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Design-Based Implementation Research: An Emerging Methodological Model for Conducting Design Research Within Educational Systems

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Schedule Information:

Scheduled Time: Wed May 1 2013, 10:35 to 12:05pm **Building/Room:** Parc 55, Fourth Level - Cyril Magnin I
Title Displayed in Event Calendar: [Design-Based Implementation Research: An Emerging Methodological Model for Conducting Design Research Within Educational Systems](#)

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Theory and Methods for Design-Based Implementation Research ([download](#))

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Taking a Societal Sector Perspective on Youth Learning and Development ([download](#))

Milbrey W. McLaughlin (Stanford University - milbrey@stanford.edu), Rebecca A. London (Stanford University - rlondon@stanford.edu)

The Principled Coordination of Learning Across Contexts: Cross-Setting Educational Interventions as an Emerging DBIR (Design-Based Implementation Research) Focus

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Adaptation by Design: A Context-Sensitive, Dialogic Approach to Interventions ([download](#))

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A School District-University Partnership for Innovation in Elementary Science Teaching and Learning

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Supporting Teachers in Schools to Improve Their Instructional Practice: A Perspective From Design-Based Implementation Research ([download](#))

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An Evidence Framework for Design-Based Implementation Research ([download](#))

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Building an Infrastructure for Education Research and Improvement: The Strategic Education Research Partnership (SERP) Model

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Taking Education Design on the Road: Fifteen Years and Counting of a Design-Based Practice System ([download](#))

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More Than a Network: Building Communities for Educational Improvement ([download](#))

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Abstract

Design-based implementation research (DBIR) is an emerging model for research and development of educational interventions that are inherently usable, scalable, and sustainable. DBIR is motivated by a concern that interventions rarely survive the translation from research to practice, and posits that existing research paradigms are inadequate to address the problem. DBIR changes the relationship between research and practice such that interventions are designed from the start with their ultimate use(s) in mind, with work motivated and informed by theories and methods from both learning sciences and policy research. This structured poster session is designed to provide a broad overview of DBIR, and invite audience members to find connections with their own work while challenging and extending the evolving DBIR approach.

Theories and Research Methodologies for Design-Based Implementation Research:
Examples from Four Cases

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Jennifer Lin Russell
University of Pittsburgh

Kara Jackson
McGill University

This chapter highlights a range of relevant theoretical and methodological perspectives and tools that can inform future work associated with design-based implementation research (DBIR). We ground our discussion by examining the theories and methods central to four projects that reflect the principles of DBIR: the Carnegie Foundation for the Advancement of Teaching's Community College Pathways, the John W. Gardner Center's Youth Data Archive, the Middle School Mathematics and the Institutional Setting of Teaching project, and the Strategic Education Research Partnership. Each project, or case, illustrates different, productive approaches to identifying, adapting, and developing theories and methods. By examining these cases we aim to support the development of common language, knowledge, practices, and tools that future researchers can use to engage in DBIR.

The Carnegie Foundation's Community College Pathways program provides an example of a project that has utilized a range of strategies to ensure that participating practitioners, designers and researchers jointly negotiate and articulate the problem of practice that provides a focus for collaborative improvement work. The Pathways program exemplifies the iterative dialogue between theory, design, implementation and research that is inherent in good DBIR. Learning theories of productive struggle and psychological theories of motivation and engagement inspired design of classroom interventions and also motivated the development of a measurement system to track community progress toward a shared aim. Theories of organizational routines are put into practice in designs for scaling up change efforts, the ongoing study of implementation, and notably, in the way that focal problems of practice get selected and understood.

The John W. Gardner Center's Youth Data Archive aims to create an integrated longitudinal data system that combines administrative records from a variety of public and non-profit institutions serving youth in the San Francisco Bay Area. In doing so, it supports practitioners and local policy makers to work across institutional boundaries and address complex social issues, such as youth development, that implicate multiple departments and organizations. The work of YDA highlights theoretical approaches and methodologies that aim to support productive work across sectors. Conceptualizing youth development and learning as stretched across a range of settings and institutions enables YDA to engage community partners in iterative, collaborative design that breaks down boundaries between typically disconnected settings and services. Theories of effective data use, coupled with novel methodologies for making sense of data across sectors, enable diverse stakeholders to collaborate in order to improve a region's capacity for youth development.

The Middle School Mathematics and the Institutional Setting of Teaching project is centrally concerned with developing, testing, and refining theory regarding the improvement of middle-grades mathematics instruction in large U.S. school districts. MIST illustrates the value in organizing empirical research to develop, test, refine, and elaborate a theory of action. It also illustrates the value of bridging and adapting literatures, for example teacher learning and implementation, that have traditionally remained somewhat siloed. Furthermore, it illustrates the value of adapting classroom design-research methodologies to studying and contributing to instructional improvement at scale.

The Strategic Education Research Partnership is centrally concerned with developing infrastructure to support practitioners, researchers, and designers to collaboratively address significant problems of practice. SERP's short-term goal is to address problems of practice, and positively impact student achievement; however, SERP's long-term goal is to support a fundamentally different working relationship between researchers, practitioners and designers aimed at supporting the development of knowledge, work practices, and tools that support sustained educational improvement.

SERP illustrates the value in grounding the design of interventions in both theories of learning and implementation, particularly if the goal is to improve student learning, teacher learning and school capacity. In addition, SERP illustrates productive ways in which to target the development of capacity for researchers and practitioners to collaboratively address problems of practice with high salience for local practitioners.

In looking across the four cases, we highlight the importance of attending to theories of learning, implementation, and organizational context in DBIR. We also highlight the importance of blending and/or adapting those theories given the specific problem of practice being addressed. Furthermore, we illustrate how guiding conceptualizations of learning, implementation, and organizational context have implications for the design of interventions and the methodologies used to study and refine particular interventions. Looking across the four projects also reveals the value of a breadth of methodologies within DBIR. The work of DBIR encompasses many different kinds of tasks, from negotiating a problem space with diverse stakeholders to the iterative design and testing of learning-focused interventions and plans for implementation.

Accomplishing these different functions requires a range of methods and sometimes requires the creation of novel methods.

Taking a Societal Sector Perspective on Youth Learning and Development

Milbrey McLaughlin & Rebecca A. London
John W. Gardner Center for Youth and Their Communities

Stanford University

Introduction: A Societal Sector Approach

Despite their common focus on young people, youth-serving institutions—schools, health and welfare services, juvenile justice agencies—typically are disconnected from, and uninformed about, each other’s programs, policies, and approaches. Yet youth’s cognitive, social, emotional and physical development does not divide neatly into institutional domains, but instead takes place over time and across diverse contexts of family, neighborhood, school, and community that youth experience. Sometimes the institutional resources available to youth are integrated in ways that reinforce developmental supports, but more typically, they are not. The result is a set of institutional silos that each work to support different areas of development in ways that often do not support integration with other areas, conceptually, technically or administratively. This problem of institutional balkanization is borne out not only in youth-serving agencies, but also in the research that informs their work.

These practical, institutional and conceptual challenges speak to the need for a broader perspective that frames youth development in terms of the multiple groups, organizations and institutions that together make up the contexts within and through which young people move. In this chapter, we argue that new cross-sector tools are necessary to support cross-institutional collaboration for youth. We describe the Youth Data Archive (YDA), an integrated longitudinal data system comprised of administrative records from community agencies and organizations

linked together at the level of individual youth. The YDA adopts a “societal sector” perspective that attends to the broad sector of actors and agencies responsible for creating the young people’s community contexts and allows community partners to define cross-institutional issues affecting youth and identify opportunities for joint action.

Design Based Implementation Research and the Societal Sector

A societal sector framework connects with design based implementation research along several dimensions: (1) engagement of multiple stakeholders and active attention to their points of view, including reliance upon multiple disciplines; (2) iterative processes of analysis and response ; (3) an intentional focus on capacity building among partners; and (4) a design/build model of research, implementation and deepening understanding.

Working within a societal sector framework presents particular conceptual, political and technical challenges. Research and implementation adopting a *sector* as the relevant unit of action encounter problems of a substantively different stripe than do research or recommendations located within a single institutional space. We provide specific examples from the YDA work in two northern California communities, Redwood City and San Francisco, to highlight the various practical and theoretical issues we encountered.

