

The Role of Design in Research: The Integrative Learning Design Framework

by Brenda Bannan-Ritland

In this article, a general model is proposed for design research in education that grows out of the author's research and work in related design fields. The model emphasizes the stage sensitivity of (a) research questions, (b) data and methods, and (c) the need for researchers to design artifacts, processes, and analyses at earlier stages in their research that can then be profitably used (perhaps by different researchers) in later stages.

In psychological research, the juxtaposition of the words *design* and *experimentation* usually connotes efforts to construct a well-defined experimental study. Since the early 1990s in educational research, however, the use of the word *design* has taken on a different meaning and assumed center stage in emerging forms of educational research labeled by some as *design experiments* or *design research*. Design and related processes, informed by Simon's (1996) notions of design and engineering perspectives, are now at the forefront of research efforts constructing persuasive narratives involving processes of iteration, feedback loops, and other characteristics of the study of complex educational systems (Brown, 1992; Cobb, Confrey, diSessa, Lehrer, & Schauble, this issue; Collins, 1999; Design-Based Research Collective, this issue; Kelly & Lesh, 2000).

Design studies involve a pronounced emphasis on the narrative report of the complex interactions and feedback cycles that can significantly blur the roles of researchers, teachers, curriculum developers, instructional designers, and assessment experts (Kelly & Lesh, 2000). Thus, some educational researchers are raising significant questions about the appropriate methods and processes to use in complex, naturalistic settings. How should we systematically create, test, and disseminate teaching and learning interventions that will have maximum impact on practice and will contribute significantly to theory? More globally, can we determine which specific research methodologies or combinations of methods are most appropriate to particular phases of the emerging model of design research?

There is a need for comprehensive models to guide research (both design and more experimental genres) from initial conceptualization to diffusion and adoption. I argue that it may be productive to consider a program of research as a design event (i.e., to articulate design research processes that view a well-crafted single study as part of an entire scope of work from original idea to diffusion of results).

Characteristics and Implications of the Integrative Learning Design Framework

I propose an integrative learning design (ILD) framework (see Figure 1) that attempts to provide a comprehensive, yet flexible, guiding framework that positions design research as a socially constructed, contextualized process for producing educationally effective interventions with a high likelihood of being used in practice. This framework attempts to move past isolated, individual efforts of design research by articulating a logically ordered, but dynamic frame that considers both field studies and experimental research methodologies in advancing the systemic impact of research across a variety of domains and social settings.

The goal of the ILD framework is not only to construct propositions about learning and teaching but also to engineer and construct effective learning environments (using software and other artifacts) that allow teachers and learners to make these propositions actionable (see Toulmin, 2001). Thus, the ILD framework may provide a broad context within which to map the design-based research processes discussed by Cobb et al. (this issue) and the Design-Based Research Collective (this issue).

The ILD framework draws from traditions of instructional design (Dick & Carey, 1990), product design (Ulrich & Eppinger, 2000), usage-centered design (Constantine & Lockwood, 1999), and diffusion of innovations (Rogers, 1995), as well as established educational research methodologies (Isaac & Michael, 1990). ILD strives to combine the creativity of design communities with appropriate adherence to standards of quantitative and qualitative methods in education. It is important to note that the ILD process is not intended to be a description of a single study in which an intervention is designed in a relatively short space of time and then tested and disseminated. Rather, it is meant to provide a program-level perspective.

Extending the stages of Ulrich and Eppinger (2000) and drawing upon other design fields, the broad phases of the ILD framework are (a) Informed Exploration, (b) Enactment, (c) Evaluation: Local Impact, and (d) Evaluation: Broader Impact. Each of these stages will be described and illustrated with an example from my work in the LiteracyAccess Online (LAO) project. LAO is designed to help teachers, tutors, and parents (acting as literacy facilitators) to use Web-based technology to foster collaborative reading processes with children, particularly those with disabilities (Bannan-Ritland, Egerton, Page, & Behrmann, 2000; Bannan-Ritland, 2002; Bannan-Ritland, Crook, & Korjus, 2002).

The Informed Exploration Phase of ILD

From the outset, and pervading all four phases of ILD, is a concern with identifying and satisfying the needs of the intended

users so that the mature innovation is successfully adopted and used to support its learning goals. The first phase of ILD, therefore, is rooted in essential research steps of problem identification, literature survey, and problem definition. To this foundation, the ILD framework adds (a) a needs analysis activity from the field of instructional system design and innovation development studies and (b) a research focus on audience characterization from the field of usage-centered design (see Figure 1).

