

American Educational Research Association Conference, April, 2007, Chicago, IL

Symposium

Reshaping Schools toward Evidence-Based Cultures: Learning through Design

(Opening and Closing Remarks)

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Aims for this Symposium

It is now widely argued in policy circles that schooling must become more evidence based if we are to achieve ambitious academic attainment at scale for all children. At one level, this is a technical task of defining the *appropriate evidence* and how *these data are managed* and processes of use organized so as to *inform practice*. Each of these elements—appropriate evidence, management of data, organization of use, and informing practice—needs considerable parsing in order to design and build effective systems to support school improvement. Much of the content of our symposium focuses on these issues.

Moreover, it will probably surprise few to learn that we have concluded, from our initial forays in this regard, that this work entails more than just good technical problem solving (which to be sure is needed). It also forces us to confront fundamental questions about the basic organization of schools, the ways individuals think about their work and how it is actually carried out “on the job floor” of classrooms and schools. Thus, a second inquiry goal for this symposium is perhaps best framed as a systemic probing of the organizational conditions needed within schools for evidenced-based practice to become normative.

Our window into this organizational change problem is through design activity – in this case the design activity associated with building a diverse mix of new tools, and social practices for their use, that are intended in combination to facilitate, shape and reorient behavior toward evidence. The “surprises” emerging in the course of the repeated design cycles of rapid prototyping and field trial provide substantial grist for this empirically grounded theory of practice of improvement.

Third, as active change agents within this larger school improvement context, we have placed our own practical efforts “under the microscope.” Again, our experiences in the context of design activity provides considerable evidence for a final integrative question across the set of papers presented in this symposium – how might we be more strategic about our own efforts to catalyze the emergence of such evidence-based cultures in schools?

Background on the Information Infrastructure Systems Group

This symposium is based on the collective efforts of The Information Infrastructure Systems Group. This group consists of a diverse collegueship of academic, clinical and commercial expertise aimed at a shared problem. Specifically, we seek to conduct an integrated program design and engineering and research activities necessary to develop and sustain an enhanced Information Infrastructure System (IIS) capable of supporting at scale the efforts of teachers and other school-based professionals to advance more ambitious learning for every child. Such a system should inform classroom instruction, enhance the communication necessary for more viable internal accountability at the school-community level, and instantiate the necessary concepts, data bases and social practices for the emergence of a genuine case-based, evidence-based system of instructional analysis and improvement. The work reported on in this symposium is an outgrowth of this larger problem-centered research and development effort.

Core Principles Guiding the Work of the Information Infrastructure Systems Group

Any vigorous effort to embrace an evidence-based school practice is tantamount to changing the core technology of schooling. This is a complex and ambitious undertaking which, in an almost tautological sense, demands a complex conceptualization to undergird effective action. Our aim, however, is not to develop an all-encompassing intervention that could easily prove too difficult to be engaged effectively in

most ordinary schools. Rather, we seek to use our “complex conceptualization” to identify constructive, “simple” levers that hold promise for catalyzing deeper changes down the road. In short, we seek to think complexly, but act strategically and opportunistically.

Start with work on the job floor in classrooms and schools seeking to advance ambitious academic work for every child. Our program of R and D takes root in a deep understanding of the day-to-day problems of practice in ordinary urban schools trying to advance more ambitious teaching and learning for every child. We place this school improvement work at the center of our design work.

As in every other workplace, technology can offer a constructive assist in solving specific work problems in schools. Moreover, an ensemble of such initiatives, coherently assembled, may constitute an effective press on the larger organizational problem of “loose coupling” where much of day-to-day decision making bears little relationship to a school’s core mission of advancing student learning. In short, our embrace of technology is not for its own sake, nor is it guided by some overly optimistic belief that we have found the “silver bullet.” Rather, we start with a basic understanding of the problems of practice involved in day-to-day work in schools and ask the “value-added question”: “Could, how, where might introducing some new tools and social practices actually advance this work?”

We complement these design efforts with an integrated research program in the service of practice improvement. We do not engage in *research* “for its own right.” Nor are we doing “design experiments” to develop and test some theory or new method in context. Rather, we posit that the conceptual and methodological tools of the disciplines can offer a constructive assist in sharpening our thinking about the practical problems of instructional improvement. We also think that through engaging in such practical work, we might, on some occasions, even advance these “academic tools” a bit.

A coordinated focus on three “Big Problems.”^[1] We have organized our overall project around three main problems confronting school reform:

1. **Informing instructional improvement**—toward more ambitious goals with timely, detailed displays about student learning and aligned “just in time” professional development resources in response to identified learning problems,
2. **Enhancing programmatic coordination**—with a clinical case management and internal accountability system for school-based supplemental services, and
3. **Connecting parents, schools and communities**—to add value to students’ learning during the “other 85 percent of children’s lives” outside of school.

This broad scope of work is important for practical, political and conceptual reasons. On the practical side, these three domains are organizationally inter-related. An effective solution in one area will make demands for coordinated action in other two domains. Correspondingly, incoherent practices in one domain may easily undermine promising initiatives in another.

On the political side, the press of high stakes accountability initiatives is driving schools to purchase an ensemble of tools, which promise short term standardized test score improvements, but may also further institutionalize the low level academic work currently experienced by many disadvantaged students and the non-professional work environment encountered by their teachers. Districts need a coherent, alternative view (including actual operating prototypes) of how technology could enter urban schools to support both more ambitious aims for students and to enable a professional practice that advances these aims.

