Combining Researchers' and Practitioners' Intelligences for STEM Improvement: A Study of the Local Labs of the Research and Practice Collaboratory

INVERNESS RESEARCH

Executive Summary

The Research and Practice Collaboratory (http://researchandpractice.org) was funded by the National Science Foundation to bring research and practice together in effective ways to address core problems of STEM improvement. The Collaboratory (RPC) supported projects in three states—California, Maine, and Washington—that had the function of serving as "local labs" for the RPC. The local labs formed research-practice partnerships (RPPs)[1] to address local problems of STEM improvement, as well as to create existence proofs of RPPs applying design-based implementation research (DBIR)[2] effectively in a variety of institutional configurations. Inverness Research produced case studies of each lab as well as a cross-case analysis of key features of design and functioning of the partnerships.[3]

Accomplishments of the local research-practice partnerships

The impetus to document the design and function of the local labs arose from the Collaboratory's mission to raise awareness of RPPs because they may comprise part of the solution to the long-standing problem of the gap between research and practice, which often manifests as a gap between theory and implementation. Leaders of the local labs disseminated a number of reports and other products to demonstrate a range of benefits to STEM improvement, such as the following:[4]

- Positive changes in teachers' confidence, knowledge, access to usable research, classroom practices, and leadership capability related to STEM improvement
- Improvements in students' engagement and learning, including STEM reasoning and social-emotional contributors to learning
- Professional learning that teachers engaged in, valued, and put to use
- Researchers' deeper understandings of school contexts and instructional improvement, as well as greater confidence in the value of their work for STEM improvement
- Scaling and institutionalizing new approaches to teaching STEM

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[1] As originally defined for the William T. Grant Foundation in a white paper by Coburn, et al. (2013). William Penuel, a co-author of the paper, served as a Co-PI of the Collaboratory.

[2] See Penuel, et al., 2011 and 2013.

[3] Find the three cases and the full cross-case analysis at https://inverness-research.org/2018/07/30/portfolio-research__practice_collab/.

[4] Inverness Research focused on design and functioning of RPPs, not results. With the exception of benefits to participating researchers and practitioners-which Inverness's study did reveal-the accomplishments included are drawn from documents supplied by other Collaboratory members.

- Multiple tools and resources for STEM improvement and greater equity, used widely in and out-of-school
- Expanded professional communities that comprise practice-informed academic researchers (senior and junior) and research-informed practitioners (teachers and administrators)

Key Elements of Design and Function

Critical to the success of the partnerships were three elements of design and function that they shared: a) the relationships that formed the partnerships; b) the nature of the work, which combined researchers' and practitioners' intelligences for improvement; and c) the organizing structure of the Collaboratory, which strengthen each labs' work and enhanced their contribution to the field beyond the sum of the parts.

A. Relationships that formed the partnerships

Each partnership was launched with important ingredients that gave them a running start[5]; these included prior working relationships among some key players, leaders with a theoretical worldview that educational research must include the practitioners' eye view, and some "**dual citizen**" members with organizational boundary-crossing skills. Even so, **laying the groundwork involved prioritizing relationship over productivity**, occupying several months to a full year at the three labs.

California lab

The **California Tinkering Afterschool Network (CTAN)** brought together practitioners (leaders, directors, facilitators, and line staff) of the Community Science Workshops (Watsonville and Fresno), Discovery Cube (Santa Ana), and Techbridge (Oakland) with educational researchers from the Exploratorium (San Francisco). CTAN involved the voices of practitioners in testing and adapting research findings relevant to the afterschool and tinkering contexts, and in designing, implementing, and studying STEM-rich tinkering opportunities in afterschool settings serving traditionally under-served youth. https://www.exploratorium.edu/education/california-tinkering-afterschool-network

Maine lab

Education Development Center (EDC) formed **Interactive STEM**, a partnership among the Auburn (Maine) School Department, the University of Southern Maine (Portland), and the University of Maine (Farmington) to focus on early math learning and the use of technology. The partnership connected pre-K-2 teachers and administrators in Auburn with researchers from EDC and the two universities to concentrate on developing shared visions of practice and on designing and studying interventions to address key problems in math learning. http://interactivestem.org/

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[5] One attempted partnership, which we termed Maine 1.0, did not thrive. None of these ingredients were present at the launch.

Forming the research + practice partnership required continual deliberate effort to **build a trusting relationship** among researchers and practitioners. Given tradition and the inherent difference in social stature between researchers and practitioners, the onus was on the researchers to earn the trust of the practitioners. Earning trust often equated with equalizing "voice"—which often meant amplifying practitioner voice and turning down the volume of researcher voice. Amplifying the traditionally silent teacher voices often required persistent effort by the researchers. One practitioner said,

> *A lot of [us] practitioners just wanted for them [researchers] to tell us what to do. We were like, 'Can't you just write the hypothesis?' But they said, 'No, we can't, because we're deciding this together.'*

The partnerships built trust through such strategies as shared leadership, values-mapping, and collaborative interpretation of data.

