CROSSROADS SESSIONS AT CADRE
June 2012

Thursday, 9:45 am - 11:45 am

In this inaugural Crossroads session, participants examine challenges of coordinating across states within a collaborative project and discuss sharing project activities with a wide array of constituencies.

Todd Campbell and Julie Luft
Arlington

Thursday, 1:45 pm - 3:45 pm

Presenters describe struggles with sustaining science teacher professional development across remote sites and explore simulation training of science educators beyond one institution's existing capacities.

Barbara Crawford and Benjamin Dotger
Arlington

Friday, 10:30 am - 12:30 pm

Explore whether Network Improvement Communities might inform and guide dissemination efforts, and then engage in debate about STEM reforms at the local or global level.

Sharon Lynch and Mark Windschitl / Jessica Thompson
Arlington

CROSS-SITE PROJECTS: COORDINATING OR COLLABORATING

Todd Campbell, *Utah State University*

Vexing about Collaborative Grant Projects

The biggest vexation I feel that we face in our project is related to running a collaborative project. Our project was funded as a collaborative project between two universities, one in the west and one in the east (i.e., Utah State University and the New York Institute of Technology). In creating our proposal, principal investigators from both sites were integral in shaping and eventually receiving the award. One of the most pressing problems has been maintaining consistency across the two locations when both sites have principal investigators on site locally with differing expertise and different pressures that influence the project.

Our project involves research into the effectiveness of leveraging cyber-enabled technologies in science classrooms in ways consistent with science education reform and grounded in teaching science as inquiry. We lead professional development for cohorts of in-service science teachers, whereby the Utah collaborators deliver the professional development in Utah and the New York collaborators deliver the professional development in New York, as one example of the collaborative roles played at each site. Despite being in two states we made a decision to use curriculum as a vehicle to provide professional development, both as an experience and then as resources for teachers to use in classrooms. Some of our problems can be traced to the differing state standards and challenge of shaping two different curriculum pieces or modules for delivery. While we have worked very hard to align our work, the problem of consistency remains a challenge in whether the same foci are receiving comparable attention across sites (e.g., pedagogical focus vs. technology focus). Efforts are made to align our projects by using comparable templates for developing modules and professional development. However, with the leaders differing across sites and teachers in different contexts (i.e., in different schools in different states) where accountability measures might be different as one example, variability across sites is still present and if not carefully monitored has the potential to undermine the focus and eventual outcomes of the research project as data consolidation occurs throughout. In summary, the vexation is how to maintain consistency across sites by better aligning and managing a collaborative project.

Venturing

Collaborations arise from shared purpose. Some characterize collaborations as ventures whereby collaborators belong to one system, frequently communicate in a way that reveals mutual trust, and consensus is sought for making decisions. This is juxtaposed with a coordination, which is offered here as an alternative way that two sites working on the same project might interact. Coordination has been characterized as the sharing of information and resources, defining of roles, communicating frequently and sharing some decision-making (Frey, Lohmeier, Lee, & Tollefson, 2006). One immediate action or venture that seems promising is ensuring that authentic, enticing, timely, and important shared work and decision-making are occurring. An example of this occurred recently as

we as a project team realized that a different analytical scheme was needed for reporting the findings emerging from one of the research surveys created in our project. This work was essential to the success and the purposes of the project and as such seemed to bring about those characteristics identified above for collaborations.

Another venture that seems to make sense, but at times may not be logistically possible, is having leaders from both sites engage in curriculum development and professional development across sites. This seems to offer the promise of helping move the immediate focus from a single-site perspective to the greater focus of the overall project. So ensuring that leaders from both sites are mixed or intricately involved across sites is another venture that is being considered.

Follow-up Vexing

With respect to the proposed venture of moving leaders across sites, some concern arises here that the approach could be interpreted as impractical or worse a threat to the scalability of the project. While opportunities for cross-pollination across sites can be conceived, this was not originally planned as the project was crafted and therefore has financial implications. In addition to the financial implications, there is a fear that in some ways this approach represents a threat to the scalability of the project (i.e., all leaders are necessary at one site for the project to operate in the way envisioned). Another consideration that pushes against this venture resides in the differing state standards that shape both the curriculum developed and the professional development that is delivered. As an example, a leader from Utah helping plan or lead at the New York site would need to do so in a way that focuses on the New York state standards. Questions arise as to whether this time spent learning more about the New York standards by the Utah leader is time best invested. While there are reasons that push against this venture, our experience to date has shown us that extended close collaboration with shared purpose leads to mutual trust and an insider's perspective of the pressures across sites.