Moreover, we believe that it is important to work in a coordinated fashion on the major problems in school practice because virtually everything else in the environment, from their political economy to the forces in the marketplace to internal school norms, exerts entropic effects which operate at cross purposes to systemic improvement. We view coordinated work on these three key fronts as critical for coherent school change. For better or worse, conceiving of an enterprise-level solution (even if we only work on parts of it at a time) seems essential.

Finally, from a more academic perspective, by working with a broad ensemble of prototype tools, each designed in response to some pervasive problem of practice in urban schools, we maximize our opportunity to learn about the issues involved in effective technology mediation of adult work in schools. Through engineering efforts of this sort, we seek to develop a grounded theory of practice improvement, which holds useful insights for practitioners about school improvement and has analytic traction for guiding subsequent tool design and use efforts.

Conceiving of school change as a consolidation of effects problem. The IIS project seeks to mediate multiple work activities in schools with new tools and social practices. While each of these interventions may be relatively simple, they all share a common language that brings focus to common aims—advancing more ambitious learning objectives for students and reframing schools as contexts for learning by adults as well. In the broadest of terms, we seek to explore whether a fundamental change in the culture of schools can result from the accumulation over time of multiple, successful experiences within such a transformed work activity system. That is, can broad scale school transformation be effected through a consolidation of effects from a series of simpler, discrete changes, provided that the overall guidance for those changes is coherent and the implementation plan is strategic? In essence, our project seeks to explore the warrant for a develop-

mental theory about how technology might actually advance systemic reform.

Exploring new institutional arrangements for more effective R & D. As part of the overall mission of the IIS project, we seek to explore new pathways for creating useful technologies at scale. We believe that the academy and actors from clinical practice are very good at identifying problems of practice and documenting how problems of practice look in the context of day-to-day work. Commercial actors, on the other hand, have very good mechanisms for creating technical applications that are robust and useable. We conjecture that a failure to blend these forms of expertise effectively leads to research insights that fail to make it into products and, products that do not reflect the realities of practice.

As a result, the IIS project seeks to engage in more direct partnerships among schools, the academy and commercial firms in the service of advancing a more effective educational R and D enterprise. We aim to both test the viability of new institutional arrangements in this domain, and if they prove successful, begin to document the essential features necessary to create more such partnerships in the future.[2]

We believe this effort may fill an important void in the organization of educational research. For the most part, the academy has ignored the type of activity being pursued by the IIS project, eschewing this domain for more prestigious pursuits such as using emerging principles from cognitive science to design new technology-based learning environments. This has left an important development work to commercial actors in their exchanges with large districts and states. The incentives here however are very conservative. Commercial actors, not surprisingly, will market tools that they believe districts want to buy and tend to be reticent to engage in R and D for products beyond this horizon. Similarly, while the public rhetoric of districts may espouse a “break the mold” orientation, their purchasing decisions are more likely to be driven by immediately political needs in a *No Child Left Behind* environment to raise standardized test scores quickly. As a result, the overall incentive system works against meaningful instructional innovations, tends to support the reification of very basic needs, and reinforces automation of simplistic ideas.

Our R and D efforts consciously focus on the near horizon—things that can be developed and used now that would actually support and advance the best intentions of educators to teach all students well. The academic-business-clinical partnerships at the heart of the IIS work represent an effort to explore use of a new institutional form to create high quality, technical innovation that can be sustained in practice.

Institutional Context and Theoretical Framing

A Primer on the Organization Groundwork for More Ambitious Instruction

Efforts to introduce more ambitious instruction on a broad scale must challenge instructional routines and organizational norms that are deeply entrenched in the institution of schooling. Although different school reform proponents might phrase these problems in somewhat different ways, most tend to embrace a common core of tenets that include:

- A reflective teaching practice where day-to-day decision-making is instrumentally constructed based on the interaction of detailed observations about students’ work in the classroom, a clear understanding of the appropriate “aims in view for subsequent instruction”, and deep pedagogical content knowledge about how best to effect such learning given the instructional system within which a teacher’s work is being conducted;
- A public teaching practice organized around a common language for both describing the development of students as learners and the pedagogical options confronting teachers in advancing such learning;
- A norm of critical dialogue about practice aimed at the collective improvement of practice;
- An ethic that adult learning to improve practice is viewed as a core professional responsibility; and
- An ongoing internal school accountability process organized around data on student learning aimed at the continuous improvement in this learning.

Central to this school transformation is a tightening of the connection between teaching practice, evidence about student learning, the communication and use of this evidence, and structured opportunities to learn from all of this. This dynamic occurs in multiple contexts:

- in the day-to-day work of individual teachers. Reflective teaching practice entails instructional decision making that is more firmly rooted in evidence about student learning and the connections of pedagogy to the promotion of such learning.
- in the social learning of a community of school professionals as they plan, engage and learn together about efforts to improve their practice.

- in the internal management of an instructional program where principals, staff developers and other school and district-based instructional leaders make critical resource allocation decisions.

Taken together, the changes entailed here represent an imposing set of new expectations for school practice. In an organizational sense, moving toward an evidence-base culture seeks nothing less than to replace the traditional loose coupling, characteristic of schools as organizations, with more coherent, coordinated action. The activity backbone to all of this is a shared, common language for teaching, learning and schooling more generally which is made manifest within a new system of tools and social practices designed to support such practice transformation.