How the Youth Data Archive Supports a Societal Sector Perspective

The YDA combines administrative records matched at the individual level from a variety of public and non-profit institutions to form a *virtual youth sector* that provides a comprehensive view of the opportunities and resources available to the community’s youth. It also promotes the creation of an actual youth sector by focusing on questions of relevance across agencies and enabling contributing partners to understand and act on resulting analyses. The YDA’s cross-

institutional data allow for analyses about youth experiences and outcomes that no single agency could undertake on its own. The ultimate goal of the initiative is to make available actionable information at the youth-sector level in order to build knowledge about resources, supports, and policies for youth development.

The YDA is a capacity-building resource that allows partners to see, sometimes for the first time, a new framework for understanding the ways their own agency addresses youth needs and shapes youth outcomes outside of their own agency's domain. Partners are supported to identify actionable research questions to which they are poised to respond collaboratively.

A Focus on Action

The YDA team defines action as taking many forms along a continuum: action can be a change in policy, practice, or programming, a determination to continue existing efforts, or even the intention to use research to discuss making these changes or continuing with the status quo. Many political and economic obstacles to action exist at a community level, and this broad definition acknowledges that even when concrete steps have not been taken, the community has engaged in a process of data-based inquiry that has allowed them to make informed decisions within their constraints.

The YDA has supported community action at all places on the continuum. For instance, in San Francisco, the findings from analyses of math and English remediation led collaborative subject-area teams to consider changes that could be made to the community college placement process to allow more students to place into courses for which they would accrue college credit. Two "pilots" will be launched in the 2012-13 school year and partners have already begun to think about what they need to know in order to ensure success for participating students. Because relevant actors were at the table and bought into the collaborative process, action

followed immediately from YDA analyses. In other cases, partners' engagement with the YDA prompted their increased engagement with each other as their new relationships enable understanding of others' perspectives, action frameworks, and constraints. For example, the YDA analyzed the educational outcomes of foster youth in collaboration with a multi-agency group comprised of child welfare advocates and service providers, juvenile court judges, county and district educational leaders and funders interested in supporting this group of vulnerable youth. The collaborative group convened the YDA to conduct the analysis, but the process of gathering data, responding to findings, and planning a course of action brought the group together with greater purpose. The iterative data analysis process helped them to stay focused on the goals that they established together at the outset of the project.

Strengthening the Youth Sector

In partner communities, the YDA has strengthened the broader youth sector. For instance, the focus on cross-agency framing, analysis, and response has supported implementation networks for response. A recent analysis that examined chronic absenteeism in Redwood City's two participating school districts led partners from school districts and other city and county agencies to collaboratively consider appropriate responses to the underlying student and family barriers that appear to be behind the absence problem.

The YDA also supports and strengthens a youth-serving sector is by providing opportunities for continuous learning and capacity building that allow partners to not only digest a current set of findings, but to look together toward the next set of questions. In a study of full-service community schools in Redwood City, we helped the elementary district establish a data system beyond the administrative records normally collected, to gather information on students' and families' participation. In addition, we held "data talks" with community school

coordinators and other front-line staff to present findings, help partners understand the results, consider the implications, and work with partners to identify follow-up questions for analysis.

Lessons for Supporting a Youth-Serving Sector

The Youth Data Archive experiences offer lessons for supporting a youth sector.

- *Motivation matters.* A problem salient to all stakeholders spurs collaboration, learning and joint action among members of the youth sector. The most actionable YDA research projects involved pressing problems that required information in order for partners to act.
- *A situated lens focuses action.* The YDA team acts on the principle that human activity is context dependent and reflects local practices, institutional histories and relationships, and political and economic realities. Knowledge about problems associated with youth development as well as effective supports for growth is locally situated and embedded in existing instructional arrangements and resources.
- *Process is product.* A collaborative stance within a youth sector requires a fundamental shift in perspective from one defined by specific institutional goals to one that focuses on broad, cross-institutional goals of youth development. The process of cross-agency collaboration toward a goal of data sharing and querying is itself a product. The structures and relationships built, if solid, will carry forward to support a youth sector beyond analysis and reporting of shared data, toward genuine collaboration and mutual goal development so as to support improved youth outcomes not only within, but across traditional silos.
- *Trust and credibility build over time.* Through its emphasis on relationship building, iterative analysis and reporting, and sharing findings when partners are ready to do so, the

YDA team establishes credibility with contributors as partners and collaborators. The YDA team becomes part of the process, embedded in the collaboration and responsive to stakeholder questions and concerns.

- *Knowledge production is interactive and collaborative.* In contrast to views of knowledge as fixed or absolute, collaborations like the YDA see knowledge as changing, changeable, and sometimes inconsistent—the result of a locally adaptive process. Notions of reciprocity, pooled knowledge and feedback are core to effective cross-institutional knowledge and learning; the resulting understandings and frames for action differ from those any single institutional could or would have developed on their own.
- *Capacity develops collectively.* The new relationships and frames for action underlying the YDA and its community partnerships require leadership and attention from collective capacity builders. Collective capacity builders take the *system* as the unit of action, and view the processes of making and sustaining change in those systems in terms of relationships, joint action and investment.

Adaptation by Design: A Context-Sensitive, Dialogic Approach to Interventions

Ben Kirshner & Joseph L. Polman

University of Colorado, Boulder

Extended Abstract for uploading to the American Educational Research Association annual
meeting in San Francisco, 2013

Executive Summary

Applied researchers, whether working with the framework of *design-based research* or *intervention science*, face a similar implementation challenge: they must step back as local actors interpret and enact new programs in varied, context-specific ways. Although this inevitable variability can be a problem for those who privilege fidelity and standardization, we argue for the advantages of researcher-practitioner collaborations that encourage local adaptation and ingenuity. We develop this argument for adaptive interventions by discussing two design-based research projects, Critical Civic Inquiry (CCI) and Science Literacy through Science Journalism (SciJourn), which create opportunities for youth to develop civics and science literacy respectively. CCI and SciJourn aim to build curricula that will travel to new schools and districts, but not through standardization. This is a delicate combination: the program must be flexible enough to enable productive adaptation, without being so protean that practitioners' implementations lack substantive commonalities. The two cases show how project leaders have sought to distinguish between invariant principles that define the intervention and heterogeneous practices that vary across sites. The cases also show how the model has improved when teachers can adapt it to their institutional context and when teachers and researchers establish social norms that encourage dialogic interactions.

Theoretical Resources

Cultural historical psychologists have extended Vygotsky's notion of "tools" or "artifacts" by showing how tools carry cultural-historical information across generations and mediate human action. According to this view, tools vary in how flexibly they can be used, with some tools being more "univocal" and others more "dialogic." Univocal tool use is when one person

(either physically present or not) imposes or dictates her viewpoint about how a tool should be used; dialogic use is when tools are flexibly adapted in context to fulfill people's goals. We aim to make SciJournal and CCI dialogic.

In community-based research university researchers form partnerships with people outside of the academy in order to collectively advance local social change goals. It rests on the belief that people without academic credentials are capable of producing useful knowledge, that research should be driven by efforts to solve problems experienced by non-specialists, and that academics have an important role to play by leveraging their training about how to carry out high quality research.

Case Studies

SciJournal

Background. The SciJournal project is based on the notion that practices of professional science journalists—such as making use of multiple, credible sources—relate to skills that scientifically literate adults could use fifteen years after they graduate from high school. SciJournal is a distributed activity system of school sites, an informal science institution, and a university, organized around the production of teen science news stories for a regional science print newspaper and online publication (SciJourney.org). Team members developed a set of science literacy standards and standards for article writing within the project.

Example 1: From writing to reading and writing. One of the notable ways that teachers in the process of implementation made the initiative their own was in stressing the *reading* of science news. The university team originally focused only on *writing* science news. In our first professional development workshop aimed at preparing teachers to facilitate their students' writing, our university team used a read-aloud/think-aloud (RATA) technique common

in elementary reading instruction to highlight the critical elements of science news texts. We did not initially advocate for use of RATAs in high school classrooms, but one teacher found them well-adapted to his time and curriculum constraints. In just a few minutes at the beginning or end of class, Mike used RATAs to model how he critically examines aspects of science news related to his curriculum, such as the credibility of sources, while assessing how important that news is to society. Mike shared how the RATAs helped him gain stronger rapport with students while fulfilling curriculum goals. More teachers utilized RATAs, and the university team has since encouraged forms of this activity as flexible means for teachers to model critical science literacy.