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SUMMER PD WAS GREAT! BACK IN MY CLASSROOM WE ARE A LONG WAY FROM FOSSIL FIELDS

Barbara A. Crawford, *The University of Georgia*

Vexation

An ongoing challenge for me has been creating a model of professional development that effectively supports teachers in engaging diverse students in the practices of science and critical thinking. My research team views learning as situated and we value the importance of authentic activities in classrooms (Brown, Collins, & Duguid, 1989). We use a community of learners framework (Lave and Wenger, 1991) in which social engagement and co-participation provides the context for learning. Key ingredients include connecting teacher to PD experts and to scientists, as well as providing access to resources. Numerous studies suggest that the best way to help teachers and their students grasp the nature of science is to participate in authentic research (i.e., Jeanpierre, Oberhauser, & Freeman, 2005) especially in partnership with active scientists.

Our PD model supports teachers to engage their students in hands-on investigations of actual fossils, as well as virtual fieldwork. The framework for our professional development immerses teachers in authentic science, which is combined with attending to the essential features of scientific inquiry and explicit teaching about nature of science (Crawford, Capps, Meyer, Patel, & Ross, 2010). Our approach situates teachers in the dual role of learner and collaborator. We integrate field experiences and pedagogy (moving from the field to the classroom to the museum) in order to help teachers understand how to support their students in carrying out an authentic paleontological investigation. The project has a special focus upon populations of underrepresented minorities and English language learners (ELL) students. Over the last four years we have had success in designing summer institutes for a range of upper elementary to high school teachers. Teachers investigate Devonian fossils as evidence of past environments to determine changes in organisms over time. We also encourage teachers to reflect on their practice. We believe it is essential to encourage productive relationships between scientists, science educators and teachers that are collaborative and mutually respectful.

The summer institutes are packed with experiences and well received. Teachers really like them. Teachers rate our summer institutes as top notch, with averages of 5.0 on a scale of 1-5 for effectiveness (on anonymous teacher self-reports). We conduct pre-post tests and determine growth in teachers' knowledge of subject matter (geology, biology, evolution, and ecology), views of inquiry and nature of science, and project teachers' intentions to teach using inquiry-based approaches. Using a quasi-experimental design we see significant increases in project teachers' and students' knowledge and views of science as compared to comparison classrooms (Woodruff, Morio, & Li, 2011). All this is very good. So, what is the problem?

Here is my vexation. What happens with our PD efforts when school is back in session? How do we stay connected with our teachers during the academic year? We know that when teachers go back to their classrooms, they get swamped with all kinds of demands – new students, of course, but also, new initiatives, parent conferences, district requirements, and high-stakes testing, to name a few. Meanwhile, back at the university we get busy with our own day-to-day activities. It is easy to lose touch with project teachers during the school year. Our project teachers reside in states across the country: New York, California, Florida, Missouri, and Massachusetts, among others. Furthermore, our project team resides in three different states: New York, Maine, and Georgia. Once teachers are back in school they are far from the fossil fields, and far from the supportive team who had nurtured them during the summer. Many of our teachers have made great strides in changing their instructional practices towards more reform-based practice, but we have found this change is not always sustained. Teachers sometimes revert back to teacher-centered, traditional practices. Teachers need on-going and just-in-time support. One January I visited one of our project

classrooms in Florida. During the lesson I observed the teacher masterfully engage her students in the Fossil Finders investigation, identifying the fossils in the scientific samples. Students showed great enthusiasm. And then, the teacher realized she had forgotten the password for entering the fossil data on the project website. She needed the password, right then, but she had forgotten how to get into the website. I just happened to be there in her classroom, and we worked on the problem together and we even telephoned the project graduate assistant for additional consultation. If I had not been in her classroom that day, then what?

Venture

My team intends to develop a transformed PD model that relies on a blended (face-to-face and virtual cyber-enhanced) experience for teachers and children across the country. We hypothesize that a blended PD model can be as effective (or, perhaps, even more effective) as the face-to-face, immersion-only model for preparing teachers to support students in inquiry-based classrooms. Such a blended model would incorporate new web-based resources, and provide opportunities for teachers to engage in on-line collaboration. In my vision, teachers would have the capability to remotely and easily assess project materials, video and visual resources, and take full advantage of a viable, asynchronous or synchronous on-line community of learners using social networking tools. We know that many PD projects use web-based tools. I would be most interested in learning from other PIs about their experiences. What are others' experiences and knowledge of viable PD projects that maintain viable connections in the school site? Do attendees know of examples of productive collaborations that support teachers far from a PD site? What are some promising ideas about how to develop and test the use of remote teacher supports, especially for large-scale PD projects?