Technology as a Lever for Change?

It is fair to note that technology has failed to-date to deliver on the potential proclaimed by its proponents over the last two or three decades. We conjecture that there are at least two primary reasons for this. First, technology in schools has typically operated as some form of an “add-on” aimed primarily at students. For example, instructional designers have added visualization technology to science or added spreadsheet technology to mathematics curricula. While the designers’ intent may have been expansive, in reality these technologies show up briefly in the instructional lives of children and teachers and just as quickly disappear.

From this perspective, technology has failed to become embedded in school life because it has not been viewed as an essential element in a larger systemic change effort. IIS initiatives, by contrast, focus specifically on adults and seek to bring to bear an integrated suite of technologies that aim to influence many, if not all, of the major aspects of their work. Such pervasive uses of technologies by adults will likely change schools in several, simultaneous, ways. Moreover, should these effects consolidate in a coherent fashion, IIS initiatives may catalyze more profound organizational transformation than we have witnessed to date.

For this to happen in productive ways, however a second concern must also be addressed. Over the last several decades, efforts to introduce technologies into schools have been under-informed. It has often been the case that technologists have led with the technology, and its functions, as a way to catalyze school adoptions. They have often tried to retrofit or create new school practices around the constraints built into the technology itself. In addition, designers have tended to conceptualize a single person or category of persons as target users, ignoring the functional interconnections among individuals within a school’s social system. For example, technologies aimed at students, have often under-articulated the role that teachers play in monitoring student use and understanding student progress. Similarly, technologies designed for teachers often specify in great detail how teachers are supposed to use them but typically under-specify how the pattern of interactions, with, and among, students might change as a result of the technology’s introduction. In short, technologies are intrinsically social and will, if they are successful, have an impact on the overall fabric of an organization.

In sum, for a very long time scholars, researchers and engineers have recognized the potential of design to catalyze change. However these efforts have been under theorized, especially from an organizational development perspective. Part of the theoretical weakness, especially in education, comes from a tool-as-implement focus rather than tool-as-organizational-lever focus.

In response, we have sought to build a program of activity around a dynamic interaction of pragmatic design-engineering work on IIS tools and social practices with efforts to develop an empirically grounded theory of practice improvement mediated by these new technologies. This linking of a deep, direct engagement with practice improvement and theory building about such praxis is at the heart of our efforts to envision new and more productive forms of R and D in education.

Why a Grounded Theory of Practice Improvement is Essential in this Domain

An evolving theory of practice improvement both disciplines our design initiatives and guides inquiry into their effects. This conceptual framework seeks clinical validity for detailing the essential elements comprising specific school practices while also affording analytic traction for organizing research on improvement of these same practices. From a clinical perspective, the framework creates opportunities for new insights about school improvement and represents a useful tool for communication among school professionals and IIS team members. As an analytic device, it identifies the key factors to be considered, organizes a hypothesized set of relations among them, and guides the processes of developing measures for each of these factors and examines empirical relations among them.

In most general terms, we argue that the effective introduction of new tools into schools must be anchored in:

- a deep understanding of specific school practices;
- a recognition of the different knowledge, skills and dispositions that school staff bring to these practices;
- an appreciation of how adult and student work in schools is shaped by local context and larger institutional features, and

- the role and effective mechanisms available to external agents to catalyze the take up, use and diffusion of innovations within a school organization.

An explicit goal of the IIS is to bring forth new forms of theorizing about how technology might more effectively engage the work of schooling. Rather than starting with technology per se, we begin instead with the pressing problems of practice that people in schools face day-to-day. In addition, rather than narrowly grounding our efforts around one class of actors (e.g. the self-contained classroom teacher) we focus on the entire social system of a school—looking to understand how collections of diverse actors with different backgrounds, working in distinctive school contexts, might use and adopt new technologies as a way to make progress on the problems of practice that they collectively face.

In sum, the IIS group has embraced the idea that technologies have failed to influence schools not because of the technologies per se, but because, as a field, we do not have good theories to discipline our work with these technologies. Our conjecture is that theories that start with practice and craft useful new tools based on practice, will lead first to a new generation of useful tools for schools; and second, will lead to a more robust set of understanding about the various factors shaping technology's impact in schools which will provide the basis for even more effective tool design in the future.

An Activity Theory Framework for Disciplining Design and Inquiry on Technology-Mediated School Practice

Choosing to Frame School Work as an Activity Theory Problem

It became apparent early on in trying to organize the efforts within the IIS group that we were in danger of creating our own tower of Babel. While we viewed our diversity of backgrounds and orientations as an essential resource for the project we sought to undertake, this also created its own tensions. We lacked our own common language for conceptualizing the focal problems embedded in school practice and for thinking about effective design affordances.

After a fair amount of collective reading and discussion we eventually settled on an activity framework for organizing our own work. This framework struck us as valuable for two reasons. First, it focuses on day-to-day activity and efforts to change such activity. In this regard it held potential to afford “clinical validity.” Specifically, it offered a relatively easy frame for conceptualizing key work problems of school practice where new technologies and social practices might well add value. Second, from an academic perspective, it provided a language context in which the efforts of learning scientists thinking about problems of cognition and motivation might easily join with organizational sociologists thinking about problems of innovation diffusion and the structural and normative features of schools necessary for new tools and social practices to be take up an used well.

