CHAPTER 8

Researcher–Practitioner Collaboration in Educational Design Research
Processes, Roles, Values, and Expectations

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The learning sciences emerged in the early 1990s, at a time when many scientists worldwide considered that basic and applied research were mutually exclusive endeavors. In the fields of learning and instruction, those concerned with basic research typically conducted controlled laboratory experiments, often using undergraduates as human subjects. It was usually a very different group of researchers who worked in real schools and classrooms to inform the development of curricula and resources that would facilitate teaching and learning. Gradually, both basic and applied researchers experienced frustration with the shortcomings of such isolation in their work to improve teaching, learning, and instructional resources.

From their own perspectives, each group began calling for integration of fundamental and applied research. Those who developed curricula and instructional resources led the way from the applied camp, citing the need for empirically derived principles to underpin development. At the same time, the cognitive scientists were those who strongly advocated for change from the basic research tradition. They were especially concerned with finding ways to derive empirical insights that were ecologically valid, and thus had the potential to inform everyday teaching and learning practices. They did so boldly, by defining a new field: the Learning Sciences (LS).

From the beginning, learning scientists were centrally concerned with bridging the research–practice gap, and having an impact in schools (Kolodner, 1991, editorial introduction to first issue of the *Journal of the Learning Sciences* [*JLS*]). The desire to contribute to practice positioned LS in stark contrast with the field of Cognition & Instruction (represented by the journal *Cognition and Instruction*). At the same time, the desire to ground technological developments in cognitive research distinguished LS from the field of instructional technology.

Starting with seminal articles by Brown (1992) and Collins (1992), learning scientists have frequently pointed toward integrated research and design cycles as a promising approach for studies that are methodologically robust *and* yield relevant knowledge that can be put to use in real-world settings. These arguments, together with those from curriculum and instruction experts in favor of scientifically underpinned design practices, have given rise to a wave of educational design research, especially in the last decade (Anderson & Shattuck, 2012).

The term educational design research refers to a family of approaches that connect basic and applied educational research in, on and/or through design. This includes design experiments, formative research, development research, design-based research and design-based implementation research. These terms are not interchangeable and some experts have gone to lengths to describe key differences (Reinking & Bradley, 2008; Penuel et al., 2011). But as discussed later in this chapter, educational design research refers to a wealth of studies that share certain defining characteristics. Namely, these studies are theoretically oriented, interventionist, collaborative, responsively grounded, and iterative (McKenney & Reeves, 2012).

Despite the fact that combining basic and applied goals has been referred to as an "astonishingly ambitious agenda" (Phillips & Dolle, 2006, p. 278), gradual but marked increase of attention for educational design research has been documented in LS over the last two decades and especially at present (Lee et al., this volume). Today, a focus on design is considered to be sine qua non for the learning scientist (Nathan et al., this volume).

Yet, as Phillips and Dolle (2006) point out, this family of research brings with it inherent challenges. This chapter discusses a particularly difficult one: researcher–practitioner collaboration during educational design research. This is often challenging because each comes from different communities of practice, occupies different organizational settings, and has different incentives and goals. This chapter focuses on the processes and convictions (concerning roles, values and expectations) that shape researcher-practitioner interaction. In so doing, it aims to prepare and support design researchers for shaping productive engagement throughout the changing phases of educational design research.

This chapter considers researcher–practitioner collaboration because it is essential to the design research enterprise (DBRC, 2003). At the same time, researcher–practitioner collaboration is notoriously complex (McKenney, Nieveen, & van den Akker, 2006), and requires more

skills than are typically taught in graduate research programs. This chapter speaks to sets of concerns, which shift as the research matures. For each main phase in educational design research, the following concerns are addressed: What are key processes in this phase of educational design research? Who does what in each process? What kinds of values serve the mission? What common issues can be anticipated? The chapter concludes with discussion of challenges related to facilitating researcher–practitioner collaboration in educational design research.

About Educational Design Research

What Is Educational Design Research?

Educational design research is a family of research approaches including Design-Based Research (DBRC, 2003), and Design-Based Implementation Research (Penuel et al., 2011), that share the dual aims of (1) deriving new knowledge through (2) the design and implementation of solutions to problems in educational practice. Though narrow conceptualizations of design research exist, in which researchers make the grand design, follow predominantly linear processes, and aim for closure and control (Engeström, 2011), educational design research involves intensive, long-term collaboration between researchers and practitioners; this is essential to developing sustained innovation in education (Bell, 2004). In educational design research, "… the iterative development of solutions to practical and complex educational problems also provides the context for empirical investigation, which yields theoretical understanding that can inform the work of others. Its goals and methods are rooted in, and not cleansed of, the complex variation of the real world" (Mckenney & Reeves, 2012, p. 7).