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BALANCING RESEARCH AND RESPONSIBLE GROWTH OF AN EDUCATION INNOVATION

Ben Dotger, *Syracuse University*

BACKGROUND

My scholarship centers on developing, implementing, and researching the effects of simulated interactions on teacher and school leader development. Medical schools commonly employ *standardized patients* to help bridge medical preparation and practice. Standardized patients are healthy individuals who are carefully trained to present the same medical symptoms, verbalizations, and evidence in a consistent, standard manner to medical students, providing opportunities to practice medical diagnoses and interpersonal skills in a simulated clinical setting (Barrows, 1987, 2000; AAMC, 1998).

In similar fashion to medical education, I have explored since 2007 the efficacy of simulations in the preparation of teachers and school leaders. Utilizing the actors and camera-equipped clinical simulations rooms of nearby SUNY Upstate Medical University, I have designed 12 general teacher education simulations, where novice teachers engage in live, one-to-one interactions with standardized parents, paraprofessionals, students, and community members. Building on this work, I have designed 15 general school leader simulations, where novice school leaders also engage with standardized individuals. Across these 27 simulations, novice teachers and leaders must navigate a wide array of problems-of-practice, including: academic and social concerns, abuse/neglect, challenged curriculum, student safety/health concerns, balancing school and community relations, substance abuse, teacher performance, collaborating with colleagues, divorce/separation, non-traditional families, and bullying/harassment.

More recently, I have begun working with colleagues to design subject- specific simulations across the secondary content areas. To date, three science simulations have been designed. An additional 26 simulations will be designed and clinically tested in the next four years (4 additional Science, 7 Mathematics, 3 Social studies, 3 English/Language Arts, 3 Music, 3 Art, and 3 Physical Education).

I have established an efficient simulation development and clinical testing process. Currently, over 740 school professionals have engaged in different simulations, allowing me to closely examine simulations for desired learning outcomes, make the necessary redesign adjustments, and continue their implementation in teacher and school leader preparation. Within my own School of Education, simulations are now embedded across our secondary education and school leader preparation programs. Currently, research on simulation effectiveness is concentrated in explorations of teacher/leader identify, exploration of emotional geographies, impact on teacher/leader dispositional development, and teachers' approaches to subject-specific problems.

Ultimately, simulations help bridge the classic gap between preparation and practice, challenging future teachers and leaders to synthesize what they know about teaching and learning and apply knowledge, skills, and dispositions to authentic and demanding problems-of-practice.

VEXATION

Frankly, I could spend the next 30 years simply designing simulations. There remains a nearly endless supply of general and subject-specific problems-of-practice that can be simulated. Alternatively, if I complete the additional 26 secondary education simulations that I have committed to designing, then I could easily spend the remainder of my career testing their impact on small samples ($n<100$) of novice teachers. There remains the question of broader diffusion, though, and therein lies my vexation.

My vexation is this – ***how do I explore responsible diffusion of simulated interactions beyond the microcosm of Syracuse University?*** I begin with a list of needs. I need colleagues and collaborators at other institutions who are willing to try simulations in their own teacher/leader preparation contexts, and join me in studying the effects and impacts of specific simulations. I need constructive critics of this work who look beyond the common questions of cost, implementation without a nearby medical school, and recording technologies. I have clear examples of how to move beyond these minor barriers. Instead, I need critics to challenge me and help make the model more robust. I need suggestions on capacity building and broader funding. My development work is grant funded, but implementing simulations is of minor cost compared to the initial development and clinical testing phases. Finally, I need help in

examining the relationship between teacher/leader simulations and student success (however we might define it).

A part of me says, "*Be quiet, examine the efficacy of your simulation models, and publish those results. Your work has not yet been broadly tested. It is not time to diffuse!*" Another side of me replies in retort, "*Get the word out. Find interested, knowledgeable scholars who can partner with you. If you spend your entire career working on simulations alone, you limit your support of novice teachers and leaders.*" As my vexation suggests, I'm leaning toward the latter and trying to responsibly diffuse my simulation models.