Capsule on Our Activity Theory Application[3]

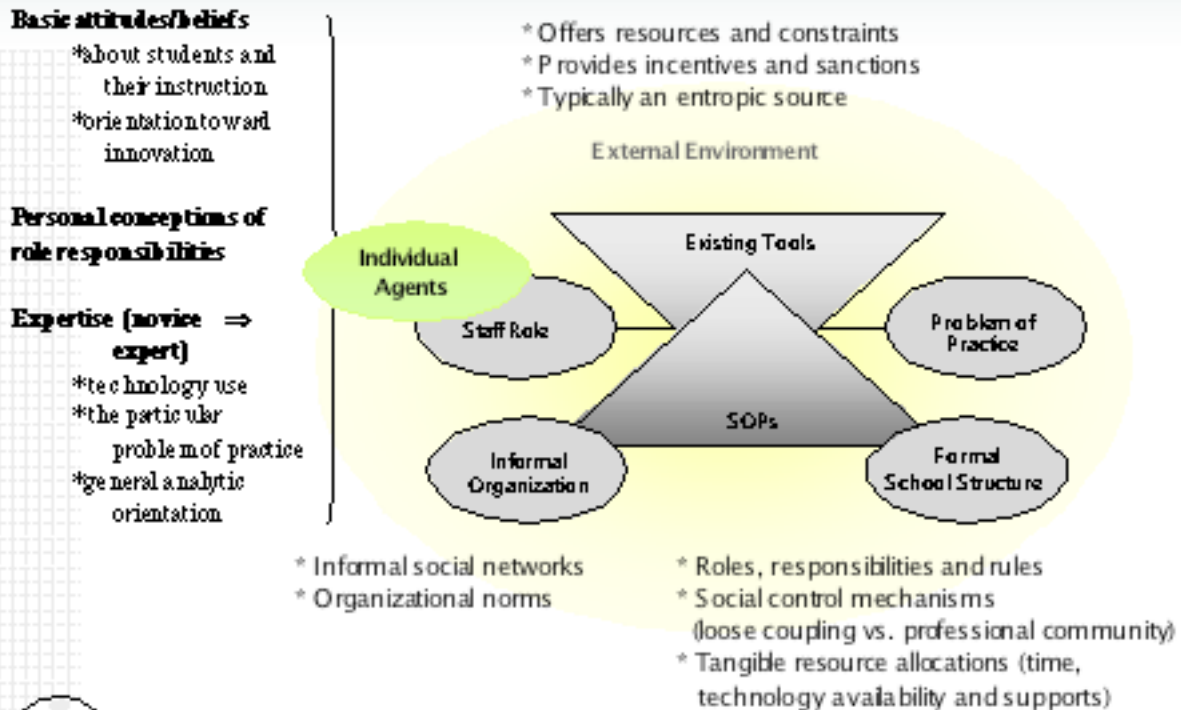
A segment of school work activity represents our primary unit of analysis. Each activity segment is rooted in a specific problem of practice embedded in some individual work roles (or interconnected set of work roles) within a school. IIS design efforts focus attention on how this work can be more effectively mediated by introducing new technologies and related social practices.

We recognize that individual agents occupy these work roles and bring varied prior beliefs, role conceptions and level of expertise to their efforts. The perceived self interests and competencies of these individual agents influence how any new tool and/or social practice enters the school context and shapes whether and how an innovation adoption occurs.

These aspects of individual agency occur within a school context, consisting of a formal organizational structure and important informal socio-normative elements, which also shape the introduction of any innovation and its pattern of adaptation. Each school, in turn, exists within an external institutional environment, fashioned by district, state and federal policies that provide resources and constraints, and that offers incentives and sanctions, which aim to define and control the proper forms of agent behavior. While current reforms seek to make this environment more coherent and “aligned”, this external environment still tends to exert a largely entropic effect on schools which remain highly open to its influences.

All of these elements, which taken together specify a work activity segment, stand in strong, dynamic interaction with one another. (See Figure 1.) At the most basic level, the identification of problems of practice is rooted both in the formal structure of schools (e.g. a commitment to balanced literacy) and their informal social organization. The base state SOPS (standard operating procedures) are shaped by both of these organizational features as well as by the collective perceived interests of school staff.