Example 2: Sources of Information for Science News. “Writing science news” has also been transformed through implementation. Students working on stories routinely search for multiple credible sources on the Internet in the manner that originators of the project envisioned, learning a great deal about how to critically consume science information on the web, and think about the kind of expertise different sources offer. But in part because the university-based researchers feared interviews were not well-adapted to the regimented time and relative isolation of schools, we did not initially push student interviews in that context. We have since learned that interviews are possible and worth encouraging in schools—school nurses, maintenance staff and local stakeholders often help teens make sense of the science and its importance. Interviewing is often a memorable and transformative experience for teens. In addition, although the project initially focused on teens using secondary science information, youth participants have included primary data from social media surveys and primary investigations from their own school in their stories.

Summary. SciJourn has been adapted in local contexts, enabled by norms for adaptation and dialogue within a distributed and diverse “ecosystem.” In contrast to highly scripted

curricula, our standards are framed as principles that many different instructional actions could fulfill. The professional development and research infrastructure facilitated and reinforced the positioning of university researchers and teachers as co-inquirers and co-developers of instruction. These factors enabled new patterns of activity to emerge and be taken up by others.

Critical Civic Inquiry

Background. CCI develops partnerships with teachers in schools serving high percentages of students from historically marginalized groups. The designers formulated parameters for CCI projects that would provide consistency while also being flexible enough to accommodate local adaptation. In brief, CCI projects are supposed to focus on a problem experienced by students *at the school*, selected *by students*, and examined through the *lens of educational equity*. For this chapter we describe two projects that on first glance appeared to depart from CCI parameters. Each of these examples shows the value of CCI projects when they can be flexibly adapted to the local school context and lived experiences of youth.

Example 1: School Spirit at Jane Addams High. At Jane Addams students expressed great excitement about building stronger school spirit, through events such as the upcoming first inaugural prom, which they said they had persuaded the school leadership to support. Without an understanding of context, students' excitement about these emblems of school spirit, a ubiquitous feature of American high school life, might appear unrelated to CCI's civic empowerment goals. We discuss it here, however, because the meaning of the prom was quite different at JAH, a school for pregnant or parenting mothers. According to the teacher we worked with, Ms. M., most of her students had experienced failure in their prior school experiences, and were now at Jane Addams because of truancy, expulsion, or weak school performance at the comprehensive

high schools they previously attended. Their effort to establish this normative rite of passage takes on new meaning in this context.

Example 2: Educational Trajectories at Pathways Academy. Pathways Academy was a “multiple pathways” school for students whose needs had not been met by comprehensive high schools. The school sought to build a relationally supportive environment where students felt cared for and known. When it came to selecting a problem at the school for their CCI project, the students and teacher had difficulty finding a topic that generated student enthusiasm. Ms. F. came to view CCI’s parameter that students focus on problems *at their school* as inappropriate for Pathways. She pointed out that most students at the school were grateful to have a second chance to be in school and they tended to speak with high regard for the sense of community at the school and the care showed by teachers. In this context, it did not make sense for the CCI project to force students to manufacture a problem at Pathways. Instead, a more meaningful iteration of the project was for students to study and take action about their experiences in the prior schools they had attended, which they did by writing letters to their former teachers and principals.

These two examples show how school contexts shape the meaning of student voice projects. What may be anodyne in one setting has a transformative potential in another. CCI action research projects need to have parameters that can be adapted by students and teachers to their local context.

Conclusion

SciJourn and CCI aim to build flexibility and dialogism into their design. Consistent with the DBIR principles, we believe that worthwhile ideas are more likely to be sustained when the core intervention is flexible and responsive to varied contexts, local actors understand the relevant principles, and researcher-practitioner networks facilitate ingenuity, critical reflection,

and adaptation. Such interventions are marked by an ongoing commitment to iteration and dialogue rather than an initial trial period followed by standardization.

Supporting Teachers in Schools to Improve their Instructional Practice

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Our names are listed alphabetically; we shared equally in the writing of this chapter.

Abstract

To meet the growing demand for teacher learning opportunities, the educational community must create scalable professional development models and study their effectiveness. In this chapter we argue that DBIR is ideally suited to these efforts, and we use two research projects in which we are currently involved as illustrative cases: *CSR Colorado* and *Implementing the Problem-Solving Cycle (iPSC)*. The core of *CSR Colorado* is Collaborative Strategic Reading, an instructional approach designed to enhance reading comprehension in content classes. The focus of *iPSC* is the Problem-Solving Cycle, a mathematics PD program designed to help teachers improve their instruction through closely examining mathematics problems, student thinking, and pedagogical practices. Each project works with a school district to bring a PD model to scale, and both are studying the structures and resources needed to build the district's capacity to sustain the model beyond the duration of the research. The chapter describes each project and discusses the successes and challenges we experienced as we collaborated with the districts and schools to carry them out. By highlighting two very different projects we show how, through different means, it is possible to achieve the same ultimate end of a scaled-up program for improving instructional practices.

Executive Summary

To meet a growing demand for professional learning opportunities for teachers, the educational community must create scalable models of professional development (PD) and study the conditions of their effectiveness (Coburn, 2003). To date, however, very little research has been conducted on efforts to scale up PD. In this chapter we argue that DBIR is ideally suited to these efforts, and we use two projects in which we are currently involved as illustrative cases: CSR Colorado and Implementing the Problem-Solving Cycle. Each project works with a school district to bring a PD model to scale, and both are studying the structures and resources needed to build the district's capacity to sustain the model beyond the duration of the research. They have followed different pathways toward these goals; yet each incorporated the four DBIR principles to some extent.

Both projects focus on the persistent problem of improving the quality of teaching in K-12 schools. Although both began with interventions developed in earlier projects, they used iterative, collaborative design to develop models for building district capacity to take up the interventions and sustain them without external resources. Both projects also are concerned with developing and refining theory through systematic inquiry. And, for both projects, the focus of theory development includes generating "ideas about how to support classroom learning [and] how to prepare teachers and administrators to implement programs" more broadly than just in their respective initiatives (Penuel, Fishman, Sabelli & Cheng, 2011, p. 333). Finally, both projects are committed to developing capacity for sustaining change in systems. Each project's goals include that its model for change will be implemented in multiple schools by the end of the research funding, and that there will be a cadre of local leaders with expertise to maintain existing programs and spread them to other schools.

The first project, *CSR Colorado*, is a validation research study with a focus on sustainability and scaling up. Through PD and ongoing support, middle school teachers learn to use Collaborative Strategic Reading (CSR) in their diverse science and social studies classes to enhance comprehension and content learning. From the beginning, the research team has collaborated closely with school district partners. The district envisioned CSR as a catalyst for change and adopted it as a district practice.

Although the district and university share a common vision for their work – to improve student outcomes – there are some differences in what they prioritize. Whereas the district is most interested in finding and implementing a program that improves students’ reading skills, we university researchers also want to figure out what it takes to scale up an evidence-based practice. We are motivated, at least in part, by a desire to build theory and inform others who also wish to scale up practices with district partners (Klingner, Boardman, & McMaster, in press). This sometimes creates tensions.

The university research team is intentionally working with multiple levels of the school system, focusing not only on improving classroom practice through CSR, but also on integrating CSR support structures into the district’s PD and teacher support infrastructure more broadly. We are striving to go beyond surface structures or procedures, such as the routines, activities, and/or materials associated with CSR, and consciously work to promote the beliefs, norms, and principles underlying the approach (Coburn, 2003).

Although the university-based researchers knew little about DBIR principles when we began *CSR Colorado*, we were intent on engaging differently in our work than we had in the past when we had operated relatively independently from the host school districts in which we conducted research. Even though we could not yet articulate DBIR principles, they reflected

SUPPORTING TEACHERS' INSTRUCTIONAL PRACTICE

what we set out to do. As we learned more about DBIR principles, we realized how valuable they could be in helping us think about our work and what it means to develop a scalable model.

DBIR has added clarity and a guiding framework as we have moved forward with the project.

We have a better sense for how our efforts in one school district fit within a larger international dialogue on scaling up reform-based initiatives. DBIR principles have helped us think about the

iterative nature of data collection and analysis. Initial findings have led to multiple changes in

the CSR PD model and to a lesser extent CSR itself. These changes have involved fine-tuning

project personnel's responsibilities; and thinking through and altering how teachers and

principals are supported, how coaches are prepared, how modifications to CSR are approved, and

how connections are made to the district curriculum.