Illustration From LAO. The research objective of the LAO study is to simultaneously investigate, describe, and support the activities that occur as literacy facilitators and children engage in reading processes. Our interdisciplinary research team consisted of educational researchers; teachers; graduate students; experts in literacy, special education, and assistive technology; as well as parent members of an advocacy group for children with disabilities. The team carried out a traditional literature review but supplemented it with both documentation of the target audience and stakeholder perceptions, and a benchmarking of related products. Activities at this stage were informed not only by the views of experts, teachers, and parents but also by observations of children and facilitators in both classroom and home envi-

ronments. This activity revealed many plausible paths for design research.

The consensus direction for the research grew from the observation that although literacy facilitators play a crucial role, they require easy access to powerful literacy supports to make their reading strategies effective (see Wittrock, 1998; Wasik, 1998; National Reading Panel, 2000). As a result, we abandoned an early design for a didactic, tutorial, child-focused intervention to move toward a collaborative, story-based reading support system that provided embedded metacognitive strategies for both the literacy facilitator and the child.

When the rough outlines for an intervention were apparent, we focused the efforts of the design team by creating a composite depiction—a sort of role model (Constantine & Lockwood, 1999) or persona (Cooper, 1999) that characterized the end users. To inform this composite, we characterized features such as the knowledge and use of reading and writing strategies; computer skills of the children (fourth- through eighth-grade children with and without disabilities); the facilitator's (parent, tutor, sibling) relationship with the child; and the child's physical, mental, or learning disabilities. This composite was used to calibrate the development of the software environment to the identified needs of