Figure 1. A basic work activity segment

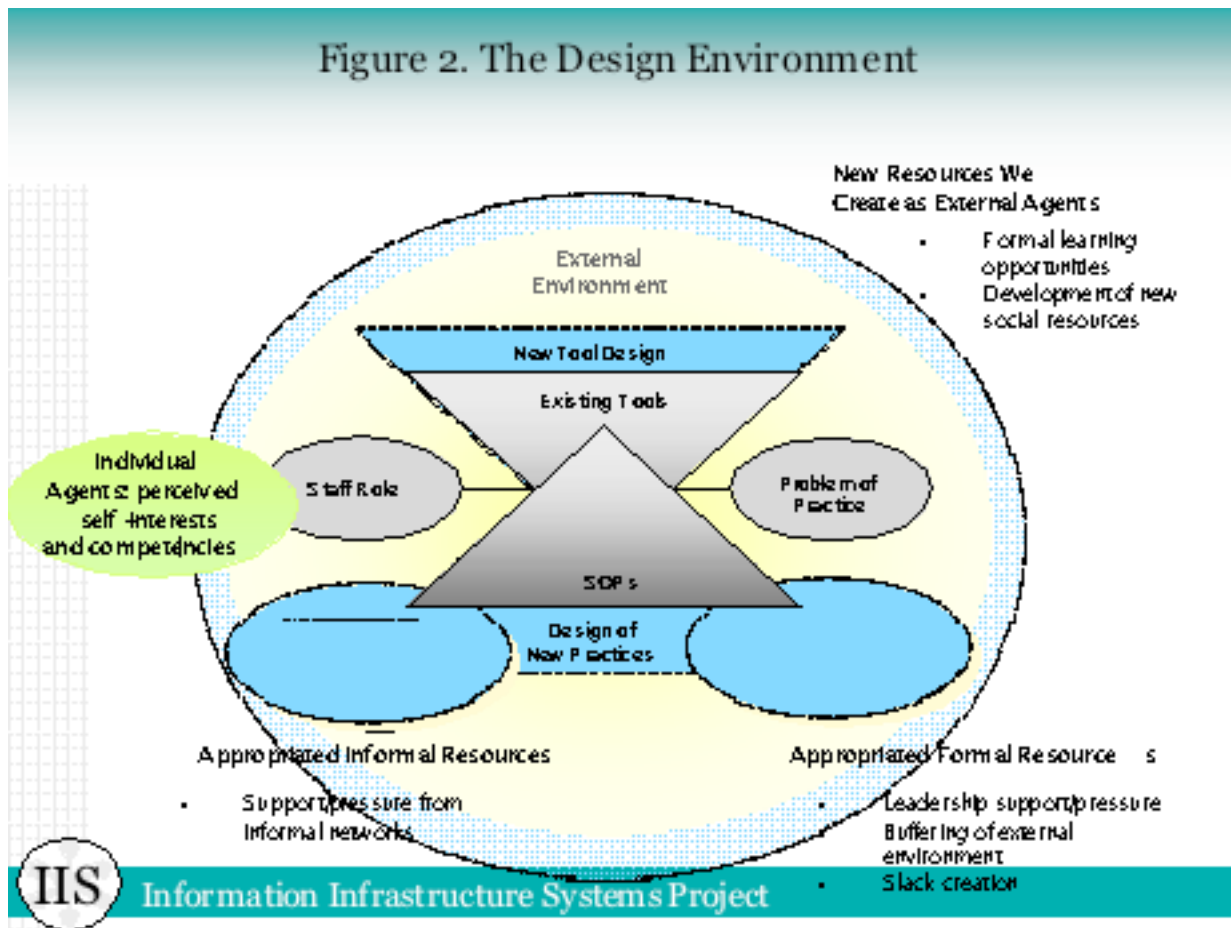


Similarly, our efforts to design new tools and social practices are anchored in, specific, work problems, which exist within a school organization with distinctive structural and socio-normative elements, and which are, in turn, subject to certain external sanctions and incentives. Each of the elements identified in Figure 1 represents a critical concern in our R and D work. To the point, an inadequate accounting for any one of these components could precipitate an overall system failure.

Filling out our design environment (see Figure 2), we also attend to: 1) the extant resources and mechanisms that can be appropriated within a school's ecology to support the introduction of innovations; and 2) any new resources which may need to be deliberately developed by the IIS team for this purpose. The extant resources on which we may draw exist in:

- the formal and informal social organization of the school (e.g. formal and informal leaders who can exert pressure/support to engage the innovation, extant social resources that can be appropriated to assist in innovation diffusion),
- the interaction of the school and its external institutional environment (e.g. the use of formal authority by principals and officials in the external environment to buffer the innovation and create slack for agent experimentation and learning), and
- in the interaction of any, or all, of these entities with members of our IIS group. In this latter regard, we may design formal opportunities to support agent learning and draw on any social resources that we may have built with individual school actors to influence their "self interest calculus" about their possible engagements with our work.

Figure 2. The Design Environment



Finally, we expect our innovations will culminate in three forms of outcomes: **activity level outcomes** relevant to each specific work problem which we seek to mediate with new tools and social practices; **individual level outcomes** where the aspects of individual agents, which form their initial engagements with an innovation, may in turn be reshaped as these activity cycles proceed over time; and **organizational level outcomes** which represent the primary aims of our work—the transformation of schools from a loose coupling toward a more tightly coupled professional environment characterized by a shared common language about the technical core, enhanced communication across the organization, and greater reliance and use of information in the reflective practice of individual staff and in the internal accountabilities across the school organization.

Introducing the Symposium

The set of papers presented in this symposium address different aspects about our learning in this regard. The papers presented here today explore the role of design for organizational change toward evidence-based school cultures. Quite simply, it is about doing work in the “blue zone” of figure 2 and what we think we are learning from this.

With this as a general organizing framework for today’s session, we now proceed to the core of this symposium.

