across all four teams, the Collaboratory developed and tested tools and approaches across contexts, developing an evidence base for the efficacy of RPP work, distilling generalizable principles, and articulating them for the field.<sup>4</sup> The team shared its products online and in events such as conference presentations, webinars, and workshops.

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<sup>2</sup> Awards DUE-1238253 and DRL-1626365.

<sup>3</sup> See the Collaboratory's RPP Toolkit, [researchandpractice.org/toolkit](http://researchandpractice.org/toolkit), and Penuel & Gallagher, 2018.

<sup>4</sup> It is worth underscoring that SRI was not assessing the efficacy of RPPs; generating and sharing evidence of efficacy was a core part of the Collaboratory's purpose. As examples, see Penuel, Bell, Bevan, Buffington, & Falk (2016), Bevan et al. (2016), Bevan, Penuel, Bell, & Buffington (2018), Bevan (2017), Penuel (2017), and Louie & Buffington (2018).

Exhibit 1. Summary of the Collaboratory's three local labs

Team	Context	Topic	Partners
California led by PI Bronwyn Bevan	Afterschool programs	Expand equity-oriented Tinkering; connect Tinkering experiences to in-school STEM	<ul style="list-style-type: none"> <li>- Leadership of four afterschool programs that serve youth underrepresented in STEM</li> <li>- (Later) Leadership, afterschool educators, and teachers from a charter school</li> <li>- Researchers and teacher trainers from a science museum</li> </ul>
Maine led by co-PI Pamela Buffington	K-3 grades, first in one district, later statewide	Improve mathematics teaching and learning, in the context of a statewide 1:1 model	<ul style="list-style-type: none"> <li>- District leadership, math coach, and teachers; scaled to schools throughout Maine</li> <li>- Researchers from two universities</li> <li>- Researchers from EDC</li> </ul>
Washington State led by co-PI Philip Bell	2 urban districts	NGSS implementation	<ul style="list-style-type: none"> <li>- District leadership; later, state leaders in a 13-state association partnership</li> <li>- U. Washington researchers</li> </ul>

SRI International (SRI) was the project's summative evaluator, coordinating with formative evaluation partner Inverness Research (Inverness). Broadly speaking, SRI's task was to examine the Collaboratory's superstructure—the strategy for and results of the four-team partnership—whereas Inverness primarily studied the four component teams.

The summative evaluation sought to understand the value of the Collaboratory's contributions to and place in the education research-and-practice (R/P) field, by examining its **strategy** as well as the **outcomes** of the work. Two questions guided the evaluation:

1. Regarding **strategy**: How do the design and function of the Collaboratory (including its focal themes and activities) collectively result in an innovative mechanism for productive engagements between research and practice?
2. Regarding **outcomes**: To what degree have Collaboratory processes and products been taken up and, (a) affected professional development efforts, models, practices among researchers and practitioners; and, (b) facilitated cultural exchange and transformation within the Collaboratory's sphere of influence?

We first describe the combination of activities and approaches that comprises the Collaboratory's strategy (section III), as context for then presenting findings related to what the Collaboratory accomplished (sections IV and V). We conclude by drawing on the findings regarding strategy and outcomes to present factors that supported the Collaboratory's success, lessons learned that may benefit similar endeavors, and ongoing challenges in R/P work more broadly (section VI).



## II. Methods

A detailed account of evaluation methods in Appendix A; here, we summarize evaluation approaches and data sources.

### Examining the Collaboratory's structure, strategy, and activities

To understand the Collaboratory's structure, strategy, and activities (described in section III), SRI observed Collaboratory events and participated in meetings and retreats; reviewed case studies completed by formative evaluation partner Inverness; reviewed other documents, including annual reports, tools, products, and Collaboratory-developed publications as well as other publications relating to education research-and-practice (e.g., journal articles, newsletters, blog posts, etc.); and drew on interviews with Collaboratory PIs and professional association leaders.<sup>5</sup> From these efforts, we developed descriptions that we then refined by checking the project's intended structures and strategies against findings from other data sources (e.g., workshop participant surveys, education R/P community surveys, digital metrics).

It is important to note that, by design, as the summative evaluation partner, SRI worked with the researcher sides of each partnership and not directly with the practitioners involved in the partnerships. We relied on the formative evaluation team's insights in that regard. However, SRI did interact with practitioners at a few of the early inquiry group meetings, and conducted interviews with educators in the Maine lab to complement Inverness's formative perspective in the case studies.

### Assessing the Collaboratory's contributions within and beyond its sphere of influence

To assess what the Collaboratory accomplished, we examined its contributions both within and beyond its sphere of influence (sections IV and V). We considered the project's sphere of influence to include the people and organizations that had participated in some aspect of the Collaboratory's work and/or used its products. To understand this aspect of the project's contributions, we considered how participation in the Collaboratory influenced the work of its team members and then traced ripple effects outward, gathering the perspectives of people

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<sup>5</sup> The term PIs is used throughout this report to refer to the PI and three co-PIs (each of whom led a local lab team) for simplicity as well as to preserve anonymity in their viewpoints.

partnering with the Collaboratory, participating in its events, and using its tools and resources, including professional association leaders, workshop participants, and website users.

SRI used available digital metrics (e.g., Google Analytics) to gauge the reach of the project and the relative audience sizes of various project activities and tools. SRI also benchmarked the Collaboratory's digital metrics against those of other reasonably similar entities in a comparative analysis. To generate a richer picture of website users' perspectives on Collaboratory tools and resources, how they use them, and with whom they share them, SRI interviewed a sample of website users.

To mitigate the potential for confirmatory bias in collecting data only from people who had potentially benefited from Collaboratory products and activities, we further sought to understand the Collaboratory within the broader education R/P landscape. To do this, we fielded a survey to investigate the views, priorities, and needs of people involved in education RPPs who had not participated in Collaboratory events or evaluation data collection activities, including people who had not heard of the Collaboratory. We also interviewed people who fund R/P work in education. Findings from those interviews, combined with findings from the R/P community survey, enabled us to place the Collaboratory's approaches and resources amid the discourse and activity of the broader field.

### **Different analytic approaches used to analyze different teams' contributions**

To help us understand the varying approaches of the local labs—which each had a different STEM education focus, and also different target scales and audiences—we used a range of analytic approaches. As a result, the different labs surface in unique ways in the analysis of the project's superstructure. For example, because UW's STEM Teaching Tools had the largest audience, we included its website alongside the Collaboratory's main website (Researchandpractice.org) in the website user study. Because the CU-Boulder team focused on RPP capacity-building, its contributions surface most in our accounts of workshops and other Collaboratory events. The Maine team focused on a state-level challenge; we conducted additional interviews with people involved in that work to capture transformative changes from a summative perspective. Bevan was the PI both of the Collaboratory and of the Exploratorium-based team; she appears here mainly as Collaboratory lead and in Inverness's formative evaluation in both roles.

## Success measures and underlying question

The Collaboratory developed a set of success measures in order to benchmark progress against its theory of action (see Exhibit 3). Alongside our work of responding to the evaluation questions, we noted which analysis activities we expected to generate evidence for each (Exhibit A-3 in Appendix A).

NSF also tasked SRI with answering a broader underlying question: How can NSF assess the value of its investments in center-like organizations that aim to build capacity and shift approaches—across communities, projects, and even subject matter—around key issues in education? Our lessons learned and suggestions for the field regarding the evaluation approach are in Appendix B.

### **III. The Collaboratory’s “Mechanism”: What It Did And How**

#### **Four teams, two levels of collaboration**

The Collaboratory was comprised of four teams of researchers and practitioners that collaborated locally, and also as a whole, to develop and test approaches and resources for joint R/P work. Three of the teams were RPPs that served as demonstration sites or “local labs”; the primary focus of the fourth team was to develop tools, resources, and routines to support RPP work. Resources for RPPs also emerged from local lab work, as the team tested tools approaches across contexts, and generated tools and guidance from the generalized principles it distilled.

A common focus on improving quality and equity in STEM education united the work across the different focal topics and contexts. The basic characteristics of the three local labs (see Exhibit 1) draw on the rich descriptions of each lab in Inverness’s case studies and cross-case analysis.

In addition to the common focus on improving equity and access in STEM education, the local labs brought highly aligned goals and approaches to their respective STEM improvement efforts. All sought to “deepen understanding of critical and enduring STEM practices,” as one PI noted (i.e. the science and engineering practices of the Next Generation Science Standards, practices of Common Core Mathematics). Over the course of the work certain practices, including argumentation, problem-solving, and perseverance, emerged as fundamental across lab contexts.

The labs also shared a focus on educator professional development (PD): in Maine, participating teacher educators worked with pre-service and in-service teachers; in California, informal educators worked with teachers; in Washington, the team developed tools and trainings for leaders and teachers related to NGSS implementation. Thus, the project’s capacity-building focus addressed both practitioner and researcher audiences: the fourth team, at University of Colorado, Boulder, developed supports and guidance for design-based RPP work, drawing on the work of the Collaboratory’s three local labs as well as on its longstanding RPP with Denver Public Schools.

#### **Four nationally known leaders supported by a large team**

Forty-eight people are named in the six Collaboratory annual reports submitted 2013–2018, with between 17 and 31 people named each year (Appendix C provides names and shows the years

each was involved, by lab team). These numbers include only people from the research side of each partnership; they exclude those on the practitioner side, as well as the formative and summative evaluators. The sheer size of the team conveys the level of effort involved in a project of this scale. SRI observed that the size of the team, the dedication of core team members, and the leadership and reputations of the PIs have all contributed to the Collaboratory's success.

## The Collaboratory's Approach to RPP

Collaboratory leadership had strong consensus in their view that RPPs can ease typical tensions between abstract theory development and the constraints that govern educational practice. One noted that researchers who work closely with practitioners are in a strong position to “explain things better, including discrepancies.” More specifically, each of the three component RPPs and the fourth local lab used design-based implementation research (DBIR) approaches to design and continuously refine solutions (Fishman, Penuel, Allen, & Cheng, 2013). The leadership shared the view that RPPs have the following key features—the first five from Coburn, Penuel, and Geil (2013), and a sixth added by Collaboratory:

1. Are long-term
2. Focus on problems of practice
3. Are committed to mutualism
4. Use intentional strategies to foster partnership
5. Produce original analyses
6. Foreground equity

In PI interviews, SRI also noted consensus in ways that PIs described strategies they pursue to foster some of these features:

- **Deep collaboration, over time, in which partners co-create solutions.** Time and effort is needed build trust, develop a common language and framework of goals, and for participants to settle into new, unfamiliar, hybrid or dual roles. The process improves awareness of blind spots for both researchers and practitioners and establishes shared ownership. Sustained collaboration results in a deeper kind of thinking that Collaboratory leaders report enhances productivity and achieves more valuable, more sustainable changes in practice.

- **A “very gradualist, incremental approach in a chaotic system”** of changing influences, by contrast to a scale-up model of change. Over time, researchers in RPPs can become the trusted “go-to people” for a range of issues related to the initial endeavor—“very much an extension of the central [district] office for some things.”
- **Providing continuity while requiring flexible adaptation.** RPPs can provide continuity through changes in leadership and policy contexts of practitioner institutions. At the same time, Collaboratory leaders described how researchers must flexibly adapt to the demands of such shifts, to maintain the relevance and value of the work. For example, districts typically have competing initiatives that change over time. Involving all RPP participants in regularly assessing alignment of RPP efforts to institutional, district and/or state objectives is necessary to keeping the work on track. Regular reflection meetings with this purpose occur at all four labs.

SRI concurs with Inverness’s finding, in its cross-case analysis, that these highly aligned values and views were fundamental to the project’s success. The project’s initial formation included a local lab that did not share these values and characteristics, and was replaced early in the project.

### **The R+P Collaboratory as collaborating laboratories**

Each of the three RPPs undertook its own local resource and process development, tailored to its own focal STEM education issue, while also reflecting on how that work could serve or improve RPP work more generally; the Boulder lab focused wholly on supporting RPP work writ large. Together as the Collaboratory (the four “collaborating laboratories”), the team also built on local work to develop resources—practical guidance, research and practice briefs and syntheses, exemplars, etc.—and processes to build capacity across the field of education research-and-practice. Underlying its improvement work, the Collaboratory systematically gathered and analyzed evidence regarding the effectiveness of RPP approaches.

As St. John, Stokes, & Helms (2018) present their in analysis of collaboratories as an investment strategy for educational improvement, the idea of a “collaboratory” arose in the late 1980s. Most definitions of this partnering model emphasize how Internet-enabled communications technologies, and digital access to remote tools, instruments, and/or datasets,

enable new forms of collaboration not bound by time or space.<sup>6</sup> A 2007 “taxonomy of collaboratories” (Bos et al.) describes arrangements to share instruments or data, to support distributed research or product development efforts, or to support professional learning in online communities.

The R+P Collaboratory does not fit well into any of these models, since none has the depth of shared purpose and intensity of joint work that have been hallmarks of this effort, including in the shared focus on STEM practices, perseverance and problem-solving skills, and argumentation. Further, while collaboratories are networked structures, the R+P Collaboratory differed from a networked improvement community, or NIC (Bryk, Gomez, & Grunow, 2010), in that a NIC unites people working in different contexts on the same problem, whereas the Collaboratory’s component RPPs intentionally focused on *different* STEM education challenges in addition to working in different contexts. And a foundational goal of the Collaboratory was to test the generalizability of its work by using it in other partnerships, which NICs generally do not seek to do.

### **The Collaboratory’s theory of action, conjectures, and measures of success**

The Collaboratory developed a three-part theory of action to guide its work (Exhibit 2).<sup>7</sup> The Collaboratory’s efforts broadly aligned with these three strands, and also went beyond them in several ways. The capacity-building work deepened—to address new needs (e.g., evidence requirements of the Every Student Succeeds Act [ESSA], scaling access to computer science education through the CSforAll initiative), and as the RPP landscape expanded dramatically. In addition, the coordinated engagement strategy the Collaboratory used to increase access and awareness reached an exceptionally broad audience.

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<sup>6</sup> See: the Science of Collaboratories, <http://soc.ics.uci.edu/>; Finholt, T. A., Olson, G. M. (Sept. 2000). From laboratories to collaboratories: A new organizational form for scientific collaboration. The University of Michigan. [http://soc.ics.uci.edu/WorkshopStuff/June2001/pdfs/Finholt\\_From\\_laboratories\\_t.pdf](http://soc.ics.uci.edu/WorkshopStuff/June2001/pdfs/Finholt_From_laboratories_t.pdf); Bos, N., Zimmerman, A., Olson, J., Yew, J., Yerkie, J., Dahl, E. Olson, G. (2007). From shared databases to communities of practice: The taxonomy of collaboratories. *Journal of Computer-mediated Communication* 12(2). <http://jcmc.indiana.edu/vol12/issue2/bos.html>.

<sup>7</sup> Exhibits 2 and 3 appear again in the detailed presentation of methods (Appendix A).



Exhibit 2. Three-part theory of action

Increase **access and awareness** [of tools and resources for connecting R/P]

Develop synthesis papers and briefs

Produce resources that “lead with practice and integrate research”

Coordinate dissemination and engagement across a family of related websites and social media channels

Use professional association networks to amplify dissemination and engagement

Foster **critical engagement** around focal education challenges, and research-practice approaches for addressing them

Convene Collaboratory participants and thought leaders to synthesize and move forward thinking on the education challenges

Build capacity for research-practice work through events such as workshops, webinars, and conference presentations

Undertake research-practice **collaborations** that coordinate in **adaptations** of tools and resources across partnerships

Establish three research-practice partnerships (RPPs) informed by design research approaches, each focused on a different STEM education challenge

Study the partnerships to develop and test generalizable principles, approaches, and tools for use in other RPP work

The team expressed the theory of action as a set of conjectures (Sandoval, 2014) and in Year 2 distilled those into benchmarkable statements, or success measures. Throughout its work, the team has reflected on the nature and strength of evidence gathered for the success measures. The success measures are in Exhibit 3.

Exhibit 3. Success measures as they relate to the theory of action

Success Measures	Theory of action		
	Increase access and awareness	Foster critical engagement	Undertake R/P collaborations and adapt tools across them
<p><b>1.</b> The R+P Collaboratory has developed and articulated <u>new strategies for strengthening connections between research and practice</u> by more fully leveraging concerns, experiences, and insights of practitioners in the production and use of evidence-based knowledge and practices.</p>			
<p><b>1a.</b> The R+P Collaboratory has <u>built the knowledge base about how to leverage both practitioner and research-based knowledge</u> in the production of K12 professional resources and convenings.</p>	●	●	
<p><b>1b.</b> The R+P Collaboratory has demonstrated that professional resources and convenings that leverage practitioner perspectives <u>can overcome barriers that have traditionally separated research and practice, leading to the uptake and use of evidence-based practices</u> in K-12 STEM education improvement efforts.</p>			
<p><b>1c.</b> The R+P Collaboratory has developed evidence about the importance and utility of <u>working in partnership with professional associations and networks</u> in order to widely engage K-12 STEM practitioners with research-based knowledge.</p>			
<p><b>2.</b> The R+P Collaboratory has generated evidence that <u>research-practice partnerships</u>, in particular, are a productive way to strengthen connections between research and practice in order to advance local K12 STEM improvement efforts.</p>			
<p><b>2a.</b> RPP partners are committed to sustaining relationships and commitments to RPP.</p>	●	●	●
<p><b>2b.</b> RPP participants develop valued social capital and social networks.</p>			
<p><b>2c.</b> Practitioners use R+P-based practices/knowledge in their decision making.</p>			
<p><b>2d.</b> The process, results, and products of RPPs are valued and used both within and beyond the RPP.</p>			

Success Measures	Theory of action		
	Increase access and awareness	Foster critical engagement	Undertake R/P collaborations and adapt tools across them
<p><b>3.</b> The R+P Collaboratory has stimulated <i>field-wide interest and engagement</i> in developing new approaches to strengthening the connection between research and practice through leveraging both practice- and research-based knowledge.</p>			
<p><b>3a.</b> Evidence shows that a wide range of <u>educational professionals, including leaders of professional associations and networks, have sought the R+P Collaboratory's assistance or participation</u> in their STEM improvement efforts.</p>	●	●	
<p><b>3b.</b> Evidence shows that a wide range of <u>educational professionals, including leaders of professional associations and networks, have undertaken actions and activities that integrate or reflect R+P Collaboratory resources and strategies.</u></p>			
<p><b>4.</b> Effectively worked as a Collaboratory as a mechanism)</p>			
<p><b>4a.</b> The R+P Collaboratory has fostered synergy and new insights and products by leveraging expertise across the Labs.</p>			
<p><b>4b.</b> Collaboratory activities and resources contribute to Collaboratory participants and the broader field.</p>			●
<p><b>4c.</b> The R+P Collaboratory has built the capacity, and added value to the work and contributions, of each of the Labs.</p>			

## **Strategies, Activities, and Routines**

Our discussion of strategies, activities, and routines by which the Collaboratory instantiated its theory of action begins with the team's internal communication. We then discuss the team's work in terms of two broad phases. In a reflective, early phase intended to lay the foundations for a successful project, the team conducted design work to refine its vision and devise strategy. In the full implementation phase, intended to improve capacity for and generate evidence for RPPs in STEM education, the project's mature strategies and activities emerged.

### **Nurturing partnership across the Collaboratory**

The local lab teams relied on regular meetings and close collaboration to monitor work progress, ensure alignment of activities to project goals, and to foster relationships. Conducting valuable joint work at the Collaboratory level additionally required intentionality and intensive time. The project had structures and routines to support that collaboration. Whole-team meetings took place monthly (i.e. including researchers from all four labs, Inverness, and SRI—practitioners involved in local lab work did not participate in meetings related to the project's superstructure); leadership meetings also occurred monthly (involving the PIs and sometimes one other person from each lab, plus Inverness and SRI). The researchers and evaluators also attended project retreats once or twice a year to share progress, work jointly in person, and reflect on strategies and plans.

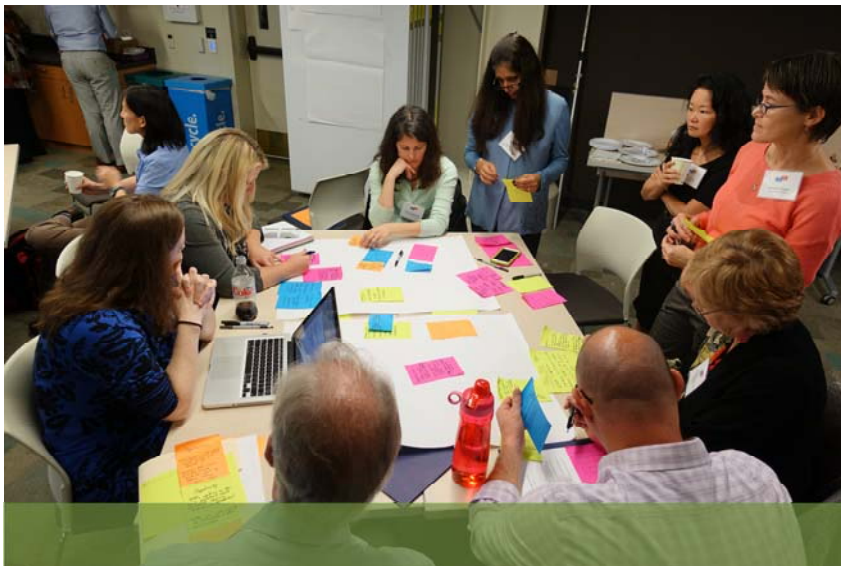
In addition to collaborating through these intentional structures and routines, project leadership and team members worked deeply and continuously together to develop the Collaboratory's joint products, including workshops, conference presentations, webinars, and other joint publications. In the project's latter years, a communications team with members from each lab coordinated the project's engagement strategy and supported knowledge-sharing across the team by identifying shared themes and strategies.

### **Reflective early phase: Inquiry Group meetings and Professional Association Network (PAN) environmental scan**

The Collaboratory's front-end design work was vital to the project's ultimate success. Given the project's grounding in DBIR, design work has been continuous to some degree. Here, we focus on two strands of early design work that helped the team identify priority needs in STEM education, hone its approach to developing products, and strategize to extend its reach.

### *Inquiry Group meetings*

The team held nine “Inquiry Group” meetings between January 2013 and November 2016 (Exhibit 4). Traditionally, inquiry groups are gatherings of faculty or professional learning communities that guide participants in reflecting over time on a given topic. Such convenings are used by organizations including the Carnegie Foundation for the Advancement of Teaching and the National Writing Project.<sup>8</sup> The Collaboratory used this format primarily for formative purposes, convening educator and researcher thought leaders to reflect on one of the project’s focal STEM education issues and how the Collaboratory’s work could best address it—whom to involve, what kinds of content and tools to develop, and with whom and how to share results. These meetings thereby extended inquiry into each lab’s work across the Collaboratory as well as across the field.