VENTURE

In 1963, when Howard Barrows first introduced the concept of standardized patients at the University of Southern California, critics suggested that such an idea was too "touchy feely" (Wallace, 1997) and served to reduce the professionalism of medicine. Building from the enthusiasm of preservice neurologists who emerged from the earliest medical simulations, Barrows and a small group of colleagues proceeded forward with the idea. Today, 98% of the 127 U.S. medical education institutions utilize medical simulations to both teach and assess the clinical skills of future medical professionals (Coplan et al., 2008). Assessments of clinical diagnostic and interpersonal skills were incorporated into the U.S. Medical Licensing Examination in 2004 and medical education institution accreditation processes (Hauer et al., 2005; Islam & Zyphur, 2007).

Across the U.S., there are 479 schools of education within twenty-five miles of a medical school that employs the simulation methodology. Of note, 188 schools of education are within five miles of a clinical simulation facility. My venture centers on these data – *I am contemplating a strategy where I leverage the close proximity of some medical and education institutions to establish teacher/leader simulation centers*. For example, Drexel University and Villanova University are geographically close, both institutions prepare teachers and doctors, and both institutions support clinical skills centers through their respective medical schools. Could I introduce them to my ideas, help connect their teacher education programs with their clinical skills centers, and foster simulations in that environment? Could I find other "hubs" across the country – like the Drexel/Villanova hub in Philadelphia – to support my diffusion efforts? This venturous strategy holds its own questions, including: How do I obtain funding for diffusing, without robust, large-scale simulation efficacy data? How do I establish knowledgeable partners at these institutions who will work to implement my simulation models with appropriate fidelity? How do I communicate and monitor responsible diffusion without nearly constant travel? Importantly, how do I find other "hubs" not associated with medical schools that are also willing to begin implementing simulations for future teachers and school leaders?

CONCLUSION

I believe that a clinical, formative environment – where teachers and leaders move beyond "know(ing) about" and instead develop and practice professional skills so that they "know how" (Daresh et al., 2000, p. 78) – remains key. Clinical simulations focus the conversation beyond the overly-general "Can you survive student teaching" to the more important, nuanced, substantive questions, like "What strategies did you employ to guide that student?" and "How did you structure your explanation for that worried father?" Additionally, clinical simulations offer opportunities for faculty and novice teachers to reflect and improve specific teaching practices in an environment designed to support both formative and summative performance assessments.

As I move forward with this work, I hope to balance three challenges: promoting the instructional and research opportunities of clinical simulations, helping interested researchers/institutions adopt clinical simulations regardless of proximity to nearby medical education facilities, and maintaining appropriate fidelity to the design and intent of each simulation.

TRANSLATING OUR WORK

Julie A. Luft, *University of Georgia*

Vexation: Can our work make a difference in the educational environment?

The projects that are funded through the DRK-12 program are forward learning and progressive in terms of education. For instance, there are studies on using technology in novel ways, different configurations of preservice teacher education programs, and alternative forms of professional development that can enhance teacher knowledge and build communities of learners. This is a result of the National Science Foundation review process that results in the selected projects, as reviewers are told to look for well-conceived plans that have the promise of impact in the education field.

Once funded, these projects entail significant time and money. The PI of the project provides countless hours of oversight, while the staff and educators involved dedicate hours enacting the vision of the grant. Along with the PI, there are staff who work with the educators, or who will collect data. Without these people, there would be no project. But having people involved in the project requires funds to secure their time, and this is often a significant expense. In fact, the time of people is often the largest expense associated with a DRK-12 project.

My project, which looks at beginning secondary science teachers, does have a significant fiscal and time component. In the first part of the project, over 120 beginning secondary science teachers participated in different types of induction programs. The second part of the project involved following the teachers over several years in order to understand how their participation in different induction programs impacted their knowledge and practices in terms of science instruction.

This project has revealed some important insights about new science teacher development (e.g., Luft, 2007, 2009; Luft, Bang, & Roehrig, 2007, Luft et al., 2011):

- In the first years, a teacher in close proximity is important
- Later on in a teacher's career, the larger community becomes important
- Teachers often take on new responsibilities over time, which competes with their time to develop their knowledge and new practices
- Teachers who engage in teaching the same subject over time have the ability to build their knowledge and practices over time.

What we* have learned in this project is important for administrators, policy makers, fellow science educators, and teachers. By working with these different groups, our work has great potential to alter how new science teachers are brought into the community of science education. Unfortunately, we struggle with communicating our findings in ways that foster change in the educational community. Colleagues in science education, for example, have limited time and fiscal resources, and they are trying to develop their own identity in science education. As a result, they recognize the importance in supporting their newly minted teachers, but have little interest or ability in providing the needed support.

In this project, it is evident that there are important messages that need to be shared pertaining to new science teachers. However, it is not clear how to share these messages in order to assist beginning secondary science teachers.