I. Transforming Teacher Learning Through Design Activity: Creating a Web-based Professional Development Support System for Video Case-based Professional Learning

LeAnne Sawyers
The University of Chicago Center for Urban School Improvement

Irene Fountas
Lesley University

Gay Su Pinnell
The Ohio State University

Patricia L. Scharer
The Ohio State University

Lisa Walker
The University of Chicago Center for Urban School Improvement

II. Case Study of ePortfolio: Design Activity to Build an Instructional Core for Evidence-based Practice

Denise Nacu, Lisa Walker, Nichole Pinkard, Stacy Beardsley, Judith Whitcomb, Kimberly Austin
The University of Chicago Center for Urban School Improvement

III. The Challenge of Evidence-Based Practice for School Social Support Teams: Understanding the Impact of the Clinical Case Management System

Tamara Gathright
Linda C. Lee

The University of Chicago Center for Urban School Improvement

Closing Comments: What Are We Learning from This Work

Design is a complex activity. Properly arranged and carried out, design activity affords multiple opportunities for learning. The work of our group is about exploring the collegueship, organizational context, and theoretical framing that maximizes the opportunities for such learning to occur through our practical design. To begin the task of interrogating what we are learning from this work we will start with how exploring how theory building has helped our work. We close with an examination of the value of our collegueship for learning and improvement. The work of the IIS is, at its core, about making education a less loosely coupled enterprise. Our theory building in meant to offer a language and set of concepts that can work for a diverse collegueship to engage in improvement.

Theory: Does it provide a useful lens?

In our work to-date we have invested a large amount of human resources in building a theoretical infrastructure that is grounded in practice improvement. A key challenge for work like that we have described is to specify vis-à-vis the theoretical framing what progress we are making and what critical gaps remain. Next we offer some closing observations on the value of theory building to our efforts – especially in helping understand the efforts described in the cases reported here. Before moving on to those reflections, it might useful to offer a comment about why new theory is needed at the nexus of school improvement and role of instructional artifacts in change. Conventional attempts to understand the impact of one (e.g. computer technology) or another (e.g. curriculum) designed artifact on school improvement can at worst appear to be a-theoretical. That is, the work, for the most part, is grounded in and characterized in terms of instrumental actions taken to design and implement the artifact itself. Our aim is to move beyond conventional conceptions of “implementing programs with fidelity”.

The traditional conception of fidelity, while useful, is limited. Its limitations stem from the narrowness of the conception. Fidelity assumes a standard which local agents can be held to when external agents, like researchers, characterize local agents’ activity with an innovation. External agents surely have visions about how an innovation is “supposed” to work. These visions may in fact be valuable and warranted. However, only assessing how people use an innovation with respect to an artifact-centric standard is limiting. To more deeply understand the value, utility and usability of an innovation, we think that the problem of innovation take-up should be accessed in broader organizational and human developmental contexts. Our theoretical frame is meant to provide such a lens on artifact take-up in terms that go beyond simple instrument descriptions. Figures 1 & 2 show that our frame attempts to characterize innovation take-up in terms of the interrelationships among individual agents or groups of local agents and the problems they seek to solve. New tools that are introduced to agents are seen as a means to work on problems of practice. In our framing these relationships are embedded in suites of already existing standard operating procedures that are constituted within the formal and informal norms of the organization. First we turn to how the IIS frame allows us to see some of the experience reported in the cases in terms of relationships in the settings and why the artifacts were taken up or not.

Self-interest, Organizational Norms and Problematizing

Self-interests. The work of design can be conveniently thought of as problem solving activity. The IIS theoretical framework calls the core problem, that is at the center of a design activity, a problem of practice. According to our framing, people or groups of people in the organization own problems of practice. It follows then, that individual or groups assess how their interests are served by the introduction of an innovation. Design can uncover organizational misalignment around problems of practice. In the E-portfolio case we can see how the design process helps to reveal that while the principal accepted and owned making student work and standards of quality associated with it public, her staff were less committed to it. Staff, because of the informal norms in the organization, were not yet accustomed to seeing student work as a resource for organizational improvement. They were more conditioned to see portfolios as an individual resource for learners. The design process served the organization by providing evidence of this misalignment. The evidence allowed the principal to

rethink the method and time course over which she would guide the organization to a new set of social practices associated with the collection and consideration of student work.

Similarly, the CCMS case suggests that perceived self-interest was associated with tool use. The data from this case seems to show that for AS3 staff, where self-interest was high, they were willing to persist through usability problems. While other staff, who presumably had low perceived self-interest, failed to persist in tool use and the development of social practice that involved the use of CCMS. Attention to patterns like these can be evidence-based diagnostics for designers and leaders to reveal misalignments within an organization's commitment to monitoring and follow-through on providing social support through AS3.

These observations from the cases offer the possibility that seeing use and usability through the theory's self-interest lens may allow design work to provide valuable information to a school organization about how initiatives are being understood and adopted. This role for design-based evidence goes beyond simply whether a tool is used or not.

Organizational Norms. An organization's norms of practice signal its readiness for change. For schools to become more evidence-centered places they not only need ready access to information to inform instructional practice. They also need to have in place standard operating procedures of various sorts to allow these practices to take root. How does one gain access to information about the normative state of an organization to gauge its readiness for change? These cases suggest that design can reveal the normative character of organizations. The E-Portfolio case offers some insight on this aspect of the power of design. This design effort set in motion, reflections that revealed a less well-developed set of norms in the organization as it relates to the use of standards. As the case suggests, a standard-based practice is an important foundation of the portfolio as the designer and school client envisioned it. While the Literacy Collaborative is a different sort of organization than a school, the design activities associated with the creation of PDS2 also had the impact of revealing how design can uncover organizational norms. In this case, the design of PDS2 assumed a collaborative pedagogy much like the forms of pedagogy the Literacy Collaborative suggests that teachers use, in its instruction with students. However, the design activities revealed that the norms of the organization were much less collaborative in their conceptions of how one prepares instruction for coaches and teachers. The important point from both of these examples, is less about the appropriateness or inappropriateness of organizational norms and more about the power of design as a practice to uncover organizational norms that may or may not be consistent with the vision that set the design process in motion. The IIS theoretical frame is an important tool, here, because it helped to focus attention on pre-existing norms that exist within the formal and informal structures of the organization.