As Stokes (1997) noted, to be sustained, reform must transition from “an externally understood and supported theory to an internally understood and supported theory-based practice” (p. 21). Everyone on the CSR-Colorado project is aware of the need to look forward and think about what it will take to sustain CSR over the long-term. Everyone agrees that more mechanisms must be built into the project for shifting ownership to the district, and they understand that CSR must become part of district culture, something ingrained in practice so that even when leaders change, CSR persists (Coburn, 2003).

The second project, *Toward a Scalable Model of Mathematics Professional Development: A Field Study of Preparing Facilitators to Implement the Problem-Solving Cycle* (iPSC) is a research project to investigate the scalability of the Problem-Solving Cycle professional development model. The PSC is an iterative, long-term approach to mathematics PD designed to help teachers increase their knowledge of mathematics for teaching and improve their instruction through closely examining mathematics problems, student thinking, and

pedagogical practices (Jacobs et al., 2007; Koellner et al., 2007). Three design principles are central to the PD approach: fostering active teacher participation in the learning process, using teachers' own classrooms as a powerful context for their learning, and enhancing teacher learning by creating a supportive professional community.

When the research team approached a local school district about participating in the iPSC project, our primary emphasis was on preparing and supporting classroom teachers as they learned to implement the PSC in their schools. District personnel noted that the project had "strong initial appeal," in large part because of its focus on developing the capacity of teachers to conduct site-based PD. They expressed a strong perceived need to develop school-based leadership capacity and felt that the structure provided by the PSC model would be an excellent fit for their needs.

The researchers' design goal for the iPSC project was to develop a model for preparing site-based Teacher Leaders (TLs). Our research questions focused on the TLs' ability to implement the PSC with integrity to its key features; and on the impact of the PSC on the TLs' and teachers' knowledge and practices, and on student achievement. In contrast to the principles of DBIR, and similarly to CSR, we began the project with an already-developed PD model, rather than developing the model collaboratively with the school district as part of the implementation process. The model for preparing and supporting school-based TLs to implement the PSC, however, was developed using an iterative design, with increasing participation in the design process by the Secondary Mathematics Coordinator and TLs.

As the project unfolded we realized that simply building a cadre of TLs would be insufficient to ensure sustainability. We worked intentionally with the Secondary Mathematics Coordinator to ensure that she had the knowledge and skills to prepare new TLs and to support

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existing TLs. As our presence in the district lessened, she took on more of the responsibility for planning and facilitating the Summer Academies and Mathematics Leadership Preparation meetings for the TLs. In retrospect, we appreciate how central her role has been to the sustainability of the project.

The iPSC project was largely successful from a scaling-up perspective. Five years after we initiated the partnership, an adapted version of the PSC has become the professional learning model for middle school math departments across the district. The research team has developed a working model of mathematics leadership preparation and we have initial evidence that the TLs were able to implement the PSC with integrity to its key features (Koellner et al., 2011). Thus, although the project was not designed with the benefit of a DBIR perspective and we did not work directly with principals or district administrators other than the mathematics coordinator, our major goals for the project were met. We believe that one important factor in this success was each party's flexibility and willingness to compromise as we worked together to incorporate the PSC into the district's PD portfolio.

Conclusion

Both projects highlighted in this chapter are successful examples of university research teams working in partnership with school districts to implement research-based instructional improvement programs. Lessons learned from the two projects point to how complicated it can be to take classroom level design research principles to scale across multiple levels of large urban districts.

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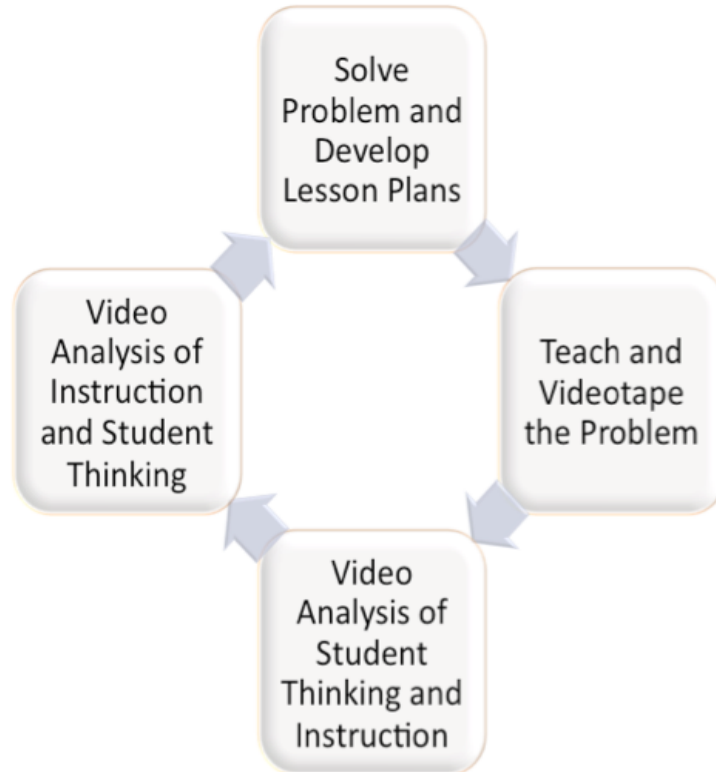
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Figure 2: The Problem-Solving Cycle



Designing for Productive Adaptations of Curriculum Interventions

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Abstract

Productive adaptations at the classroom level are evidence-based curriculum adaptations that are responsive to the demands of a particular classroom context and still consistent with the core design principles and intentions of a curriculum intervention. The model of design-based implementation research (DBIR) offers insights into complexities and challenges of enacting productive curriculum adaptations. We draw from empirical research in mathematics and science classrooms to illustrate criteria for productive adaptations. From these examples, we identify resources needed to encourage and sustain practices to promote productive adaptations in classrooms.

Teachers face a balancing act between being faithful to the goals articulated by curriculum developers and local policy makers and being responsive to the interests and resources of students, parents, and local community members, as well as their experiences as practitioners. A commitment to fidelity reduces the interactional focus of instruction and instead emphasizes inflexible and less intentional uses of curriculum, which limit teachers' ability to be responsive to their local classroom's needs as they arise. The fidelity perspective thus privileges a few stakeholders while diminishing the importance of local responsiveness.

Design-based implementation research (DBIR) conceives of curriculum use as an inherently interpretive, and thus responsive, process. DBIR also emphasizes multiple layers and actors involved in negotiating features of classroom practice. In productive adaptations, teachers effectively respond to the dilemma of being faithful to the intentions of curriculum developers and policy makers while also being responsive to the characteristics and resources in local contexts.

Criteria for Productive Adaptations

The criteria for productive adaptations stem from assumptions that productive adaptations are responsive to the local context, reflect the design principles of the curriculum developers, and are geared toward forms of pedagogy that are both ambitious and equitable. Thus, productive adaptations entail high-level engagement for all students in practices that are associated with deep learning in a discipline. Furthermore, we argue that an important way teachers can be responsive to students is to design classroom discourse practices that elicit and build from students' linguistic and cultural resources and integrate these practices into iterative cycles of revision and curricular adaptation.

Productive adaptations: (1) balance the interests and goals of multiple stakeholders, who include students, parents, and their communities; (2) help students make cultural and discursive connections between the reasoning practices of their home communities and those of the classroom; and (3) maintain or even enhance the task complexity intended by the curriculum developers while providing avenues for broad participation in valued disciplinary practices. Making productive adaptations is a kind of advanced professional practice that requires different instructional knowledge and skills, and so new models of professional development are likely needed to support teachers in this practice.

Case Examples in Mathematics and Science

The role of curriculum designers and professional developers in helping teachers adapt materials in ways that meet the intentions of the curriculum designs and address the demands of their local contexts is illustrated through qualitative case analyses from mathematics and science classrooms. These cases describe the enactment of and challenges associated with productive adaptations.

The mathematics cases come from the NSF-funded ACCLIME project (Choppin, 2008), which focused on teacher-initiated adaptations to the Connected Mathematics Project (CMP) curriculum program (Lappan et al., 2006). The data collection involved videotaping 12 teachers' enactments of instructional units. Case examples of adaptations are drawn from two teachers.

The science cases come from the NSF-funded Contingent Pedagogies (CP) project, which focused on designing tools to help middle school Earth science teachers productively adapt their formative assessment practices. Twelve teachers implemented the CP tools, which included *pedagogical patterns* and *classroom talk moves*. The science example highlights one teacher's implementation of CP adaptations.