*Photo: Research+Practice Collaboratory*

At other Inquiry Group meetings, participants undertook more concrete tasks. As examples, at the second STEM Practices gathering, smaller groups began to explore possible formats and topics of what would become the STEM Teaching Tools. Similarly, in October 2016, the Maine lab team brought together mathematics education researchers, content experts, and association representatives to develop two resource collections.<sup>9</sup> The team also used the Inquiry Group format to develop work in a new area: following the passage of the Every Student Succeeds Act (ESSA), the team convened an Inquiry Group whose participants reflected on how RPPs can help states and districts respond to the new legislation’s evidence requirements.

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<sup>8</sup> See the Carnegie Foundation’s Faculty Inquiry Toolkit, or the National Writing Project’s Teacher Inquiry Communities.

<sup>9</sup> The STEM Teaching Tools research and practice briefs are available at: <http://stemteachingtools.org/tools>. The Interactive STEM resource collections developed during the October 2016 Inquiry Group meeting are available at: <http://interactivestem.org/learning-collections>.

Exhibit 4. *Inquiry Groups Convened by the Collaboratory*

Topic	Location	Date
STEM Practices (NGSS Implementation)	Seattle, WA	July 2013
STEM Practices, Part Two	Seattle, WA	January 2014
Cross-setting Learning	San Francisco, CA	February 2014
Interactive STEM (digital resources and early math learning)	Auburn, ME	November 2014
Equity in Out-of-School STEM Learning	San Francisco, CA	January 2015
Formative Assessment in NGSS, Part 1	Seattle, WA	2015
Formative Assessment in NGSS, Part Two	Seattle, WA	July 2016
Developing Open Tasks and Communication & Critique in Early Mathematics	Auburn, ME	October 2016
The Role of RPPs in Supporting ESSA Evidence Requirements	San Francisco, CA	November 2016

***Professional association environmental scan***

Also early in the project, SRI worked with the Collaboratory to conduct an environmental scan of professional associations related to STEM education and interested or involved in R/P work, to lay the foundations for the PAN strategy. SRI conducted background research and interviewed leaders of nine associations or similar organizations to gather information on (1) their current efforts to integrate research and practice, (2) their perceived needs in this area, and (3) the anticipated value of the Collaboratory to help address these needs. In broad terms, the interviews aimed to build mutual understanding of the benefits the Collaboratory might provide to individual associations and the field. (See the full description of this work in Appendix A.) SRI then tracked the team’s collaboration with the associations included in the environmental scan. Parallel to the inquiry groups, the formative PAN work helped identify priority needs and ways in which the Collaboratory’s work could be more impactful.

Initially, the team pursued relationships with a larger number of associations, and centrally managed these through one team member. The work was then distributed, so that each PI sought to deepen their own already-established relationships. The success of the PAN strategy in 2016 and 2017 (see Results of the mature PAN strategy in section IV) thus followed an evolution in the team’s approach to this aspect of the work.

For the environmental scan, in 2013 SRI spoke with leaders of the American Society for Engineering Education (ASEE); the Center for Advancing Research & Communication in

Science, Technology, Engineering, and Mathematics (ARC); the STEM Learning and Research Center (STELAR, the ITEST Learning Resource Center); and the Regional Educational Laboratory Northeast and Islands (REL-NEI). Also included in the scan were some of the groups around which the PAN efforts coalesced in 2015–2017: CAISE, NSTA, NCTM, and the Afterschool Alliance.<sup>10</sup>

### **Full implementation phase**

The Collaboratory’s mature “mechanism” consisted of routines for collaboration and tool development, technical assistance or capacity-building events (e.g., training others on tools and routines), and online and in-person engagement. Linking several of these strategies was the notion of “bundling,” the team’s term for sharing (a) tools and resources via (b) live events and (c) online engagement.

#### ***“Bundling” starts with tools and other resources***

The Collaboratory’s approach to tool production and use reflects, as one leader stated, a “deeply Vygostkyian” view of how people learn through cultural tools: “co-producing them, adapting them, sharing them with others in purposeful contexts.” SRI found this view borne out in web user and PAN interviews particularly, as well as among workshop participants.

The component local labs were fundamental to the tool development process since tools resulted from successes in local lab work distilled into generalizable principles. The project’s tool sets include (1) guidance for all facets and stages of RPP work—from getting started to sustaining partnerships, and strategies for topics ranging from identifying shared needs to seeking funding—alongside practical examples from the lab work; (2) supports for improvement around the focal STEM challenges, e.g., STEM Teaching Tools for NGSS implementation; and, (3) guidance for leveraging RPP in various contexts, i.e. to generate evidence required in ESSA.

The Collaboratory also developed a host of other resources aimed to support the field and the use of the tools, including research and practice briefs, narrative exemplars of “RP in action,” and publications (e.g., books, journal articles, newsletters, blog posts, etc.). The tools and resources are primarily designed for researchers and education leaders (e.g., state and district

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<sup>10</sup> The team later developed important collaborations with some associations not included in the scan (e.g., CSSS, NCSM). See the discussion of PAN-related outcomes in “Leveraging Professional Association Networks” in section IV below.



leaders, educators who are active in associations and lead PD), with the idea that leaders will use them to train others. At the same time, the Collaboratory designed them for use by the broadest possible audience; as we discuss below, the wide reach of the project's audience, as reflected in website metrics and website user interviews, indicate that many educators encounter the tools themselves, outside of professional development.

The Collaboratory team developed the majority of the resources that it shares with the field. It also synthesized and brokered information for the field by curating others' resources alongside its own. One example of this is the web forum series, in which the Collaboratory moderated discussion among guests involved in partnership work; the Collaboratory then posted on its website a list of resources guests referenced.

### ***Integrated communication and engagement strategy***

To engage researchers and education leaders in STEM improvement via its tools and resources, the Collaboratory combined a coordinated digital strategy (using a set of project websites, email newsletters, and social media campaigns) with in-person events such as conference presentations and workshops.

### **Distributed approach to online engagement**

The Collaboratory shifted from the centralized online engagement of its first two years to a distributed approach, ultimately using a family of websites to post and cross-post tools and resources, and using social media, email newsletters, and in-person events to drive traffic to the websites. The team shifted significant project resources towards rethinking and then carrying out this revised strategy, and established a communications team with members of each lab to implement and monitor it. The "comm team" met regularly to strategize and reflect, and used SRI's monthly reports on digital metrics as the basis of its reporting to project leadership.

### **Sharing tools and resources at events**

The team held and participated in several types of events, from multi-day workshops and trainings to webinars and conference presentations. These events aligned with the critical exchange strand of the project's theory of action, in that they aimed to build capacity for R/P work and engage the community in moving the field forward. Events also increased access and awareness, and helped the team nurture relationships with PANs and other organizations.

Two types of events were designed to support early career researchers and practitioners, based on the PIs' view that helping early-career professionals navigate the challenges of RPP work could help expand and sustain the education R/P field: a workshop for early career researchers and doctoral students, and a fellows program, in which early career researchers and practitioners were sponsored to attend conferences typically attended by people in the other role (i.e. practitioner fellows attended AERA, researcher fellows attended NSTA), where they also met with Collaboratory leadership.

### **Coalescing PAN efforts**

As the Collaboratory developed routines in terms of event types, it also nurtured relationships with its target audiences. Associations are already trusted sources for their memberships and are connected both “up and down,” as one PI noted, to policymakers and to practitioners. Collaboratory leaders used the PAN strategy to jump-start buy-in for its efforts among large networks and to extend the R/P approach: identifying needs rooted in practice, nurturing relationships, and working through sustained collaborations to address them. One Collaboratory PI summarized the approach as: “Go where the networks are. Embed yourself. Discover the needs. Develop things that meet them.”

The most intensive PAN relationships developed in 2015-2017 with CSSS and CAISE, while relationships also deepened with NSTA and Afterschool Alliance. The Collaboratory also maintained less intensive relationships with some of the other organizations included in the 2013 environmental scan (e.g., REL-NEI), and further developed collaborations with numerous other field-serving organizations (e.g., Achieve, the William T. Grant Foundation, NNERPP, MSPNet).

Having described the project's basic components and key strategies (the first part of our response to evaluation question 1), we now examine how the project's structure played out by considering the Collaboratory's contributions both within its sphere of influence (section IV) and beyond it (section V). Sections IV and V contain our response to evaluation question 2.

## IV. The R+P Collaboratory's Contributions Within Its Sphere of Influence

This section begins with how and in what ways the Collaboratory influenced the work of its direct participants and then follows the project's contributions outward. We use digital metrics to gauge the project's reach, and delve deeper into how people use Collaboratory tools in findings from the website user study. We then consider results from close collaborations with the project through the PAN strategy. The section concludes with findings related to the Collaboratory's capacity-building efforts, particularly workshops.

### Contributions to the work of Collaboratory team members

Inverness's cases of the Collaboratory's local labs demonstrate that the Collaboratory has enriched the professional opportunities and networks not only of those directly involved in the four local labs but also of others involved in closely related work. The Collaboratory enabled new collaborations and opportunities for its team.

The experiences of Maine team members are illustrative of transformational change accomplished in the local labs. SRI followed up with Maine team members featured in Inverness's formative case to fully document changes that were just beginning when the formative analysis occurred.

### Examples of professional transformation in Maine

Across the Collaboratory partnerships, we have identified transformative impacts of participation in these endeavors. One strong case can be derived from the work of the Maine lab, where teachers and researchers collaborated in a partnership focused on elementary math instruction in rural 1-to-1 classrooms (i.e., in which each student has a tablet). The partnership involved researchers from EDC and the University of Maine-Farmington,



*Photo: Interactive STEM, Research+Practice Collaboratory*

and classroom teachers, principals, and instructional coaches from the Auburn School District working together in a professional learning community (PLC).

Practitioner partners interviewed (a mix of Auburn teachers and instructional coaches, and University of Maine faculty) all spoke of developing a genuine appreciation for research. They described learning from the joint work how useful researchers can be in the classroom. They also noted that their voices were valued. They described feeling empowered to speak about their classroom experience as a valued resource for identifying and solving problems. Teachers also reported being able to demonstrate the effects of their monthly meetings with researchers, and the deep understanding of the context that the researchers brought to the relationship; the team recorded classroom video to document the changes transpiring in their classrooms.

### ***Valued voices, new roles***

Based on what researchers observed and teachers reported, the team jointly identified challenges and designed PD to address them. Those interviewed held very positive views of this PD, with one calling it “the best PD I have ever received.”

*They valued that the PD not only introduced a new proposed solution (often in the form of a new digital learning tool), but also thoroughly addressed implementation, for example by highlighting examples and videos of use in familiar contexts.*

They noted that the examples came from real classrooms in their district, operating with similar circumstances and constraints as their own. Further, they reported being encouraged and coached on how to reflect on observations from their own implementations back and share them at the next PLC meeting. Furthermore, the administrators were highly supportive of participation, and all participants were compensated for their time, which made them feel less like “customers of commercial products” and more like equals in the improvement process. All practitioners also reported feeling empowered to reach out to researchers directly—a testament to their growing appreciation of research that is grounded in partnership, and clear evidence that their professional networks have expanded in critical ways through this engagement.

One interviewee described her trajectory from classroom teacher participating in PD led by the EDC and UM-Farmington researchers to becoming a K-3 math coach for the district. In her new role, she provides resources to her district and also attends national conferences, where she

presents on the partnership, and shares resources developed in the partnership with other teachers and math coaches.

Researchers from UM-Farmington who were interviewed highlighted a similar sense of equity in the partnership, and noted that they felt more confident in the guidance they provide and PD they develop because the approaches were grounded in teacher input and observation. Having the opportunity to engage with practitioners through this partnership has also enabled the researchers to develop new and relevant lines of research they would have not otherwise thought of pursuing. Additionally, they reported that participating in this partnership has also led to partnership work in other projects, in which they now carve out space and time to more fully engage the practitioners involved. One such example is a current effort with instructional coaches. Since participating in the Collaboratory's Maine lab team, the professor has changed how she manages the time and interactions with the instructional coaches prior to devising new implementation strategies. She reported that this Collaboratory strategy was working well in this other partnering context.

Upon reflection, the researchers did not feel that participating in the Maine lab fundamentally changed their research goals; rather, the experience provided them a unique platform to engage in R/P work, the resources (both tools and funding) to do it well, and strong evidence to fuel publications and future funding proposals to support new partnership work. The researchers also all reported deriving from the EDC-UMF-Auburn partnership a level of motivation and satisfaction unmatched by other recent research experiences.

## **Uptake and use of Collaboratory resources**

In terms of the project's sphere of influence beyond those involved in local lab work, we first illustrate the sheer reach of the Collaboratory using digital metrics (e.g., Google analytics), and benchmark those findings against those from a comparative analysis. We then place these numbers in the context of findings from interviews with people who use Collaboratory websites, discussing how people learn of the resources, how they use them, and what they value about them. Then, in the analysis of the professional network association (PAN) strategy, we similarly explore how professional association leaders use and value Collaboratory resources and approaches. Across the Maine lab work described above, the website user interviews, and the PAN analysis, a theme emerges: people report that Collaboratory tools and routines make their work not only better but, more fundamentally, make it possible.

## PI and co-PIs prominent in summative perspective: a note on the use of individual names

In the sections that follow, we sometimes refer to the Collaboratory team but we also use individual PI and co-PI names to convey informants' experiences as they shared them. Although nearly everything the Collaboratory produced depended on the efforts of multiple people—the work would not have been possible without a large, committed team—in interviews with people who partnered with the Collaboratory or used its tools and resources, we heard over and over the name or names of specific PIs, but very rarely heard anyone evoke a team or name another team member.

To some degree, the way informants elide the team reflects their individual experiences: indeed, the PIs were the ones who generally led workshops and led collaborations with professional association leaders. Further, though, SRI found that even people who use Collaboratory tools and resources but had never or only briefly met the PIs also referred to individuals by name to metonymically refer to the work of the Collaboratory. This reflects the degree to which the four Collaboratory leaders are nationally known. They are called on to testify to Congress, conduct pre-proposal workshops on behalf of NSF, and contribute to a range of field-serving publications. They are considered vital partners in national-level efforts.

SRI posits that these four individuals have become personally branded as “the Research+Practice Collaboratory” and as symbols of research-and-practice quality more broadly. In a RPP workshop in which the Collaboratory was not involved, SRI observed a slide that featured the *faces* (not accompanied by names) of Buffington and Penuel, among faces of other RPP leaders. The fact that faces sufficed reflects the PIs' known positions as field leaders.

In other words, the PIs are both the tips of the local lab icebergs and individuals, with personal Twitter followings, work styles, relationships, and bibliographies, all of which have also been essential to the project's success. The data, from the summative perspective, reflects that the Collaboratory is fueled by a large team as well as by star power. Further, the leadership's highly aligned values and approaches, refined throughout the work, enabled them to stand in for one another in interfacing with the field, a synergy that extended the reputations of each as well as extending the impacts of the work.

## Digital metrics and website user interviews

SRI examined the reach of Collaboratory products and processes, and explored who uses them and how, as part of answering evaluation question 2 (outcomes). The Collaboratory's online

engagement strategy provides a range of metrics that describe the reach of resources; interviews with users of the Collaboratory websites with the most traffic—the main site, Researchpractice.org, and STEMTeachingTools.org—provide a more in-depth view. The presentation of findings from analysis of digital metrics and interviews focuses on the use of these two websites and the materials they help make available. SRI also benchmarked the reach and engagement levels of Researchandpractice.org against metrics from comparable websites to provide context for the Collaboratory’s reach.

### ***Analytics demonstrate national reach***

The team has been highly effective in coordinating its communication strategy to increase traffic to its websites and build awareness of its tools and resources. A communications team with members from each lab followed a centrally devised strategy for online engagement, and systematically combined social media engagement with in-person events to amplify the Collaboratory’s reach.

The success of this strategy is shown both in growth of reach over time and as benchmarked against comparable websites. To gain a richer understanding of the Collaboratory’s digital metrics, SRI conducted interviews with website users. Interviews addressed how people use resources they download, including whether they adapt or combine them, and with whom they share them and in what contexts.

The timeframes selected in the following analysis derive from specific Collaboratory developments. In late 2015 and early 2016, the Collaboratory launched a redesigned Researchandpractice.org site and shifted website development and maintenance from an outside vendor to an internal team member who quickly proved skillful and responsive. Also at that time, SRI worked with NSF and Collaboratory leadership to revise its evaluation approach, including to take better advantage of the metrics available from Researchandpractice.org and the related channels shown in Exhibit 5. Download tracking was enabled on most team websites in late April 2016. For the remainder of the project, SRI provided the team with summaries of the analytics, which the communications team presented in team meetings.

SRI uses a period of two full years of Collaboratory activity available following the relaunch of the website (January 1, 2016 – December 31, 2017) for some metrics below, but uses the period May 1, 2016 – December 31, 2017 for analysis of patterns in resource downloads, since May 2016 is the first full month for which download data is available.



Exhibit 5. The R+P Collaboratory's digital assets

<p><b>Websites</b></p> <ul style="list-style-type: none"> <li>- Researchandpractice.org</li> <li>- STEMTeachingTools.org (UW)</li> <li>- LearnDBIR.org (CUB)</li> <li>- InteractiveSTEM.org (Maine)</li> <li>- CTAN (Exploratorium)</li> </ul>	<p><b>Twitter</b></p> <ul style="list-style-type: none"> <li>- @rpcollaboratory</li> <li>- UW - @STEMTeachTools</li> <li>- EDC - @edcrpcollab</li> <li>- Exploratorium/CTAN – @ctantinkering</li> <li>- CU-Boulder – @learndbir</li> <li>- Bronwyn Bevan - @BronwynBevan</li> <li>- Bill Penuel – @bpenuel</li> <li>- Phil Bell - @philipbell</li> </ul>
<p><b>Facebook</b></p> <ul style="list-style-type: none"> <li>- Collaboratory</li> <li>- STEM Teaching Tools</li> <li>- Phil Bell</li> <li>- Bill Penuel</li> </ul>	<p><b>Email newsletters (Mailchimp)</b></p> <ul style="list-style-type: none"> <li>- Collaboratory</li> <li>- STEM Teaching Tools</li> </ul> <p><b>Youtube</b></p> <ul style="list-style-type: none"> <li>- Collaboratory (where RPP Forum videos are also posted)</li> </ul>

### Mapping Relationships Among Collaboratory Websites and Other Websites

In late 2015, the Collaboratory took something of a gamble to shift significant project resources towards developing a more distributed online presence. The team's use of the term "ecosystem" to refer to the group of websites reflects the project's aim of establishing relationships among the websites and with other non-project websites.

SRI gauged whether this aim was reflected in website user behavior by using the Google Analytics metric of referrals (by which a user arrives on a website by having clicked a link to it on another website). Exhibit 6 illustrates the interrelated activity of the Collaboratory family of websites and the strategy's success in staking out a place in the field.<sup>11</sup> It maps the websites' relationships over the period January 1 2016 – December 31, 2017 as indicated by the number of referrals between each site, i.e. the number of times a user clicked from one of the sites included to arrive at another one pictured.

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<sup>11</sup> The CTAN website is a subsection of the Exploratorium's website. We do not include it in Exhibit 6 since the CTAN work had largely ended as the Collaboratory was revising its web strategy, so this one played a secondary role in the overall engagement effort.



Exhibit 6. Traffic from other websites to four Collaboratory websites, January 1, 2016 – December 31, 2017

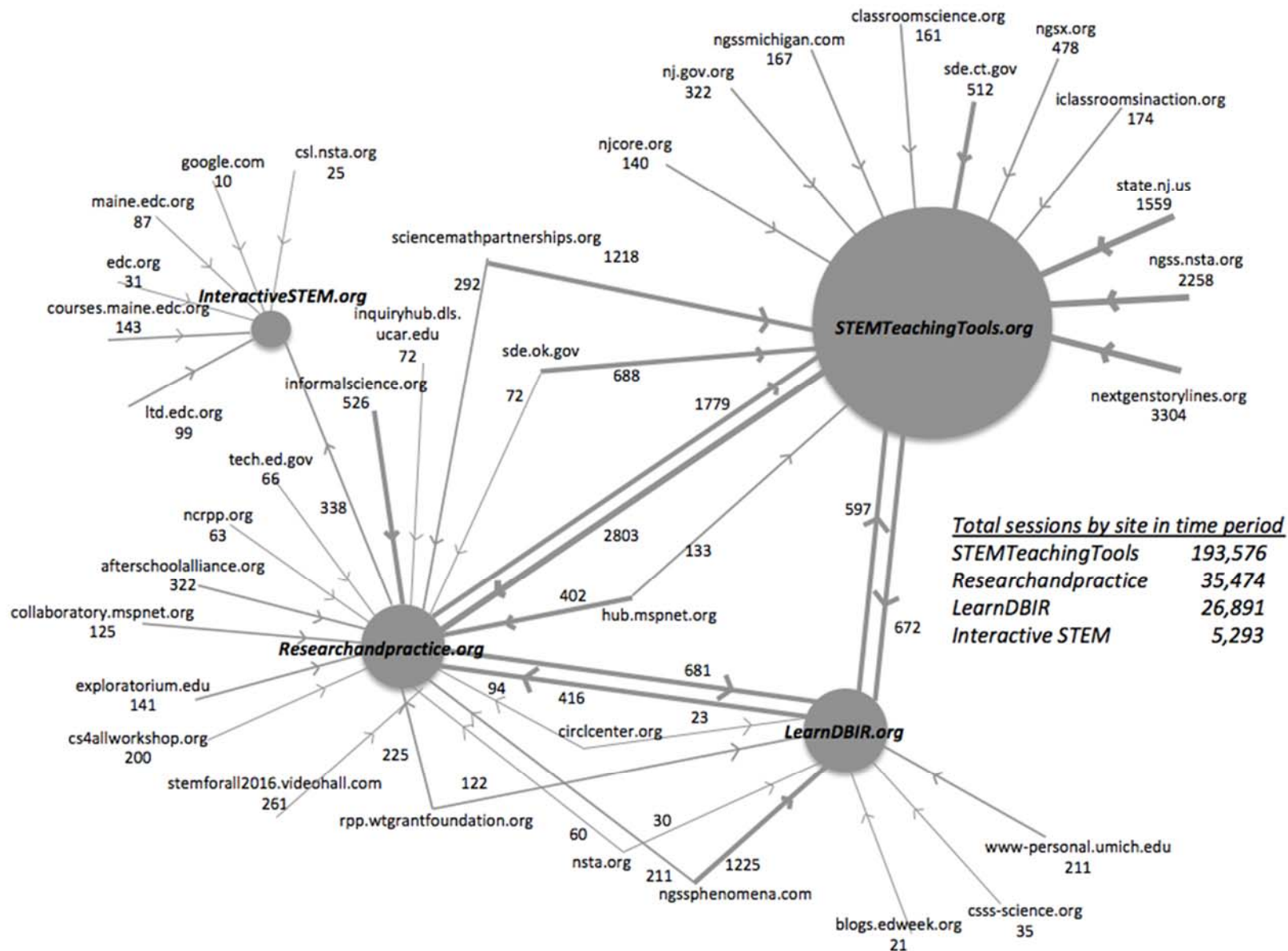


Exhibit 6 also shows the total traffic volume (i.e. total sessions) of each of the Collaboratory’s websites over the same time frame, and the portion of total traffic for each generated by referrals. It is important to note that each arrow represents only *incoming* traffic and only that incoming to four Collaboratory-affiliated websites.