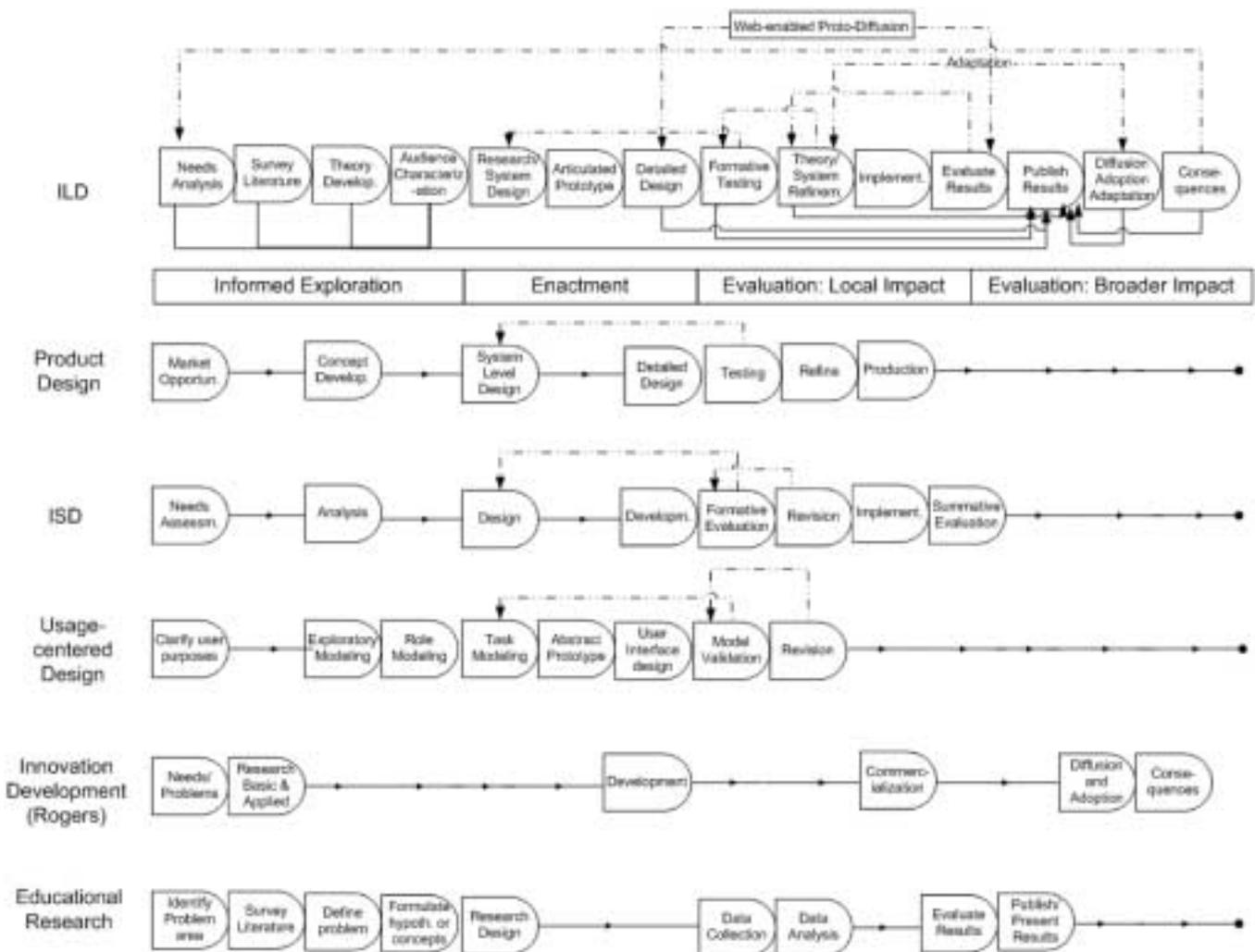


FIGURE 1. Merging of design and research processes into the integrative learning design framework.

the users. In addition, we produced a narrative report and Web repository of the processes of the Exploration phase: (a) for archival purposes, (b) to support team and user communication, (c) to act as a reference for future stages of the design, (d) to inform later replications of the studies, and (e) to provide future adopters with the “tacit design knowledge” accompanying the innovation.

The Enactment Phase of ILD

The ILD framework views an intervention as a socially constructed object that must be systematically articulated and revised over a number of cycles rather than as a standard “treatment” intended to test hypotheses. Thus, the Enactment phase is comprised of initial intervention design, prototype articulation, and the subsequent development of a more fully detailed intervention. Development in this phase is primarily influenced by evaluations conducted on the local impact of the intervention. Nonetheless, when early prototypes are posted on the Web (as with LAO), the Enactment phase may also be influenced by feedback by unsolicited users of the intervention providing ongoing real-world input on design and development. This phenomenon (not seen in proprietary design environments such as business) is described as “Web-enabled proto-diffusion” in ILD (see Figure 1). The Enactment phase may last for a considerable period of time and involve multiple design cycles.

Illustration From LAO. The theoretical design of the LAO learning environment was translated into an articulated prototype on paper according to procedures adapted from usage-centered design (Constantine & Lockwood, 1999). This draft representation allowed facilitators, teachers, an expert panel, and researchers opportunities for input and co-construction of LAO prior to the more time-intensive computer-based production of the learning environment.

From this process, flowcharts, technical specifications, and storyboards were produced leading to the creation of a Web-based prototype. Qualitative and quantitative techniques employed at this phase included designer logs posted on the project website, expert panel reviews of the design, and documented reviews of the design by content experts, audience members, and the research team. Over the 4 years of LAO, approximately 100 unanticipated users have discovered the website and contributed to our thinking during the Enactment and Evaluation phases.

The Evaluation Phase: Local Impact

In the ILD framework, evaluation is a two-stage phenomenon. The goal of the first stage is to evaluate the local impact of the intervention: How well does the designed intervention satisfy its clients (in the case of LAO these included teachers, parents, literacy facilitators, and children)? The goal of second stage is to

look at issues of ecological validity and successful dissemination and adoption in a broader context and to a broader audience.

At the Evaluation: Local Impact stage, data collection and analysis are an iterative process in which formative evaluation of the intervention interacts with local theory development during an extended implementation phase including (at maturity) more summative evaluation of the study’s results and products (for a more comprehensive discussion, see Design-Based Research Collective, this issue). Note that data collected in this phase may lead to substantial changes in the designed intervention (necessitating, in some cases, revisiting the Enactment phase). Further, data from unsolicited users of the (more mature) prototype (via the Web) may continue to inform design decisions.