Recommendations for Supporting Productive Adaptations

The examples from mathematics and science illustrate two key themes. First, teachers can engage in systematic observations over a span of years that lead to adaptations that are productive in terms of (1) building from student thinking in ways that are responsive and informative, (2) maintaining or enhancing the complexity of the tasks, and (3) following the intentions of the curriculum developers. Second, it is possible to anticipate adaptations that are likely to be productive through a process of co-design in which teachers and curriculum developers create and adapt tools to facilitate productive adaptations.

These examples point to the need for resources to support teachers in enacting productive adaptations that are responsive to multiple stakeholders, reflexively related to responsive discourse practices, and maintain or enhance task complexity and engagement. Opportunities to co-design tools and participate in professional development with colleagues as well as educative curriculum materials can help teachers to identify how to adapt tasks based both on local context and an understanding of curriculum developers' intentions. Teachers find it difficult to elicit, value, and build on all students' ideas both in terms of asking the right types of questions at the right time. Thus, resources, such as questions to pose to students and follow-up questions to probe for additional thinking, may help teachers anticipate the range and types of student conceptions, engage in dialogic interactions that inform them about where their students are at, and thereby allow them to adapt to address their students' needs. The findings from these cases also suggest that with increased communication (via wikis or other open-sourced web sites), local communities can determine how elements of the curriculum will work for their students and where their students may need additional supports or different experiences.

Adaptations to curricula are inevitable and must be supported both in the design phase by curriculum developers and in the planning and enactment curriculum phases with teachers.

Productive adaptations, however, are not sustainable without broader support within the larger infrastructure. While adaptations can be anticipated to an extent, there should also be some intentionality in providing resources that facilitate adjustments that are specialized for a teacher's classroom and give the teachers the tools to make informed and productive adaptations.

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The Nature of Evidence in Design-based Implementation Research

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Abstract

In this paper, we explore the nature and interpretation of evidence within the emerging tradition of design-based implementation research (DBIR) by contrasting DBIR practices with the prevailing evidence standards for education research promoted by national policy. We analyze the assumptions underlying Department of Education research phases and knowledge dissemination programs on the one hand and descriptions of design-based implementation research on the other. We highlight the ways in which DBIR is a departure from much educational research in terms of both the phasing of different kinds of research activities and the conceptualization of what it means to conduct research that is useful and usable in education settings. An implication of our analysis is that a more flexible, less linear framework for education R&D is needed to make research usable by practitioners.

The Nature of Evidence in Design-based Implementation Research

This paper examines the approach to evidence implicit in the defining features of design-based implementation research (DBIR) and compares it to the prevailing evidence standards for educational research. We provide a frame for knowledge building within DBIR that draws from the strengths of both design-based research methods and research designs that permit causal inference about program impacts. Moreover, we show how DBIR challenges current thinking about what counts as credible research.

Prevailing Standards of Evidence for Education Research

To fully appreciate the implications of design-based implementation research for the structuring of research and development, it is helpful to contrast DBIR with the prevailing evidence standards and the associated sequencing of types of education research promoted by the Institute of Education Sciences (IES) of the U.S. Department of Education. The IES evidence standards are deeply engrained in federal policy for education research funding. If we consider the logic behind the adoption of these standards, we find the basic assumption that there are clearly defined education programs or interventions that either "work" or "don't work" (see, for example, IES, 2011). Given this assumption, the researcher's goal is to collect evidence to place an intervention in one or the other category. In this view, the contribution that research makes to practice is through identifying "what works" and disseminating this information to practitioners.

In contrast to the IES evidence standards, the evidence framework underlying DBIR treats educational interventions not as fixed objects but as practices that will be adapted to local circumstances and can be expected to undergo modifications and improvements throughout their lifespan. Accordingly, educational interventions are viewed as complex combinations of human actions, organizational supports, and instructional resources that play out differently in different contexts and with different kinds of students (e.g., Cobb et al., 2003; Fishman et al., 2004). Thus, in the DBIR model, the implementation of an intervention in particular settings is itself an object of research and a critical part of understanding how to scale an intervention without diluting its effectiveness.

Implications of DBIR Principles for What Constitutes Evidence

The four core DBIR principles (Penuel, Fishman, Cheng, & Sabelli, 2011) point researchers and practitioners to early and continued joint engagement in defining a research agenda, designing and refining an intervention, and developing a theory of implementation and impact. DBIR's emphasis on collaboration and iterative implementation has important implications for how research evidence is defined and used.

Working with practitioners to jointly select the problem to address is the starting point for DBIR. A basic principle of DBIR is that the research agenda is jointly negotiated with the practitioners who are partnering with researchers. Rather than defining a research question about a particular intervention and then recruiting education entities willing to implement that intervention as defined, the researcher forms a partnership with practitioners and then negotiates the research questions with them. Such negotiation, essential to DBIR, is difficult to reconcile with the model of research adopted by IES because applicants for funding must focus on research designed to identify causal relationships between education interventions and student outcomes. The degree of intervention standardization required by traditional education research models necessarily puts the researcher in the role of defining the intervention a priori and then recruiting schools and districts willing to implement the intervention as defined in the experimental protocol with fidelity, a stance that is fundamentally incompatible with negotiating the intervention to be implemented with those who will implement it.

Iterative, collaborative design involves practitioners in making design decisions, and many of those decisions get driven by types of evidence other than randomized control trials. The collaborative nature of DBIR calls for research and practice partners to engage in multiple cycles of design, implementation, and refinement. Those who engage in these efforts find that designing and developing an educational intervention involves a huge number of decisions, not all of which could possibly be tested through experimental design. For early-stage innovations, there is typically a tradeoff between gathering stronger causal evidence of effectiveness and gathering more data on implementation in a range of contexts. Innovation developers are inclined to emphasize the latter kind of data collection because they expect their intervention to be undergoing rapid evolution (U.S. Department of Education, 2013). Implementation data are considered important for getting feedback on the appeal and usability of

the intervention in practice and for establishing the range of desirable and acceptable variations in how the intervention is implemented.

DBIR is designed to support the development of theory related to implementation as well as to classroom learning. Ample research demonstrates that interventions that "work" in one setting and occasion do not necessarily work elsewhere or at another time (Cole, Kemple, & Segeritz, 2012; Means & Penuel, 2005). DBIR proponents do not assume that an intervention that achieves a positive effect size in a handful of experimental studies will necessarily have similar positive effects wherever it is implemented. Rather, they work with their practitioner partners to lay out a theory of the implementation process that is specific to the practitioners' context, and to study both implementation processes and outcomes simultaneously.

DBIR researchers would expect that students exposed to an intervention would have better outcomes in those settings where theorized essential components of the implementation model are in place. Looking for the presence or absence of these correlations is key to testing the theoretical assumptions underlying the implementation model (Weiss, 1995). These theoretical assumptions matter because they articulate the essential workings (i.e., the how and why) of an intervention.

DBIR seeks to develop capacity for sustaining change in education systems. The hope is that DBIR partnerships lead to increases in both researcher and practitioner capacity. Researchers are expected to become smarter about how to target issues that matter for education systems in their work and about how to conduct solid research within the constraints of practicing education systems. Collaborating districts are expected to become more interested in and adept at collecting data about both their implementation practices and the outcomes for their programs and interventions. There is not an expectation that classrooms, schools, and districts will launch a program of massive experimental research, but rather that they will carefully plan out implementation of major new initiatives and monitor both implementation processes and outcomes, seeking to gain insights from the variability of outcomes related to different implementation practices and settings that can be used to refine the implementation plan for the next iteration.

Building a Knowledge Base by Synthesizing Findings across DBIR Projects

Part of what attracts educators to collaborating in DBIR is the very contextualized nature of the work. Local insight is combined with research techniques in the pursuit of further insight and on-the-ground improvements in processes and outcomes. Accordingly, one of the strengths of DBIR should be the careful documentation of implementation and contextual variables. Quantitative meta-analysis across DBIR studies of similar phenomena will be facilitated to the extent that various DBIR projects embrace common definitions and taxonomies of implementation variables so that these definitions and categories can be used in coding studies for research synthesis and moderator variable analyses.

In addition, there are several emerging alternative approaches to research synthesis that are compatible with DBIR. One entails comparative analysis of design-based research projects engaged in similar work. Another approach for tying different DBIR studies in different locations together is through the use of common tools. This approach has been suggested by others in the learning sciences community (see, for example, Blumenfeld, Marx & Harris, 2006). Aside from savings in time and dollars, using common tools is a way to insure common definitions and measures, thus facilitating synthesis of findings across projects. Finally, there is the strategy of tying multiple research efforts together through sharing datasets, a strategy that supports testing the generality of outcomes.