Educational design research is a genre, a family of approaches whose variation has been described in literature (Bell, 2004; McKenney & Reeves, 2013). This kind of research may stand on its own or be embedded in broader projects. For example, lesson study frequently requires cycles of design research to progressively hone an intervention while also building theory about how it works (Lewis, Perry, & Murata, 2006). Educational design research is not a methodology; it uses quantitative, qualitative, and/or mixed methods, and these often vary throughout the life cycle of a project.

Educational design research is more defined by its goals than its methods (Bereiter, 2002). That is, it is driven by the need to solve a real and

complex problem in practice (Bannan-Ritland, 2003). It is often used when problem solving is addressed through the design of an intervention (Plomp & Nieveen, 2009; van den Akker, 2002). The processes encourage active involvement of participants and use of their expertise in design (Barab et al., 2008). Empirical investigation is embedded in the development of the solutions and thereby provides the context for research (Cobb & Gravemeijer, 2008). The methods used during empirical investigation may be quantitative, qualitative or – possibly most common – mixed. The standards for rigor that are associated with qualitative and quantitative methods are no different when used in educational design research than in other forms of inquiry. The findings from the investigation inform the intervention while also yielding theoretical understanding that is of potential value to others (Reeves, 2011; Reinking & Bradley, 2008).

Why Use Educational Design Research?

The interest in bridging scientific goals with practical ones has grown more popular in recent years, but is not new. More than a century ago, John Dewey and Hugo Munsterberg called for a linking science that would bring the two together (McKenney & Reeves, 2013). In the early 1990s, experts in educational research and educational design articulated the need for modes of inquiry that connected research and design. As mentioned previously, learning scientists especially argued for ecologically valid studies. They pointed to the need for research that would yield knowledge about and relevant for functioning classrooms, as opposed to findings gained in (and applicable only to) artificial laboratory settings. Since then, the improved contributions to theoretical understanding have been celebrated: "By engaging in design on both a technical and a social level, we were able to arrive at valuable insights in how to foster computer-supported collaborative learning" (Hoadley, 2004, p. 210). Practical motives were championed by Plomp (1992), van den Akker (1999), and Walker (1992). These experts stressed the need for an empirical knowledge base that could robustly inform design, and increase the chances of rendering meaningful improvement on the ground. "In design-based research, practitioners and researchers work together to produce meaningful change in contexts of practice (e.g., classrooms, after-school programs, teacher on-line communities)" (DBRC, 2003, p. 6).

For these reasons, the use of educational design research has clearly grown in the last decade (Anderson & Shattuck, 2012). Proponents of this kind of research have noted that, to date, it has been used primarily in

settings where capacity is already present (Penuel et al., 2011). Yet increasingly, this kind of work is being conducted in extremely challenging contexts (Bakah, Voogt, & Pieters, 2012; Raval, McKenney & Pieters, 2014a). Because of the demonstrated potential to yield theoretical understanding and productive change, experts continue to advocate for this as an approach of choice toward fulfilling a socially responsible research agenda (Reeves, Herrington, & Oliver, 2005).

What Are Educational Design Research Outcomes?

The problems tackled through design research are typically real and complex, and the specific interventions created through this process vary greatly. The kinds of interventions developed include: programs, processes, products, and policies. For example, design research has yielded teacher professional development programs in developed (Dede et al., 2009) and developing (Raval, McKenney, & Pieters, 2014b) countries. This approach has also been used to derive domain-specific learning sequences (Gravemeijer & Cobb, 2006) as well as generic ones (Oliver & Herrington, 2003). Products created through design research include instructional materials, in print or online (e.g., Internet environments for science education [Linn, Davis, & Bell, 2004]) or frameworks to underpin them (Krajcik, McNeill, & Reiser, 2008). Finally, policies derived from educational design research have improved functioning in organizations, for example, by harmonizing individual and organizational objectives (Stokic, Correia, & Reimer, 2013); revised public policies have also improved synergies between specific public health and urban planning initiatives (Hoehner, Brennan, Brownson, Handy, & Killingsworth, 2003). For many projects, the ultimate outcomes (in addition to knowledge) are not the interventions, but what they engender such as student achievement gains at scale (e.g., Donovan, Snow, & Daro, 2014).