Illustration From LAO. When a prototype was in place, formative testing commenced and illustrated the highly iterative nature of the Evaluation phase as it informed and refined both our theories and redesign efforts. The complex interactions between facilitators and children that can occur in multiple settings informed

the series of studies in LAO: (a) parent-child dyads in an informal setting with extensive involvement by researchers, (b) parent-child dyads in a structured workshop experience supported by researchers, and (c) preservice teacher dyads in a field trial closely modeling authentic conditions. These studies attempted to closely mimic the tasks that would be embedded in LAO. Data-gathering techniques across these studies included observations, interviews, child and parent journal entries, videotaped use of the system, and pre- and post-online surveys (Bannan-Ritland et al., 2000; Jeffs, 2000). This multitiered, multimethod eval-

uation scheme informed changes in theoretical conjectures and research design as well as LAO redesign. Among the findings were the following: (a) parent literacy facilitators developed awareness and skill in implementing reading activities and identified supports for their child in a structured setting; (b) children showed improvement in literacy skills using technology-based support when participating in a guided workshop environment; and (c) preservice teachers felt that the strategies and activities embedded in the LAO environment facilitated children’s comprehension, motivation, and interest when working with them in this environment.

The Evaluation Phase: Broader Impact

The ILD framework extends the typical “dissemination” phase of educational research in which publication or presentation of findings is sometimes seen as a closure event. Drawing instead from the work of Rogers (1995; Zaritsky, Kelly, Flowers, Rogers, & O’Neill, this issue), ILD directs attention not only at publication but also at concerns related to the adoption (and adaptation) of researched practices and interventions. The framework also actively

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considers the consequences of the use of the products of the research. For example, Brown (1992) warned of the possible “lethal mutations” of research findings, which could end up impacting broader audiences in unpredictable and perhaps undesirable ways. However, a teacher or student might find a more creative and powerful way to use an intervention (a productive mutation). Data from dissemination, diffusion, adoption, adaptation, and consequences are considered important not only for the current design or redesign study but also for the design of a program of work that might span a decade or more.

Illustration From LAO. Although the LAO research has not progressed fully through this stage, initial explorations in this area have yielded some insights into the dissemination process. More rigorous evaluations using LAO are underway that are increasing the number of participants and varying contexts. These studies involve detailed tracking of computer-based activities of dyads in school and home settings, assessment of facilitator and child use of metacognitive strategies prior to using LAO, and pre- and post-comprehension measures after several weeks of using the system. As noted earlier, LAO as a Web-based learning environment affords the opportunity to publish working prototypes on-line for early adopter use. We have tracked over 100 early adopters who located the LAO site on their own (as part of the aforementioned Web-based proto-diffusion). We plan to incorporate more sophisticated computer-based data collection and analysis techniques such as data mining into later versions of LAO and in future projects. Given the iterative nature of this program of research and the emerging needs of the teachers, students, and literacy facilitators that will use LAO, we expect that LAO design research will not terminate with diffusion but will result in a consequences feedback loop (both positive and negative, expected and unexpected)—yielding new theoretical and applied questions, and prompting the entire process once again (for us and, we hope, other researchers).

Conclusion: Limitations and Potential of ILD Framework

This article describes an attempt to derive from my own design research studies in technology and literacy a metamodel melding the methods of a number of traditions that view design processes as central to their efforts creating new materials and new knowledge. These traditions may be seen as operating in Pasteur’s quadrant (Stokes, 1997). The proposed model takes no sides on the relative merits of “quantitative versus qualitative” methods; rather, it draws upon qualitative and quantitative techniques in a stage-sensitive manner, leaving the judgment of relative merits up to the interdisciplinary team members.

Shavelson, Phillips, Towne, and Feuer (this issue) suggest that findings from design studies are suspect if randomized clinical trials are not used. I would like to suggest that the ILD framework considers multiple (and phase specific) data streams with the primary goal being not global warranted propositions, but the creation of products, artifacts, or processes that leverage learning and teaching by making insights usable, actionable, and adoptable. The question becomes not simply one of warrant abstractly, but warrant for whom and for what purposes? I recognize, of course, that the National Research Council (2002) report did not specifically address issues of the use of educational research.

I conclude with a number of methodological questions that flow from the general ILD model. Assuming, for argument’s sake, the validity of the proposed phases, what is an appropriate and powerful balance of the Exploration, Enactment, Local Impact, and Broader Impact phases for educational research questions, particularly as they might apply to a program of work and not just a single study? For which questions are the approaches or methodologies in each of the phases most useful (see Rubin, 1994)? For example, where in this framework might randomized field trials be appropriate (e.g., Mosteller & Boruch, 2002)? How should educational research resources be allocated so as to successfully move a promising innovation toward widespread adoption, and how should the processes of adoption be viewed as a research object? Should educational research be expected to follow such a progression at all, or can varieties of educational research be self-justified within the stages proposed?

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