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Fostering Knowledge Use in STEM Education: A Brief on R&D Partnerships with Districts and Schools

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If you are proposing to conduct research and development (R&D) in science, technology, engineering, and mathematics (STEM) education, your work will benefit from effective partnerships with schools and school districts. While almost every education R&D project requires contact with schools, this brief makes the case for *partnership*. By this we mean a relationship that is long-term, usually involves formal organizational commitments, draws on both partners' expertise, and has benefits for each partner.

As researchers and developers in STEM education, we offer this brief as a summary of what we have learned about creating and maintaining partnerships that support high-quality R&D. The nature of our experience with R&D partnerships has varied, because all of our projects have been different, but we have all found that partnerships enhance learning for researchers and practitioners alike. We also have seen that they work best when approached with realistic expectations and designed for sustainability. This brief describes our observations, emphasizing practical lessons to help other researchers and developers launch and maintain successful partnerships with practitioners.

We Believe Partnerships Will Improve Your Project

Partnerships allow R&D projects to operate in Pasteur's quadrant (Stokes, 1997), responding to the dual drivers of scientific curiosity and practical need. By effectively teaming up with education agencies and practitioners, projects sharpen their focus on genuine problems of practice. Little benefit comes from research projects that “dive bomb” into a district, seeking to solve a problem, without pausing to understand how—or whether—the district is experiencing that problem. Similarly, the absence of partnership weakens the work of development: many of the excellent materials sitting in district warehouses and on classroom shelves, still in their shrink wrap, are the remnants of projects that never engaged practitioners in foreseeing and solving the challenges of implementation. We argue that projects benefit from partnerships by gathering sound and complete data and by producing resources, models, and technologies that are relevant, useful, and usable for teachers and likely to be adopted and sustained by district decision makers.

In research projects, we have worked with teachers as colleagues. For example, they have developed and used classroom observation instruments and, by bringing their knowledge of content and pedagogy, have produced observational data with high reliability—greater than that of the graduate assistants who might otherwise have done the observations. These teachers' participation is critical, not incidental, to the research.

In our development projects, “user-centered design” has been a hallmark. By this we mean that the people whom the project is supposed to benefit are part of the design process. We repeatedly consult practitioners, as members of our teams, after they have used trial versions of

the resources we are developing. Practitioners and developers know that if teachers and students don't like a resource, it will likely be scrapped.

We Know It's Never Easy

Working in schools and school districts requires R&D professionals to recognize and bridge cultural divides. Respecting the cultures, rules, and incentives of schools is crucial. Districts and schools have to operate under tighter constraints and time frames than R&D projects. Decision makers who must answer urgent questions (such as whether to continue using a particular textbook) are impatient with researchers whose answer is, "it depends." Relationships fail when someone thinks that his or her expertise is "better" than that of others. Instead, a successful partnership has a culture of mutual respect, with the realization that different types of expertise can come together for mutual benefit.

Some difficulties stem from districts' and schools' previous experiences with teams based in universities or R&D organizations. Based on past experience, a district may expect that teachers will be offered a program of professional development, not participation in an open-ended inquiry. Or they may expect a randomized controlled trial that will impose serious constraints on school and classroom flexibility. Most often, too, they have little expectation that the R&D team will want to know what they think. We have found ourselves struggling to overcome the residue of disappointment left by other R&D teams.

At a practical level, schools are busy with existing initiatives. Their textbooks and scope-and-sequence guides may fill up the time available for instruction. The days dedicated to teacher professional development may be fully scheduled far in advance. Getting a handle on the complex patchwork of initiatives and curricula in a school or district is a challenging task. It is also an important one, since that patchwork can present logistical barriers for participation, competing educational approaches, and uneven or inconsistent buy-in.

Leadership changes and staff reassignments are frequent in districts and schools. An R&D project that runs four years from proposal submission to project completion will almost surely see turnover in key partners, such as the superintendent, key district staff like mathematics or science coordinators, principals, or teachers. A change in leadership or staffing can have dire implications, even for a project that has established itself.

Having faced these challenges and more in our projects, we know that they can be managed with planning, understanding, and a respectful relationship. Below, we offer our advice to those who want to carry out research and development through effective partnerships with schools and school districts. Not every suggestion will pertain to every situation, but we encourage you to consider whether they could work for you.