Researchers also put effort into being of **service to practitioners**, especially by serving as just-in-time conduits to relevant, well-vetted research in the form of readable articles, good web links, or ideas for workshop topics. Other strategies involved generally "bending over backwards" to be "a really good partner," as described by one researcher:

> *We have to tell to our [academic researcher] colleagues about what it means to really partner, and it includes a number of things that I don't think are always understood, from providing coffee when the district can't figure out to spend money to get coffee for teachers, to offering to put together slides for the board meeting when some grumpy board member is asking about science or math… There is a bunch of that kind of stuff going on all of the time.*

B. Combining intelligences for improvement

Research-practice partnerships differ from the traditional "consent" relationship by forming around **mutually beneficial effort.** The DBIR approach emphasizes that-within a domain of interest such as NGSS practices or after-school access to tinkering-research focuses on **specific problems of practice that are negotiated** rather than framed a priori by the researcher. Researchers gained insight into relevant problems of practice through repeated observations of practice and listening to teachers, as well as looking for alignment with school- and district-based improvement initiatives. One researcher said:

Washington lab

The **Partnership for Science and Engineering Practices (PSEP)** joined University of Washington researchers with administrators and teachers from the Seattle Public Schools and Renton School District. PSEP addressed problems related to teachers in grades 3-8 shifting their teaching to include NGSS practices.
http://stemteachingtools.org/about

> *We have been paying attention to what are these emerging problems of practice that teachers have been talking about, or we identified them, that kind of rose to the surface, and we want to respond to those and address those rather than to say, 'Nope, we have done our plan.'*

Researchers also made an effort to time cycles of research so as to match the process and outcomes to teachers' work cycles, as well as serving the goals of the larger RPC mission.

The work of the labs was designed to engage researchers and practitioners as learners together, an approach that we termed **"hybridizing the inquiry."** Comments like this occur in each case: "Everybody put on the hat that we were all going to be learners in the endeavor and find out together." With this conceptual playing field established, leaders made an effort to **combine researcher and practitioner capabilities to learn—i.e., intelligences—to enable new understandings**. This comment reflects the idea:

> *We are really trying to figure out how can researchers bring their expertise in terms of the literature that they read or the research that they have done in the past – and how can practitioners bring their expertise in terms of the daily experience in their different spaces—and share the knowledge in a way that is accessible to both sides, of both worlds, and develop a new understanding of the work.*

All three labs designed settings for work that invited this hybrid inquiry. These settings may have appeared typical—they were classrooms, professional development workshops, planning meetings, and research meetings—but the **RPP leaders altered work spaces normatively** so that data analysis, meaning-making, questioning, and decision-making combined perspectives, interests, and goals of both practitioners and researchers.

C. Affordances of the Collaboratory as support structure

While the labs operated autonomously, the Collaboratory served a "hub" function that enriched the work of each lab and enabled them as a group to make a larger contribution to the field.

Convening local lab directors as Co-PIs. Annual reflection retreats, joint planning, monthly check-ins and updates, and shared projects (such as web development) kept the lab PIs well enough informed about one another's work that they readily found synergies and learned from one another.

Engaging PIs in collective conjecture mapping. The Collaboratory PIs practiced Sandoval's (2014) technique of mapping conjectures as an approach to making design research more systematic. The PIs jointly formulated and refined conjectures about the Collaboratory as a whole, holding the autonomous groups to social accountability and keeping shared research questions in view.

Sponsoring cross-lab Inquiry Groups on STEM practices, cross-setting learning, equity-oriented facilitation, and interactive technology. Convening members of all labs around issues that were central for an individual lab, as well as cross-cutting, broadened the shared knowledge base across labs, deepened the improvement work at individual labs, and formed new social capital across the country among researchers and practitioners with shared values about STEM improvement. The intensive 2-day meetings reinforced practices of cultural exchange across the worlds of research and practice, along with generating concrete knowledge products reflecting combined intelligences.

<u>Promoting collaborative dissemination efforts</u>. Leaders of the local labs collaborated frequently on papers, conference presentations, webinars, and meetings with key policy makers. These contributed to the Collaboratory's mission of building broad field awareness about RPPs as well as to expanding the human capital resource of "hybrid" educators.

Implications for Field Building

The examples of the RPC local labs produce a number of lessons that can inform the field about effective design and functioning of research-practice partnerships.

- **Research-practice partnerships are arrangements grounded in core values**

Creating a productive and lasting research-practice partnership requires that researchers value implementation-based research that combines research and practice perspectives for the purpose of generating knowledge of value to practitioners as well as to researchers.