The theoretical understanding produced by educational design research can be used for various purposes, specifically to describe, explain, predict, or prescribe (McKenney & Reeves, 2012, 2013). Especially in earlier stages of design research, we often seek to understand the initial situation, for example by describing teacher beliefs or explaining how children reason. In more mature studies, we often seek understanding that can be used for normative purposes, such as predicting which problems are likely to crop up when implementing new standards or prescribing the kinds of support schools and universities need under certain circumstances (McKenney & Reeves, 2012).

What Does Educational Design Research Look Like?

According to Wang and Hannafin (2005), educational design research is pragmatic; grounded; interactive, iterative, and flexible; integrative; and contextual. It is pragmatic because it refines theory and practice, and because theory is judged on its ability to improve practice. It is grounded because it builds on both existing research and real-world investigation. The fact that designers collaborate with other stakeholders, through multiple cycles of design–development–implementation–redesign, with the intention to adjust course based on emerging insights is what makes this approach interactive, iterative, and flexible. The authors mention the integrative nature of design research because mixed methods are often used, specific methods tend to evolve along with the project, and yet rigor remains a core priority throughout. Finally, contextual refers to the fact that the studies are carried out in authentic (not laboratory) settings, and that contextual considerations which influence (re-)design are documented and used to inform subsequent steps.

While existing models and frameworks describe varying nuances of the educational design research process, most include the basic phases of analysis (studying the needs, context, and problem at hand); design (drafting and crafting interventions); and evaluation (formative and summative investigation). Design research inherently involves planning for and realizing implementation (of the designed intervention). And along the way, work is shaped through continuous interaction with practice (e.g., the children, teachers, principals, etc. involved).

It is not feasible to comprehensively represent educational design research in this chapter. However, Table 8.1 provides three examples from international literature, all of which embody the characteristics described earlier. That is, each: strives to develop an intervention and scientific understanding; uses iterative cycles of analysis, design, evaluation to feed the development of both; and takes place in authentic learning contexts, using mixed methods. At the same time, this set of examples illustrates variety in context, focus, and approach. To demonstrate that design research can be done well by doctoral students, the examples selected here are all PhD projects. Following the table, each study is briefly described, and references with additional informations are provided.

Vanderhoven (2014) describes a design study that sought to achieve three main objectives, one per each main phase. During the analysis phase, the objective was to formulate a state-of-the-art proposal with regard to the current educational situation related to online safety,

Table 8.1. *Three doctoral studies demonstrating educational design research variation*

	Vanderhoven (2014)	Raval (2010)	Oh (2011)
Problem	High school students unaware of risks and unsafe behavior using social network sites	Para-teachers lack of expertise for their rask of conducting remedial teaching	Graduate student collaboration in online learning course was superficial and unproductive.
Main focus	Reducing risk and changing unsafe behavior of high school students using social network sites	Para-teacher professional development for remedial education in Indian slums	To optimize collaborative group work and student learning in an online higher education learning environment
Intervention developed	An instructional package for use in regular high schools to raise awareness and change unsafe behavior	A regular way of working that features the plan–enact–reflect cycle	"E-learning Evaluation" course based on authentic tasks for online delivery
Knowledge created	Descriptive and explanatory portrayal of current habits; design principles for similar interventions	Design principles for initiating and sustaining the plan–enact–reflect cycle	Thirty design principles and associated strategies to enhance group work in online courses
Research methods used	• Observations • Document analysis • Focus group • Surveys • Pre-/posttest surveys	• Observations • Interviews • Focus groups • Document analysis • Learner pre-/posttests	• Participant observations • Questionnaires • Interviews • Three sequential case studies
Research scope	The researcher's salary and research expenses were funded by an external project.	During the four-year study, the researcher received a scholarship for travel, while the hosting organization paid her salary	This study lasted two years with no direct funding.

(*continued*)

Table 8.1 (*continued*)

	Vanderhoven (2014)	Raval (2010)	Oh (2011)
Primary practical contribution	The designed instructional package is being disseminated by the ministry of education to all high schools in Flanders.	The plan–enact–reflect approach was piloted with twelve teachers and later spread to hundreds of para-teachers within the organization	An online course design for a graduate level course based around authentic tasks was developed with substantial support for group work.

including a concrete and clear problem statement taking into account the needs of teenagers and educational stakeholders. During the design phase, the objective was to develop evidence-based educational materials that can be used in secondary education to fulfill the needs as defined by the research conducted in the analysis phase. Ultimately, the study aimed to derive design principles for use by practitioners, researchers, and developers when creating new educational materials for increasing risk awareness and changing unsafe behavior of teens using social network sites. Specific phases of the study are described in several conference contributions, book chapters and practitioner journals, as well as the following scientific journal articles:

- Analysis
  - Vanderhoven, E., Schellens, T., & Valcke, M. (2013). Exploring the usefulness of school education about risks on social network sites: A survey study. *Journal of Media Literacy Education*, 5(1), 285–294.
  - Vanderhoven E, Schellens T, Valcke M, Raes A (2014) How safe do teenagers behave on Facebook? An observational study. *PLoS ONE*, 9(8), e104036.
- Design and Evaluation
  - Vanderhoven, E., Schellens, T., & Valcke, M. (2014). Educating teens about the risks on social network sites: Useful or pointless? An intervention study in secondary education. *Comunicar*, 43, 123–132.
  - Vanderhoven, E., Schellens, T., & Valcke, M. (2015). How authentic should a learning context be? Using real and simulated profiles in a

classroom intervention to improve safety on social network sites. *The International Journal of Cyber Society and Education*, *8*(1), 1–18.
    - Vanderhoven, E., Schellens, T., Valcke, M. (in press). Changing unsafe behavior on social network sites: Collaborative learning vs. individual reflection. In M. Walrave, K. Ponnet, E. Vanderhoven, J. Haers, & B. Segaert (Eds), *Youth 2.0: Social media and adolescence – connecting, sharing and empowering.* Dordrecht: Springer.
    - Vanderhoven, E., Schellens, T., Valcke, M. (unpublished manuscript). Decreasing risky behavior on social network sites: The impact of parental involvement in secondary education interventions.
    - De Wolf, R., Vanderhoven, E., Berendt, B., Pierson, J., & Schellens, T. (unpublished manuscript). Self-reflection in privacy research on social network sites.
- Overall
    - Vanderhoven, E., Raes, A. & Schellens, T. (2015). Interpretation in the process of designing effective learning materials: A design-based research example. In P. Smeyers, D. Bridges, N. Burbules, & M. Griffiths (Eds.), *International handbook of interpretation in educational research methods* (2 vols.), pp. 1219–1237. Dordrecht: Springer.
    - Vanderhoven, E., Schellens, T., Vanderlinde, R., & Valcke, M. (unpublished manuscript). Developing educational materials about the risks on social network sites: A design-based research approach.

Although para-teachers make up a substantial portion of the world's educational work force, little empirical research has been conducted on their professional development. Raval (2010) describes a design study that gained insight into desirable characteristics of a professional development program for Indian para-teachers in urban slums. The research flanking the evolution of a para-teacher professional development program helped to (re)shape each cycle of implementation and to track lasting effects on organizational climate, teacher agency, and pupil learning. Specific phases of the study are described in several conference contributions and book chapters, as well as the following scientific journal articles:

- Analysis
    - Raval, H., McKenney, S., & Pieters, J. (2012). Contextual factors that foster or inhibit para-teacher professional development: The case of an Indian, non-governmental organization. *International Journal of Training and Development*, 16(1), 23–38.

- Design
  - Raval, H., McKenney, S. & Pieters, J. (2010). A conceptual model for supporting para-teacher learning in an Indian NGO. *Studies in Continuing Education*, 32(3), 217–234.
- Design and Evaluation
  - Raval, H., McKenney, S., & Pieters, J. (2011). Institutionalizing planning, enactment and reflection of daily lessons through appropriate organizational restructuring. *The Asia-Pacific Educational Researcher*, 20(3), 438–455.
  - Raval, H., McKenney, S., & Pieters, J. (2012). Supporting para-teachers by regularizing and strengthening planning, enactment and reflection of daily lessons. *Staff and Educational Development International*, 16(1), 5–21.
  - Raval, H., McKenney, S., & Pieters, J. (2014b). Remedial teaching in Indian under-resourced communities: Professional development of para-teachers. *International Journal of Educational Development*, 38, 87–93.
- Overall
  - Raval, H., McKenney, S., & Pieters, J. (2014a). Portraying the design research cycle: Professional development in Indian slums. *Zeitschrift für Berufs-und Wirtschaftspädagogiek*, 27, 177–196.