The ties mapped by website user behavior in this exhibit indicate that the Collaboratory’s tools and resources have reached the audiences of the non-Collaboratory organizations shown and, further, suggest relationships between Collaboratory leadership and that of the other entities. We explore these ideas further below.

### **The Numbers**

This section focuses on the Collaboratory websites with the highest volume of traffic, Researchandpractice.org and STEMTeachingTools.org. Over 25,000 users downloaded tools and resources over 7,000 times from Researchandpractice.org in 2016 and 2017, while nearly 143,000 users made nearly 38,000 downloads from STEMTeachingTools.org in the same timeframe (Exhibit 7).<sup>12</sup>

*Exhibit 7. Website traffic and Twitter followers, January 1, 2016 – December 31, 2017*

Metric	Researchandpractice.org and @RCPCollab	STEMTeachingTools.org and @STEMTeachTools
Total sessions	35,474	193,576
Total users	25,247	142,832
Total downloads	7,229*	32,759*
Twitter followers (as of December 2017)	988	5,620

\*Note: Downloads were enabled on both websites in late April 2016. As a result, this total counts downloads only from May 1, 2016 – December 31, 2017.

Traffic levels reflect the sites’ respective purposes (Exhibits 7 and 8). Researchandpractice.org serves to cross-post the products of the contributing local labs and to share the team’s jointly

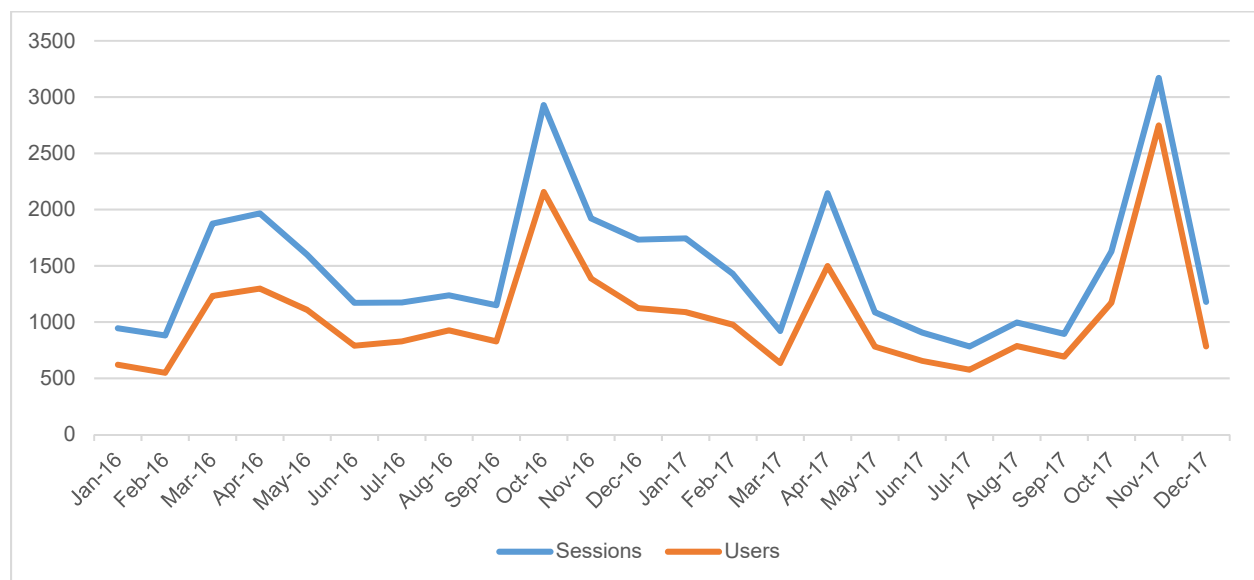
<sup>12</sup> It is worth noting that not all Collaboratory-affiliated products were intended to reach national audiences or supported by similar promotion efforts. Nor did each website enjoy the same level of autonomy: the CTAN website, for example, lived within the Exploratorium’s site.

produced and other-produced products focused on supporting RPPs. As the grant was closing, the PIs agreed to maintain the site and the R+P Collaboratory brand for linking some future efforts but in general website user activity waned in the project’s final months.

STEMTeachingTools.org, which supports education leaders and teachers in NGSS implementation also serves an ongoing coalition of CSSS state leaders involving two Collaboratory co-PIs (Advancing Coherent and Equitable Systems of Science Education, ACESSE<sup>13</sup>, led by Penuel and Bell), so activity there continues apace while use of the Tools continues to expand beyond ACESSE partners as well.

### Researchandpractice.org

Exhibit 8. Researchandpractice.org sessions and users by month, January 1, 2016– December 31, 2017



In January 2016 – December 2017, Researchandpractice.org saw **nearly 96,000 pageviews**. In May 2016 – December 2017, the site averaged **over 1,000 users and 360 downloads per month**. The Twitter feed gained an average of 30 followers per month in the same timeframe.

### Snapshot of Researchandpractice.org activity

**Download activity centered on STTs and resources on RPPs and equity.**

<sup>13</sup> See [cosss.org/ACESSE](http://cosss.org/ACESSE).

- 125 resources were downloaded (including different versions of the same resource).
- 12 resources were downloaded more than 50 times. Nearly 50 resources were downloaded more than 30 times.
- 10 of the top 20 downloads relate to STEM Teaching Tools. Among the top 50 downloads, resources for developing RPPs and resources on equity predominate.

**Most-viewed pages were about the Collaboratory, its workshops, funding opportunities, and RPP supports.**

- Five pages about the Collaboratory figure in the top 15 most viewed pages (ranging from 1700 to over 3000 views each, plus the home page, with over 20,000 views).
- Four pages about Collaboratory-led workshops and funding opportunities, each with between 1500 and 2000 views.
- Thirteen of the top 50 pages are specific RPP tools and resources, including those in the RPP Toolkit.<sup>14</sup>
- Few pages about lab-specific work are among the most-viewed. Five of the top 50 pages relate to STEM Teaching Tools, two to making and tinkering, one to early math.

**Traffic sources illustrate multi-pronged strategy**

- **Direct hits** (43% of traffic in 2016-2017) occur when users enter a specific URL—for example, one shared in person at a conference presentation, workshop, or professional development event.
- **Referrals**, or links from other websites, account for 35% of traffic in 2016-2017. STEMTeachingTools.org is the top-referring site; other team and PAN websites follow on this list, as shown in Exhibit 6.
- **Social media** generated 11% of traffic in 2016-2017, the majority via Twitter, with a smaller portion coming from Facebook. In 2016, the social media campaign was more active, generating 15% of traffic.

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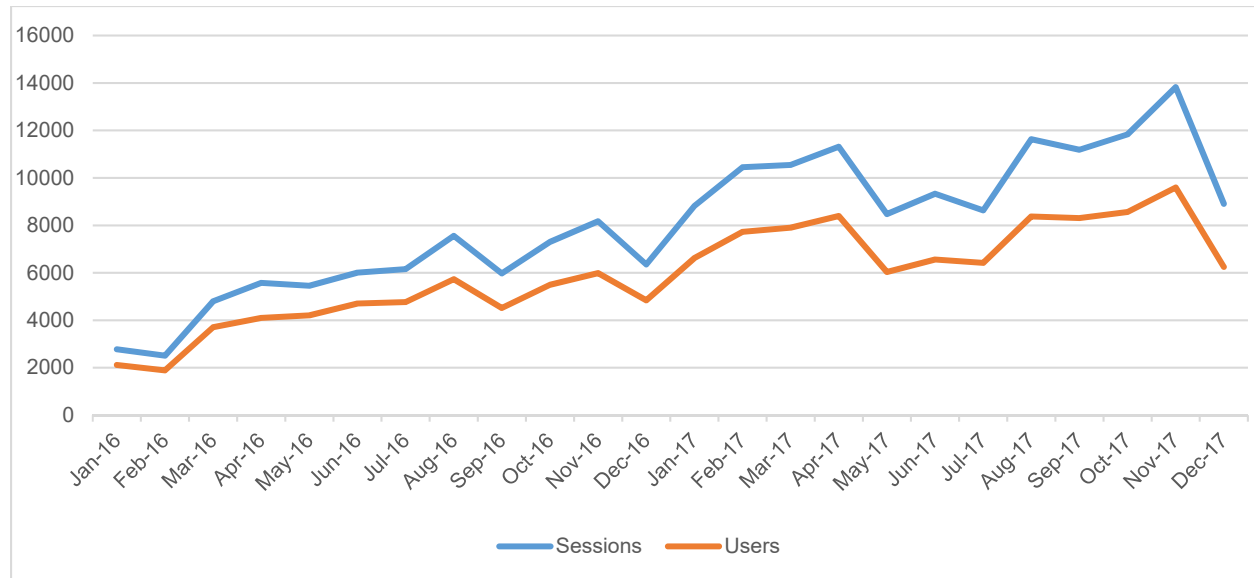
<sup>14</sup> These included resources on building equity, a guide map for partnerships, value mapping, sustaining partnerships, kicking off collaborative design processes and negotiating the collaborative focus of joint work, as well as RPP toolkit resources on building relationships, designing for equity, building partnerships, gathering and using evidence, and communicating with different audiences. As the overlap in topics here suggests, some redundancy in tools emerged over the course of the work, as some new ones were developed for the Toolkit rather than being taken from the team’s already created materials.

## National reach

- Users in over 35 locations had 100 website sessions in 2016 – 2018.
- Users in another 85 locations had between 30 and 99 sessions in those two years.

### **STEMTeachingTools.org**

Exhibit 9. *STEMTeachingTools.org sessions and users by month, January 1, 2016 – December 31, 2017*



In January 2016 – December 2017, STEMTeachingTools.org tallied over 510,000 page views. In May 2016 – December 2017, the site averaged over **6,500 users and 1,600 downloads per month**. Website traffic has grown steadily. So has the Twitter following, averaging over 170 new followers per month; @STEMTeachingTools was identified as a top influencer at NSTA 2017.

### **STEMTeachingTools.org: Snapshot of download activity and page views**

- 128 different resources downloaded, including different versions of the same resource.
- 65 resources have been downloaded more than 100 times.
- In summer 2017, top downloads relate to assessment, use of phenomena, and cross-cutting concepts. Resources related to nurturing student talk became more prominent in months that those resources were promoted in workshops and on social media. Resources explicitly focusing on equity and inclusion were generally not in top downloads although also quite well-viewed and -downloaded.

- Nearly all of the 50 most-viewed pages are those of specific tools, with between 2300 and over 11,000 views each. The main tools page had over 68,000 views.
- The team’s strategy of grouping resources ready for use was popular. Pages housing collections of materials for leading professional development sessions received over 33,000 views total (across the main page and the pages for each of four sessions).
- Other groups of thematically related tools (i.e. “playlists”) were less popular, at least insofar as page views indicate: the most-viewed playlist is the 49<sup>th</sup> most-viewed page.

### ***Comparative analytics underscore success of digital engagement***

In order to better understand the broader impacts and reach of the Collaboratory’s activities, SRI identified other comparable entities (three NSF program resource centers and one foundation) and requested website data and other online engagement metrics for a 5-month period, August 1 – December 31, 2016. We then collected the same metrics for the same period from the Collaboratory’s website, Researchandpractice.org, in order to benchmark Collaboratory usage data against others. All metrics are in Appendix D. The R+P Collaboratory is a unique entity; it was difficult to identify comparable entities, especially ones willing to share sensitive data with us.

Our findings are all the more remarkable given that the comparison websites have the advantage of age—they all predate Researchandpractice.org by at least several years (and by over 15 in one case). Further, all but one are associated with NSF funding programs, giving them something of a pre-defined audience. We found that researchandpractice.org reaches a smaller but more active and engaged community, as measured by Google analytics, email newsletter metrics (Mailchimp), and social media metrics (Twitter and Facebook). Highlights from this analysis follow:

- Researchandpractice.org has **fewer but more active users**. It has a disproportionately larger percentage downloads, pageviews, resources created, resources downloaded, and number of downloads for the most-downloaded resources.
- Website traffic generated by **referrals** (i.e. links from other websites) is **well above the average** as compared to other sites. This reflects in part the networked structure of the Collaboratory, as a family of websites and other online assets (see Exhibit 5) with Researchandpractice.org at its hub.

- The Collaboratory is **much more effective at using social media** to drive website traffic than the other websites. Website traffic generated by Twitter, their primary social media tool, is nearly double that of every other site.
- The Collaboratory has the smallest raw number and percentage of Facebook followers and “likes” of the group. Among Twitter users, as a percentage of followers to unique users of the website, they are close to the median of the group. This, too, signals a **heavily engaged user base**, more reliant on Twitter for connecting with the Collaboratory than other organizations’ users.
- The Collaboratory has the smallest number of newsletter subscribers, but again, the metrics indicate that they have a dedicated and engaged audience, which indicates **well-targeted and efficient communication** by the Collaboratory team. Metrics for the Collaboratory’s email newsletter are at the upper end for “open rate” and near the middle of the group for “click rate.”<sup>15</sup>

### After the download: how people use the tools and resources

Findings from web user interviews showed that in some cases a single download corresponds to tens or hundreds of uses of that resource. Echoing PIs’ reports of distributing stacks of hard-copy sets of resources at workshops, web users reported sharing the resources electronically and in hard-copy, particularly when they lead PD or curate sets of resources on a particular STEM education topic.

The website users we interviewed were all already involved in R/P work and/or STEM teaching in some capacity, and actively using the websites’ resources to support and advance that work. All six of the STT website users we interviewed were practitioners, including science teachers; district and state education leaders, and a leader of a state science teachers’ association. Of the four Researchandpractice.org website users interviewed, two were researchers (e.g., at research institutes), one was a practitioner (a secondary science specialist for a school district); and one identified with both researcher and practitioner roles, as a leader at an education policy and advocacy organization.

Two of the four Researchandpractice.org users interviewed used the website to find supports for RPP work while the other two used it to find STEM Teaching Tools. This reflects the team’s

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<sup>15</sup> Mailchimp, the source of this data, calculates “open rate” as the percentage of successfully delivered emails that is opened. “Click rate” is defined as the percentage of successfully delivered emails on which a reader clicks at least one time. See <https://mailchimp.com/help/about-open-and-click-rates/>.



strategy of posting to Researchandpractice.org resources produced by each lab and the overall prevalence of STEM Teaching Tools among Researchandpractice.org downloads.

### ***How website users learn of the tools and resources***

These website users reported learning about new website resources from a wide range of sources. This aligns with the Collaboratory's strategy of engaging across multiple channels. Users cited these sources of information in addition to the two websites:

- **Social media.** Some reported following @STEMTeachTools and/or co-PI Bell on Twitter, tweeting about resources themselves, or hearing of and/or posting resources via professional Facebook groups (e.g., NGSS Educators, Advancing Ambitious Science Teaching, state-based science teachers' groups).
- **Email newsletters.** These include the RPC and STT newsletters—one noted, “the newsletter is a great reminder to check the website for other new tools”—as well newsletters from associations and other professional groups.
- **Other organizations.** Users find and/or post resources on other organizations' websites (e.g., Achieve, professional associations),
- **Word-of-mouth and in person,** among colleagues and at meetings and other events. Two users reported first encountering the resources in hard copy at PD events. One was “given a set” of STEM Teaching Tools at a PD involving a community of practice of a state board of education and the state's county superintendents' association. The other attended a workshop for NSTA Curators led by the RPC. One RPC website user was already familiar with the resources when she gained more experience with them at a Collaboratory-led CSforAll proposal development workshop she attended.

### ***What website users value about the tools and resources***

Both RPC and STT website users had high praise for the resources available on the sites—mainly for specific tools but also in a few cases for research syntheses and other materials. Here's what they value about them:

- **They fill a need.** Users reported not having seen any similar resources that served the same purpose. This echoes PAN contacts' views that Collaboratory-produced resources are unique in the field.
- **They are created in partnerships—they are research-based and reflect educators' input.** About half of those interviewed knew the resources were jointly developed by



researchers and practitioners. All interviewed—those who knew at the outset and those who learned about the R/P genesis of the resources during the interview—believed that the co-design gave the resources more credibility. As one user said, “yes, I do appreciate that they are from a partnership, [based on] work that is being done on the ground—real-time implementation of research, I appreciate that about the resources.” Another stated,

*“I didn’t know what research-and-practice meant, but now that I know that, yes, having the educator voice is critical. As a science teachers’ organization, we see that voice lacking in things that come out of higher ed and don’t have applicability in the classroom.”*

- **They are from a trusted source.** Most website users interviewed trust the tools based on the reputations of Collaboratory leadership and/or NSF. One commented that the resources are “associated with people I really respect, like Bill [Penuel]. That gives them instant credibility.” Another stated,

*“NSF [...], that is another sign of quality. And I knew names of people involved in the project, knew their reputations.”*

- **They are easy to use alongside other resources.** Users find it helpful that both the RPC and STT resources are modular and are the right “grain-size” for addressing particular needs and circumstances. Users interviewed appreciate that they can easily “pick and choose” the resources that meet their needs, and easily fit their classroom or PD activities or their partnership meetings. Similarly, users value that they contain links to other resources.
- **They are clear, well-organized, and succinct. The design is appealing.** All users interviewed appreciate the clarity and the step-by-step instructions in some tools. One RPC user stated,

*“I like the way it's laid out, it's accessible and easy to use. It's something I can print out and take with me, and lead a session with it. I like the look and feel. They are very visually appealing and inviting, not super text heavy. That's important when you're using a tool like that with a new group.”*

- **They serve as communication aids.** RPC users find the resources help communicate with both research colleagues and educator colleagues about what RPP work is and how to conduct joint work at various points in the partnership. STT users find the resources are particularly helpful in starting meaningful conversations with teachers.

Amid the praise, two suggestions for improvement emerged, both related to accessibility for teachers and informal educators.

- **The tone is sometimes too academic.** One STT user finds the tone of some resources more teacher-friendly than others. Some resources read like “they are written by grad students trying to impress their advisors,” she observes, “not trying to write for the teachers who will use it.” One user of both RPC and STT resources finds the tone “too academic-y.”<sup>16</sup>
- **Practitioners may not recognize big researcher names.** One person suggested that the resources “have more names from the practitioner space—like Jean Ryoo from CTAN—recognizable or visible voices that they know.”

PIs are explicit that the tools are designed for not only for education leaders but also teachers and other “front-line” educators. Certainly, the sheer numbers of website visits and downloads suggest use goes far beyond education leadership. SRI and Inverness both observed, however, that education leaders may be best positioned to fully use the tools—the teachers who described using the resources in interviews (Exhibit 10) are active in state and national associations, for example. To maximize use by leaders and educators, efforts to simplify the language, even out the tone, and more prominently feature practitioner names alongside researcher names would be welcomed by leaders as well as those they train.

### **Focus on STEM Teaching Tools**

Exhibit 10 illustrates the limitations of website analytics to show the reach of the tools; STT website users who lead science teacher PD described printing sets of tools to share in trainings. As noted above, two people reported receiving printed sets of STTs as PD



*Photo: STEM Teaching Tools, Research+Practice Collaboratory*

<sup>16</sup> These views do not reflect users’ views of all Collaboratory tools, only of tools and resources encountered by users of the project’s two websites with the highest traffic. PAN contacts and practitioners involved the Collaboratory generally considered the materials’ accessibility a strength.

participants. Reported uses in PD include training people to incorporate anchor phenomena into assessments and to develop and integrate 3D formative assessment tasks. Teachers who reported using them directly in their classrooms did so to support hands-on and inquiry activities, student investigations in their communities, and to promote student talk.

*Exhibit 10. How People Use STEM Teaching Tools*

**A leader in a state-wide STEM community of practice and affiliate CSSS member:** “I have used Brief 28 (Anchor phenomenon) -- #17 -- one particular group needed support for talk – and also #20, #31, #22, #38 and #42.”

**A state science teachers’ association leader:** “I look for the ones on access and equity issues -- English learners, culturally relevant instruction” to share with members, including in response to emailed queries and via retweets.

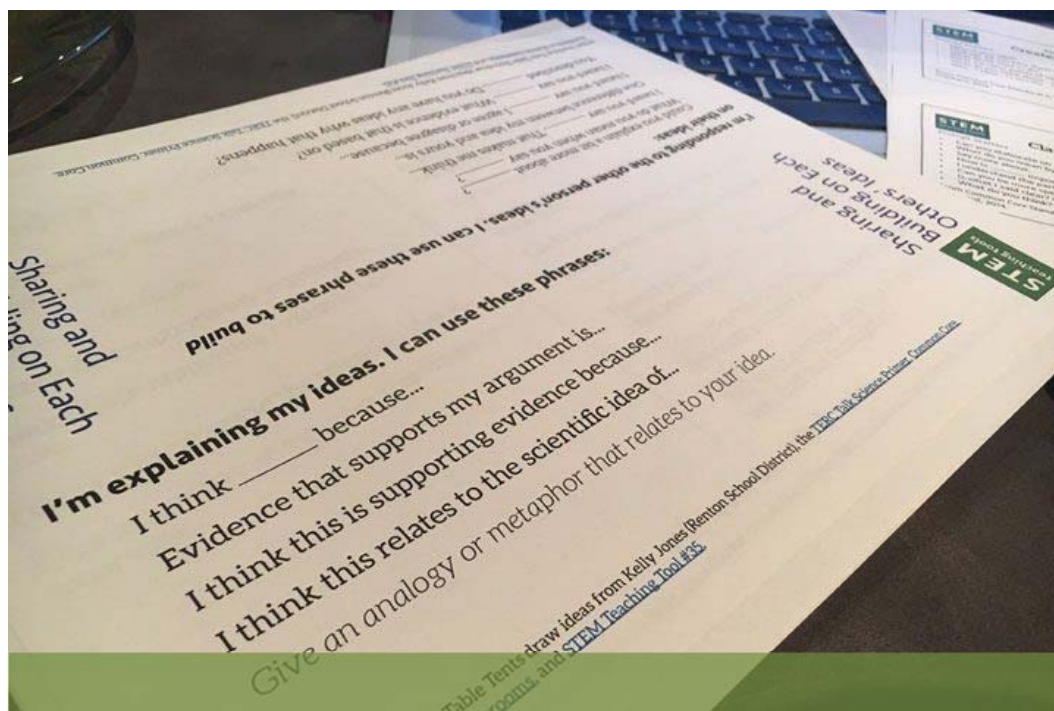
**A secondary science specialist** also involved in an RPP focused on science explanation and argument: “Tools 30 and 41, I usually use 30 and 41 together. I want them to integrate all three dimensions so it’s good to use these together. I used 41 yesterday with teachers. Also, a couple about argumentation. Also used it in conjunction with supporting ELL students, Tool 33. Also 34 used with these. Also 29 with steps to designing 3D assessments. Practice Brief 1. Assessment for ELLs and cultural argumentation, Tool 25. Tool 28, have used it a lot – good anchoring phenomenon. Tool 31, cultural formative assessment.”