Summary

There are three notable ways in which DBIR is a departure from much educational research in terms of its priorities, evidence standards, and conception of what it means to do usable education research. First, DBIR tends to place more emphasis on understanding local actions and outcomes and to make fewer claims for generality than other research approaches (notably IES Scale-up Evaluation studies). This feature is related to the insight that programs that produce desired effects in one context may have very different outcomes in another. Second, DBIR attends to implementation processes, not just “implementation fidelity.” It looks for unanticipated or unintended consequences of introducing a new practice or new instructional material into an educational setting, not just whether an experimental protocol is being followed as stipulated. DBIR has a somewhat more flexible stance toward testing causal hypotheses than is embodied in IES standards, but does not eschew experimental design as an important research

tool. And third, DBIR follows a research trajectory that is more flexible and less linear than the prevailing education research and development cycle. Building understanding of how contextual features influence implementation practices and how those practices relate to outcomes gets as much or more attention as does establishing the average effect under the DBIR approach. DBIR expects variation in outcomes across different contexts and prioritizes the study of implementation in context as a strategy for refining the intervention as well as one for understanding implementation and context. Evidence from more rigorous longitudinal, observational, and experimental studies is both desirable and feasible to obtain through DBIR collaborations, but this effort is not allowed to overshadow the development of insights that help education partners improve their practice.

Generating research findings that are not just useful in principle but are actually *used* by those making decisions that affect education is a fundamental goal of DBIR (Penuel et al., 2011). An implication of our analysis is that a more flexible, less linear framework for education R&D is needed to make research usable by practitioners.

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Design Research with Educational Systems: Investigating and Supporting Improvements in the
Quality of Mathematics Teaching and Learning at Scale

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Executive Summary

This chapter describes the Middle School Mathematics and the Institutional Setting of Teaching (MIST) project, which seeks to develop an empirically grounded theory of action for improving the quality of mathematics instruction at scale. We limit our focus to the first phase of MIST, conducted 2007-2011, in which we partnered with four urban districts that served a total of 360,000 students. The approach we took in collaborating with leaders in the four districts was consistent with the basic tenets of design-based implementation research as articulated by Penuel, Fishman, Cheng, and Sabelli (2011) and involved testing, revising, and elaborating conjectures about school and district supports and accountability relations for instructional improvement. The current iteration of the theory of action comprises five interrelated components: curriculum materials and associated instructional guidance instruments such as curriculum frameworks, pull-out teacher professional development and school-based teacher collaborative meetings, mathematics coaches' practices in supporting teachers' learning, school leaders' practices as instructional leaders in mathematics, and district leaders' practices in supporting the development of school-level capacity for instructional improvement.

Project Overview

The four partner districts were all responding to high-stakes accountability pressures by attempting to implement strategies that went beyond "teaching to the test" by supporting and holding teachers accountable for improving the quality of their instructional practices. The types of classroom instructional practices on which the districts focused involve achieving ambitious mathematics learning goals by building on students' current reasoning. Teachers' development of practices of this type requires significant teacher learning that involves reorganizing rather than merely elaborating or extending current practices (Franke, Kazemi, & Battey, 2007). Our

collaboration with the districts therefore provided a context in which to investigate improvement strategies for supporting teachers', coaches', and school leaders' reorganization of their current practices.

In consultation with district leaders, we selected approximately six middle-grades schools in each district that were representative of district schools in terms of their capacity for instructional improvement. We then recruited 30 middle-grades mathematics teachers in each district, the mathematics coaches that served these schools, and the school leaders, as well as district leaders across central office units, for a total of approximately 50 participants in each district. Each year, we conducted a data collection, analysis, and feedback cycle in each district that involved documenting the district's improvement strategies, collecting and analyzing data to assess how these strategies were being implemented, and reporting the findings to the district and making recommendations about how the strategies might be revised.

Levels of Analysis and Research Tools

In conducting this work, we differentiated two distinct levels of analysis. The first level was pragmatic and involved providing the districts with timely evidence of how their strategies were playing out in schools. The second level focused on our primary research goal of developing an empirically grounded theory of action that can inform instructional improvement in other districts. These two levels of analysis were interdependent in that insights that we developed while formulating empirically grounded recommendations to the districts informed the revision of our theory of action. Conversely, the current iteration of the theory of action was an essential research tool at each point in our collaboration with the partner districts and guided our formulation of recommendations about how they might revise their improvement strategies.

We found it essential to create a second research tool, an interpretive framework that we could use to assess the potential of each district's designed or intended strategies to contribute to instructional improvement, and to account for the consequences of the strategies once they were implemented. The interpretive framework distinguishes between four general types of supports that capture all the improvement strategies that our four partner districts attempted to implement across the four years: new positions, learning events (including professional development), organizational routines, and tools. In developing the framework, we drew on research in the learning sciences, teacher learning, and related fields to assess the potential of each general type of support to scaffold teachers', coaches', and school leaders' reorganization of their practices.

Pragmatic Level of Analysis: Feedback to Partner Districts

Each October, we documented each district's intended or designed improvement strategies by interviewing approximately ten leaders from each district. We reported our analysis of the districts' strategies in *District Design Documents* that we shared with district leaders to determine whether we had accurately represented their improvement goals and strategies. Each January, we interviewed the 50 participants in each district to document how the districts' improvement strategies were playing out in schools and classrooms. These interviews focused on both the formal and informal supports for members of each role group, and to whom and for what they perceived themselves to be accountable. The process that we developed for analyzing these interviews involved synthesizing findings first at the school level and then at the district level. This approach enabled us to substantiate findings by backtracking through the successive steps of the analysis to the raw data if necessary.

Before we could make recommendations to the districts about how they might revise their improvement strategies, we had to explain *why* their strategies were playing out in the ways

that we had documented. To develop these explanations, we accounted for changes (or the lack of change) in participants' practices by using our interpretive framework to assess the learning opportunities and press for improvement afforded by the implemented supports and accountability relations. Against this background we then developed recommendations for how district leaders might revise their improvement strategies by drawing on the current iteration of our theory of action for instructional improvement. The final products of each annual cycle were *District Feedback and Recommendations Reports* (DFRRs) for the four districts that built directly on the *District Design Documents* and were intentionally structured around districts' major improvement strategies. The following October, after district leaders had developed plans for the new school year, we interviewed them again to document their revised instructional improvement strategies. Our analyses of these interviews indicated that leaders in all four districts acted on our recommendations to a significant extent. In this regard, our partnership with the districts exemplified two of the key principles of DBIR identified by ([Penuel, et al., 2011](#)): “a focus on persistent problems of practice” from the perspectives of both practitioners and researchers, and “a commitment to iterative, collaborative design” (p. 332).

Research-Oriented Level of Analysis: Revising Theory of Action for Instructional Improvement in Mathematics

The initial conjectures about supports and accountability relations that we developed prior to our collaboration with the four districts were relatively global. In the course of working with the districts, we elaborated these conjectures by specifying both potentially productive practices for members of various role groups, and supports and accountability relations necessary for the development of those practices. Evidence for these revisions came from the research

literature, from a series of retrospective analyses of a wide range of different types of data in addition to participant interviews, and from our ongoing findings about how the districts' instructional improvement strategies were being implemented. In formulating recommendations for the partner districts, we necessarily had to address concrete organizational design challenges by proposing how each district might support and hold members of particular role groups accountable for improving their practices. Addressing these challenges was a primary context for our learning as we sought to understand what it might take to support instructional improvement in mathematics on a large scale. Once we completed each annual data collection, analysis, and feedback cycle, we stepped back and framed our findings about and recommendations for the districts' improvement strategies as cases of attempting to support instructional improvement at scale. In doing so, we identified recommendations to a particular district that represented refinements or elaborations of our current conjectures and that had more general implications.

Discussion and Conclusion

The empirical grounding for and the interdependence of our pragmatic and research conjectures illustrates a core principle of design-based implementation research articulated by ([Penuel, et al., 2011](#)): conducting systematic inquiry to develop theory related to improving the quality of classroom instruction and student learning at the system level. In addition, our emerging theory of action for instructional improvement and the interpretive framework that we outline in the chapter exemplify two general types of research tools that are, in our view, essential for design-based implementation research.

