

Information Infrastructure System Deepening the Framework, Developing the Warrant through Research

Developing the initial conceptual framework has been a collective priority for the IIS team. Now we are working to deepen this conceptualization and to develop its empirical warrant through a combination of participatory observations during design processes and structured field studies as new tools and social practices are introduced into school sites.

Different Questions and Methods for Alpha Versus Beta R and D Phases

During the alpha phase, we typically engage in multiple cycles of co-design and redesign with school staff. From a research and evaluation perspective, our key focus during alpha stage work is to thoroughly document the rationale for why specific tools and social practices have been designed as they are. This includes considering: the ways the tools and social practices bring into focus and support practitioners in addressing problems of practice; the ways the tools and social practices meet the differing needs and levels of expertise of tool users; and the influences of features of the organization on the design of the tools and social practices.

As is our customary research methodology during the alpha phase where we are actively working in a small number of schools, we rely heavily on the observing participant field notes from our design research staff. We also engage in some limited additional data collection such as interviews and field observations, and where appropriate, think aloud protocols to guide our alpha testing. In addition, we track and analyze how (if) teachers and students actually use the new tools provided and whether this use appears to result in any changes in efficiency or productivity (see discussion of activity-level outcomes below). Taken together, this evidence allows us to develop detailed principle-based accounts of each technology and its use. These accounts are an essential support for our subsequent efforts to take IIS initiatives to a larger scale.¹ They create affordances for others to learn about the “why” as well as the “how” of an innovation and offer a source of guidance for successful tool and process adaptation to other local contexts.

In contrast, beta field trials for new IIS tools and social practices will typically occur in a larger number of school sites which may spread over a wider geographic area. From a design perspective, our attention shifts more toward concerns about the possible adaptations required for effective IIS use in different kinds of school contexts. Developing a better understanding of this context specificity, along with a stronger evidence base about project efficacy, represent the primary research and evaluation objectives for this project phase.

For these beta investigations, we expect to employ a more structured field design, similar to the IES study of PDS2 that we have initiated. We will likely use some combination of structured interviews, surveys, work logs and/or observation protocols, use-data generated by IIS tools, along with sociometric information to assess student and teacher

¹ This work promises to advance a theory of travel for complex innovations of the type being sought by the IIS. Principled accounts of technology and its use represent one key resource for travel along with: the tools, materials and procedures we design; the expert human resources developed through this work in alpha and beta phase school sites who can in turn help others learn how to engage in similar work; and a social infrastructure of academic, clinical and commercial expertise that can sustain social learning around these endeavors into the future.

use, context conditions affecting this use, and how core features of context may in turn be transformed (see discussion below on organizational-level outcomes) as a result of our initiatives. This would also be accompanied by either a quasi-experimental value-added design, or possibly a randomized trial where sensible and feasible, to examine the changing impact over time on teachers' beliefs and practice (see discussion of individual-level outcomes below) and student learning.²

An Integrated Focus on School Work and the Context in Which It Occurs

During both the alpha and beta phases, our activity theory framework suggests inquiries from two distinct perspectives. First, we consider the specific school “problems of practice” which new tools and social practices are being designed to mediate. The “problems of practice” perspective focuses our attention on the introduction of each new tool and any new social practice immediately connected to that tool. We look for possible changes in work activity and individual-level outcomes and explore why (or why not) these changes are occurring.

Second, we consider the broader school context in which this work activity is embedded and which also represent a primary change objective for the IIS project. The organizational context studies begin with an analysis of the base state of the school organization; how its general features may influence the design and “take up” of new tools and social practices; and how our multiple innovations may consolidate over time to affect how individuals' perceive and conduct their work and to reshape fundamental features of the school's organization.

In this research tandem, we are in essence examining the school's activity system, both from the “top down” of tool-level design and intervention, and from the “bottom up” of a school's social practices and the organizational context in which the IIS designs are embedded.

A Multi-level Outcome Framework

This conceptualization naturally leads us to organize our work around three broad categories of outcomes:

- Work activity changes as a result of introducing new tools and social practices;
- Individual-level outcomes where the beliefs, perceived self-interests and competencies of school staff may be reshaped over time through multiple IIS initiatives; and
- Organizational-level outcomes that represent the broader aims of our work.

The discussion below derives directly from the conceptual framework. All of our work to date has focused on how technology might advance instructional improvement through mediating the work of adults.

² We have just begun to develop our first data collection protocol of this sort for a 20 school randomized efficacy trial of the PDS2 system to begin in 2005. As we engage in the subsequent beta trials, proposed here, we will look to employ common data protocols, wherever appropriate, across these multiple trials.

Activity-level outcomes. This class of outcomes is directly tied to the specific work problems that we seek to assist with new tools and social practices. For each work activity in which we intervene, a common set of question can be asked:

- Is there any evidence that our new tools and social practices are being used?
- Have any efficiencies been introduced into these tasks?
- Has new activity been introduced that previously did not exist?
- Is there any evidence that individuals in the corresponding staff role are now more reflective in addressing this particular problem of practice?³

From a research perspective, each of these represents a relevant question about a possible direct causal effect of a planned intervention into a specific activity segment. By maintaining a common outcome specification across our “tool-oriented” research studies, we also afford possibilities for post-hoc “meta-analyses” of why changes may occur in some situations but not others.

Individual-level outcomes. The IIS consists of multiple interventions into a school’s activity system. Collectively, these interventions may effect changes in teachers, including their:

- Attitudes and beliefs about students’ academic capabilities and appropriate aims for instruction, and orientation toward innovation especially the utility of adding new technologies to their practice;
- Conceptions of their role responsibilities including: attitudes and beliefs about the appropriate social organization of their work, the development of norms about professional responsibilities for continuous learning, maintenance of a shared professional practice, and personal accountability for students’ academic progress; and
- Professional expertise in technology use, in the specific aspects of instruction being mediated by new IIS technologies, and more generally in their analytic capacity to use data on student learning to reflect, plan and evaluate instruction.

We note that this class of outcomes is germane for both the tool-oriented and organization-oriented inquires discussed above.

Organizational-level outcomes. Achieving more ambitious instruction for every student entails fundamental changes in the organization and operation of schools. Specifically, the IIS project seeks to promote the following organizational outcomes:

³ It seems plausible that individuals might become more reflective as a cumulative result of the various innovations introduced into their schools. It is also plausible, in fact quite likely, that they may become more reflective about certain problems of practice (e.g. those that we are intentionally mediating), while remaining unreflective in other regards. This suggests that we examine, at least initially, the changing reflectivity that may be occurring at the activity/task level, leaving open the question as to whether this eventually generalizes to a broader individual-level change in disposition toward one’s work.

- A shared professional language for describing students intellectual development (e.g. as emergent readers and writers) and for guiding instructional decision making aimed at advancing this learning;
- Enhanced communication and work coordination across the school context;
- Increased internal accountability for the overall progress of students and more informed decisions about how to accelerate this progress; and
- Emergence of a school-based professional community where both critical dialogue about programmatic improvement and social support/pressure for expertise development is normative.

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