Launching a Partnership

Partnerships are social endeavors that often grow out of pre-existing relationships, and that depend on engaging the right mix of individuals. At the same time, partnerships are business relationships. We suggest building and tapping into wide networks of practitioners, looking for a good match of needs and purposes with the organizations you approach, strategically enlisting the right mix of individuals in the organization, and agreeing upfront about key commitments.

One starting point is to be alert to a range of potential partners:

- ***Cultivate and contribute to practitioner networks over the long term.*** Before even beginning to pursue partners, we have reached out and developed relationships in the field, such as by volunteering services to local schools, serving on state and district advisory boards, and providing support to leaders on specific problems. We have contacted district leaders who are alumni/ae of our institutions and who have been receptive to the idea of partnering. And many of us are inveterate networkers. One created a database of people with common interests, drawing originally from a conference that she hosted. Since then, she has shared resources within the network, facilitated networking, and called on individuals to be partners in later work. In another case, one of our institutions has formed a long-term alliance with districts that serves as a clearinghouse for approaching superintendents about possible projects.
- ***Be dependable in all interactions with practitioners.*** More fundamentally, all of us have learned that our partners have to know they can depend on us. We know that in a sense we are always being interviewed and observed as potential partners.
- ***Work with existing networks and linkers.*** We have also engaged with existing networks for partners and partner recommendations. Practitioner professional associations are a natural source of networking help. Linking organizations, such as intermediate units within states (e.g., Education Service Centers, Regional Service Districts, Area Education Agencies), have a mission of facilitating opportunities for districts. They are often open to brokering partnerships, and they themselves are valuable partners because of their experience in negotiating many kinds of bridges between research and practice.

When recruiting a partner, it is important to spell out how that partner will benefit, specifically addressing the organization's needs, interests, and strategic direction. While we are enthusiastic about the many potential benefits of our own projects, we try to adopt the partner's perspective and focus on the specific fit.

- ***Know the priorities of partner organizations and individuals, and be alert to immediate needs that create windows of opportunity.*** One of us appealed to target districts by designing a science intervention specifically for high-minority, high-poverty schools that incorporated math and literacy content. Other projects give university-based professional development credit to participating teachers. Different participants will each have their own priorities: one of us remembers the experience of being welcomed into a school by

the principal, only to find that the teachers were unaware of the project and were uninterested in participating until they learned that the project offered professional development credits that they needed. In another case, we found that a district did not have funds for the professional development to complement its recent technology purchases, and was glad to participate in the professional development that we offered—although in past years we had struggled to make a place for our offerings on the district’s crowded professional development calendar.

- ***Be honest about the uncertainties inherent in research and development.*** In identifying and connecting with practitioners’ priorities, you must recognize that their purposes are not necessarily served by studies that generate more questions than answers or by interventions that turn out not to work. We have seen researchers overpromise, only to leave a participating district frustrated when an innovation did not produce the hoped-for results. School and district leaders have much less margin than researchers and developers have for learning from failure.
- ***Whatever your views of the prevailing assessments, standards, and curricula, understand that schools focus on them.*** We try to show how an intervention aligns with state assessments and academic standards, including Common Core standards, or local curricula. Under accountability pressures, districts and schools are looking for help in interpreting and using their data from state and local assessments.
- ***Start early and in person.*** E-mail is a fine means of communication for some purposes, but not for launching a partnership. People need to meet and sit and talk, regularly.

In putting together a working partnership, it is important to be strategic in identifying partners and to involve a range of individual participants in a district or school. What are the individual partners’ roles, levels of influence, and likely stability within their own organizations? How can they help with sustainability and scale-up? We suggest the following:

- ***Learn and attend to institutional procedures and structures when recruiting partners.*** Every school district has distinctive rules and requirements for prospective partners, which must be understood and addressed. The Institutional Review Board (IRB) is often a gatekeeper, with detailed requirements for research proposals, yet some districts may not have an IRB. In other words, the necessary procedures for opening the door to partnership may or may not be spelled out in official documents that are easy to find, but you will still need to learn what they are. Just as important are the informal systems and structures in the organization with which an R&D team needs to establish credibility and trust, and that can help you navigate opportunities and obstacles.
- ***Bring multiple players into the fold.*** Enlist individual participants, representing different parts of the organization, for different roles. For example, a project that uses technology in a content area benefits from active engagement of both the content coordinator and the information technology coordinator. By contracting with a district’s research and evaluation office, one of our projects gained easy access to professionals who knew the data system, knew the questions to ask about what the project needed, and efficiently

retrieved the needed data. And, by partnering with the district mathematics supervisor, the project could readily gain teachers' consent for analysis of linked teacher-student data.