Venturing

In thinking about the dissemination of this work, there are several paths that we have taken. In terms of colleagues in science education (i.e., those directly involved in science teacher education), we have published our research in a variety of journals and we have presented on this topic at different conferences. People seem interested in the topic, but we are just not sure if science educators are thinking differently about their new teachers.

This research has also been published in National Science Teachers Association (NSTA) journals, and presented at NSTA conferences. The journal article seemed to get a good deal of attention a few years ago. Presentations are often to a limited group of attendees – most of whom are new science teachers themselves.

We have talked to a few administrators. For the most part, administrators are worried about all new teachers and think a content mentor is adequate for a new science teacher. Given the fiscal concerns of administrators, their concerns seem justified.

Policy makers were at one time interested in science as inquiry, which involved this research. Given the large number of issues on the plates of policy makers, it makes sense that this research has not been picked up by this group.

In talking to these different groups, it does seem that our work is important to share. And, given the time and funding that have been given to this project, it is essential to share the results of the project. However, it seems that we have gone as far as we can with those in education who need to learn about our work. Or have we?? Should we continue to pursue our dissemination? If so, why, and how?

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* We in this paper refers to myself and the graduate students who have been involved in this research project over the years.

IS NARST WOISTLR SINCE IT GLOBALIZED? — THE CHALLENGE OF ACRONYMS AND IDEAS

Sharon Lynch, *George Washington University*

Vexation

NARST is the largest organization for science education researchers in the world, and carries some substantial prestige. Its reach and potential growth increases, as the world gets smaller and more flat. NARST seems likely to figure into the rollout of the US New Generation Science Standards, and some of its member scholars have been influential in helping to get them written. Despite many legitimate criticisms of the organization, it provides scholarly opportunities for those new to the field and to those who have been around for a bit of time. The annual conference is a gathering of science education researchers from around the world.

That said, have you ever tried, in a sentence or two, to explain the organization and your role in it, to a friend, colleague or professional acquaintance?

> *I belong to NARST. What is that? It is a Worldwide Organization to Improve Science Teaching and Learning through Research. Pregnant pause. Silence as colleague tries to reconcile "NARST" with "WOISTLR".*

The acronym, NARST, hangs uncomfortably in the air for anyone who has mastered the rudiments of phonics as they struggle to reconcile the tagline, the likely acronym, WOISTLR.

> *Change of subject.*

However, the change in the NARST tagline was an earnest one, developed over a year by a committee of serious members of the NARST Board, and subsequently adopted unanimously. The tagline was intended to convey inclusivity and that the organization seeks to be international or global, in scope and reach. It does not intend to be tied only to its United States roots. There are probably many very good reasons for this intentional change in the tagline, and here are just three:

- We live in a global community and it is best to recognize that fact, and its implications.
- Much of the research on science education is conducted all over the world, and implications of many research findings can be nearly universal, such as how children learn science (but respecting cultural and contextual differences).
- About 30% of NARST members reside outside the US and are major contributors to both science education research and to the organization; it makes sense for them to be a part of an international organization, rather than one based in the US.

That said, there are some growing pains that likely occur when an organization goes "global". About 70% of NARST members reside and do their work in the US, and that is their frame of reference and research context. They must grapple daily with the substantial problems of US science education. Being part of a national science education research organization makes sense because:

- Science education is often (not always) practiced locally. Many members are very interested in science education policy and practice in the US, and NARST forms an important network, especially for people new to the field and who do not want to get lost in a global research network as they begin their careers.

- There is no other US-based science education research association; abdicating NARST's US-based role leaves no other organization to fill the research, policy and practice breach, especially important as the US is about to launch the US New Generation Science Standards.

- It is hard to have national clout when the tagline of an organization a global scope. It is like having UNESCO intervene in US agricultural policy—the US Department of Agriculture wins.

It seems to me that both aspects of NARST future considered above can be equally compelling, depending on where one sits. My vexation is, how can one develop NARST as a global community of science education researchers working together to further science education for all children, a lofty if somewhat dilute goal, as one simultaneously works to advance NARST on the national front at this crucial time for US science education? This is not merely a vexation, it is a real dilemma. It is an intellectual dilemma because both directions make a great deal of sense. It is an interpersonal and organizational dilemma because one wants to unite researchers over ideas, rather than one nation's interests.

