

## Commentary: The Growing Utilization of Design-Based Research

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Dr. Roblyer's (2005) excellent overview of educational technology research makes a compelling case for improving the manner in which research on educational technology is conducted. I commend CITE Journal for its initiative in publishing and deconstructing a series of exemplary studies that illustrate best practices in education research. This commentary is intended to extend and deepen Roblyer's very brief discussion of one particular type of research—studies of technology-based instructional designs—that she describes as “almost non-existent.” In fact, scholars are publishing a growing body of high quality, design-based research studies that address many of the weaknesses of typical scholarship in educational technology Roblyer highlighted.

### What Is Design-Based Research?

Design-based research (DBR) is a relatively new methodological strategy for studying a wide range of designs, including technology-based instructional designs. Collins, Joseph, and Bielaczyc (2004) defined DBR thus:

Design experiments bring together two critical pieces in order to guide us to better educational refinement: a design focus and assessment of critical design elements. Ethnography provides qualitative methods for looking carefully at how a design plays out in practice, and how social and contextual variables interact with cognitive variables. Large-scale studies provide quantitative methods for evaluating the effects of independent variables on the dependent variables. Design experiments are contextualized in educational settings, but with a focus on generalizing from those settings to guide the design process. They fill a niche in the array of experimental methods that is needed to improve educational practices.

Recently, both the special issue on DBR of *The Journal of the Learning Sciences* (Volume 13, No 1, 2004) and the special DBR issue of *Educational Researcher* (Vol. 32, No. 1, 2003) provided detailed, research-oriented expositions of this methodology's theoretical, conceptual, and analytic foundations. In contrast, a special issue of *Educational Technology* (Volume 45, No. 1, 2005) focused on more applied perspectives about DBR, illustrating these with case studies of exemplary work using this method. The reader is referred to those sources for more detailed definitions of DBR and examples of exemplary DBR studies in educational technology.

### How Does DBR Address the Issues Roblyer Raises?

Design-based research methodology intrinsically incorporates many of the features Roblyer asserts are lacking in typical educational technology scholarship.

### **Significance for Practice and Implications for Theory**

Numerous researchers, practitioners, and policy makers have criticized many of the findings from educational research as having little impact on practice, or even on the evolution of theory (Haertel & Means, 2003; Lagemann, 2002). In contrast, as Stokes (1997) described, DBR resembles the scholarly strategy chosen by the scientist Pasteur, in which investigation of difficult, applied, practice-driven questions demands and fosters studies of fundamental theoretical issues. As one illustration, the research my colleagues and I are conducting on multi-user virtual environments (Nelson, Ketelhut, Clarke, Bowman, & Dede, 2005) tests the efficacy of three alternative pedagogical strategies based on different theories about learning: guided social constructivism, expert mentoring and coaching, and legitimate peripheral participation in communities of practice. We are examining which of these pedagogies works best for various types of content and skills, as well as for different kinds of learners.

### **Beyond a Gulf Between Quantitative and Qualitative Methods**

Roblyer depicts quantitative methods as appropriate for the generalizability of an experimental intervention across sites, while qualitative methods are portrayed as useful for studying its impact at a single site. Design-based research takes a more nuanced, mixed-methods view of quantitative and qualitative analytics. Many DBR studies utilize a form of “interventionist ethnography,” in which research studies perturb a range of typical learning settings by introducing evocative, theory-influenced designs, then use both qualitative and quantitative analytics to draw out implications for new theories of teaching, learning, and schooling. For example, Yasmin Kafai (2005) is using DBR to evaluate and evolve a pedagogical approach called “classroom as living laboratory” by keeping several variables constant (such as the teacher, pedagogy, and students) while varying key aspects, such as collaborative arrangements. This study involves a rich mixture of quantitative and qualitative analytics to elucidate implications for design, theory, practice, and policy.

### **Improving Scalability and Sustainability Via Sophisticated Implementation**

Another key way in which DBR differs from both conventional design and traditional research is its emphasis on adapting a design to its local context, a vital attribute for scaling up an innovation successful in one place to many other venues with dissimilar characteristics (Dede, in press). In making judgments about the promise of an intervention, differentiating its design from its “conditions for success” is important. The effective use of antibiotics illustrates the concept of “conditions for success”: Antibiotics are a powerful “design,” but worshipping the vial that holds them or rubbing the ground-up pills all over one’s body or taking all the pills at once are ineffective strategies for usage – only administering pills at specified intervals works as an implementation strategy. A huge challenge we face in education, and one of the reasons our field makes slower progress than venues like medicine, is the complexity of conditions for success required in effective interventions; nothing powerful in facilitating learning is as simple as an inoculation in medicine.

Design-based research findings typically show substantial influence of contextual variables in shaping the desirability, practicality, and effectiveness of designs. For example, studies of educational technology frequently depict “conditions for success” challenges related to teacher professional development, a common issue in many types of educational interventions. Resolving implementation problems such as this presents choices about alternative approaches to the iterative evolution of a design. In this particular case, alternative strategies include changing the design so that the intervention

is more “teacher-proof,” expanding the design so that extensive teacher professional development is now part of the “treatment,” or abandoning the design as unpromising because its effective use requires a level of knowledge and skill likely unattainable in the typical teaching population for the foreseeable future.

This is not an easy dilemma to resolve and illustrates the ways that DBR, in contrast to many types of conventional research, intrinsically confronts scalability issues of great interest to practitioners and policymakers. For example, with NSF funding my colleagues and I are currently studying the feasibility and potential value of a “scalability index” that would provide a quantitative measure along different contextual dimensions on the extent to which the effectiveness of a technology-based intervention would be eroded by shortfalls from ideal conditions in a particular implementation context.

### **Conclusion**

I applaud CITE Journal’s initiative for seeking to improve typical research on educational technology and Roblyer’s thoughtful conceptual framework for accomplishing this. Extending that framework and the exemplary studies deconstructed to include the growing body of scholarship using design-based research methodologies would strengthen this effort.

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