- **Research-practice partnerships require, and continue to build, professional capacity for "hybrid" research**

Working in partnership builds new forms of professional capacity. Researchers listen to and become more sensitive to practitioners' realities, and practitioners adopt a more inquiring stance toward their teaching and toward ideas coming in from the outside.

- **Research-practice partnerships can thrive in a variety of organizational configurations**

The three labs involved large and small school districts, R-1 and teaching universities, a variety of informal out-of-school learning institutions, and intermediary education organizations. These variations suggest there is little limit to the types of organizations that can form and participate in RPPs, given the needed core values and goals.

- **Sustainability and spread**

Every lab has continued its work, though the work has evolved into new projects with new people, different funding sources, new goals and products, and different organizations as partners. Sustaining the work required adaptive leadership capacity, particularly the ability of key leaders to seek out new funds and interested partners. The **evolving work draws from and continues to build needed capacities**—the values and skills—for research-practice partnerships.

Spreading the values and skills needed by researchers are practitioners has occurred not only through dissemination of Collaboratory-sponsored knowledge and products, but also through the **mobility of early career researchers**, e.g., graduate students who take faculty positions where they can perpetuate the work, and through new **stances of researchers and practitioners toward practitioner preparation and development**.

An Emerging Conceptual Framework

Below we display a conceptual framework that is emerging from our study of the design and functioning of the research-practice partnerships of the RPC.

Figure 1. An emerging conceptual framework for research-practice partnerships
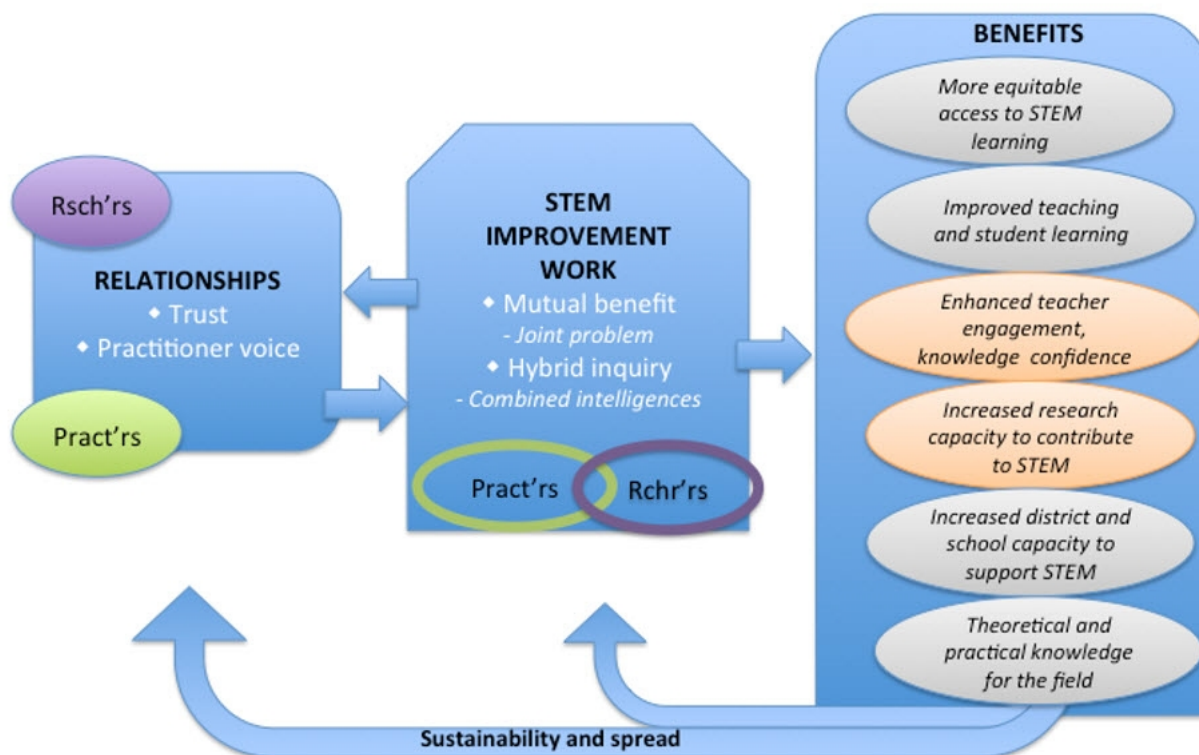
The framework reflects the partnerships as relationships that permit a type of STEM improvement work that combines the particular intelligences of researchers and practitioners for the benefit of both, which ultimately results in STEM improvement that benefits students, capacity-building among researchers and practitioners and their institutions, and valuable knowledge for the field. The presence of research-practice partnerships in the educational landscape builds field capacity to sustain and spread new arrangements that combine the intelligences of researchers and practitioners to address problems of practice.

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