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Beyond Classrooms: Scaling and Sustaining Instructional Innovations

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about Learning from Educational Research and Their Applications) with Sarah Michaels and Cathy O'Connor.

Abstract

In this chapter, we describe the evolution of an intermediary organization, the Institute for Learning (IFL) at the University of Pittsburgh, devoted to improving teaching and learning in some of America's largest and most challenged school districts. Over the nearly 20 years of IFL's life we have learned that design-based researchers have to move beyond classrooms and focus on entire school systems if they hope their innovations will scale and sustain. Specifically, we believe the best way to develop capacity for sustaining innovation is through the careful design of practices intended to provide an ongoing forum for mutual engagement among actors from various levels of the education system. These practices, we have found, provide a productive way for actors from different levels of the system to understand and support the local activity of other levels.

Executive Summary

We describe in this chapter the evolution of an intermediary organization, the Institute for Learning (IFL) at the University of Pittsburgh, devoted to improving teaching and learning in some of America's largest and most challenged school districts. Like many intermediary organizations, the IFL began as a response to a specific set of conditions and tailored its work to the expressed needs and theories of action of its initial school district partners. IFL then shaped its theories and practices in response to the changing needs of its partners, along with a continuing flow of research and evaluation data. To date, the IFL has worked with over 70 partner school districts.

Origins of the IFL

In the 1990s, scholars and practitioners began to document the key roles that district leaders played in supporting ambitious improvements in teaching and learning. One critical ingredient repeatedly identified in the research on school systems was that leaders of school districts demonstrating improved student learning focused on instructional improvement as the core of their work.

As the research cumulated and became known, district leaders began to seek more focused ways of actively promoting specific instructional reforms in their schools. One group of superintendents from large urban districts challenged Lauren Resnick (Director of the Learning Research and Development Center (LRDC) at the University of Pittsburgh and co-Director of the New Standards Project) to begin to work with them on innovative ways to make instructional improvement the core of their work. The immediate result of the superintendents' request was the creation of the Institute for Learning (IFL).

The IFL's Role as Design-Based Implementers

The formal concept of Design-Based Implementation Research had not yet been named when the IFL was created. But looking back through the lens of DBIR, it is clear that this is the approach that IFL adopted: IFL's collaborative projects with school districts each centered on a persistent set of problems related to instruction and learning and involved iterative, collaborative work between scholars and practitioners. In addition, with each successive IFL undertaking it was necessary to extend the theoretical boundaries underlying our work. We began with principles of cognitive psychology and learning science and then moved quickly to incorporate theories and practices of "situated learning." Throughout, we sought to bring the theories of action of thoughtful practitioners to broader audiences.

The Concept of Nested Learning Communities

In the IFL's first years of operation, superintendents brought "leadership teams" to a series of meetings that were highlighted by distinguished speakers interspersed with carefully designed working sessions in which the group crafted the shared language that they would use to build new practices in their districts. This resulted in the creation of the IFL's well-known Principles of Learning.

The initial cohort of IFL superintendents saw it as their job to lead and support what they began to refer to as Nested Learning Communities. They chose the term "nested" to highlight the two-way accountability needed for successful education reform. Superintendents could not simply command their principals to enact the principles. They would, instead, need to put in place opportunities for principals to learn new strategies of leadership and management. And principals, in turn, would have to establish and support

teacher learning. These founding district leaders, then, acknowledged that continual upgrading and refining of instructional competencies was a key part of a community's professional work. The IFL's original theory of Nested Learning Communities was, then, one of two-way accountability at every level of the district organization. We initially believed that the new learning would happen mainly through a process of communication.

Entering the Nest

The IFL then began to provide on-the-ground training and coaching of principals along with key central staff professionals. The IFL's professional development approach evolved from being dependent on national meetings and tools to focusing on within-district professional development. Using the Principles of Learning and the concept of Nested Learning Communities, a professional development plan was customized to meet the needs of each partner district. Professional development experts, called IFL Fellows, were assigned to each of the IFL districts. The IFL Fellows served as effective brokers between the IFL and its partnering districts. The Fellows bridged research and practice; they introduced the IFL's theory and tools into the school and district communities in accessible practitioner language. Each Fellow was hired in a national search and had experience as a distinguished practitioner at the classroom, school or district level. Because of this practitioner experience and training, they had credibility with the district personnel in each of the IFL partner districts.

Even with these efforts at brokering, evaluations of the Institute's early work in districts were mixed. It became clear that IFL would need to find a way to introduce new

principles and practices simultaneously across several layers of the organization and simultaneously activate the support system of the entire organizational nest.

Content-Focused Coaching: The Classroom as the Focal Point for Nest Building

In an attempt to embed ourselves more deeply into districts' instructional practices, the Institute decided to bring its Content Focused Coaching ® (CFC) program into its partnering districts. Our working theories of school and classroom change suggested that for coaching to succeed in raising student achievement, four conditions were necessary: 1) principals must experience the training and should not use coaches to evaluate teacher performance; 2) the coaching must be subject-matter specific, preferably based on practice with well-crafted lessons suited to the content and grade level of the students to be taught; 3) coaches had to be selected carefully to assure that coaches themselves were already reasonably good teachers of the content and skills they were to help other teachers master; and 4) the school schedule under which coaches worked had to allow teachers sufficient time for coaches to work with teachers in small study groups and in their classrooms.

Stabilizing and Sustaining Innovation in a Community of Practice

The IFL then began to use what we know about sociocultural theories of learning. We designed a set of practices intended to provide an ongoing forum for mutual engagement among actors from various levels of the education system. Furthermore, to be sustainable, we designed these practices in a way that encourages a process of “appropriation.” That is, we designed the practices in a way that allows users to adapt the practice to their particular conditions and capabilities.

One such adaptable practice is IFL’s Content and Pedagogy Practice (CPP), which was developed as part of our Disciplinary Literacy Program. Disciplinary Literacy (DL) is a research-based and highly evaluated program designed to ensure that all students have access to and can profit from classroom instruction with a rich, rigorous and relevant curriculum in the four core content areas. DL is built on a learning system of classroom and school supports, as well as routines for school learning communities, to provide a learning environment where all students can acquire rigorous ways of knowing and thinking in each core content area.

Conclusion

The Institute for Learning (IFL) at the University of Pittsburgh has developed multiple forms of Design-Based Implementation Research over the past two decades. Our story began with a few district leaders asking a scholar to help them build the capacity of their staff to enact a mid-1990s version of standards-based reform. It continues to the present day with several partners asking us to join them in building the capacity to enact the new Common Core State Standards. As we pursue our work with districts and state, we continue to consider how an innovation initiated in a particular part of the nested learning system might be enabled or constrained by actors situated in various other levels of system.

Our underlying mission – changing practice so that all children will learn – has not changed since our founding. However, the iterative process of examining “uptake” of our programs have led us to make substantial changes in the kinds of programs we recommend to partners. We focused at first on our programs and the ways in which to help partners develop their own implementation strategies. From our inception, we have

understood that we have to work with entire schooling *systems* rather than individual schools or teachers. But our early expectation that simply *providing information*—even in language carefully crafted for the audience—was not adequate. Over the years we learned that we have to enter the nested layers of organizations and bring multiple actors into successful communities of practice. We now provide partners with materials and training that allow them to establish a structured set of practices that provide a forum for mutual engagement.

Furthermore, we have learned that successful collaborations often require design-based implementation researchers to negotiate the language of their innovations in a way that it will match that of other reforms that the district considers important. For example, when we brought our Disciplinary Literacy program into a district that had recently begun to focus on Professional Learning Communities (PLC), we had to negotiate the language of Disciplinary Literacy so that it blended with their newly adopted PLC language.

While iterating our theory and ideas, we aim to develop knowledge that is useful across a range of settings, with a particular focus on developing practitioner understanding of the foundational ideas underlying the new practices that they are adopting. We stress heavily the need for active engagement between people at different layers of the nested learning community. Our guiding theory of Nested Learning Communities is particularly useful in informing designs for sustainability. Instead of focusing on how a few teachers implement a new curriculum, for example, we spend considerable time figuring out how the success of the new curriculum is dependent on various actors throughout the nest. That is, our design moves beyond classrooms and investigates the larger communities of practice in which our innovations are enacted.

We believe the best way to develop capacity for sustaining innovation is through the careful design of practices explicitly intended to provide an ongoing forum for mutual engagement among actors from various levels of the education system. These practices, we have found, provide a productive way for actors from different levels of the nest to understand and support the local activity of other levels.