Design as Problematizing. It is easy to think that design, as an activity, is mostly about execution of a pre-existing plan. These cases and the IIS framework help to show that, in addition to execution, design as an activity is also about deeper problematizing as design activity unfolds. In all three of these cases, it's possible to see, for example, how the design activity challenged the roles that local actors had within the organization. For example, in the case of E-Portfolio, the design activity challenged the conception that teachers, in what is acknowledged to be a professional development school, had themselves adopted the role of teacher-to-their-colleagues. In order to be an external teacher, one has to first adopt a role as a collaborative teacher, locally. In a similar vein, as design processes reveal normative structures that are at variance with the assumed norms in the design, the task at hand is re-problematized. The value of a framework like the one we present here, is to provide a language for, and a set of ideas, to talk about self-interest as a locus, and formal and informal structures as loci, to begin to characterize the task of re-problematizing within design. In summary, design activities when seen through the lens of a theory like the IIS framework, provide an opportunity for better specification of the problem, at hand, and the organizational levers in play, to genuinely address the problem.

Efficiency concerns are often the opening wedge for initiating technology-based work of the sort described here. However as design proceeds, it is possible to see how efficiency and self-interest are not uniform from an organizational perspective. Powerful theoretical tools can provide a way to develop more nuanced forms of evidence about how and to whom tools are useful. For example the cases reported here were initiated in part to facilitate efficiencies in organizational process. E-Portfolio's efficiency goal was to revamp the cumbersome paper and folder systems for student portfolios. CCMS sought to bring more efficiency to the provision of the relevant data associated with the AS3 process. And PDS2 sought to make multi-media data about practice more easily available to staff developers. As we proceed however this eventually opens up more fundamental questions about coordination, communication, common language, common standards, public practice etc.

Seen through our theoretical lens, design practice moves us from just automating parts of the work, to the second big way in which technology transforms work-informing complex practices and in the course of this, raising fundamental questions about how the practice is actually conducted.

Sometimes our task involves helping school-based actors to problematize school practice and have local actors come to own these problems i.e. in the end we don't always just build what they want even though we may start there. Design, therefore, is not just as a technical act. Design is more fundamentally a task of problematizing.

Collegueship: Who is learning what, through this work?

The design activities presented in today's symposium have created numerous and diverse opportunities for learning from within our collegueship. From the beginning we have conjectured that understanding and transforming education is a multifaceted endeavor that required a very diverse collegueship. Minimally, this collegueship had to engage in both the study and creation of environments that created new conditions in which schooling could take place. Like others (e.g. Schoenfeld and Burkhardt) we think that education requires engineering and design of new tools and social practices to be transformed. Further as we have explored in these papers, acts of technology design are not merely technical acts but windows into practice, and organizational potential, for those who are part of the design enterprise. Next we explore whether, and how, design activities served as opportunities to learn for the collegueship.

Designer's learning. These papers make it clear that design work can lead designers to become agents of change in realms that extend beyond the immediate objects of design. In the case of both the e-portfolio and PDS2, the designers watched their roles evolve from translator and builder to co-creator and collaborative co-problematizer. The work described here suggests how designers saw the work evolve. Modern designers understand that they often help make design problems clearer to clients. In the papers presented here, we see the designer's role in a different light. For example, not only did PDS2's design clarify the problem, but the work of design helped to uncover deep tensions in pedagogy where the client had one perspective on pedagogy for teaching children and a different one for adult learning. It is not that this is necessarily incorrect or even inappropriate. Rather, this observation underscores to IIS designers that our role in the ecology of school change is more expansive than we, and others, have heretofore believed. These reports make clear that design places in sharp relief issues afoot with the local organization. As this role for design is better understood, designers can change and reflect on their own forms of agency within the transformation process. These reports seem to show that IIS designers are getting smarter not just the particular design problem in which they may happen to be engaged, but more generally about issues of context and school organization. The papers suggest that designers have opportunities to learn how to operate mechanisms that contribute to fundamental school change.

School leader's learning. School leaders are an integral part of the IIS collegueship. Our experience as reflected in these reports suggest that design helps them reflect more deeply on what it will really take to improve their organization. Design and especially the subtle resistance to public practice that we observed in the E-portfolio case helped Stacy, the school leader see more clearly and in a more detailed fashion, what change would entail for her organization. Design at the school level, helped to bring more specificity to the broad mantra of change revealing in a more granular manner the inner organizational reality of change in her school. She saw, for example, that while her staff was comfortable with making their practice public to outsiders in order to improve, it was much more problematic to use their practice to catalyze their own transformation. In this case, the design process helped the leaders see some of the nuanced ways staff understood the school's role as a professional development school. It was easier to adopt the role of professional development when it meant exporting practice. It was difficult for our client school to be a professional development school when that meant being a model of how to engage in organizational self-reflection. Without the design process as aid, this nuance of organizational understanding may have remained hidden.