**A science teacher, member of state science teacher association who leads PD on NGSS implementation, and serves on the standards-writing committee, and as an NSTA Curator:** “Questions around cross cutting concepts, I find [those tools] extremely useful in the classroom. I don’t have to reinvent that wheel, I can use what someone else has come up with and add to it when I need to. When it comes to PD, anything around 3D learning and phenomena are really helpful for me to steer teachers towards that because that’s the PD I’m looking at. And assessment, and a lot of work on assessment [...] because I think it’s the next place that everyone is struggling – ‘how do we assess 3 dimensionally?’ The one on misconceptions is helpful too. Equity are good. [...] I do pull those out when I do PD.

**A leader at a STEM policy and advocacy organization:** “I did a webinar with Phil Bell and compiled a NGSS resource guide that references a lot of STTs, and posted it on our website.”

*Key to Practice and Research Briefs (STEM Teaching Tools) mentioned in Exhibit 10:*

- 1 Is it important to distinguish between the explanation and argumentation practices in the classroom?
- 15 How can we promote equity in science education?
- 17 Beyond the written C-E-R: Supporting classroom argumentative talk about investigations
- 20 Getting their hands dirty: Engaging learners in authentic practices outside the classroom
- 25 How can formative assessment support culturally responsive argumentation in a classroom community?
- 27 Engaging English learners in the science and engineering practices
- 28 Qualities of a good anchor phenomenon for a coherent sequence of science lessons
- 29 Steps to designing a three dimensional assessment
- 30 Integrating science practices into assessment tasks
- 31 How to launch STEM investigations that build on student and community interests and expertise
- 33 How to design assessments for emerging bilingual students
- 34 Designing an assessment system that measures three-dimensional science learning
- 37 Beyond “misconceptions”: How to recognize and build on facets of student thinking
- 38 What is the role of informal science education in supporting the vision for K-12 science education?
- 41 Prompts for integrating crosscutting concepts into assessment and instruction
- 42 Using Phenomena in NGSS-designed lessons and units
- 53 How to avoid known pitfalls associated with culturally responsive instruction misconceptions



*Photo: STEM Teaching Tools, Research+Practice Collaboratory*

### **Adaptation and use of STTs with other resources**

All STT website users interviewed reported adapting STTs and/or using them in conjunction with other resources. Several people reported including STTs alongside other resources as they gather materials for PD workshops or ongoing support of science teachers. One noted that sometimes the Tool is already the right “grain-size” but sometimes she needs to go “farther into the content than the STEM Teaching Tools are intended to do” to serve teachers’ needs in her state.

Another person noted building from ideas in the STTs on the fly in the classroom:

*I’ve looked at some of these resources, a light bulb goes off and I think, oh, I can use this in this way, or I can adapt this in this way, and it’s going to get to what I need to with my students. So I think it’s the fact that something else is out there and it’s another place for me to grab onto an idea that I can incorporate.*

One person described adding prompts for student-student talk to one resource:

*The question stems for cross-cutting concepts—those, I’m also going to adapt and use for students to question each other, which is my next step in that. [The Tool has] stems for me to ask as teacher, but there also should be questions that students ask each other in their daily science talk.<sup>17</sup>*

Another interviewee reported that while she uses individual tools “as-is,” she did make changes to an STT PD module “to include a variety of ways of processing for teachers, to fit our model of professional learning.”

### **Leveraging professional association networks**

Collaborating with professional association networks to reach broad audiences and increase the relevance and usefulness of education research was both a key strategy and a key innovation for the Collaboratory. The team presented on the strategy in a presidential session at AERA

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<sup>17</sup> SRI conducted the website user interviews in summer 2017, just as the STT team was starting a coordinated push around its student talk resources (e.g., STTs 6, 7, 35; see key to titles in Exhibit 10).

2018, led by the four PIs and leadership from CSSS, CAISE, NCSM, and Afterschool Alliance—reflecting collaborations with each PI (see Bevan et al., 2018).<sup>18</sup>

As expected, the PAN strategy yielded different results with different associations. The strategy depended not only on PI efforts but also on the prior history and maturity of relationships, synergies of needs and expertise, and organizational culture and history of R/P work. SRI found the mature PAN strategy illustrative of the Collaboratory’s balancing highly aligned common goals and approaches with situated, varied paths to achieve them.

Over the course of the project, Collaboratory leadership developed the most intensive PAN collaborations with CAISE (Center for Advancement of Informal Science Education) and CSSS (the Council of State Science Supervisors). Bevan transitioned from advisor to co-PI at CAISE, where she became involved in three initiatives. Bell and Penuel partnered with CSSS on an NSF-funded grant, ACESSE, that carries the STEM Teaching Tools work on improving NGSS implementation (developed under the Collaboratory) into an RPP with CSSS leaders from 13 states. ACESSE builds capacity in state networks through researcher-led PD and by state leaders’ using what they learn in the partnership to work jointly with teachers on evidence-based improvement. The team also continued to collaborate with NSTA and Afterschool Alliance, as well as with NCSM and NCTM.

Some of the entities included in the initial PAN environmental scan (e.g. STELAR and REL-NEI, along with MSPNet) have remained dissemination partners of Collaboratory resources in a mutual arrangement less intensive than the core PAN work. These groups have called on the Collaboratory to develop webinars for their audiences, and also featured Collaboratory resources in newsletters and on their websites.

The Collaboratory has also developed mutualistic relationships with other organizations (e.g., Achieve, the William T. Grant Foundation, NNERPP, TODOS). Collaboratory leaders consider these groups “traveling partners” on the path to the common goal of building capacity for education research-and-practice.

The findings reported here draw on document review and interviews with Collaboratory leaders and PAN contacts. After the 2013 environmental scan, SRI collected updates on PAN work from

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<sup>18</sup> A description of the session is available here: <https://www.aera.net/Events-Meetings/Annual-Meeting/Additional-Presidential-Sessions>.



PIs in 2015, then conducted two rounds of interviews with PAN contacts, in 2016 and 2017: with leadership of CSSS (three interviews in each year), NSTA (two interviews in each year), and CAISE and Afterschool Alliance (1 interview respectively in each year). Bell, Penuel, and Bevan—the leaders working with these four organizations—figure centrally here, while the collaboration with NCTM and NCSM, led by Buffington, is not adequately captured. SRI was able to complete only one of four interviews planned with NCTM and NCSM in 2016 and 2017.

### **Results of the mature PAN strategy**

The team’s revised PAN strategy has resulted in notable shifts in perspectives regarding research and practice at two organizations, where relationships have evolved into new partnerships. Leaders of one of these associations (the Council of State Science Supervisors, CSSS) attest to transformative changes in how they work with researchers, peers, and with teachers throughout their state networks. The PAN strategy has also involved Collaboratory leadership in periodic joint endeavors with CAISE, the National Science Teachers Association (NSTA), and the Afterschool Alliance.

Fundamentally, the success of the PAN strategy has accelerated the uptake of the tools among key audiences. For example, working with state science leaders at CSSS meetings on improving NGSS implementation led to the use of Collaboratory tools in state-hosted trainings for district science leaders in multiple states. Similarly, Bevan’s work with CAISE, a nationally known and trusted source of evaluation and research in informal STEM learning, elevated the visibility of Collaboratory resources for informal learning researchers and practitioners.

### ***Foregrounding equity***

Equity emerges as a key theme across PAN interviews, providing evidence for the Collaboratory’s conjecture that RPPs are especially suited to improving equity. One CSSS leader values the RPP approach in part because “equity is front and center. We’ve finally all realized that if we don’t get at that, we have a big disconnect. If we can make progress on it, we’ll be in a good place. Science ed people come at their job through the content, not through the equity lens, historically.” Equity issues are also at the center of Bevan’s work with CAISE, as we note in more detail below.

There was consensus among association leaders interviewed that RPPs are in a unique position to help shift thinking and make progress on equity, but several noted they have yet to see that progress on a large scale. They view improvement in equity and access as critical work

that remains to be done, including closing achievement gaps and realizing broad improvements in afterschool program quality. This points to an ongoing need for RPPs with an equity focus.

### ***Growth in capacity for formative assessment and evidenced-based improvement in CSSS***

The three CSSS leaders interviewed are excited by their joint work: “[Penuel and Bell] value my expertise and my expertise shapes the work,” noted one, stating, the collaboration has “changed the way I think of research in education reform.” All three attribute positive changes in their professional perspective and capacity to the joint work with Bell and Penuel:

- **They described stepping out of their roles to think like researchers.** “Now we feel much more competent with research, and not just the terminology, but the process, the way I think about analysis, the use of practical measures.” Regarding responding to state and federal reporting requirements, one added, “I’m pushing now for different measures [that are ] meaningful, that help you see the reality of what’s going on.”
- **They have earned teachers’ buy-in for evidence-based conversations about practice.** One described using formative teacher survey data to ground a discussion about teacher practice. Prior to this partnership, they did not have such data available. “I’m getting little resistance [from the teachers]. I learned from them [Bell and Penuel], ‘I’m not just going to show you [the teachers] a set of education data, instead I’m going to ask you what you think.’”
- **They are more adept at formative assessment.** “Working with Bill and Phil, and in the Inquiry Group [on Formative Assessment, held in Seattle in July, 2016] changed the way I think and work on formative assessments. Now it’s a way to inform instruction—[...] embedded assessment through instruction. We’ve now done tons of PD [across the state] since the Inquiry Group, and the briefs and tools produced since then have been taken up by large districts.”

The CSSS leaders further described efforts to extend the benefits of their work with Bell and Penuel throughout other aspects of their work:

- They are carrying **Collaboratory routines and tools into their other projects**, and seeking to **model future researcher partnerships** on this RPP. One described “introducing RPP work, papers, and resources available from the Collaboratory” into another partnership with researchers.



- They are **involving others** in the joint development of new STEM Teaching Tools.
- They are seeking to develop resources modeled after STTs for disciplines beyond science.
- **They also observe and implement the processes** underlying Bell and Penuel's partnership work in other contexts: "In those weekly meetings, I look at the workflow, the ways [Bell and Penuel] work, the ways they communicate and martial resources. It's helped me work smarter." This leader is implementing parallel processes at his organization and finds employees benefit from the changes.

While RPPs are known to be time-intensive, participants clearly find the benefits are worth the investment. One CSSS leader highlighted the efficiency of being able to send a STEM Teaching Tool in reply to a listserv query about cross-cutting concepts: "It's an easy, high-quality on-ramp—foregrounding it with the background of how they were developed, it gives power. The mechanism [of creating STTs] keeps you from having to write the same email over and over. It explains the rationale, gives details about what teachers can do. Twenty-plus districts [in my state] are using them."

The only challenge cited was that CSSS leaders need more of Bell and Penuel's time than they can get: "There aren't enough Collaboratory researchers to go around. I hope this effort builds out to a point where researchers have a region, where you'd know, as a state, this is your person. At this point, we're taxing people more than they sometimes have the capacity to deal with."

This challenge recalls the idea presented above that the field perceives mainly the Collaboratory leaders, often not realizing what a large team supports the work. Empowering the team's most senior non-PI members to represent the project alongside or in lieu of PIs could potentially mitigate the perennial scarcity of PI time but SRI did not observe efforts to do that. Generally speaking, other team members readily represented the work of local labs but not its Collaboratory super-structure. This may point to a tension between building legitimacy and capacity in the RPP field: the best-known figures are more needed in a still-emerging area to help sustainably establish and expand it.

### ***Focus on Equity and Broadening Participation with CAISE***

CAISE leadership noted that the Collaboratory brings a value-add to CAISE by complementing other CAISE efforts without duplicating them. CAISE leaders reported considering Bevan their

go-to person for research-and-practice. They also valued the opportunity to participate in Collaboratory-led Inquiry Groups with field leadership.<sup>19</sup>

Over time, the collaboration with CAISE included highlighting Collaboratory work regularly on the CAISE website and in its newsletter. In addition, CAISE has called on the Collaboratory to respond to NSF requests that CAISE support the field in building capacity for R/P and DBIR. Week-long webinar events, led by Bevan, Bell, and Penuel resulted from both requests. The collaboration evolved as Bevan took on the role of CAISE co-PI in late 2016, to spearhead broadening participation efforts, produce state-of-the field reports, and otherwise work to strengthen CAISE support for R/P. She was leading the development of briefs modeled on the STEM Teaching Tools as part of the R/P work strand there.

In interviews, CAISE leadership identified equity and broadening participation as the threads linking all of Bevan's work with CAISE. She was involved in a CAISE study gathering baseline data around the state of intersections between informal science education and science communication; CAISE's Broader Participation Task Force; and an R/P taskforce that launched in 2018. Bevan also worked with CAISE and AAAS to convene and co-lead an RPP workshop for partnerships interested in developing RPP-centered proposals in the informal learning space. Over 30 teams applied to attend the workshop; nine were selected. One criterion for selection was the degree to which proposed projects foregrounded equity concerns.

A possible difference between CAISE and other PAN organizations is that its needs may sometimes be driven more by NSF than arising as problems of practice in the field. For example, NSF requested that CAISE help the field improve capacity for design-based implementation research, an approach which some in informal learning circles view as more appropriate or feasible in formal education settings.

### ***Reaching educators through NSTA and Afterschool Alliance***

The team has also been working with NSTA and the Afterschool Alliance. Collaboratory PIs have co-presented with NSTA leadership at conferences and led workshops at NSTA meetings. STEM Teaching Tools have featured prominently in the NSTA email newsletter, "Next Gen Navigator." At the 2017 annual conference, @STEMTeachTools was ranked third among top influencers (Smith, 2017). Collaboratory leadership has also co-led with Afterschool Alliance

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<sup>19</sup> References to informants among CAISE leadership in this section refer to people other than Bevan.

webinars on NGSS and informal learning research for Alliance stakeholders. But collaborations with NSTA and the Alliance have not resulted in the shift in thinking regarding R/P that comes across so clearly with CSSS and CAISE leadership.

SRI posits that these differences relate to differences in membership needs and organizational cultures of R/P. As teachers and informal educators, most NSTA and Alliance members are likely a few steps farther removed from education research than the state leaders of CSSS, or the NSF-funded researchers at CAISE. The Collaboratory may need a different approach to successfully reach STEM educators who are not also district, state, and association leaders. Afterschool Alliance leadership considers Bevan a “trusted advisor” but thinks the Collaboratory can go farther to take practitioner perspectives into account.

NSTA and Alliance leadership hold a more translational view of connecting research and practice. One NSTA PAN contact described his work as “taking that work, from the research community, and figuring out how to repackage that—to take that info, and better share it with teachers. Also [...] we take on the role of being the voice for teachers in talking with the research community.” The partners with whom RPC leaders work most closely share their view of R/P not as translational but as a mutualistic joint endeavor, in which educators are empowered to work directly with researchers, and researchers’ work is directly shaped by educators’ needs. That NSTA and Alliance leadership feel they need to translate or “repackage” the resources for their members recalls the critique of some website users, that some Collaboratory resources sound too academic.

### ***Conference presentations and relationship development with NCTM and NCSM***

The Collaboratory worked with NCTM from the inception of the Collaboratory; an informant involved in the 2013 environmental scan remained involved throughout. In addition, the team developed a relationship with NCSM national and regional leaders. Buffington and Penuel developed a webinar for NCTM membership that the PAN contact helped promote. Both NCTM and NCSM welcomed Collaboratory leadership at its conferences: Penuel gave a keynote address at NCTM 2015 with Catherine Martin; Buffington and the Maine lab team presented work at NCTM research conferences, as well as at multiple NCSM conferences. NCSM leadership participated in a fall 2016 Inquiry Group meeting and joined other association leaders and Collaboratory leaders at the 2018 AERA presidential session on the PAN strategy.

NCTM leadership reported valuing the Collaboratory's work, which they viewed as aligned with their institutional value of connecting research and practice. NCTM reported promoting such connections on its website (e.g., briefs for practitioners in a "research and advocacy" section; video clips to provide multimedia introductions) at its annual conference (e.g., an annual pre-conference workshop), and its publications (e.g., its *Schools* journal has an R/P component).

Even though NCTM leadership valued the Collaboratory's work, viewed it as aligned with a key association value, and had mechanisms for promoting it in place, however, NCTM leadership remained unsure how the association could benefit from or support the work more deeply. In other words, even with will and interest on both sides, seemingly smaller barriers may arise. NCTM leadership reported remaining highly interest in connecting R/P, particularly among teacher leaders and school and district leadership, and hoped the association could use Collaboratory resources in the future, such as through conference offerings.

***It's mutual: PAN leadership also values extending networks via Collaboratory relationships***

For the Collaboratory, the PAN strategy represents an intentional, national-scale engagement and field-improvement effort. PAN leaders also reported benefiting from the arrangement. PAN contacts at CSSS and CAISE as well as at NSTA and the Alliance valued relationships with the Collaboratory as a means to connect to a broader network and knowledge base. One PAN leader described collaborating with the PI as working "not just with her but also through her," connecting with her professional network. Another described Bell and Penuel as "a bridge to the larger research community in general, to the Framework authors in particular. Bill and Phil can call them and call their work to mind, just like that. And on equity work, they facilitated work with other researchers. They opened doors to engage with other researchers on certain topics like professional learning and equity."

## **Capacity-building through events and initiatives**

The Collaboratory's conference presentations, workshops, webinars, and professional development meetings were one pillar of its "bundling" engagement strategy, which paired online engagement and dissemination with in-person or virtual events. The team also viewed these efforts as an important means of advancing the critical engagement and cultural exchange strands of its theory of action. The Collaboratory used these events to build capacity for design-based RPP work and to share strategies tested in the Collaboratory, including engaging professional associations, and routines for developing tools that aim to be accessible

and useful for practitioners. As noted above, the local labs held a range of educator-focused PD events related to their respective STEM improvement topics. In addition, the team worked to build capacity for R/P work by holding numerous workshops, developing webinar series, and mentoring early career researchers and practitioners through a workshop and a fellows program.

As examples of these events, we estimate that the Collaboratory led or co-led approximately 28 workshops for audiences not otherwise involved in the Collaboratory (excluding teacher professional development events), at least 13 of which were hosted with PAN partners or held at PAN conferences; examples of these are in Exhibit 11. Most of these workshops sought to build capacity either regarding NGSS implementation or regarding forming and maintaining RPPs.



*Photo: Interactive STEM, Research+Practice Collaboratory*

*Exhibit 11. Examples of Collaboratory Workshop Contexts and Participants Types*

Formats and Venues
<ul style="list-style-type: none"> <li>- Pre-conference formats at NARST and for PAN partners CSSS, NSTA, and CAISE</li> <li>- Held at other professional meetings, including of the National Science Education Leadership Association, International Conference for the Learning Sciences, European Science Museum community</li> <li>- Convened independent of another professional meeting, participation by application.</li> </ul>
Participant types
<ul style="list-style-type: none"> <li>- Early career researchers interested in pursuing RPP work</li> <li>- Participants in new or established RPPs (both researchers and practitioners)</li> <li>- Scientists engaged in broader impacts work</li> <li>- State science leaders working to improve NGSS implementation</li> <li>- State and district leaders and industry partners working to expand CS education</li> <li>- Policy leaders, state and district leaders, and researchers working on ESSA evidence requirements</li> </ul>

Because we discuss NGSS implementation work in detail in the CSSS section of the PAN findings, we focus in this section on workshops, and specifically the more intensive RPP workshops—one for early-career researchers and practitioners, two on the role of RPPs in the CSforAll initiative, and one on RPPs focused on informal learning. We also then briefly discuss an ESSA-focused Inquiry Group meeting as a workshop, to illustrate the team’s varied use of the workshop format and its responsiveness to changing contexts. The events included here all featured at least several hours of in-person facilitation—more often a day or two—and active roles for participants.

### **Mentoring early career researchers and practitioners**

Just as the Collaboratory developed tools and resources to support participants in RPPs at all stages of development, it has sought to support professionals engaging in RPP work at various stages in their careers. It can be especially difficult for early-career professionals to pursue partnership work; they may lack institutional support for a time-intensive effort, or lack knowledge of funding sources or other supports.

To mitigate these barriers, the Collaboratory invested in mentoring early-career researchers. SRI considers this investment part of the Collaboratory’s sustainability plan. Particularly at the outset of the project, when interest in education R/P had not yet grown as it has since, including among funders, giving early-career researchers tools to undertake or continue partnership work was an important potential means of expanding the R/P field.

One of these investments was a workshop for early-career researchers new to partnership work. The Collaboratory also later invested in a conference fellows program, through which it sponsored competitively selected researchers and practitioners to attend conferences typically attended by those in the opposite role: 11 researchers were sponsored to attend ISTE, NCTM, NCSM, while 15 practitioners were sponsored to attend research conferences (AERA and NARST). At the conferences, Collaboratory leadership met with the sponsored attendees. The workshop primarily aligns with the cultural exchange strand of the Collaboratory’s theory of action, while the fellows program primarily aligns with the critical engagement strand. Below, we share findings from the workshop.

### ***Findings regarding the Early Career / Doctoral Candidate Workshop***

SRI sought to understand what participants learned in the workshop and the degree to which and how the workshop might influence their pursuit of partnership work over the longer term. To this end, SRI observed the workshop and conducted a baseline survey and a follow-up survey.