But NARST members who reside outside the US are likely to belong to a national organization that accomplishes their nation's science education goals, leaving US NARST members in a sort of dead zone as it globalizes, just as US national issues are heating up. Interestingly, one of my doctoral students who works for an international NGO tells me that other organizations are facing similar dilemmas. For instance, as one prominent US-based environmental organization went global and began to collect money to save rain forests around the world (who could possibly argue with that goal?), its members were less eager to contribute money than when it focused on preserving forests and wetlands within the US. There is a human tendency to want to know and experience the results of one's generosity and efforts.

The Venture

This dilemma is too large for me to solve alone, and too important to sweep under the rug, it seems. NARST needs to find a way to expand both sets of goals, at once, it seems to me, rather than leave things to chance. My venture is two pronged. The first is to let the NARST Board hash this out at its October Board meeting. I think we need to talk more about it, and develop an agenda that honors both movements with initiatives. The second action is to find key note speakers for the NARST Annual International Conference that render the global and US-based aspects of NARST of interest to all (most?) members of the audience, so that the conversation can expand into thought and action.

NETWORKED IMPROVEMENT COMMUNITIES

Mark Windschitl & Jessica Thompson, *University of Washington*

VEXATION: Six years ago our research team took up a series of studies on the classroom practices of new science educators. We hoped to learn enough to somehow accelerate novices' development towards rigorous and equitable teaching. Among our early findings were that novices struggle with the very aspects of teaching that are crucial for students' participation, identity development as capable knowers, and to meaningful forms of learning. For example, our beginning educators could elicit students' science and everyday ideas, but they could/did not use these as resources to extend student thinking; they could not sustain meaningful and purposeful discourse in the classroom, and they could not help but funnel kids towards the reproduction of canonical explanations from the text. And, from a planning standpoint, they struggled to identify ideas with explanatory power in their curriculum and embed these in anchoring phenomena that kids could relate to.

As we contemplated how to support more ambitious forms of instruction, we began reading in the literature about the emphasis on teaching as ***practice***. Teacher education journals promoted the development of "practice" as the new foundation for pre-service preparation. From the broader literatures in subject matter areas came the idea of high-leverage practices (primarily from Mathematics with increasing interest from English/Language Arts and History). More recently the notion of a limited set of ***core*** practices, that all teachers should become proficient in, has been circulated. For us then, the notion of a practice-based beginner's repertoire began to take shape—a set of specific, recognizable practices that could be taught to and learned by beginners. But beyond that it could also form the basis of a common language among novices and their mentors, and could become the basis for a system of tools to support a community engaging in these practices. Historian Dan Lortie seemed to frame the problem we were trying to solve (written nearly 35 years ago), arguing that the lack of a technical core in education allowed teachers to invent their own definitions of what works based on individual experience or folklore, and that this might explain the "reflexive conservatism" that characterizes instruction in classrooms. Working in isolation and unable to transcend their own experiences, teachers continually revisit and cement the relationship between their beliefs and what they do with students.

Our challenge seemed clear. In response we developed a system of four "core" practices tailored to the needs of beginners. We now refer to them as: developing a big idea; eliciting students' understandings; making sense of material activity; and constructing evidence-based explanations. We also developed a system of tools (discourse tools, video of exemplary teaching keyed to the practices, a teaching progression for the practices, samples of student work, heuristics for developing big ideas to teach, and more…). In testing these with beginning secondary educators in high needs classrooms we documented that many (but by no means all) of our young teachers demonstrated the kinds of rigorous and equitable instruction we had hoped for, in some cases engaging in remarkably sophisticated pedagogy that we had not seen even in experienced teachers. In the process (and true to an anthropological view) they began to develop their own sets of tools for their specific classroom needs, for example tools for supporting student talk about evidence, student metacognition, and students' testing/revising of scientific models. Importantly, we no longer feel that these practices and tools are useful only to beginners, we have had many experienced teachers and teacher leaders in the Puget Sound region take these up in their own classrooms and as the basis for professional learning communities.

Our vexation? We now feel that we have to scale up this system. But these practices are not like clothes you can just try on. They have been carefully modeled for our teachers, rehearsed by them under sheltered circumstances and debriefed multiple times in the university setting and in the field. Coaching and feedback are essential, but supporting beginners' attempts at these practices requires its own levels of instructional expertise. Moreover, these practices are ambitious partly because these are so unlike the conservative practices used in many science classrooms (see TIMSS video study, Science Education in Europe: Critical Reflections, Looking Inside the Classroom, etc.). There is the inevitable pushback from cooperating teachers and from departmental peers.