Researcher's learning. For the most part it is clear how design can lead learning that is highly context specific. For example, we learned a great deal in the PDS2 case about how to build a case tool for coaching. However on occasion, opportunities for general knowledge development emerged from design activity. For example, today the field has a lack of clarity on how adults use video to learn about practice (ref). The PDS2 case provides general insights bringing to the surface assumptions about how adults learn to use video for practice improvement. The naïve assumption that guides many attempts to use video to support learning is that the goal is to find the exemplary video for instruction. With exemplary video at their disposal learners are, in essence, thought to just copy what is done on the video in their practice. The fallacy of the fidelity assumption is laid bare by the PDS2 case. The case shows clear, and perhaps general, examples about how moving instructional conversation to a focus on actual student learning is more than a matter of just exemplary video. The case suggests that expertise development is catalyzed by a range of kinds of video and commentary on the video. This work suggest ways in which focused design work can push the envelope on empirically grounded theories of school practice improvement while at the same time working to solve specific problems of practice.

Sustaining Collegueship. In doing this work we have experienced several enduring tensions. We close by highlighting three of them. First the very concept of Design Research is problematic. It is underspecified. In terms popularized by Donald Stokes, our work takes us to both Edison and Pasteur's quadrant. Which of these forms of work is more important? We conjecture that there is a clearly implied devaluing of work in Edison's Quadrant among educational researchers. We, of course, value general and theory based knowledge. However, much of the work of the improving of schools, as our cases show, is not just about making things work. To manage the tension we have to find work arrangements that value both forms of work equally. One small way to manage this tension is to move away from referring to our work as Design Research and instead, to referring to it as Design Engineering and Development (DED). DED highlights the pragmatic elements of the work rather the theoretical elements of it. Given, the prominence of theory in the academic economy of ideas, we suspect it will always have an exalted place in our work and the work of other. DED, however, leads us to theorize in the domains of practice.

The second tension centers around recognition and reward for effort. The social sciences, in general, and education, in particular, value the

individual investigator as the prototypical model of intellectual work. The work of school improvement requires large teams. The intellectual products of such work are necessarily the result of broad-based contributions. Making sure that reward and praise is given and received such that every contributor finds institutional reward is difficult. The only progress we have made here is the progress of recognition and continued vigilance.

The third tension is to constantly make sure that we work on problems that come from practice and not the problems that we wish practitioners had or those that non-practice based theories tell us should be important. Managing this tension is not as simple as asking practitioners what problems they want fixed – however there is some of that. Nor is it as simple as building a practice-based theory (not that that is simple) and selecting problems from it. Our experience has taught us that this tension is managed in the conversation between emerging theory and day-to-day problems. Can design problems be expressed in terms of each? If the theory can characterize it and people on the job recognize it, it is likely to be a problem worthy of design investigation.

Conclusion

The work of the IIS, over the last several years, has convinced us that doing design, engineering and development work is not like standard experimental or descriptive science. As we hope we have shown here, the collegueship and technical underpinnings are somewhat different. Developing new tools and social practice to support evidence-based organizations is fundamentally about advancing complex professional work among in a complex organizational setting. We have come to realize that the ensemble of tasks involved in this work include the clear articulation of principles that undergird a tool as an innovation. This articulation, in our judgment, must highlight a clear problem of practice and make clear how members of an organization are connected to that problem of practice through patterns of self-interest. Further, how framework makes it apparent that the place that the problem of practice, has within the formal and informal structures, of the organization are very important. The act of making tools and specifying the social practice that they entail help us instantiate, in a principled way, how an organization is developing. Our work is convincing us that approaches to design that are primarily about fidelity of implementation only weakly characterize the factors necessary to understand how innovations can be catalytic within organizational settings. Understanding the development of social practices, and how new social networks come into play, as a function of new tools is key to characterizing how a community's development unfolds. While our framework, and the tools that it helped to create, are still in their infancy, we feel that coupling design to organizational theory in the way that we have tried to do so here will ultimately allow us to make progress in supporting school change.

We hope that the work, presented here, suggests ways that we might more strategic about our efforts to catalyze evidenced-based change in schools. We think that building a theoretical framework helps us be more reflective and disciplined in our inquiry. And, in particular, our symposium suggests that by assessing the insights that our framework leads us to, and by assessing how we as colleagues grow within this activity, are among the important ways that we can be more strategic. We have come to understand that the designer's task of problematizing practice means that the designer needs to know the practice well. Design is an act of fundamental structural change. We continue to experiment with different organizational forms in our designs teams as we strive to get the balance of design and research right.

[1] The papers presented in this symposium describe some of our efforts on the first two of these questions.

[2] In extolling the potential virtues of new forms of partnership, we are also highly cognizant that many potentially serious pitfalls may also lie ahead. Moreover because at least some parts of this work redesign may be controversial (in particular the effort to forge closer partnerships with commercial firms), this conduct of the IIS is being subject to independent scrutiny by the MacArthur Network on Teaching and Learning. Lisa Rosen, working in close collaboration with Mary Kay Stein at the University of Pittsburgh and Cynthia Coburn at the University of California-Berkeley, is undertaking an ethnographic documentation of this entire endeavor.

[3] This is a capsule summary from a separate working paper in progress.