SRI found through observation and the baseline survey that the workshop filled a need for participants, nearly all of whom were just getting involved in partnership work.

- Respondents indicated that **prior to this workshop they did not have the resources or tools** to engage in this type of work.
- They further reported that **they had never received this type of information** as part of their graduate training, nor as part of other early career professional development experiences.
- Participants also reported that **input from journal editors was one of most important aspects of the workshop**. Given the centrality of publications to academic tenure and promotion, participants found conversations with editors of the *Journal of the Learning Sciences* to be of great value; following these conversations, they felt more equipped to publish their findings in academic outlets. The participants left the workshop highly motivated to work on partnerships.
- Nearly all workshop participants **felt prepared or very prepared to approach organizations and educators about partnership work**, including teachers and state and district leaders, and informal learning educators and organizations.

SRI fielded a follow-up survey nearly two years after the workshop with the goal of understanding the role of the workshop in participants' subsequent partnership work. After four rounds of attempts, we secured responses to the follow-up survey from only 5 of the initial 11 respondents to the baseline survey, a 45% response rate.

- **Participants were generally optimistic about their RPP work**, regarding both current efforts and their ability to continue partnership work in the future.
- Regarding **barriers** to continuing RPP work, a few cited the funding landscape. Other reported obstacles included teacher attrition, insufficient time or academic credit for participating in this type of work, and convincing district leadership of the importance of teacher participation.



- **All reported having approached other educators or organizations about RPP work** since the workshop: they reported having approached teachers (4 of 5), state and district leaders (1 of 5), leaders of informal learning organizations (3 of 5) and informal educators (2 of 5).
- One respondent credited the workshop with important exposure to ideas and framing of RPP work that contributed to **a successful proposal to IES**. Others noted much of what they learned had proven helpful for framing discussion of manuscripts and conversations with potential partners.
- All respondents also reported **ongoing engagement with the Collaboratory**: all reported receiving emails from the Collaboratory, and 4 of 5 reported having visited [Researchandpractice.org](http://Researchandpractice.org) in the past 12 months.

Two workshop participants, both now junior professors, also stayed in touch with SRI evaluators. One assisted Collaboratory PIs in leading CSforAll workshops (described in the next section); the other also remained engaged in RPP work.

## RPP Workshops

The Collaboratory's RPP workshops promoted a DBIR approach to RPP work, addressing why and how to form partnerships and how to maintain them. Some of the workshops focused on seeking funding for RPP work and were offered in pre-proposal formats.

At NSF's request, the Collaboratory conducted three types of RPP workshops in late 2016 and 2017. At the first, held at the White House in October 2016, the Collaboratory provided a RPP lens and examples of current partnerships for an Expanding Computing Education Pathways (ECEP) meeting attended mainly by state education leaders, regarding strategies for achieving the vision of CSforAll. The other two workshops addressed how to develop RPP-based proposals. One, related to a NSF CSforAll solicitation, was co-hosted by universities in three cities in January 2017. The other was for RPPs in informal learning, for which possible funders include NSF's AISL program and IMLS. That workshop was co-hosted by CAISE and AAAS and held at AAAS in July 2017.

We first summarize findings across surveys from all three workshop types, drawing on results of the survey given to participants in the ECEP workshop (shared with us by SageFox, the evaluator of ECEP), and results of the survey administered by the Collaboratory at the informal learning RPP workshop, as well as the survey SRI administered to participants in the CSforAll workshops. We then provide more detail regarding the CSforAll workshop survey results.



### ***Synthesis of survey results from three types of RPP workshops***

Looking across survey data from the three types of workshops, the following themes stand out:

- **Participants in all three workshops valued learning more about RPPs.** Better understanding of RPPs and how they differ from other ways of working was one of the key participant takeaways and outcomes for the CSforAll workshop, cited by over 85% of respondents. Likewise, all CAISE workshop respondents found the workshop valuable, and between 70 and 80% of ECEP workshop participants found the Collaboratory sessions valuable or very valuable.
- Participants also valued receiving **information on securing RPP funding and structuring proposals**. This was mentioned as a strength of the CSforAll workshop. Over a quarter (27%) of CAISE workshop participants requested more information on these points. Some participants with newly forming RPPs did not find proposal-focused information particularly helpful.
- One implication of the survey results is that **support may be most effective when tailored for the stages of RPP development**. Indeed, the Collaboratory has generally tailored its materials for different levels of RPP involvement, not only in workshops but in other critical engagement and cultural exchange outreach. ECEP workshop participants were generally new to the idea of RPPs. CSforAll workshops included participants at different stages, such that some materials addressed participants' current needs better than others. The requirements for the CAISE workshop were the most selective: only groups already collaborating were accepted. Not surprisingly, more than half of CAISE workshop respondents wanted more support in "ongoing and detailed work on the practical dimensions of RPPs."

As noted, discussion of RPPs at the ECEP summit was introductory. After the summit, 85% of participants (nearly all practitioners) agreed or strongly agreed that it is important to partner with computer science education researchers. Nearly 40% of ECEP summit participants felt that the meeting met the goal of exploring RPP models for their work mostly or to a great extent.

### ***Results from CSforAll pre-proposal workshops in Chicago, Los Angeles, and Atlanta***

SRI surveyed participants from all three January 2017 locations of the CSforAll pre-proposal workshop to gather data on the usefulness of the workshop and its materials, whether participants submitted a subsequent proposal (and if not, the workshop's role in that decision, if any), and suggestions for improving similar workshops in the future. We sent surveys to 328

participants and received 115 complete responses (24 Atlanta, 53 Chicago, and 38 Los Angeles participants). In identifying their professional roles (as many as applied), nearly all respondents (102) selected at least one educator role (e.g., teachers, district leaders, teacher professional development providers), 74 selected research roles, and 28 identified association, non-profit, or other district leadership or university-affiliated roles. We summarize findings here.

- Most respondents (66%) said that the workshop would be **useful to both researchers and practitioners**. Respondents suggested it would be especially useful to those new to RPPs and those trying to secure RPP funding. Some respondents stated that it seemed more suited for researchers than practitioners—in the words of one respondent, “because it facilitated and authorized a kind of collaboration outside the norm for them.” Some respondents said that the workshop was helpful for understanding how to submit not just RPP proposals but also NSF proposals generally.
- Survey results suggested that the workshops gave participants a **clear sense of what a successful RPP proposal requires**. While participants were committed to the ideas of RPP work, they were also cautious about their ability to submit a successful proposal. Respondents for whom the workshop played a role in their decision not to submit a proposal cited the following reasons for not submitting:
  - not yet having the right partners involved
  - gaining a better understanding of RPPs, and thus realizing that either their work is not an RPP or their goals can be achieved in another way
  - learning that a different NSF program might be a better fit (several cited STEM+C), or
  - planning to submit instead in the next round.
- Across the three sites, most participants (69%) **shared materials or ideas from the workshop with others afterward**, including with school district leaders, colleagues who could not attend the workshop, and potential collaborators/partners. Materials more focused on explaining what an RPP was or the importance of doing RPP-type work were **shared outside the immediate project team**. When sharing with project teams or close colleagues, participants were more likely to share all of the resources from the workshop.
- **Participants overwhelmingly enjoyed the workshops**. More than a third (37%) had **very positive comments**, stating they would not change anything, or even that it was “one of the most impactful learning experiences I’ve had.”

Most (74%) had a specific suggestion for improving workshops in the future. Two themes emerged from those suggestions. Most feedback asked for workshops to be more tailored for people at different stages of RPP development. Many people wanted more help connecting/matching with partners and building up early partnerships. Others, already having partners or understanding the basics, wanted more details about how to manage a RPP or how to scale it. Some participants made suggestions related to the workshop's timing, asking that workshops be held much earlier in advance of the solicitation due date or held at a time more convenient for K-12 teachers.

### **Workshop on how research-and-practice can support responding to ESSA evidence requirements**

The Collaboratory convened an ESSA-focused workshop-style Inquiry Group meeting in November 2016 to generate guidance on partnerships' being well-suited to generate ESSA-required evidence, for five target audiences: state leaders, district leaders, partnership participants, policymakers, and advocacy organizations. As a convening of thought leaders with the goal of designing new resources and related engagement strategy, this convening resembled the Inquiry Group meetings that took place in the project's early stages; however, while those gatherings helped the Collaboratory refine its goals and focus, this meeting reflects the project's ongoing design work and its responsiveness to the new policy context. The Collaboratory's flexibility reflects the team's view that RPPs must be able to adapt to changes in stakeholder priorities or needs to remain valuable and relevant over the duration.

The workshop resulted in a guide, a book chapter, and webinars, which the team posted on the Collaboratory website along with other related resources.<sup>20</sup> As of April 27, 2018, the page describing the guide had been viewed 555 times and the guide downloaded 218 times from [Researchandpractice.org](http://researchandpractice.org) since becoming available on August 16, 2017.

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<sup>20</sup> See Penuel, W., Allen, A., & Finnigan, K.S. (2017). How research-practice partnerships can support ESSA implementation for educational improvement and equity: a guide for school districts, state education leaders, and researchers, and Collaboratory's webpage on how partnerships can support ESSA implementation, <http://researchandpractice.org/partnerships-can-improve-essa-implementation-for-student-success/>.

## V. The R+P Collaboratory in the Broader Research-and-Practice Landscape

To explore the degree to which R+P Collaboratory activities are reflected in a shift of the attitudes, discourses, and practices of researchers and practitioners in the broader education research and practice community (i.e. beyond the Collaboratory's sphere of influence), SRI surveyed people currently or recently funded to undertake R/P work, and conducted interviews with program officers who manage R/P funding programs at two foundations. SRI also observed how Collaboratory resources were used at an RPP workshop that was planned and conducted without Collaboratory knowledge or involvement.

SRI undertook analysis of the broader R/P community to generate findings we could check against those from analysis activities that focused on Collaboratory activities and their results. The results presented in this section aim to mitigate potential for confirmatory bias from gathering data only from those who have benefited from the project's activities, and gather further data for counterfactuals identified by Collaboratory leadership (e.g., Tools produced by R/P engagement have limited meaning or use beyond the communities that produced them).

Overall, we found that the priorities of the broader education R/P community closely align with the focal efforts of the Collaboratory. We also found that the Collaboratory's engagement strategy—combining multi-pronged digital engagement with in-person workshops and other events— reflects the ways in which researchers and practitioners report learning of useful resources. Survey respondents with knowledge of the Collaboratory (approximately half) accurately described its purpose and activities.



*Photo: Exploratorium*

## Findings from a survey of the broader education research-and-practice community

The survey asked respondents whether they had heard of the R+P Collaboratory (other than in the survey) and/or used any of its family of websites. It also asked respondents to identify current top challenges in education, the suitability of RPPs to address those challenges, what resources they find useful in their R/P work, and how they learn of those resources.

The survey was sent in June 2017 to 141 people who received funding for R/P work—from NSF, IES, the W.T. Grant Foundation, or the Spencer Foundation—no earlier than 2012 and no later than June 2016, who had not been directly involved in Collaboratory activities. The sample includes both researchers and practitioners; when possible, we included both researcher and practitioner partners from the same project. We received 48 responses (including two from people declining to participate), for a 33% response rate. Full results are in Appendix E.

Thirty respondents self-identified as researchers, 8 as practitioners, and 8 as neither. The self-identified “practitioners” included classroom teachers, district leaders, and PD providers for teachers. Those who said they were neither researchers nor practitioners included non-profit leaders, funders, curriculum developers, and RPP directors.

*Exhibit 12. Professional roles of RPP community survey respondents*

Role	N	Avg Years
Classroom teacher (PK-12)	3	9
School leader	3	9
District administrator	5	6.8
Regional or state education administrator	2	12
Informal learning educator	1	7
Teacher education	9	13.2
PD provider for teachers	18	13.3
PD provider for informal educators	4	9.5
Professional association staff	0	--
Policy/advocacy organization staff	2	6.5
Graduate student or post-doc	1	3
Researcher	31	18.2
Other	10	10.6

Respondents were also asked to select their specific professional roles from a list and could select more than one answer (Exhibit 12). All but one who selected roles of teacher educator, PD provider for teachers, and PD provider for informal educators self-identified as researchers.

### **Knowledge of the R+P Collaboratory**

Slightly more than half of practitioners had heard of the R+P Collaboratory before the survey, while slightly less than half of researchers had. All but two respondents who had heard of it had visited at least one of the Collaboratory websites.

Respondents who had heard of the Collaboratory were also asked what they think it does. There was little variation in the responses, with most referencing an emphasis on STEM education, as these examples illustrate:

- “encourage and support research practice partnerships through training and outreach”
- “provides resources and research to support research/practice partnerships, particularly in the area of STEM”
- “share information and tools for researcher-practitioner partnerships, particularly those focused on STEM”

These responses are accurate; the second further captures the Collaboratory’s role in RPP research.

### **Views of education research-and-practice**

When asked to define education research-and-practice, most respondents mentioned a mutually beneficial relationship between equally valued researchers and practitioners and working together to solve problems of education. We found greater variation among these responses than among Collaboratory participants:

- “Researchers and practitioners work toward solving a common problem. Each brings a different lens and approach, and both are valued.”
- “...mixed teams working together to improve classroom practice and student (and teacher) understanding”
- “Interplay between authentic research and actual practice requires us to have both to have practice be effective.”

A few others focused more on one side of the equation or described it primarily as a methodology: “a method to improve practice through validation by research” and “using research in a targeted way to inform practice.” One person simply stated: “Learning together by doing together.”

### Top education challenges and the role of RPPs in addressing them

In an open-response survey item, respondents were asked to identify the top three issues in education. SRI coded the results thematically, finding that half of respondents cited issues relating to equity and half mentioned issues relating to systemic structural issues within the school system at multiple levels, such as how school funding mechanisms (e.g., using local property taxes) leads to and/or supports inequities across schools and districts; federally mandated programs without adequate resources attached; and state and federal educational policies and structures that are not supported by research. Together, these two related issues were mentioned by 78% of the respondents. The next most pressing issue was teacher quality and professional development (cited by 39%), followed by funding and availability of resources (28%). Quality of instructional materials was an important issue for 17% of respondents. Testing and assessment-related issues (13%), technology and data (11%), and socio-emotional learning (9%) were cited as well. These issues are listed in Exhibit 13.

*Exhibit 13. Top education challenges identified by the education R/P community*

Education challenges
Equity issues
Systemic structural and policy issues
Teacher quality and professional development
Limited funding and resources
Quality of instructional materials
Testing and assessment
Technology and data
Socio-emotional learning

Nearly all respondents (over 95%) said that **RPPs are extremely important or somewhat important in addressing these issues**. When asked (also in an open-response item) what education challenges, if any, RPPs are not suited to address, respondents identified issues relating to policymakers, funding, and high-stakes testing.



Respondents identified formal education and equity-related issues as **types of challenges that RPPs are most likely to effectively improve** (respectively, 21 and 22% strongly agreed, 20 and 21% agreed), followed by informal education (17% strongly agreed, 25% agreed) and ESSA implementation (12% strongly agreed, 30% agreed).

### **Where researchers and practitioners learn of useful resources for partnership work**

To gauge the place of Collaboratory resources in the broader R/P community, the survey asked respondents to identify where they find resources they consider useful in partnership work. Researchers were asked for sources for resources on partnering with practitioners, while practitioners were asked for sources for resources on partnering with researchers.

Overall, we found that the sources and communications types respondents cited intersect closely with the Collaboratory's "bundling" engagement strategy: the Collaboratory has been successful in promoting its products in the formats and venues in which the education R/P field seems most likely to find them. Many of the specific organizations and communications cited by respondents have featured Collaboratory work, including those of PAN partners and organizations Collaboratory leadership considers "fellow travelers."

#### ***Researcher-reported sources***

Exhibit 14 summarizes the most common researcher-reported sources for useful resources for partnership work, and the most common communication types by which they learn of them. Social media and newsletters were less popular communication types. Specific event types and communications channels noted included numerous professional conferences (e.g., AERA, SREE), the CAISE newsletter, journal articles, blog posts, the W.T. Grant Foundation, and the Knowledge Alliance.

#### ***Practitioner-reported sources***

Exhibit 15 summarizes practitioner-reported sources and communication types. Practitioners have found a wide range of resources helpful, from sources including AERA, MSPnet, and the National Academies Press. They reported seeking mainly resources closely related to their current RPP work. In many cases, the resources helped with background research for a proposal or helped keep the practitioners up to date on specific issues (such as the CSforAll initiative). Nearly all reported sharing such resources with another colleague.

*Exhibit 14. Researcher-reported sources of useful resources for partnership work and how they learn about them*

Most common sources of useful resources	Cited by
Fellow researchers	93%
Educator colleagues	53%
Professional associations	37%
Funders	37%

Most common communications types for learning of useful resources	Cited by
In person / directly from a colleague	73%
Conferences	60%
Journals	60%
Websites	43%

*Exhibit 15. Researcher-reported sources of useful resources for partnership work and how they learn about them*

Most common sources of useful resources	Cited by
Researcher colleagues	100%
Professional associations	88%
Educator colleagues	50%

Most common communications types for learning of useful resources	Cited by
In person / directly from a colleague	100%
Conferences	75%
Newsletters	50%
Journals	38%
Websites	38%

## Use of Collaboratory resources among broader R/P community

The survey asked respondents whether they had used any of the Collaboratory family of websites (listed in Exhibit 5). Those who had used any of the websites reported having done so to seek resources on the following topics (Exhibit 16). Almost half (43%) of people reported using the R+P Collaboratory website, 26% used the STEM Teaching Tools website, and 26% used the LearnDBIR website. For the R+P Collaboratory website, this 43% represents slightly less than half of the self-identified researchers, half of the self-identified practitioners, and those who are neither researchers nor practitioners. The STEM Teaching Tools website was more heavily favored by practitioners and others while LearnDBIR was mostly used by researchers.

*Exhibit 16. Education R/P Community Interest in Resources on Collaboratory Websites*

Resource topic	Number
Science education / NGSS implementation	12
Equity in education	10
Forming or sustaining a partnership	9
I wasn't looking for resources on a particular topic when I visited this website.	9
Informal learning (including Tinkering/Making)	5
Math education	6
Support for integrating technology in instruction	6
Other	3

## Funders' perspectives on the Collaboratory and the research-and-practice field

In addition to surveying RPP grantees, SRI also interviewed foundation program officers, each of whom leads RPP funding efforts at his/her respective organization. These interviews are a key component of the evaluation given the growth of the R/P field over the course of the Collaboratory's work. SRI found that the Collaboratory has supported that growth but its PIs note that they could not have predicted nor can they take credit for the high levels of interest in research-and-practice that has arisen over the course of the grant, including beyond the Collaboratory's sphere of influence. PIs also note that they are not intensely involved in (although they do collaborate with) other large-scale efforts around capacity-building for RPPs, such as the National Network for Education Research-Practice Partnerships (NNERP) at Rice University.

Program officers were unequivocal that the Collaboratory has helped to legitimize the RPP field, specifically through its efforts to gather evidence on the effectiveness of RPPs and publish its findings. They credit Collaboratory leadership with some of the seminal thinking on research-and-practice in education. Co-PI Penuel's paper on RPPs (Coburn, Penuel, & Geil, 2013) was cited as a seminal contribution to the RPP field by one program officer, who stated that the paper has heavily influenced how this and other foundations have conceptualized its support of RPP work. One program officer finds that RPP work by the Collaboratory and others provides needed academic recognition, which complements funders' efforts to legitimize the field through dedicated funding streams.

In terms of Collaboratory-created resources, program officers reported that practical tools for engaging in and sustaining partnerships are of great value to the field (although they were generally unfamiliar with the specifics of each of the Collaboratory's component labs). One program officer shared concerns, however, that branding and funding particular types of RPP engagements may lead to siloes among types of approaches. This person called for synthetic efforts, such as an R/P clearinghouse, to consolidate learnings across these different models—for example, to enable learning across the Collaboratory's DBIR-based approach and other RPP models such as Carnegie-informed Networked Improvement Communities.

In January 2018, Penuel, representing the Collaboratory, was invited to participate in a forum, hosted by multiple foundation funding programs, that aimed to bring different organizations, foundations, researchers and practitioners together to collectively identify productive means of moving forward the RPP field. As RPPs have matured, new needs may be arising to support established partnership work, such as tools for sustainability. Meeting organizers shared with SRI that they were very interested in hearing Collaboratory perspectives from across the local labs.

### **Collaboratory resources “in the wild”: resource use at a RPP Workshop that did not involve the Collaboratory**

As part of investigating to what degree and in what ways RPC products are used by others in the field (evaluation question 2), in October 2018 SRI attended a day-long workshop at North Carolina State University's Friday Institute, entitled “Designing for Educational Improvement: A Research-Practice Partnership Workshop.” The Friday Institute has been engaged in RPP work since at least 2013, when it received an RPP-based award from NSF's Math Science Partnerships Program (award number DRL-1319293). The goal of the workshop was to “engage

participants in immersive, hands-on sessions focused on building relationships, establishing a common understanding of project goals, communicating and collaborating, and gathering and using high-quality evidence.”

The workshop creators were well aware of the Collaboratory. They had attended Collaboratory workshops on partnerships, and were familiar with its website and resources, some of which they had already used in their own partnership work. They also have close professional ties with its leadership. They did not, however, coordinate with or involve the Collaboratory in planning the workshop, which no one from the Collaboratory attended.

In the workshop, Collaboratory materials were used in conjunction with other resources and tools produced by other entities, including The Friday Institute, The Carnegie Foundation for the Advancement of Teaching, The Core Collaborative, Harvard Graduate School of Education, and the W. T. Grant Foundation. The workshop used Collaboratory materials to discuss the general lifecycle of RPP engagements, and used other organizations’ documents to direct more specific activities, such as defining a problem of practice or identifying short-term and long-term outcomes. Pictures of two Collaboratory leaders (Buffington and Penuel) were highlighted in a slide mapping “Synergy of the RPP Movement.”

Participants in the workshop reported that they appreciated the Collaboratory materials, citing their clear, concise format and simple language. Although they had not previously heard of the Collaboratory, they felt encouraged to learn of resources that include both broad overviews of how to engage in RPP work and guidance focused on navigating critical points in the work.