It is interesting to note here that we have learned that to successfully “scale up”, you have to design innovation that has the ability to “scale down.” That is, we believe, innovations that are meant to span across schools and districts, must encourage a process of modification and appropriation that makes them work for local contexts.

More than a Network: Building Professional Communities for Educational Improvement

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Abstract

This chapter is a case study of the Carnegie Foundation for the Advancement of Teaching's Pathways™ program. The goal of the Statway™ and Quantway™ pathways is to improve the success rate of community college students who place into developmental mathematics. What makes these programs unique is their strategy of building a particular kind of professional network, what Carnegie refers to as a *networked improvement community* (NIC), to organize and lead an array of continuous improvement processes. NICs are a social mechanism through which the collaborative designs and practical theories produced by DBIR can become live resources for the improvement of systems. NICs are comprised of highly structured groups of education professionals, working in collaboration with designers and researchers, to address a practical problem. Driver diagrams are introduced as a tool for organizing the improvement work of NICs. After briefly describing several drivers behind the Pathways program, the chapter details the main elements of the network organization driver as a distinct approach to building communities aimed at improving education.

Executive Summary

This chapter is a case study of the Carnegie Foundation for the Advancement of Teaching's Pathways™ program. The goal of Pathways is to improve the success rate of community college students who place into developmental mathematics. Currently, only five percent of students placing into developmental mathematics receive college-level credit one year later. To try to dramatically improve these outcomes, Carnegie formed a network of community colleges, professional associations, and education researchers in the summer of 2010. The aim of the network is to develop and implement two new course sequences, or *pathways*, that overcome persistent barriers to student success.

But the new curriculum and course structure of Carnegie's Pathways programs, known as Quantway™ and Statway™, is not what most distinguishes them from other education reforms or research-practice partnerships. What makes these programs unique is the strategy of building a particular kind of professional network, what Carnegie refers to as a *networked improvement community* (NIC), to organize and lead an array of continuous improvement processes. The idea of a NIC came from the work of Douglas Engelbart (1992), who wrote about strengthening the capacity of technology organizations to work together to accelerate their ability to improve. However, Engelbart's writings never detailed the specific structure and tools for network learning and improvement. Building on his work, Carnegie has partnered with the Institute for Healthcare Improvement (IHI) to adapt resources from improvement science (e.g., Kenney, 2008; Langley et al., 2009) to education contexts.

Like Design-Based Implementation Research (DBIR), NICs are concerned with building capacity to change education systems. At root, DBIR is an approach to research and development that is defined by its focus on problems of practice (principle 1) and developing capacities to

sustain systemic change (principle 4). To this end, DBIR promotes an approach to inquiry that focuses on iterative, collaborative design (principle 3) and the development of practical theory (principle 2) (Penuel, Fishman, Cheng, & Sabelli, 2011). NICs are a *social mechanism* through which the collaborative designs and practical theories produced by DBIR can become live resources for the improvement of systems. For DBIR-type work to address practical problems sustainably and at scale, an organizing structure is necessary which has the capacity to put such resources to productive use.

The innovation of a NIC is using a highly structured network of education professionals, in collaboration with designers and researchers, to address a practical problem. The focus on education professionals distinguishes the Pathways NIC from forms of inquiry led by researchers. Professional leadership helps NICs tap into the innovation capacity of front-line workers and accelerate improvement. Whereas traditional educational inquiry looks at improvement over the course of academic terms or years, NICs measure improvement over weeks and months. Professional leadership of the network helps ensure network activities prioritize problems of practice, especially the challenge of effective implementation.

In a NIC, effective implementation means improving a process (e.g., teacher questioning strategies) within the system (e.g., community colleges in the network) with the overall goal of *achieving efficacy with reliability at scale*. Research knowledge is often critical for improvement, but a NIC's knowledge demands are disciplined by its improvement aims. To be a NIC priority, knowledge should inform the actions or decisions of NIC members or leaders in ways that help the network achieve its aims. In this sense NICs are engaged in problem-disciplined inquiry as a feature of professional practice. The most important feature of a NIC is a common problem or challenge around which the work of the network is organized.

The Pathways NIC consists of a number of different roles and organizing structure. First, NICs require a coordinating hub as “an initiator of activity and an integrative force for the overall enterprise” (Bryk, Gomez, & Grunow, 2011, p. 156). Currently Carnegie is serving in this capacity, at least in the early stages of NIC development. But the long-term goal is for hub responsibilities to progressively transition from Carnegie to a leadership body within the Pathways network. Second, there is a general network membership comprising teams from different colleges. The Pathways network consists of twenty-six community colleges and four universities located across eight different states. And third, there are NIC-affiliates who are engaged by the hub around specific NIC-related goals. These include expert advisors on instructional design and development, lesson study, and math education. It also includes contract design work writing and reviewing lessons, developing assessments, and building and adapting online instructional platforms. And it involves partnerships with organizations committed to similar work. These partnerships provide key relationships for finding and attracting members, as well as settings to share and discuss the work.

The network organizing activity of the Pathways hub is guided by four main elements, each of which plays a key improvement-related function in the operation of the NIC.

A rapid analytics infrastructure is a core capacity of the hub that helps collect, manage, analyze, and share data across the network. This plays two important improvement functions. First, common performance measures allow the Pathways NICs to chart progress towards network- and college-level goals. Regular charting of progress keeps members focused on performance, encourages a common understanding of success and failure, and promotes internal accountability. Second, the analytics infrastructure is designed to help understand variation in performance. In the Pathways the main sources of variation are the students entering the

pathways, their classroom experiences, and their institutional context. Studying this variation allows program designers to understand what works, for whom, and under what set of conditions. This is critical to designing pathways that work across the diverse conditions of the network.

Common *tools and routines that enable disciplined inquiry* are critical to coordinating member activities across a dispersed professional network. They facilitate network learning and engagement that is essential to scaling improvement within an education system. Routines are regularly followed procedures that specify an established or prescribed way for participants to act. In so doing, they coordinate the joint work of people within an organization or distributed across organizations (Feldman & Pentland, 2003; Sherer & Spillane, 2011). Routines are not mindless in the sense that something is routine, but rather the concept evokes effortful accomplishments or a way of channeling action (Feldman & Pentland, 2003). Carnegie incorporated routines in multiple aspects of the NIC's work, spanning the different levels of activity. They range from classroom level routines of interaction embedded in instructional materials to protocols that guide lesson study in college-based professional communities to modes of network-wide inquiry into variation in performance. In each case, concrete tools and/or artifacts are designed to anchor routines. Tools in this sense provide parameters that enable and constrain work practices in the NIC (Barley, 1986; Wertsch, 1991). Channeling the work of participants toward a common set of practices is central to improvement work such that it aims to promote implementation of core practices with integrity, that is, in a manner that remains true to its essential ideas and guiding principles, while being responsive to local conditions and context.

Candidate improvement knowledge can come from many different sources. *Innovation conduits* are a way promising ideas inside or outside of the network are identified, tested, refined,

and scaled. Carnegie uses several strategies for channeling ideas from education professionals, designers, researchers, and people or organizations in other fields. Ninety-day cycles were originally developed by Procter & Gamble based on the recognition that lots of important innovations were happening outside the company. The challenge was to “move the company’s attitude from resistance to innovations ‘not invented here’ to enthusiasm for those ‘proudly found elsewhere’” (Huston & Sakkab, 2006, p. 60). IHI adapted P&G’s strategy and made it their main approach to research and development. A very different innovation strategy is the *Carnegie Alpha Lab Research Network*. The lab’s goal is to engage academic researchers from diverse fields in helping to improve community college students’ success in developmental math. By providing a structure through which researchers can work on problems and priorities set by the Pathways, the Alpha Labs produce cutting edge research that deepen understanding of problems and test theory-based solutions. The hub facilitates relationships with Pathways colleges, provides access to Pathways data, helps identify funding sources, assists in research grant writing, and provides forums for sharing research findings.

Lastly, NICs require a *culture that embraces a collaborative science of improvement*. This culture includes contextual elements and the broad social surround necessary for a sustainable NIC. It supports the development of professionals committed to collaborative inquiry around a shared problem. Faculty need to see themselves, and be seen by others, as reflective practitioners engaged in improvement and committed to working with other network members in trusting relationships around shared problems of practice in developmental math. The NIC culture must also provide participants with valued psychic incentives to sustain membership.

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