- ***Build relationships that can protect the project in case of turnover.*** In particular, it is important to build multiple levels of relationships all the way from the classroom to district leadership. A project's success—and its very survival, in case of turnover in partner staff—can depend on having supporters up and down the line, as well as across organizational divisions. We assume that any district will experience change in leadership or key staff over the life of an R&D project, and that the people who remain on the job will have to vouch for us if we want to continue working in the district.
- ***Seek individuals who “play well with others.”*** Individuals with a reputation for dependability are valuable partners, as are those who can work through disagreements toward project goals. And at a very practical level, you need to partner with people whom you can call and say, “I need a place to meet on Saturday; can you help me get a space?”
- ***When selecting partners, consider their potential role in sustainability and scale-up.*** One of us, based in a university, engaged a nonprofit partner that could potentially continue to work with the partner district as a professional development provider on a fee-for-service basis. Another deliberately chose partner organizations that were open to the idea of later applying for their own grant money to sustain project work, as well as partners that were active in networks that could help to scale the work.

Partners who sign on to an explicit description of their role, or who are contracted as project staff or subgrantees, are more likely to remain committed and take ownership.

- ***Codify the agreement with key partners early on.*** A district may not be willing or able to spell out all of its commitments at the proposal stage, which could be at least a year before educators begin participating. But as early as possible, the partners should clarify in writing who will do what, when, and with what funds. Implications for district policies or programs should be addressed. In working with a district, we recommend getting the superintendent's sign off as well as agreement from program-level staff and school leaders. Informed by years of experience, one of our projects asked for a letter of commitment in which the district agreed to designate time in school schedules for teacher collaborative planning and to provide school-based follow-up support to the teachers. This letter also formalized the district's agreement to data collection by external and internal evaluators.
- ***Determine what type of agreement you will need in order to carry out the project design.*** Although we recommend making the agreement as specific as necessary, the type of specificity needed will vary across projects. For projects that ask the district or school to make major changes, their agreement to those changes should be confirmed. For projects in which the R&D team will work closely with a few teachers, the arrangements for teachers' participation may be the only essential element of the agreement.

- ***Put power in the hands of a researcher-practitioner team.*** Many of us have established a formal group, such as a steering committee or leadership team, with a substantive role in project decision making. The project benefits when this group meets regularly and has established procedures for communication. However, group membership may change over time. For example, one of our projects had a steering committee for three years, with varying responsibilities and shifting membership to match: the committee reviewed all contents of the project’s website; one member took charge of alignment with standards; three members were recruited midway through the third year from a school that was participating in pilot testing.
- ***Contract with a district as a project subgrantee.*** A subgrant gives the district direct control of project funds for carrying out specific project activities, and it can ensure the survival of the partnership. In an environment of belt-tightening, districts tend to hold on to subgrants, especially those funding indirect costs. A contract relationship can also smooth the way to many needed steps in a project. In one example, a district subgrant facilitated the IRB process, enabled the project to gain access to student-level data, and garnered easy buy-in at the school level.
- ***Build individual partners into the budget.*** Hire partner staff part- or full-time, or pay stipends. This has both symbolic and practical value: in addition to bringing needed expertise onboard, it demonstrates respect for the staff members’ time, and the business relationship helps solidify their commitment. The project can and should pay for the materials that schools will need for participation, which often means including a line item for copying and other basic supplies.

Working in Genuine Partnership

We are passionate in the conviction that teachers’ contributions are indispensable to our research projects and to the development of useful, usable classroom materials. Far more than guinea pigs for our ideas, the teachers with whom we have worked have brought insight and expertise to all stages of the work. It requires humility on the part of the R&D team, but once you accept that your own expertise has serious limits, practitioners will help you produce results that are better because they draw on a wide variety of types of knowledge.