The Friday Institute workshop developers believe that the Collaboratory resources are among the best materials to share with others interested in partnership work and report that these resources have been instrumental in their own successful RPP engagement. The following materials developed and distributed by the Collaboratory were used and distributed during the workshop:

- RPP Questions and Methods Mapped to Different Phases of Research
- A Guide Map to Research-Practice Partnerships
- Building Equity in Research-Practice Partnerships
- How to Negotiate the Collaborative Focus of an RPP
- Negotiating the Focus of Joint Work in a Partnership
- Fishbone Diagram Template

- RPP: Fostering Equitable Collaboration
- iHub Science Self-check
- UW-Bellevue Exit Cards

Looking across findings related to the broader education R/P community, funders' perspectives, and the use of Collaboratory resources at an event in which the Collaboratory was not involved, SRI found that the Collaboratory contributed to the growth of the education research-and-practice field through its successes in (1) developing tools and resources that researchers and educators viewed as useful and shared with others, and (2) disseminating them by leveraging strategic relationships, developing in-person and virtual events, and via online engagement. That funders' interest in research-and-practice increased over the years the Collaboratory was funded extended the project's impacts and possibly contributed to increasing the audience for its RPP-focused products. In the following section, we complete our response to evaluation question 1 (strategy) to address factors that supported the Collaboratory's success, including its key innovations, and lessons learned regarding this unusual type of collaboration.

## VI. Successes and Lessons Learned

This section summarizes the factors that supported the Collaboratory's successes and presents two key lessons learned of possible interest to other similar endeavors. It concludes by considering ongoing challenges of RPP work more broadly.

### Factors that Supported the R+P Collaboratory's Success

**The structure of “collaborating laboratories” was well-suited to the project’s goals.** The combination of coordinated RPP demonstration sites and a collaborative superstructure enabled the team to pursue different local STEM improvement goals in a highly synergistic way. SRI observed consensus across the team regarding balancing highly aligned values (e.g., foregrounding equity), approaches, and themes with the flexibility and responsiveness needed to continuously test new approaches and adapt to emerging needs in the field.

In addition, PIs viewed the project’s funding structure, in which each local team had distinct funds, as supporting the work. The PIs moreover appreciated having substantial funding for work that was largely exploratory. This enabled them to pursue innovative ideas and new relationships—for example, they were able participate fully in early conversations with CSSS, which ultimately developed into one of their most productive partnerships.

**The work benefited from four nationally known leaders, a large and committed team, and prior collaboration among leaders and teams.** The leadership all have large professional networks, including strong connections with funders and professional associations. Two of four leaders brought important social media followings to the project. Project leadership and members of local labs also had a history of collaborating; local partnerships were already well established in 3 of 4 cases.

**The range of formats and venues through which the Collaboratory engaged audiences with its products aided in achieving high uptake.** The Collaboratory is widely viewed as providing much-needed tools, resources, and approaches available from no other source. Funders and those who benefited from the Collaboratory’s work—including PAN contacts, workshop participants, and website users—value the Collaboratory’s work and view it as providing unique benefits. Website users find the tools accessible and useful, and share them widely. One PAN contact called the Collaboratory “extremely unusual.” Another stated, “I’m not aware of many that are attempting to do this. I think it’s unique and it’s of value. It’s critically



important from a ‘contribution to the field’ point of view.” Funders viewed the Collaboratory as a vital complement to their efforts to promote and sustain R/P in education.

**The risks the Collaboratory took in developing innovative partnering and communications strategies supported the ultimate success of those strategies.** The Collaboratory’s strategies for promoting its work represent a third layer of ideas the team was testing: in addition to R/P strategies for STEM improvement and supports for RPP work, the team experimented and refined its “bundled,” coordinated communications strategy and PAN approach over the course of its work. In both cases, key shifts made mid-way through enabled the ultimate success of these aspects of the work.

Both the communications strategy and the PAN project initially were more centralized in the team, managed by a single person rather than part of the cross-lab work. In 2015 and 2016, the team distributed both tasks. They moved responsibilities for PAN work to the project leadership, maximizing the benefit of prior relationships and likely accelerating the growth of some relationships. They also established a communications team with representatives from each lab. This sub-team met regularly to share information, review SRI’s reports on digital metrics, and plan engagement campaigns for upcoming events and releases of new tools, coordinating across the Collaboratory’s family of websites, other online engagement channels, and related in-person events. The results of the mature PAN strategy and communications strategy provide models for amplifying the impact of a team’s efforts in ways that go beyond R/P or STEM improvement.

**The Collaboratory’s work took place at an auspicious time: it worked to expand education R/P as the education R/P field began expanding, because of and independent of its efforts.** SRI’s analysis of the broader education R/P field found that Collaboratory resources align with the field’s priority concerns; moreover, the team packaged and distributed its tools and approaches in the formats and venues researchers and practitioners were most likely to encounter them.

## **Lessons Learned and Ongoing Challenges to RPPs**

This section presents a few lessons learned from the R+P Collaboratory that may be of use to future R/P work in education and/or to work involving large teams. It also presents challenges that persist for RPP. (Lessons learned from the summative evaluation are in Appendix B.)

## Lessons Learned from the R+P Collaboratory

The most important lessons learned involve the trade-offs in composing a leadership team and the doubly time-intensive nature of conducting RPP work within a collaborating superstructure.

SRI occasionally heard the critique that Collaboratory leadership should include practitioners: why would four researchers always represent, at the Collaboratory level, the views and experiences of the educators involved in the local lab work, or the needs of the educators for whom the tools are intended? There could be some advantages to having practitioners in the leadership, but there are also trade-offs, the PIs note.

PIs report and Inverness found that the Maine partnership first included in the Collaboratory team (which Buffington's Maine team replaced) did not thrive in part because its leaders did not share language and values as closely as the other leaders and teams. The PIs' shared positionality, in their view, contributed to the momentum of this large, complex project, and enabled smooth collaboration in the superstructure. Rather than feature educators in the project leadership, the Collaboratory used educator ambassadors (e.g., many of the PAN contacts); in addition, some of the PIs are fairly well known not only among researchers but also among educators. The tools and resources reached a very broad audience with four researchers leading the team; it is impossible to say whether including educators among the leadership would have further increased uptake of Collaboratory tools and resources.

The other important lesson learned relates to the time needed to pursue this type of work. It is well-documented that RPP work is time-intensive. This was even more true for the Collaboratory, with its superstructure collaboration in addition to local RPP work. The Collaboratory was intentional in allotting time every two weeks for alternating whole-team and leadership meetings, in addition to time spent in the joint development of tools and resources, promoting the work in person, and attending team retreats.

Even so, some PIs noted a need for more time for reflection at the project's superstructure level or, as one PI put it, for "sense-making across labs." According to two interviewees, differences in local lab contexts make additional reflection and synthesis time more necessary. The Collaboratory crosses informal and formal education contexts, math and science education. Others planning Collaboratory-like endeavors or NICs should budget significant time for this meta-level reflection.

## Ongoing challenges in education R/P work generally

In addition to Collaboratory-specific lessons learned, the PIs noted a few ongoing challenges to R/P work that go beyond those the Collaboratory's work aimed to mitigate (e.g., lack of alignment between educators' and researchers' needs)

### **Funding structures do not evenly award the research and practice sides of the equation.**

Overall, more funding is still needed to support RPPs, given their potential to create sustainable change in practice. As importantly, existing funding that appears to support connecting research and practice can tend to more heavily fund the research side of the equation. For resulting solutions to be truly co-created, the funding structure needs to acknowledge the work on the practitioner side as well.

**Better alignment and connectedness are needed across layers of formal education.** In formal education circles, one PI noted a need for improving connections across levels and departments (i.e. of schools, districts, states), so that RPPs can attend to the full range of contextual and policy factors rather than operating at one level, pursuing change that is possibly at odds with priorities or constraints at other levels.

## VII. Conclusion

While the Collaboratory's work has concluded, its component teams have continued to pursue STEM improvement work and RPP capacity-building in a range of follow-on projects. The team also continues to engage in some types of work under the R+P Collaboratory banner. For example, in late August 2018, the R+P Collaboratory announced two upcoming workshops for new RPPs and two to support resubmission of CSforAll proposals to NSF. Bell and Penuel's ACESSE collaboration with CSSS also continues; ACESSE hosted an "ACESSE 50" workshop for all CSSS state leaders and will host second ACESSE 50 workshop as well. Collaboratory leaders have also undertaken a new line of collaboration with scientists, working with the National Alliance for Broader Impacts (NABI) and the American Association for the Advancement of Science (AAAS). As importantly, the Collaboratory's products remain widely available and widely used. Development and promotion of STEM Teaching Tools, for example, has continued in the ACESSE project, and tools for developing and sustaining RPPs continue to be shared in conference presentations and workshops. The Collaboratory's successes in advancing its focal STEM improvement issues, demonstrating the efficacy of RPPs to promote sustainable change in education, and developing formats and strategies to amplify its impacts, ensure the work will continue to influence field growth in coming years.

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## Appendix A: Detailed Description of Evaluation Methods

This detailed account of evaluation methods complements the methods overview in report section II. SRI's summative evaluation focused on the R+P Collaboratory's superstructure—the strategy and outcomes of the four-team partnership—whereas the formative evaluation partner, Inverness, primarily studied the project's four component teams, three research-practice-partnerships (RPPs) and a fourth team that developed tools and supports for RPP work. In this account, SRI first presents the Collaboratory's theory of action and success measures, followed by the evaluation questions and an overview of evaluation activities, data sources, and analysis methods. We then provide a by-task account of evaluation methods.

### R+P Collaboratory theory of action and success measures

The Collaboratory's work was guided by a three-part theory of action (Exhibit A-1).

*Exhibit A-1. Three-part theory of action.*

- Increase **access and awareness** [of tools and resources for connecting research and practice (R/P)]
  - Develop synthesis papers and briefs
  - Produce resources that “lead with practice and integrate research”
  - Coordinate dissemination and engagement across a family of related websites and social media channels
  - Use professional association networks to amplify dissemination and engagement
- Foster **critical engagement** around focal education challenges, and research-practice approaches for addressing them
  - Convene Collaboratory participants and thought leaders to synthesize and move forward thinking on the education challenges
  - Build capacity for research-practice work through events such as workshops, webinars, and conference presentations
- Undertake research-practice **collaborations** that coordinate in **adaptations** of tools and resources across partnerships
  - Establish three research-practice partnerships (RPPs) informed by design research approaches, each focused on a different STEM education challenge
  - Study the partnerships to develop and test generalizable principles, approaches, and tools for use in other RPP work



While each of these types of activity was present throughout the project, in broad terms the third part, undertaking R/P collaborations and adapting tools and resources across partnerships, laid the groundwork for the first two. Work within and across the project’s three RPPs and the Colorado team (which developed tools and supports for RPP work) formed the basis of the materials disseminated through the project’s engagement strategy (part 1, “increase access and awareness”). The “critical engagement” in Part 2 encompassed both formatively gathering and synthesizing perspectives on the project’s focal STEM education issues, and expanding the field’s capacity for RPPs, by teaching others how to use the tools and approaches, and by sharing the evidence, developed in parts 1 and 3.

The team expressed the theory of action as a set of conjectures (Sandoval, 2014) and in Year 2 distilled those into benchmarkable statements, or success measures (Exhibit A-2).

*Exhibit A-2. Success measures as they relate to the theory of action.*

Success measure	Alignment to theory of action		
	Increase access and awareness	Foster critical engagement	Undertake R/P collaborations and adapt tools across them
1. The R+P Collaboratory has developed and articulated <u>new strategies for strengthening connections between research and practice</u> by more fully leveraging concerns, experiences, and insights of practitioners in the production and use of evidence-based knowledge and practices.			
1a. The R+P Collaboratory has <u>built the knowledge base about how to leverage both practitioner and research-based knowledge</u> in the production of K12 professional resources and convenings.			
1b. The R+P Collaboratory has demonstrated that professional resources and convenings that leverage practitioner perspectives <u>can overcome barriers that have traditionally separated research and practice, leading to the uptake and use of evidence-based practices</u> in K-12 STEM education improvement efforts.	●	●	
1c. The R+P Collaboratory has developed evidence about the importance and utility of <u>working in partnership with professional associations and networks</u> in order to widely engage K-12 STEM practitioners with research-based knowledge.			

Success measure	Alignment to theory of action		
	Increase access and awareness	Foster critical engagement	Undertake R/P collaborations and adapt tools across them
2. The R+P Collaboratory has generated evidence that <u>research-practice partnerships</u> , in particular, are a productive way to strengthen connections between research and practice in order to advance local K12 STEM improvement efforts.			
2a. RPP partners are committed to sustaining relationships and commitments to RPP.	●	●	●
2b. RPP participants develop valued social capital and social networks.			
2c. Practitioners use R+P-based practices/knowledge in their decision making.			
2d. The process, results, and products of RPPs are valued and used both within and beyond the RPP.			
3. The R+P Collaboratory has stimulated <u>field-wide interest and engagement</u> in developing new approaches to strengthening the connection between research and practice through leveraging both practice- and research-based knowledge.			
3a. Evidence shows that a wide range of <u>educational professionals, including leaders of professional associations and networks, have sought the R+P Collaboratory's assistance or participation</u> in their STEM improvement efforts.	●	●	
3b. Evidence shows that a wide range of <u>educational professionals, including leaders of professional associations and networks, have undertaken actions and activities that integrate or reflect R+P Collaboratory resources and strategies</u> .			
4. Effectively worked as a Collaboratory (as a mechanism)			
4a. The R+P Collaboratory has fostered synergy and new insights and products by leveraging expertise across the Labs.			●
4b. Collaboratory activities and resources contribute to Collaboratory participants and the broader field.			
4c. The R+P Collaboratory has built the capacity, and added value to the work and contributions, of each of the Labs.			

## Overview of Evaluation Questions and Activities

SRI's summative evaluation sought to understand the value of the Collaboratory's contributions to and its place in the education research-and-practice (R/P) field, by examining its strategy as well as the outcomes of the work. Two questions guided the evaluation:

1. Regarding strategy: How do the design and function of the Collaboratory (including its focal themes and activities) collectively result in an innovative mechanism for productive engagements between research and practice?
2. Regarding outcomes: To what degree have Collaboratory processes and products been taken up and, (a) affected professional development efforts, models, practices among researchers and practitioners; and, (b) facilitated cultural exchange and transformation within the Collaboratory's sphere of influence?

To answer these questions, SRI undertook three related sets of qualitative and quantitative evaluation activities.

### Activity 1: Synthesize project activities from the local labs and broad Collaboratory efforts

Tasks in this activity helped SRI gain a deeper understanding of the Collaboratory's design and function—that is, how the team operationalized the three-part theory of action. This group of tasks involved review of Inverness's formative evaluation work, interviews with local lab team members in Maine, annual PI and co-PI interviews, and analysis of the project's reach as reflected in website analytics and other digital metrics. This work provided the basis for our response to the first evaluation question (strategy), and also provided data that oriented our approach to Activities 2 and 3.

### Activity 2: Documenting the Collaboratory's contribution to researcher and practitioner communities

To understand whether and in what ways the Collaboratory built capacity for research-practice work in the education R/P field, SRI studied Collaboratory tools, resources, events, and engagement from the perspective of the project's audiences—the association leaders who partner with the Collaboratory, and the researchers and practitioners who used its websites and/or participated in events. We sought to understand how people benefit from using Collaboratory tools and resources: what they learn from them, in what contexts they use and/or adapt them, and with whom they share them.

SRI collected and analyzed survey and/or interview data from association leaders, website users, participants in RPP online forums, and participants in Collaboratory workshops. The overarching purpose of this activity was to determine whether any cultural change was taking place related to the Collaboratory's efforts and if so, to describe it. Tasks in this activity aligned most directly with the first two parts of the theory of action (i.e. increase access and awareness, foster critical engagement) and generated most of our response to evaluation question 2 (outcomes).

### **Activity 3: Investigate RPC's impact and influence on the broader RPP community**

Like Activity 2, this one most directly addressed the first two parts of the the project's theory of change. To mitigate the potential for confirmatory bias associated with gathering data only from within the Collaboratory's sphere of influence (as evaluation question 2 calls for), SRI also collected data from outside that sphere. We posited that the broader impact of R+P Collaboratory activities should be reflected in a shift of the attitudes, discourses, and practices of researchers and practitioners in the broader RPP movement. This activity was intended to generate findings that could be checked against findings from the previous two activities (which focus on RPC strategy, products, and results). In addition, this activity provided an opportunity to collect data for counterfactuals identified by Collaboratory leads (e.g., tools produced by R/P engagement have limited meaning or use beyond the communities that produced them).

We surveyed researchers and practitioners engaged in RPPs who had not participated in Collaboratory activities regarding their perspectives on RPPs, sources of useful resources, and knowledge and views of the Collaboratory. We also interviewed RPP funders and observed an RPP workshop that did not involve the Collaboratory.

### **Overview of Data Sources and Analysis Approaches**

The data sources for the summative evaluation were published documents, internal project documents, surveys, interviews, digital metrics (e.g., Google Analytics, Twitter), and observations of Collaboratory meetings and workshops.

To understand the Collaboratory's structure, strategy, and activities (described in report section III, the first part of our response to evaluation question 1), we observed Collaboratory events and participated in meetings and retreats; reviewed cases by formative evaluation partner Inverness; reviewed other documents, including annual reports, tools, products, and Collaboratory-developed publications as well as other publications relating to education

research-and-practice (e.g., journal articles, newsletters, blog posts, etc.); and, drew on interviews with Collaboratory PIs and professional association leaders. From these efforts, we developed descriptions of the project's structure, strategies, and activities; we then refined these descriptions by checking the project's intended structures and strategies against findings from other data sources (e.g. workshop participant surveys, education R/P community surveys, and digital metrics).

To examine the Collaboratory's influence both within and beyond its sphere of influence, on one hand we gathered the perspectives of people partnering with the Collaboratory, participating in its events, and using its tools and resources. These data collection activities involved professional association leaders, workshop participants, and website users. On the other hand, we examined the the views, priorities, and needs of people involved in education RPPs who had not participated Collaboratory events or evaluation data collection activities, including those who had not heard of the Collaboratory. We also interviewed people who fund R/P work.

To analyze use across the family of project websites, SRI used available digital metrics to gauge the sheer reach of the project and the relative audience sizes of various project activities and tools. SRI also benchmarked the Collaboratory's digital metrics against those of other reasonably similar entities in a comparative analysis. To generate a richer picture of website users' perspectives on Collaboratory tools and resources, how they use them, and with whom they share them, SRI further interviewed a sample of website users.

### **Development of Interview Protocols and Survey Instruments**

Over the course of the evaluation, SRI conducted four types of interviews—with the PI and co-PIs, professional association leaders, users of project websites, and RPP funders—and administered three types of surveys—e.g., for early career / doctoral candidate workshop participants, CSforAll pre-solicitation workshop participants, and members of the broader RPP community. We also developed a very brief website user survey in order to capture names, emails, and contact permission to generate a website user interview sample. Protocols for each interview type and items for the surveys were developed following the same process. SRI generated a list of topics and subtopics associated with each evaluation question. We then created a matrix showing that list along one axis and the data collection activities along the other, and determined in which data collection activities we would seek information related to which subtopics and topics. Throughout this process, we sought to address each subtopic through multiple data sources to enable triangulation of findings. (As an example, following this

process we collected similar data regarding views of the quality and utility of Collaboratory tools and resources from professional association leaders, users of project websites, and workshop participants.)

Once we identified which subtopics we sought to address in which instruments, we developed items reflecting subtopics for inclusion in the selected instruments. We reviewed resulting draft instruments as a team for length, clarity, and alignment of items with the targeted topical coverage. We also shared draft instruments with the Collaboratory team and revised when needed based on their input. Each instrument underwent multiple rounds of revision before being used.

SRI also developed very brief surveys as the basis for the RPP online forum study and the website user study. These surveys aimed primarily to generate a pool from which to sample for follow-up interviews, so they captured only limited information.

### **Analysis of Interview Data**

SRI audio-recorded all interviews and had the recordings transcribed. The team then coded transcripts by topics from the matrix mentioned above and analyzed the coded data for commonalities and differences across interviews. We also coded unexpected data (that did not align with the scheme) and reviewed them for patterns as well.

The topics matrix and other themes that arose provided the structure for interview summaries. Summaries were discussed within the team to ensure they fully reflected each interviewer's notes. In these discussions, researchers developed tentative claims from the summarized evidence. The PAN interview summaries were then analyzed alongside the PI interview summaries to generate findings across both sources and to identify any contradictions. The funder interview data was similarly reviewed alongside the PI interview data.

### **Analysis of Survey Data**

Each survey was administered online using Qualtrics. Once each survey was closed, the team validated and cleaned the data (e.g., excluding any duplicate data; excluding data from individuals in the broader R/P community sample who had directly benefited from the Collaboratory's work). Researchers then calculated basic descriptive statistics for quantitative items, and analyzed qualitative data from open-response items to identify themes and exceptions. Researchers then generated a narrative summary report for each survey. Findings from the two workshop participant surveys were triangulated with findings from Collaboratory

leadership interviews, document review, and workshop observations. Findings from the broader R/P community survey were triangulated with findings from interviews with Collaboratory leaders and funders.

## **Revisions to the evaluation plan**

Exhibit A-3 shows the analysis tasks that comprised each evaluation activity, and which tasks SRI expected to generate evidence for which success measures. We added some of these tasks when we revised our approach in early 2016, in response to NSF and some shifts in Collaboratory activities and strategy (e.g., decentralizing the professional association networks strategy, the distributed approach to online engagement and the related formation of the communications team, etc.). Two external evaluation experts reviewed the revised plan, which we then further revised to incorporate their input. In the final revised plan, SRI focused professional association data collection on the closest collaborations (see Task 2.1); developed the study of online engagement (Task 1.3) and website users (Task 2.4) to better capture the project's reach; and added data collection from the broader education R/P community and its funders (Tasks 3.1 and 3.2) in order to understand the Collaboratory's place in the field, beyond the community of those participating in or directly benefiting from its work.