We would like to know, for a wider population of educators whom we may never interact with in person, are there ways to: 1) represent our own knowledge and experience to them, using some form of technology infrastructure 2) cultivate familiarity with the practices and some level of expertise among those who would be teaching pre-service teachers or leading experienced practitioners, 3) stimulate a sense of co-ownership and a long term commitment to the work by them so that practices and tools have a chance to work and be refined, 4) tap into the wisdom of practitioners and teacher leaders and incorporate their ideas into the system, 5) and, for us, not make the predictable mistakes about scaling up (especially when relying on technology as a key element) that others have already warned about? We are out of our comfort zone here, leaving the familiar territory of instruction and learning, and sailing out into what seems like a working space more defined by sociology and organizational thinking.

VENTURE: To address this challenge we are now planning to implement a model becoming common in medicine and industry (see Goldsmith & Eggers 2004; Podolny & Page 1998; Powell 1990) referred to as a ***Networked Improvement Community*** (Englebart, 1992). We believe it addresses our five "vexation" concerns, at least theoretically. This community is made up of three inter-related levels of participants and their interdependent activities (Figure 1).

A-level activity is the on-the-ground work of carrying out the organization's primary business. The "A" level in our model is the classroom where teachers and students use a variety of tools and other resources to mediate learning directly. We are referring here to the core practices that support ambitious (rigorous + equitable) teaching. Teachers not only implement the tools and practices, but also test their effectiveness under different instructional conditions or test new variations of these resources. If teachers can provide evidence of improved student learning or participation as a result of an innovative adaptation, that resource can be distributed to the larger community at the C-level (described later).

B-level activity describes organizational efforts that are designed to improve the on-the-ground work. The "B" level functions as a local improvement network (LIN) and consists of clusters of participants, including individuals involved in teacher preparation (interns, mentor teachers, methods instructors, etc.) or district consortia (teachers, coaches, department heads, professional development providers, etc.) These local-level clusters regularly interact for the purpose of collectively and collaboratively improving their teaching and learning through the principled testing of classroom practice. We plan to use the tools we have developed for classroom practice, as well as the tools we designed for mentoring around these practices, to support groups of practitioners in adopting ambitious practices in their local schools, and in creating practice-driven innovations in the tools and practices themselves. Just as individual teachers from the A-level can propose new variations of classroom practice to the larger community, the leaders of LINs can propose changes in the collaborative processes that support teacher conversations about experimentation with ambitious practices. Through summer institutes and on-line forums, this project will directly support the development of about 30 LINs in their work.