- ***Recognize and respect teachers as essential contributors to the project.*** A small example can illustrate teachers’ ability to save a project from a fatal misstep: one of our projects was planning to develop kits of materials for use in kindergarten classrooms and the vendor proposed to package the kits as individual packets of different materials. The kindergarten teachers said, “Absolutely not,” knowing that reassembling the packets would take time that they did not have; instead, they said the vendor should group the materials by shape and color so that kindergarten students could reassemble them. This change made the difference between materials that would be used only once and materials that could support ongoing learning.

- ***Enlist teachers as researchers.*** In some of our projects we have worked with teacher-researcher colleagues. Some have developed classroom observation instruments and have gathered observational data with high reliability. In another study design, teachers gave us invaluable insights into the ways in which students would act if they understood a task, partially understood it, or did not understand it at all.
- ***Convince teachers that you are taking them seriously as partners.*** Both researchers and practitioners may implicitly expect to carry out stereotypical roles in which expertise resides with the researchers while teachers are simply asked to follow instructions. If you want to break out of these stereotypes, as this brief urges you to do, you will have to work hard to demonstrate that you expect a different kind of interaction. For example, one of us wanted to gather teachers' self-reports on their use or non-use of prescribed materials, expecting that the teachers would often have good reasons for departing from what they had been told to do. Formulating an effective set of questions was a challenge; as we tried out different versions of the questions we asked teachers, "Would you be scared to answer this question? Would you tell us what you think we want to hear? How do we get you to trust that we want the truth?"
- ***Stay engaged with teachers.*** Our most effective relationships with teachers have been of years' duration, but even a several-month working relationship is more productive than a one-time interaction. Through continuous collaboration, we learn how the project is affecting classrooms over time, and our partners' engagement in the work can build. Later in project stages, several of us have engaged participating teachers in new ways, such as in dissemination or facilitation of project activities in other places.
- ***Demystify the R&D process.*** In many of our projects, teachers have been hesitant to correct our initial errors. We actively solicit their critique, not only saying, "Let's think together about how to change these materials," but also thanking them warmly for every negative comment, and then acting on their ideas. In one project, where teachers were asking us for instructions rather than volunteering their ideas, we gave them t-shirts sporting the quotation: "If we knew what it was we were doing, it would not be called research, would it?—Albert Einstein"

We have also developed insights through our partnerships with district staff, who have helped us set agendas and then make sense of unexpected turns that our projects take. And we have learned to maintain lines of communication with many stakeholders in and around schools.

- ***Be open to and prepare for new directions in the work.*** In a project's design stages, we suggest asking district leaders, "What would be most useful for you to know?"—and then being willing to take their agenda seriously. Partners will want to weigh in, and including them in decision making can turn them into committed advocates. Sometimes you have to be willing to sacrifice certain aspects of the research model to accommodate your partners. Of course some elements of a research design will be non-negotiable, and we cannot be cavalier about those, but we have found that partners are more disposed to respect our non-negotiables when we have shown flexibility and responsiveness on other decisions that are important to them. Furthermore, responding to partner interests may

improve the project's relevance and usefulness to the district, and possibly to other districts like it.

- ***Engage the partners in making sense of interim results.*** One of us had a useful midstream discussion with district staff when a project as originally designed was showing mixed results. She sought their ideas, saying, “Here's what we're hoping to help you do, here's what's happening. Please help us figure out what we can do to better help you.” These discussions of early results can also elicit district leaders' helpful ideas about ways of presenting the data for usability.
- ***Recognize the sensitivity of negative results.*** While researchers and developers can derive great learning value from a failed intervention, district leaders almost never have that luxury. You can mitigate the potential embarrassment of negative results by showing those results to key partners well in advance of release and by honoring confidentiality in accordance with partnership agreements and consent documents.
- ***Stay alert to changes in policies or staffing.*** Shifts in programs, priorities, and personnel are more the rule than the exception in districts. This makes it essential to keep the conversation going and plan together how to adapt to a changing landscape. Such communication can help partners respond to stakeholders and maintain their support for the work. In addition to maintaining the conversation with existing partners, we have learned to seek an early, face-to-face meeting with the new leadership in order to communicate directly about the partnership.
- ***Communicate progress often and purposefully.*** In the midst of implementation, it is easy to sideline communication efforts. However, organization heads and others with political capital may need reminders of the project's progress and benefits. One of us works with participating teachers to conduct an annual project showcase for other teachers, district leaders, and school board members. This project also engages principals in a half-day role-alike group during annual summer teacher institutes in order to discuss progress and principal concerns. Another one of us developed a PowerPoint presentation about her project, designed specifically as an overview for principals and coaches. This presentation has been well received and has helped build give-and-take relationships with these key leaders.
- ***Reach out to the community.*** Misconceptions about a project sometimes spread and grow through the rumor mill, but good information can pre-empt this destructive cycle. Consider setting up a web page and sending out brief newsletters to parents and the community, describing the project's aims and its benefits for children.