Exhibit A-3. R+P Collaboratory success measures and SRI analysis tasks

Analysis task	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
Success Measures	Review formative evaluator cases	Interview Maine lab team members	Interview PI and co-PIs	Analyze online engagement	Professional association interviews	Early career workshop study	Website user study	RPP workshop survey analysis	Education R/P community survey	Interviews with RPP funders	Observation of other RPP workshop
1. The R+P Collaboratory has developed and articulated <u>new strategies for strengthening connections between research and practice</u> by more fully leveraging concerns, experiences, and insights of practitioners in the production and use of evidence-based knowledge and practices.											
1a. The R+P Collaboratory has <u>built the knowledge base about how to leverage both practitioner and research-based knowledge</u> in the production of K12 professional resources and convenings.	•		•		•		•	•	•	•	
1b. The R+P Collaboratory has demonstrated that professional resources and convenings that leverage practitioner perspectives <u>can overcome barriers that have traditionally separated research and practice, leading to the uptake and use of evidence-based practices</u> in K-12 STEM education improvement efforts.	•	•	•		•	•	•				
1c. The R+P Collaboratory has developed evidence about the importance and utility of <u>working in partnership with professional associations and networks</u> in order to widely engage K-12 STEM practitioners with research-based knowledge.			•		•		•		•		

Analysis task	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
Success Measures	Review formative evaluator cases	Interview Maine lab team members	Interview PI and co-PIs	Analyze online engagement	Professional association interviews	Early career workshop study	Website user study	RPP workshop survey analysis	Education R/P community survey	Interviews with RPP funders	Observation of other RPP workshop
2. The R+P Collaboratory has generated evidence that <i>research-practice partnerships</i> , in particular, are a productive way to strengthen connections between research and practice in order to advance local K12 STEM improvement efforts.											
2a. RPP partners are committed to sustaining relationships and commitments to RPP.	•				•	•			•		
2b. RPP participants develop valued social capital and social networks.	•		•		•	•					
2c. Practitioners use R+P-based practices/knowledge in their decision making.	•	•	•								
2d. The process, results, and products of RPPs are valued and used both within and beyond the RPP.	•		•	•	•		•	•	•	•	•

Analysis task	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
Success Measures	Review formative evaluator cases	Interview Maine lab team members	Interview PI and co-PIs	Analyze online engagement	Professional association interviews	Early career workshop study	Website user study	RPP workshop survey analysis	Surveys and interviews with RPP grantees	Interviews with RPP funders	Observation of other RPP workshop
3. The R+P Collaboratory has stimulated <u>field-wide interest and engagement</u> in developing new approaches to strengthening the connection between research and practice through leveraging both practice- and research-based knowledge.											
3a. Evidence shows that a wide range of <u>educational professionals, including leaders of professional associations and networks, have sought the R+P Collaboratory's assistance or participation</u> in their STEM improvement efforts.			•		•	•		•	•	•	
3b. Evidence shows that a wide range of <u>educational professionals, including leaders of professional associations and networks, have undertaken actions and activities that integrate or reflect R+P Collaboratory resources and strategies.</u>			•	•	•			•	•	•	
4. Effectively worked as a Collaboratory (as a mechanism)											
4a. The R+P Collaboratory has fostered synergy and new insights and products by leveraging expertise across the Labs.	•		•			•					
4b. Collaboratory activities and resources contribute to Collaboratory participants and the broader field.	•		•	•	•				•	•	
4c. The R+P Collaboratory has built the capacity, and added value to the work and contributions, of each of the Labs.	•		•								

## Evaluation Methods by Activity and Task

### Activity 1

To understand the Collaboratory's structure, strategy, and activities (described in report section III, the first part of our response to evaluation question 1), SRI observed Collaboratory events and participated in meetings and retreats; reviewed cases by formative evaluation partner Inverness; reviewed other documents, including annual reports, tools, products, and Collaboratory-developed publications as well as other publications relating to education research-and-practice (e.g., journal articles, newsletters, blog posts, etc.); and conducted interviews with Collaboratory leaders. SRI also analyzed the project's online engagement strategy and evaluated digital metrics to determine the degree to which the strategy worked as intended. From this work, we developed our response to question 1 (strategy).

As part of charting the project's structure, strategy, and activities, SRI also examined whether and how the Collaboratory benefited its direct participants; findings contributed to our response to question 2 (outcomes). Activities 2 and 3 then focused, respectively, on the reach of the Collaboratory's influence and benefits to those who participated in its activities or used its products, and the project's place in the field from the perspective of funders and others in the education R/P field who had had no involvement with the project, including people who had not heard of it.

#### ***Task 1.1: Review formative evaluation cases***

Formative evaluation partner Inverness Research developed case studies of each of the Collaboratory's three local labs, a cross-lab case, and cases of inquiry group meetings and of Collaboratory as a whole. SRI reviewed these products as part of responding to the first evaluation question (strategy). The lab and cross-lab cases provide a detailed description of the context and activities of local labs, including key actors and relationships, and thereby complemented SRI's focus at the project's superstructure level. Based on changes in professional roles and perspectives reported in Inverness's Maine case, SRI decided to conduct follow-up interviews with Maine team members later in the project (Task 1.2). The inquiry groups case provides an in-depth look at one Collaboratory activity type, while the Collaboratory case explores whether and in what ways the structure of "collaborating laboratories" facilitated the project's success.

### ***Task 1.2: Interviews with Maine local lab team members***

SRI conducted interviews with members of Maine’s local lab team in order to fully document the transformative changes resulting from that RPP, which were only just emerging when Inverness worked on the case in the project’s earlier stages. We selected the Maine lab as illustrative of local lab work in the summative evaluation based on Inverness’s Maine case and because the work of other labs figured more prominently in findings related to other tasks. The leader of the Maine lab work proposed names of people SRI could interview. SRI reviewed relevant documents (e.g., Inverness’s Maine case, the digital math inquiry group report), developed a semi-structured protocol, and scheduled and conducted interviews with three people.

### ***Task 1.3: Interviews with Collaboratory PI and co-PIs***

SRI interviewed the Collaboratory PI and co-PIs annually during each year of the project. Topics included project activities, perspectives on RPP work within and beyond the project, and perspectives on Collaboratory strategy and results. These interviews enabled SRI to cross-reference information from the Inverness case studies and gather data on activities at each lab and in the Collaboratory overall. Each year, we analyzed the PI interview data from that year as a set and identified commonalities and differences in the experiences and perspectives of Collaboratory leadership, as well as any changes taking place over time (i.e. within a single year and year to year). Findings from PI interviews were then reviewed in light of findings from PAN interviews (Task 2.1) and our understanding of the uses of and perspectives on Collaboratory tools and resources gained from other tasks.

### ***Task 1.4 Analyze online engagement***

SRI examined the Collaboratory’s online engagement to gauge the project’s reach, including changes in reach over time, and as part of evaluating the success of the Collaboratory’s “bundling” strategy (i.e. of linking resources with online engagement and in-person events). SRI also benchmarked the analytics for Researchandpractice.org by conducting a comparative analysis.

#### ***Online engagement study of Collaboratory digital assets***

SRI used Google analytics and metrics available via Twitter and Mailchimp as the basis for this analysis. We used metrics from Google analytics for the family of Collaboratory websites (Researchandpractice.org, the three local labs’ websites, and the CU Boulder team’s website, LearnDBIR.org) to track:

- Numbers of sessions
- Numbers of users
- User geographic locations (density and spread and change over time)
- How users arrive at the sites (e.g., from a link in social media, from another website, by typing a link directly into a browser window, etc.)
- User behavior on the site (e.g., trends in page views and downloads)

To assess growth over time and to understand what kinds of Collaboratory engagement efforts were most impactful, SRI also tracked numbers of Twitter impressions and followers for the team’s Twitter accounts and, via Mailchimp, click rates and open rates for links featured in email newsletters affiliated with [Researchandpractice.org](http://Researchandpractice.org) and [STEMTeachingTools.org](http://STEMTeachingTools.org).

To place numbers from these metrics in the context of project activities and strategies, findings from this analysis were triangulated with data from PI and co-PI interviews and other conversations with team members, and findings from the website user study (Task 2.3) and the survey of the RPP community (Task 3.1). This enabled us to understand, for example, the relationship between uses of resources at live events and spikes in certain types of website activity, and how patterns in most-downloaded resources followed the focus of the team’s engagement strategies.

### **Ongoing formative reporting**

Analysis of online engagement served formative as well as summative purposes. SRI developed a memo with guidance on metrics useful to the evaluation and to local lab teams’ ongoing review efforts. SRI also reviewed Google analytics, Twitter activity, and Mailchimp monthly from November 2015 (following the redesign and relaunch of [Researchandpractice.org](http://Researchandpractice.org)) through December 2017. Each month, we developed and shared with the team four summary reports that placed the prior month’s metrics in the context of recent patterns and changes in the metrics and project activities. The reports covered the project’s four main websites—[Researchandpractice.org](http://Researchandpractice.org), [STEMTeachingTools.org](http://STEMTeachingTools.org), [LearnDBIR.org](http://LearnDBIR.org), and [InteractiveSTEM.org](http://InteractiveSTEM.org)—and associated Twitter and email newsletter activity. The Collaboratory’s communications team contributed additional information regarding trends and plans, and presented these reports in team meetings.

## **Comparative analytics**

To benchmark the Collaboratory's online engagement metrics, SRI sought to identify four reasonably comparable entities and requested they provide data associated with a common set of metrics, covering a specific 6-month timeframe. It was difficult to identify efforts with a scope, focus, and longevity comparable to the Collaboratory's, especially ones willing to share the kind of data we requested. We attempted to mitigate the differences between the entities ultimately selected and the Collaboratory by addressing them in our interpretation of the results. See report section IV for a summary of the results; full results are in Appendix D.

## **Activity 2**

To assess what the Collaboratory accomplished, we examined its contributions both within and beyond its sphere of influence (see report sections IV and V, our response to evaluation question 2). Activity 2 tasks focused on capturing the views of the people and organizations that had participated in some aspect of the Collaboratory's work and/or used its products, i.e. those who partnered with the Collaboratory, participated in its events, and used its tools and resources. This group of tasks comprised analysis of the professional association networks (PAN) strategy; a study of website activity that drew on digital metrics (see Task 1.4 above) and website user interviews; observation of Collaboratory workshops and surveys of workshop participants; and a survey of viewers of an online RPP forum series.

### ***Task 2.1: Professional Association Network (PAN) interviews***

This task, which aimed to examine the Collaboratory's strategy of working with professional association leadership, took place in two phases. The first phase (in 2012) was a landscape study and had the following formative objectives: (1) provide the Collaboratory with an initial field scan of the prevalence and interest in RPPs among candidate professional associations; (2) understand the breadth of approaches to interacting with the professional associations; (3) provide the Collaboratory with useful feedback on which efforts and forms of interactions are yielding beneficial and promising partnerships; and, (4) gain a preliminary understanding of the extent to which jointly developed events and resources provide association memberships with unique and informative tools, products, and processes that can be used in the service of future R/P work.



### Formative PAN analysis

SRI's formative analysis of the PAN strategy comprised background research, interviews with association leaders, and systematic updates from team members coordinating with those leaders. In late 2012 and early 2013, SRI conducted interviews with leaders of nine associations or similar organizations identified as engaged or interested in R/P, to gather information on (1) their current efforts to integrate research and practice, (2) their perceived needs in this area, and (3) the anticipated value of the Collaboratory to help address these needs. In broad terms, the interviews aimed to build mutual understanding regarding the benefits the Collaboratory might provide to individual associations and the field. SRI provided synthesized findings from background research and interviews in a field scan report in February 2013. Over 2014 and 2015, SRI gathered regular reports from team members working on the PAN strategy with the goal of cataloging activity and identifying productive partnerships.

### Summative PAN analysis

Over time, the team's PAN strategy shifted: activity coalesced around a subset of the organizations included in exploratory interviews, and responsibility for nurturing relationships with these groups was distributed among Collaboratory leadership. Exhibit A-4 shows the nine organizations included in the first round of PAN interviews; asterisks indicate those that emerged as the focus of the work's second phase. SRI sought to interview relevant leadership of the starred groups in 2016 and again in 2017, as well as of the National Council for Supervisors of Mathematics (NCSM), which was not included in the initial review.

#### *Exhibit A-4. Organizations included in initial PAN interviews*

Afterschool Alliance\*  
American Society for Engineering Education (ASEE)  
Center for the Advancement of Informal Science Education (CAISE)\*  
Center for Advancing Research and Communication in STEM (ARC)  
Council of Chief State School Officers (CSSS)\*  
STEM Learning Resource Center (STELAR)  
National Council of Teachers of Mathematics (NCTM)  
National Science Teachers Association (NSTA)\*  
Regional Education Laboratory—Northeast and Islands (REL-NEI)

The two rounds of summative PAN interviews enabled SRI to cross-reference data from PI and co-PI interviews, understand attitudes towards and uptake of Collaboratory resources by

association leadership and members (including the fit between Collaboratory resources and association needs), and gauge the strength and nature of relationships, including over time. Interviews gathered association leaderships' views on connecting research and practice within their organizations; whether and how Collaboratory leaders had become strategic resources; how Collaboratory products were used and viewed by association leaders and members; the nature of relationships between both Collaboratory and association leadership, and association leadership and membership; and, the specifics of association activities related to Collaboratory (e.g., association strategies for promoting use of Collaboratory resources among members).

SRI developed semi-structured protocols for both formative and summative interviews following the process described above. SRI used the same protocol in the 2016 and 2017 rounds of interviews, focusing in 2017 on updates to the prior year's information. In total, SRI conducted seven interviews with leaders of four associations in both 2016 and 2017; we also conducted one interview with a fifth association in 2016 but were unable to schedule that interview in 2017. SRI analyzed the PAN interview data by systematically reviewing transcripts, identifying themes, and pulling data from across interviews pertaining to each theme. We also analyzed commonalities and points of distinction across interviews, particularly with regard to views on the value of the Collaboratory for association leaders and members, and experiences with Collaboratory activities and resources.

### ***Task 2.2: Early career researcher workshop participant survey***

Collaboratory leadership led a workshop on RPPs for early career researchers and doctoral candidates in conjunction with the International Conference of the Learning Sciences (ICLS) in Boulder, Colorado, in June 2014. Workshops were a key part of the Collaboratory's in-person engagement strategy, as was building capacity for RPP work among researchers and practitioners at various career stages. This workshop's focus on early career researchers parallels the project's investment in conference fellows in 2016 and 2017.

SRI sought to understand participants' involvement in R/P work over time, and the role of the workshop in their R/P activities, as well as the perceived barriers to entry and availability of resources for pursuing RPP work among doctoral candidate and early career professors. To this end, we first administered surveys to 16 workshop participants to create a baseline of their involvement in R/P activities: 11 of these participants were early career researchers and doctoral candidates; the other five were mentors. To understand the longer-term impacts of attending the workshop, SRI then sought to survey the 11 early career / doctoral candidate

participants again in May-June 2016. After four requests for participation, 5 participants responded, representing a response rate of 45%. The surveys addressed participants' R/P activities participants, their plans for future R/P work, barriers to pursuing that work, and their needs for institutional and other support in carrying out partnership work.

#### **Task 2.4: Website user study**

SRI undertook a study of website users in order to understand how people learn about and use Collaboratory tools and resources, what they think of them, and with whom they share them. This study provided context for findings from our analysis of online engagement, and enabled us to triangulate findings with those from RPP workshop surveys, PAN interviews, and the RPP community survey, as part of our response to evaluation question 2 (outcomes).

Focusing on Researchandpractice.org, the Collaboratory's main site, and STEMTeachingTools.org, the site with largest number of users, SRI first coordinated with the webmaster to field a web pop-up survey, which gathered data on the professional role of the user, frequency of visits, and the motivation for the visit. We also decided to share the link to the survey via email to both sites' newsletter subscriber lists, in an effort to boost responses. Although this introduced the risk of inviting people who had not visited the website to take a survey about it, we felt that risk was minimal.

To set a reasonable target number of responses, we first reviewed response rates of two similar surveys.<sup>21</sup> Then, taking into consideration (1) the website user population was largely unknown (in terms of user identities), (2) the website users cut across diverse professional communities (e.g., they are not all members of the same associations, they are not all funded by the same sources), and (3) email newsletter subscribers are known but include both people who subscribed themselves and people subscribed by the team, SRI set a target survey response rate of 7% of each site's website users.

We then calculated target numbers of RPC and STT website users by taking 7% of an estimate of total users. To estimate total users, we subtracted suspected illegitimate users (i.e. whose visits came from "bot" websites) from the total user numbers for each of three prior months (August-October 2016), then averaged estimated legitimate users over the three-month period.

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<sup>21</sup> See Quimby, C., & Vega, V. (October 2016). [InformalScience.org User Study](#). Rockman et al., and St. John, M., & Hirabayashi, J. (Fall 2011). A survey of MSPnet Users: Key Findings. Inverness, CA: Inverness Research.

This resulted in estimates of 1068 users per month average for ResearchandPractice.org and 4842 users per month average for STEMTeachingTools, for target survey response numbers of 75 and 339 respectively.

We fell a bit short on both counts, ultimately receiving 63 of 75 targeted responses from Researchandpractice.org users and 294 of 339 targeted responses from STEMTeachingTools.org users. Fifty-nine percent (n=37) of Researchandpractice.org user respondents provided permission to contact them for an interview and a working email address, while 62% (n=183) of STEMTeachingTools.org user respondents did so.

From among the set of respondents that provided permission and a working email address, SRI selected a subset for interviews. We sampled purposefully, selecting for a range of professional roles, spread across researchers and practitioners, and a range of years of experience in roles. We also oversampled Researchandpractice.org users to be sure to gather data on multiple aspects of the site's resources, since web analytics showed a trend of site use primarily to access cross-posted STEM Teaching Tools. From the Researchandpractice.org website pop-up survey results, we selected 12 users, including people representing professional associations (3), researchers (3), teachers (3), professional development providers (2) and afterschool organizations (1). From the STEMTeachingTools.org survey results, nine were selected from the following groups: district or State education leaders, community and cultural organizations, teachers, professional developments staff, graduate students, informal educators, non-profit staff, and County officer science coordinators.

Ultimately, we were able to conduct interviews with 10 people, four Researchandpractice.org users and six STEMTeachingTools.org website users. Interviews were conducted in July – August 2017. We analyzed these data thematically, looking across all participants, and within STEMTeachingTools.org and Researchandpractice.org website subsets.

### ***Task 2.5: RPP workshop survey analysis***

In addition to the early career / doctoral candidate workshop study, SRI analyzed three sets of participant survey data from workshops on RPPs that the Collaboratory developed in response to requests from NSF. As we note in the report, we counted as workshops more intensive Collaboratory events (i.e. lasting at least several hours and as much as 2 days) in which participants play an active role. As compared to inquiry group meetings, which seek to surface

the best thinking to identify and address a shared challenge, Collaboratory workshops intended to build participants' capacity for their own RPP work.

### **CSforAll pre-solicitation workshop**

The Collaboratory first led this workshop in three cities in January 2017, to support NSF's solicitation for researcher-practitioner partnerships in service of the Computer Science for All (CSforAll) initiative. SRI administered surveys to all participants to explore their professional roles, their opinions of the workshop, and whether the workshop played a role in their plans to submit a proposal. We invited 328 participants to take the survey by email. After sending two reminders, we received 115 complete responses (24 Atlanta, 53 Chicago, and 38 Los Angeles participants). We calculated descriptive statistics of quantitative items and identified trends in qualitative data. We later synthesized the resulting findings with findings from two other survey data sets to look across three different types of RPP workshops.

### **Workshop at ECEP CSforAll meeting and CAISE/AAAS Informal STEM learning RPP proposal workshop**

SageFox, the evaluator of ECEP, shared survey results from participant surveys it administered following an October 2016 meeting of state education leaders and industry partners, at which the Collaboratory shared examples of RPPs and led a workshop. Similarly, the Collaboratory shared with SRI survey results from its proposal workshop on RPPs in informal STEM learning, offered in partnership with CAISE and AAAS. We reviewed both sets of results alongside our findings from the CSforAll workshop surveys and identified broad themes, e.g., in participants' opinions of Collaboratory resources.

### ***Task 2.5: RPP web forum study***

The University of Colorado, Boulder, team developed and led a series of six webinars (web forums) in which co-PI Penuel facilitated discussions of various aspects of RPP work with a panel of guests. Viewers could join live or view the webinars later on the Collaboratory's Youtube channel. (See <https://www.youtube.com/channel/UCPPc2wwW95KMQoLINLB1xwQ/videos>). The webinars were part of the Collaboratory's strategy of extending its reach (i.e. increasing access and awareness) by sharing its tools and resources through multiple modes of engagement.

With the goal of learning more about who viewed the webinars, how viewers learned about them, their impressions of them, and how they planned to use any tools or resources they

learned of in the webinars, SRI fielded a brief online survey with the primary objective of capturing a respondent pool from which to select subjects for follow-up interviews. (We took a similar approach with a brief online survey in the website user study; see Task 2.4). We posted an invitation to take the survey and the link on Youtube under the webinar listings, and co-PI Penuel also asked people to take the survey towards the end of the webinars. We did not advertise the link by any other means, although the webinars themselves were advertised by the Collaboratory team, including in newsletters and via Twitter.

As we began to receive survey responses, we consulted with Collaboratory leadership and decided to reallocate resources to expand our plan for the website user study (see Task 2.4). This shift enabled us to add STEMTeachingTools.org users to the study. By doing this, we gained insights into the Collaboratory's broadest audience segment, which in turn helped us delineate a more complete picture of the Collaboratory's overall reach.

We received 18 responses to the webinar viewer survey. Of those, 60% of viewers identified as white and 28% identified as Asian. Seventy-seven percent of those who reported gender identified as female. As for professional roles, eighty-nine percent identified as researchers (including graduate students and postdoctoral researchers). Fifteen of 18 respondents provided email addresses; of those, four were students of or affiliated with the academic departments of Collaboratory co-PIs. As of April 27, 2018, views of the six webinars had been started a combined total of 2,165 times. (The Youtube "view" metric counts the numbers of times that a video was started; Youtube provides no other viewing data.) As of that date, the Youtube channel had 45 subscribers.

### **Activity 3**

We sought to understand the Collaboratory within the broader education R/P landscape in order to mitigate the potential for confirmatory bias in collecting data only from people who had benefited from Collaboratory products and activities (Activity 2). This group of tasks, designed to generate part of our answer to question 2 (outcomes) includes a survey of the broader education R/P community, interviews with funders of education RPP work, and observation of an RPP workshop in which the Collaboratory was not involved.

#### ***Task 3.1: Study of Collaboratory resources in the broader R/P community***

In order to understand the Collaboratory's influence beyond individuals with direct connections to Collaboratory activities, we undertook a study of the broader education R/P community. We

first developed a survey that asked about respondents' professional roles and their views on the potential for and challenges in R/P work. The survey also asked whether people had heard of the Collaboratory and which Collaboratory tools and resources, if any, they had used.

The survey was sent in June 2017 to 141 people who had received funding for R/P work from NSF, IES, the W.T. Grant Foundation, or the Spencer Foundation—no earlier than 2012 and no later than June 2016, who had not been directly involved in Collaboratory activities. The sample includes both researchers and practitioners; when possible, we included both researcher and practitioner partners from the same project. We received 48 responses (including two from people declining to participate), for a 33% response rate.

We analyzed the survey data to obtain descriptive statistics for each quantitative item. We grouped open-ended responses by theme or type, and wrote brief descriptive summaries to characterize the thematic groups.