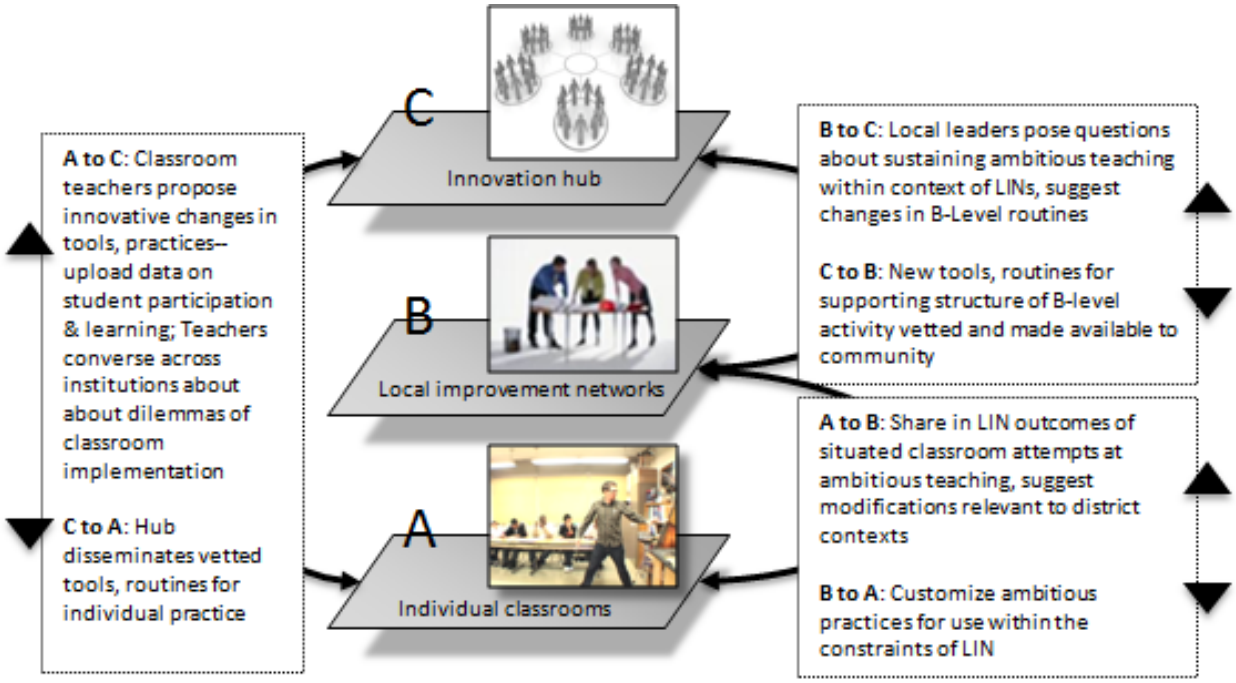

Figure 1. Activity within the Networked Improvement Community

C-level activity is trans-institutional, generating the capacity for learning to occur across organizations. The C-level is comprised of a small number of experienced teachers, teacher-leaders, and researchers, who manage a web-based innovation hub that "houses" the resources of the community. In our proposed system, these individuals vet suggestions for changes forwarded electronically from the A and B-levels to the community's tools, practices, and other resources. They also analyze input from the LINs to frame problems of collaboration and individual practice in ways that are more tractable for developing solutions. Having the technology-mediated means for individuals both at the C and B-levels to look at how activity varies across different organizational contexts puts relevant aspects of the contexts in sharper relief and can help each local setting see its efforts from new vantage points. Englebart (2003) notes that C-level activity affords mechanisms for testing the validity of local knowledge, adjusting local understanding of the true nature of a problem, and advancing local support structures for improvement in classroom practice. For this project we plan to put the "shared expertise" together across the network to solve persistent equity-based problems of practice that have surfaced in our prior research, and that appear to be common problems in reform-based teaching.

OVERVIEW OF CROSSROADS

Science Education at the Crossroads is an annual conference emerging from dissatisfaction with traditional session formats at the large education conferences. What became the most productive conversations were those that took place outside the official conference schedule. Bored by the "stand-and-deliver" approach and peeved that sessions were pedagogically abhorrent, we sought a venue to re-create the coffee house and barroom discussions that had been so productive and generative to our careers. In short, Crossroads was an effort to legitimize professional dialogue about something other than end products.

What emerged was a unique approach to conference sessions that we call Incubators. The structure of Incubators represents a signature pedagogy that has proven to be valuable for jumpstarting new educational projects and for renewing commitments to professional agendas. Incubators and Crossroads are not a replacement for NARST or AERA sessions. Instead, they offer an alternative whereby newly conceived projects are aired before colleagues.

The schedule for an Incubator is as follows:

0. **Quick Introductions**: Facilitator, Presenters and Attendees
1. **Statement**: Presenter gives a verbal description of his/her Vexation and Venture.
2. **Clarify**: Attendees ask clarifying questions.
3. **Incubate**: Discussion of Vexation and Venture – while presenter sits in silence.
4. **Rejoin**: Presenter is allowed to respond, pose follow-up questions and summarizes.

In preparation for the Incubator, each presenter drafts a Vexation and Venture. The Vexation describes a challenge, problem and difficulty being faced within one's professional life. This provides a context that is intellectual and contains a certain measure of emotional impetus. The Venture then identities one (or multiple) possible strategies the presenter is contemplating that has the potential for mitigating the Vexation. Rather than identify a global or institutional problem, the Vexation situates the discussion very close to where the presenter is doing his or her work. Similarly, the Venture identifies a local response rather than offering a lamentation about the system or the field. Thus, the Vexation and Venture are intertwined. The issue the presenter nominates is necessarily hitched to a mechanism that he or she may put into motion.

None of this automatically happens …

Six PIs with active DRK12 projects were recruited to participate in the 3 Crossroads sessions during the June 2012 CADRE meeting. Each person was familiar with *Science Education at the Crossroads* and was willing to present their work using this format. They drafted a Vexation and Venture that was then revised in response to feedback from the organizers. Those documents are included here for you to consult.

To keep us on schedule, a designated person serves as the Facilitator. This individual provides the structure and authority to ensure that individuals have opportunities to share their views and that the discussions focus on the topics identified by presenters in their Vexations and Ventures. Once an Incubator is underway, the Facilitator takes control and is thereby an advocate and support of the presenters.

While Crossroads has been a stand-along conference and the Incubator format has been used in other educational settings, we are interested in evaluating its appropriateness as an opportunity for PIs at CADRE meetings. We will spend time within each session debriefing on the structure and its affordances. Your generous and honest input would be appreciated.