Looking Toward Sustainability and Scale

Education projects notoriously fall by the wayside after outside funding dries up, even when they have produced good outcomes. Working purposefully toward sustainability throughout the project period has benefits for schools and districts, which gain more lasting value from their participation, and also for developers, who learn how to build greater staying power into the resource or model they are designing. Sustaining and spreading the use of project knowledge requires strategic action, and partners can figure heavily in success. Practitioner partners can become owners and advocates for continued implementation and help in getting the word out to their colleagues near and far.

Often it is easier for researchers and developers to focus on daily implementation issues, rather than on how to maximize the broader impacts of their work. However, our experience is that projects benefit from careful thought about sustainability and scale throughout the project life, right alongside discrete project tasks like communicating with participants or collecting the next round of data. Planning for the grant cycle's endgame should begin up front, address the roles of partners, be sustained throughout implementation, and work toward the continued life of project knowledge.

- ***Address sustainability and scale-up as part of project design, starting in the early planning stages.*** We suggest, at start up, identifying sustainability as goal of both the project team and the partner schools, strategically planning for a new culture of use, and working with partners to identify and target possible funding streams to sustain work after the project ends. One of us started a project with a letter of support from the state, offering the possibility of future support for scale-up if it was successful.
- ***Be open to adaptation.*** You may picture a project remaining in place unchanged, but sustainability may be selective: practitioners will keep what is working for them rather than adhering to all the details of your original design. We recommend ongoing deliberation to identify the essential “non-negotiable” features of the project, as well as to weigh the costs and benefits of designing opportunities for adaptation.
- ***Learn from the adaptations that emerge in practice.*** For example, in a project that introduced teacher professional learning communities, early experience showed that scheduling the meetings during the school day made a big difference in implementation. Over time, the participating school principals and district administrators recognized this and made the needed adjustments in scheduling. The result was an intervention that had staying power in the district. As the grant ended and formal project activities faded, district staff and principals began stepping in to lead activities using project materials and applying what they had learned in the partnership.
- ***During the project period, start with the most motivated users, then branch out to the less motivated.*** For example, teachers who will participate in professional development on their own time are an invaluable resource in the early stages of development. Sooner or later, though, the program will also have to work with more reluctant participants, whose participation may require different individual incentives and organizational

arrangements. Testing these arrangements is a part of the work of development and has implications for sustainability and scale-up.

- ***Engage partners in dissemination to practitioners and researchers.*** District and state leaders report that they learn about research and programs through word of mouth among others in similar jobs. Some of us have engaged our partners as co-authors and presenters. Teacher leaders have presented not only at practitioner conferences like the NSTA, but also at conferences with more academic membership.

A Final Note

In closing, we underscore that the advice here reflects our own experiences with partnerships with practitioners. Obviously, we are enthusiastic about the great benefit that partnerships have brought to our work, and we want to share the hard-won lessons that we have learned from our missteps as well as our successes. We know that much more remains to be learned, and we hope that future researcher-practitioner conversations and formal scholarship will contribute to the knowledge base on partnerships.

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David Barnes is the Associate Executive Director for Research, Learning, and Development at the National Council of Teachers of Mathematics and a co-PI on two Discovery Research K-12 (DR K-12) grants. The first is Using Research to Target Title I Needs in Mathematics, a conference grant that convenes Title I professionals and mathematics educators. The second, Response to Intervention in Mathematics: Beginning Substantive Collaboration between Mathematics Education and Special Education, brings together special education and mathematics education researchers and practitioners to develop joint professional development and research efforts.

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