We initially intended to conduct follow-up interviews with a subset of survey respondents. We developed a protocol and selected a sample for this purpose but, in the end, this aspect of the study was not feasible. We were not able to schedule more than a few interviews. We most wished to hear from respondents who had not heard of the Collaboratory (since the website user study and PAN interviews had already provided some insights into use of Collaboratory tools by those familiar with the project) yet those interviews were the hardest to schedule. To partly mitigate the absence of interview data, we added the observation in Task 3.3.

### ***Task 3.2: Interviews with RPP funders***

Interviews with RPP funders provided insights into funders' views of how the Collaboratory has influenced the broader RPP field and how funders identify new funding priorities in the field. Interviews were conducted with 3 program officers, all representing different foundations that fund RPPs in education. Findings from funder interviews were triangulated with findings from Collaboratory leader interviews, the broader R/P community survey, and the workshop observation (see Task 3.3 below) to understand perceptions of the Collaboratory in the field, particularly among those not benefiting from its work.

### ***Task 3.3: Observe a workshop on research-practice partnerships not affiliated with the Collaboratory***

To deepen our understanding of how others engaged in RPP work perceive the Collaboratory and possibly use Collaboratory-produced tools and resources (without having participated in



Collaboratory events or sought the team's assistance), SRI attended a one-day workshop hosted by a large state university-affiliated education research institute. This observation complemented the perspectives gathered in the broader R/P community survey.

## Limitations

SRI encountered two limitations in data collection and analysis tasks related to assessing the Collaboratory's influence in the broader field. First, we saw lower participation than hoped for in data collection from those not involved, or only peripherally involved, in the Collaboratory's work (i.e. the broader education R/P community, website users). Given the value of using these data in mitigating the potential for confirmatory bias, as well as for gaining a deeper understanding of shifts in attitudes, discourses, and practices in the broader field, it would be valuable to incentivize participation for such data activities in future studies.

Second, in the comparative website analysis, it was very difficult to identify comparable organizations or centers from which to request website metrics we could use to benchmark the Collaboratory's metrics. Differences in founding dates, scales of intended audience, related engagement strategies (e.g., email newsletter, social media), and other website strategies (e.g., provide resources to read online, vs. providing resources to download), all limited the strength of comparative claims we could make.

In addition, two limitations related to the Collaboratory's complexity, and its flexibility to evolve in response to ongoing testing and needs-sensing, in accordance with its design-based implementation research (DBIR) methods. SRI evaluators kept abreast of project priorities and accomplishments by participating in regular leadership and project team meetings, as well as in team retreats. Still, we occasionally fell out of step, e.g., relied an old version of the success measures without realizing the mistake until later. In retrospect, it may have been helpful to hold focused interviews with project leadership quarterly rather than annually.

Also, as the project evolved, SRI occasionally had to coordinate with leadership to choose which types of project activities were most pertinent to the evaluation, while focusing less on others. This approach involved a few trade-offs, notably in cases where a project activity expanded beyond initial plans. One example was the conference fellows program, in which, for two years, the project sponsored attendance at certain conferences (practitioner conferences for researchers, research conferences for practitioners) for competitively selected applicants, and project leaders in attendance met with the fellows. The fellows program exemplified the

investments in personal relationships to pursue its strategies of increasing access and awareness and fostering critical exchange and transformation. In that sense, it built on the early career workshop and paralleled the team's professional association networks strategy. It would have been valuable to study the role the of the fellows program alongside the Collaboratory's other field-building efforts.

A final limitation arose from the project's coinciding with a period of high staff transition at SRI, leading to the evaluation's having four PIs in five years. SRI minimized the impact of these transitions by careful documentation and by drawing new leaders from within the evaluation team, i.e. who were already immersed in the project; nonetheless, these transitions cost us some time, and to some degree, required an extra effort to rebuild trust with project leadership.

## Conclusion

In combination, the three evaluation activities generated findings that enabled SRI to respond to both evaluation questions (regarding the Collaboratory's strategy and its outcomes). The first activity, which addressed all three parts of the project's theory of action, provided a deeper understanding of its design and approach. The second and third activities then focused on the project's efforts to increase access to and awareness of tested tools and supports for RPP work, and to foster critical engagement around the efficacy of RPPs in transformative STEM education improvement (the first and second parts of the theory of action), first by investigating how people benefited from involvement with the Collaboratory or from using its tools and resources, then by looking beyond the Collaboratory's direct sphere of influence for Collaboratory-related shifts in the attitudes, discourses, and practices of researchers and practitioners in the broader RPP movement.

## Appendix B: Considerations for Evaluating Center-like Investments

In response to a request from NSF, SRI developed the following list of factors to consider in planning and conducting evaluations of large, center-like entities, based on its experience evaluating the R+P Collaboratory.

### Relationship between or among evaluators and center

**Evaluation expertise needs to align to the center's focus, reflecting both relevant content areas and evaluation approaches.** For example, Inverness and SRI's expertise evaluating informal and formal STEM teaching and learning programs, as well as in evaluating efforts aimed at system-level change, was well-aligned with the Collaboratory's focus and goals. In addition, both Inverness and SRI are well-acquainted with design-based approaches and design-based implementation research (DBIR) in particular. Experience with equity-centered approaches was also key.

**As part of early design and planning and throughout the work, explicit conversations are needed to articulate shared goals, and to inventory the priorities, expertise, and roles on both sides.** Particularly in cases where the center team has expertise with design research or evaluation, certain types of work could be conducted by either the evaluator or the center team, or some combination thereof. As examples, the formative efforts to establish norms for communication and a shared team culture and vision, or to conduct needs-sensing or test early ideas with stakeholders, could be undertaken by either evaluators or the center team. Close coordination is needed to ensure work remains internally aligned and non-duplicative.

**Evaluation partners can be involved from the center's earliest ideation stages. Evaluators can play a range of formative roles to serve a center's goals.** In the Collaboratory, evaluators conducted two lines of formative work. Inverness developed case studies focused on the enactment of research-practice partnerships (RPPs) in the three local labs. SRI conducted a professional association networks (PAN) landscape study that contributed, along with team's Inquiry Group meetings, to refining the team's sense of field needs and of the best mechanisms for developing and disseminating tools to address them.

Evaluators can also guide the team in developing and building consensus for a center's theory of change. The Collaboratory team developed its theory of change as a set of conjectures, an

approach grounded in design research (Sandoval, 2014), and mapped the conjectures to the project's lines of work. By revisiting the conjectures periodically, the team was able to assess the processes by which successes would be achieved, and accordingly to double down on productive lines of work and redirect or reframe others

**The complexity and duration of a center's work may call for involving two evaluators in different roles, and/or one evaluator with a shifting role.** The evaluator role may shift from that of a "traveling partner" in earlier phases to a more external perspective in later phases of longer-duration projects. In a developmental role, the evaluator can usefully act as a sounding board for the center to ensure a well-directed trajectory for the center. However, taking this early role may later require evaluators to remove themselves from the role of traveling partner and begin to critically evaluate the outcomes of the work. Moreover, in the later phase, evaluators will need to more fully engage the stakeholders and beneficiaries of the work in a way that is very different from how they engaged the stakeholders at the outset the work. In cases where evaluators have shifting roles over time, it will be useful to develop a common understanding with the center at what point in the work the role changes and how the shift will be enacted.

### **Defining what success looks like and identifying what to measure**

**Measures of success are needed to enable the center to benchmark the degree to which it achieves its desired outcomes.** The Collaboratory team used the conjectures to assess processes, and developed the success measures to assess outcomes. Depending on the evaluator's role and the goals of the evaluation, the evaluator and team can collaborate closely to understand what types of evidence will be gathered for success measures and evaluation questions; as noted above, in cases where these roles may overlap, clear documentation of which responsibilities lie with each (team or evaluator), and of a shared understanding for the goals, will be vital.

To optimally serve their purpose of improving capacity, centers must balance staying true to their core mission and flexibly adapting their strategies in response to what they are learning and also to changes in context. This balance is a fundamental characteristic of any design-research endeavor, as well as the Collaboratory's RPP work. In this sense, the success measures, too, will be revisited periodically and some adjustment may be in order. It is more a question of fidelity of purpose than of fidelity to a specific model.

**Available digital metrics can be useful in assessing the reach of a center’s work. Combining qualitative analysis with quantitative analysis of digital metrics can provide rich insights into how people use the center’s tools and resources.** SRI used Google Analytics to understand the size of the Collaboratory’s website user base, what they did in the sites (e.g., viewing and downloading resources), and change over time, as well as to analyze the relationship of the websites with those of other related organizations (e.g., professional associations, other STEM education organizations), and to assess the team’s integrated communications strategy, of using digital engagement (via the websites, social media, and e-newsletters, mainly) with in-person events such as conference presentations and workshops.

For this strategy to be successful in centers with networked structures or multiple websites, selected digital metrics should have comparable value across the websites included in the analysis. For example, if one website is designed to promote downloads, while another primarily curates links to other resources while also offering some downloads, numbers of downloads will not be a comparable measure of resource uptake across the two sites. Further, evaluators need to coordinate with the center that data relating to priority digital metrics will be available throughout the study period (e.g., that download tracking is enabled).

To complement analysis of digital metrics, qualitative study can help evaluators gain understanding of the story behind the numbers. SRI’s website user interviews bore out the team’s impression, for example, that district and school leaders download the resources to use in training others.

### **Gathering perspectives from beyond the center’s sphere of influence: potential challenges and possible solutions**

**Evaluations that gather data only from those who have participated in a center’s work or used it some way run the risk of confirmatory bias.** Further, those who have benefited most from the work may be most likely to respond to a survey or participate in an interview. As a result, it is imperative to gather data from beyond the center’s known reach—but it can be very difficult to do so.

First, it can be challenging to identify a sample of people whose work aligns closely with the center’s role and goals but are not already part of its known audience. SRI elected to sample recipients of RPP funding from three national (foundation and federal) funders. This choice suited the Collaboratory’s national-scale audience but may have left aside people such as those involved in RPPs at regional or state levels.

Second, once an appropriate sample is identified, it can be difficult to overcome low response rates. One possible solution could be to use “ambassadors” to get word out about the data collection. Can the people in the sample can be reached by a trusted funder or association leader who understands the need and can encourage them to participate in the data selection? If so, it will probably be worth the evaluator’s time to identify those brokers and gain their buy-in for helping to contact the prospective respondents.

## Appendix C: R+P Collaboratory Team Members

Exhibit C-1 lists people listed in the annual reports the Collaboratory submitted to NSF in 2013–2018, by contributing local lab team, excluding people on the formative or summative evaluation teams. The list does not include those who contributed to the project but were not directly funded by it, e.g., those on the practitioner sides of the California, Washington State, or Maine RPPs, or those involved in the closely related RPP with Denver Public Schools. Forty-eight people are named across the six annual reports, with between 17 and 31 people named each year.

*Exhibit C-1. R+P Collaboratory Team Members Listed in Annual Reports to NSF*

Team	Name	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
<b>California</b>	<b>Bronwyn Bevan (PI)</b>	•	•	•	•	•	•
	Molly Shea (Project Director)	•	•	•	•		
	Nicole Bulalacao		•	•	•		
	Michelle Choi			•	•	•	•
	Margaret Escude			•	•		
	Jean Ryoo				•	•	•
	Lindsay Hurth					•	
	Deanna Gelosi					•	•
<b>Washington State</b>	<b>Philip L. Bell (co-PI)</b>	•	•	•	•	•	•
	Savannah Benally	•					
	Andrew Shouse	•	•	•			
	Jeanne Chowning		•	•			
	Marissa Spang		•	•			
	Tana Peterman		•	•	•		
	Kerri Wingert		•	•	•		
	Nancy Price		•	•	•	•	•
	Thomas Hank Clark II			•	•	•	•
	Heena Lakhani			•	•	•	•



Team	Name	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
	Deborah Morrison				•	•	•
	Abby Rhinehart					•	•
	Donald Labonte					•	•
	Enrique Suarez						•
<b>Colorado</b>	<b>William R. Penuel (co-PI)</b>	•	•	•	•	•	•
	Anna Ruth Allen	•	•	•	•	•	•
	Tiffany Lee Clark		•	•	•	•	•
	Julie Cafarella			•			
	Vanessa de Leon			•			
	Joanna Weidler-Lewis			•			
	Jennifer Ciplet				•	•	•
<b>Maine</b>	Barbara B. Berns (co-PI)	•	•				
	Joni Falk (co-PI)	•	•	•			
	<b>Pamela Buffington (became co-PI in 2014)</b>	•	•	•	•	•	•
	Brian Drayton	•	•				
	Rena Stroud	•	•				
	Austin Matte	•	•	•			
	Lisa Miller	•	•	•			
	Steve Spodaryk	•	•	•			
	Catherine McCullough	•	•	•	•	•	•
	Marian Pasquale	•	•	•	•	•	
	Josephine Louie		•	•	•	•	•
	Amy Busy		•	•	•	•	•
	Lisa Hogan		•	•			
	Kimberly Descoteaux		•				
	Kathryn Hobbs		•				

Team	Name	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
	Peter Orne			•	•		
	Jennifer Stiles			•	•	•	•
	Shanna Russ			•	•	•	•
	Peter Tierney-Fife				•	•	•
	Carlene Kaler				•	•	•

## Appendix D: Comparative Website Analytics

The following table provides results of SRI’s comparative analysis of metrics from the Collaboratory’s main website, Researchandpractice.org, along with information related to its email newsletters and social media use, relative to metrics from four reasonably similar entities. These findings are described in section IV of the report.

Overall website characteristics and purposes					
	R+P Collaboratory: Researchandpractice.org	Website 1	Website 2	Website 3	Website 4
Launch Date of website	2015	2013	2014	1997/2014	2013
Do you ask visitors to register?	No	No	Yes	No	Yes
If so, N registered users.	--	--	3015	--	4001
Do you create resources for visitors as well as curate them?	Yes	Yes	Yes	Yes	Yes
Do you host online events on the site?	No	No	Yes	No	Yes

Visitors, resources, and resource use, 8/1/2016 – 12/31/2016

	R+P Collaboratory: Researchandpractice.org	Website 1	Website 2	Website 3	Website 4
N unique users (users)	5,878	7,553	16,266	67,929	45,587
N sessions	8,973	11,235	20,915	93,911	61,520
N pageviews	24,618	26,562	38,187	208,624	143,271
N unique pageviews	17,631	19,992	30,811	171,587	108,842
Top-viewed page	Home page	Home page	Resource	Home page	Blog entry
Top-viewed page other than homepage	Fellows	Associated projects	(not provided)	Events	(not provided)
N of resources organization created available for download	56	53	8	90	N/A
N downloads total, of resources organization created	1,577	589	136	5,925	4,670
N downloads for top download	656	60	35	713	111
Direct hits (i.e., user entered the URL)	40%	28%	23%	26%	22%

Website traffic sources, 8/1/2016 – 12/31/2016

	R+P Collaboratory: Researchandpractice.org	Website 1	Website 2	Website 3	Website 4
Organic Search	12%	58%	70%	58%	65%
Referral (linked from another website)	29%	7%	2%	12%	6%
Social	17%	6%	5%	3%	5%
Email	2.3%	0.1%	0%	0.8%	2.6%
% Social traffic from Twitter	73%	34%	35%	38%	41%
% Social traffic from Facebook	16%	58%	49%	40%	14%
Other sources of social traffic to website	Weebly (7.9%), Reddit (2.2%); Stack Exchange, LinkedIn, Pinterest, Google+, Ning, paper.li each had <1%)	LinkedIn (2.2%); Stack Exchange, Weebly, Google+, Pocket all <1% each	--	22%	N/A
#1 Referring website	Partner website (23%)	Funder's website (11%)	Funder's website (21%)	Twitter	Reddit
#2 Referring website	Partner website (6%)	Another funder's website (4%)	Professional association (14%)	Facebook	Twitter
#3 Referring website	Professional Association (3%)	Research organization (4%)	Newsletter links (5%)	Wikipedia	Professional Association website
#4 Referring website	Blog site (3%)	Blog site (4%)	(not provided)	(not provided)	(not provided)
#5 Referring website	Funder's website (3)	University site (3%)	(not provided)	(not provided)	(not provided)

Email newsletter and social media metrics

	R+P Collaboratory: Researchandpractice.org	Website 1	Website 2	Website 3	Website 4
Email newsletter? (Y/N)	Yes	Yes	Yes	Yes	Yes
N subscribers	603	1,574	3,318	21,720	6,292
Open rate	40%	40%	19%	17%	
Click rate	5%	18%	3%	1%	
Facebook Group? (Y/N)	Yes	Yes	Yes	Yes	
N Likes	48	840	492	2,706	
Other uses of Facebook (paid ads)?	Yes	Occasionally boost posts	Boosts of posts for events/publications	No	
Twitter Account (Y/N)?	Yes	Yes	Yes	Yes	Yes
N followers as of 12/31/2016	598	792	650	38,700	3,449

## Appendix E: Results of the Education Research-and-Practice Community Survey

This Appendix presents data from the education R/P survey, described in section V of the report. SRI used the survey, along with funder interviews and observation of an RPP workshop that did not involve the Collaboratory, to investigate the education R/P field beyond the Collaboratory's sphere of influence, in order to check findings against findings based on data from people who benefited from the Collaboratory's work.

There were 48 total responses to the Broader Community Survey. Two respondents declined to participate, so 46 responses were analyzed.

An initial question asked respondents whether they self-identified as researchers, practitioners, or neither. Responses were as follows.

All (N=46)
Researcher (N=30)
Practitioner (N=8)
Neither (N=8)

What is your professional role? (Please select all that apply.)

Role	N	Avg Years
Classroom teacher (PK-12)	3	9
School leader	3	9
District administrator	5	6.8
Regional or state education administrator	2	12
Informal learning educator	1	7
Teacher education	9	13.2
PD provider for teachers	18	13.3
PD provider for informal educators	4	9.5
Professional association staff	0	--
Policy/advocacy organization staff	2	6.5
Graduate student or post-doc	1	3
Researcher	31	18.2
Other	10	10.6

Respondents could select more than one professional role. 32 participants selected research professional roles (i.e. researcher or graduate student or post-doc); 14 selected educator roles (i.e. teachers, school or district leaders, informal educators); 31 reported teacher / educator training roles (i.e. teacher education, PD provider for teachers or informal educators). Note that



although only 8 self-identified as practitioners, the Collaboratory would consider all 14 educator roles and perhaps most of the teacher education roles as practitioners.

Ten selected “other.” Those who selected “other” on the question listed their roles as: administrators, non-profit leaders, funders, curriculum developers, and directors of RPPs.

To what extent do you agree or disagree with the following statements about the role of R/P?  
(Select one response for each row.)

R/P can effectively...

	Strongly agree	Agree	Disagree	Strongly disagree
improve formal STEM education.	22	21	1	1
improve informal STEM education.	17	22	3	0
improve equity in education.	21	20	3	1
improve ESSA implementation.	12	30	3	0

Do you have plans to engage in other work that involves collaboration between researchers and practitioners in the next two years?

43 participants responded to this question; 81% of them responded Yes, they are planning future projects (beyond their current funding).

Sources from which you most often learn of useful research or research-based resources:

	Practitioner (N=8)	Researcher (N=30)
Educator colleagues	4	16
Researcher colleagues	8	28
Professional association	7	11
Informal education institution leadership	1	1
School leaders (principal, instructional coach, etc.)	0	5
District leaders	1	9
Funders	2	11
Other	1	4

Means by which you most often learn of useful research or research-based resources:

	Practitioner (N=8)	Researcher (N=30)
In person or directly from a colleague	8	22
Websites	3	13
Conferences	6	18
Journals	3	18
Newsletters (email or print)	4	5
Social media	0	8
Other	0	2

Have you heard of the Research+Practice Collaboratory (other than in this survey)?

	Yes
All (N=46)	23
Researcher (N=30)	14
Practitioner (N=8)	5
Neither (N=8)	4

Visiting Websites and Using Resources

Have you visited the following websites?

	The Research + Practice Collaboratory	STEM Teaching Tools	California Tinkering Afterschool Network	Learn DBIR	Interactive STEM
All (N=46)	20	12	2	12	2
Researcher (N=30)	12	4	1	8	0
Practitioner (N=8)	4	5	1	1	1
Neither (N=8)	4	3	0	3	1

Please indicate whether you were looking for resources on any of the following topics on these websites.

#### The Research + Practice Collaboratory

	All	Researcher	Practitioner	Neither
Forming or sustaining a partnership	6	3	2	1
Science education / NGSS implementation	4	2	2	0
Informal learning (including Tinkering/Making)	2	2	0	0
Math education	5	4	1	0
Support for integrating technology in instruction	2	2	0	0
Equity in education	5	3	2	0
Other	2	1	0	1
I wasn't looking for resources on a particular topic when I visited this website.	8	5	1	2

#### STEM Teaching Tools

	All	Researcher	Practitioner	Neither
Forming or sustaining a partnership	1	0	0	1
Science education / NGSS implementation	9	3	5	1
Informal learning (including Tinkering/Making)	3	0	1	2
Math education	2	0	1	1
Support for integrating technology in instruction	2	0	1	1
Equity in education	7	2	3	2
Other	0	0	0	0
I wasn't looking for resources on a particular topic when I visited this website.	0	0	0	0

### California Tinkering Afterschool Network

	All	Researcher	Practitioner	Neither
Forming or sustaining a partnership	0	0	0	0
Science education / NGSS implementation	2	1	1	0
Informal learning (including Tinkering/Making)	0	0	0	0
Math education	0	0	0	0
Support for integrating technology in instruction	0	0	0	0
Equity in education	0	0	0	0
Other	0	0	0	0
I wasn't looking for resources on a particular topic when I visited this website.	0	0	0	0

### Learn DBIR

	All	Researcher	Practitioner	Neither
Forming or sustaining a partnership	5	4	0	1
Science education / NGSS implementation	3	3	0	0
Informal learning (including Tinkering/Making)	0	0	0	0
Math education	1	1	0	0
Support for integrating technology in instruction	1	1	0	0
Equity in education	2	2	0	0
Other	3	2	0	1
I wasn't looking for resources on a particular topic when I visited this website.	3	1	1	1

## Interactive STEM

	All	Researcher	Practitioner	Neither
Forming or sustaining a partnership	1	0	0	1
Science education / NGSS implementation	1	0	1	0
Informal learning (including Tinkering/Making)	2	0	1	1
Math education	0	0	0	0
Support for integrating technology in instruction	2	0	1	1
Equity in education	2	0	1	1
Other	0	0	0	0
I wasn't looking for resources on a particular topic when I visited this website.	0	0	0	0

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