Oh (2011) reports the findings of a design study that pursued two primary goals: (1) optimizing collaborative group work in an online graduate level course focused on "E-Learning Evaluation"; and (2) developing a refined model of group work in online courses and identifying design principles for supporting online collaborative group work among adult learners. Further, this study documents how mixed methods were applied across several semester-length iterations of an online course. It yielded thirty distinct design principles for supporting group work by adults. Specific phases of the study are described in several conference contributions as well as:

- Design and Evaluation
  - Oh, E., Liu, Y., & Reeves, T. C. (2014). Supporting adult learners' authentic learning experience by optimizing collaborative group work in distance learning courses. In A. P. Mizell & A. A. Piña. (Eds.), *Real life distance education: Case studies in research and practice* (pp. 139–158). Charlotte, NC: Information Age Publishing.

- Oh, E., & Reeves, T. C. (2013). Collaborative group work in an online authentic Learning environment: An educational design research project. In T. Plomp & N. Nieveen, (Eds.). *Educational design research – Part B: Illustrative cases*. Enschede, NL: The Netherlands Institute for Curriculum Development (SLO). Retrieved from http://international.slo.nl/publications/edr/contents/c46/.

- Overall
  - Oh, E., & Reeves, T. (2010). The implications of the differences between design research and instructional systems design for educational technology researchers and practitioners. *Educational Media International*, 47(4), 263–275.

Researcher–Practitioner Interaction in Educational Design Research

About Researcher–Practitioner Interaction

Design study researchers address problems of practice, together with practitioners, to yield relevant and usable knowledge that can be put to use in developing solutions. Given that the research is set in authentic contexts, the findings stand to yield *usable knowledge* (Lagemann, 2002) for the immediate setting and beyond. Because practitioner voices help establish the focus, the outcomes are also likely to be relevant to researchers and practitioners (McKenney & Reeves, 2012). Moreover, because design research teams engage in the co-creation of knowledge, actual uptake and use of new insights is stimulated (Vanderlinde & van Braak, 2010). Although broader dissemination of knowledge may take place through more distributed channels, this type of work does represent a departure from translational research or research into practice (Donovan et al., 2014). The generation of ecologically valid, usable, and relevant knowledge can then, in turn, (better) ground the design and implementation of educational innovations (van den Akker, 1999). Situating research in everyday teaching and learning settings requires that researchers and practitioners collaborate. Taken seriously, this changes the agenda and the resulting products (Donovan et al., 2014). It is challenging not only because this brings differing perspectives and expertise to the group. Even ostensibly simple tasks, such as finding time to meet and establishing the infrastructure needed to support teamwork, is extremely difficult (Hall, 2001).

Many researchers now seek methods that invest more genuinely in practitioners (Wang & Hannafin, 2005). Yet this genre of inquiry requires that researchers adopt stances that are, for many, rather unfamiliar. For example, while researchers are used to guarding scientific rigor, framing work based on existing theory and research evidence, and ensuring methodological fit, the role of the designer also requires knowledge of design processes, intervention enactment, and the construction and use of enabling artifacts (e.g., teacher guides, learning technologies, or planning tools). Rather than remaining objective observers, design researchers commonly help to shape the environment through their engagement throughout the integrated research and development processes (Barab & Kirshner, 2001). Researchers are seen not as the source of answers but as responsive partners in improvement efforts (Donovan et al., 2014). According to McKenney and Reeves (2012), good design researchers are able to blend analytical and creative mindsets, shifting fluidly between rational, empirically driven reasoning and creative innovation that embraces opportunity as circumstances dictate. Although the "willingness and capacity to study locally-initiated innovations, to invest in repeated cycles of principled adaptation, and to accumulate and spread knowledge in ways that enable local adaptation and ownership" are crucial (Lewis et al., 2006, p. 10), they are also more rare than common. Creating capacity for change requires the ability to work across contexts, which needs relationships, trust, norms of interaction, and shared commitments (Donovan et al., 2014).

In educational design research, the engagement of researchers and practitioners can take various forms, and tends to shift over time. Based on a generic model for educational design research (McKenney & Reeves, 2012), the dotted circles in Figure 8.1 highlight continuous interaction with practice as an integral process in design research. The figure portrays the overall design research process as revolving around three core phases (analysis and exploration, design and construction, and evaluation and reflection), which are served by analytical and creative mindsets. Two main outcomes are shown: maturing intervention and theoretical understanding. The multiple arrows suggest cycles of iteration in a flexible process, as many different pathways could flow through the diagram. The invigorating yet challenging work of conducting design studies can be served by a priori understanding of research–practice interaction in educational design research. Therefore, with the aim of supporting productive design studies, the remainder of this chapter examines such interaction for each element in the model. Specifically, it discusses: key processes (what are we doing?); common roles (who does what?); core values (which

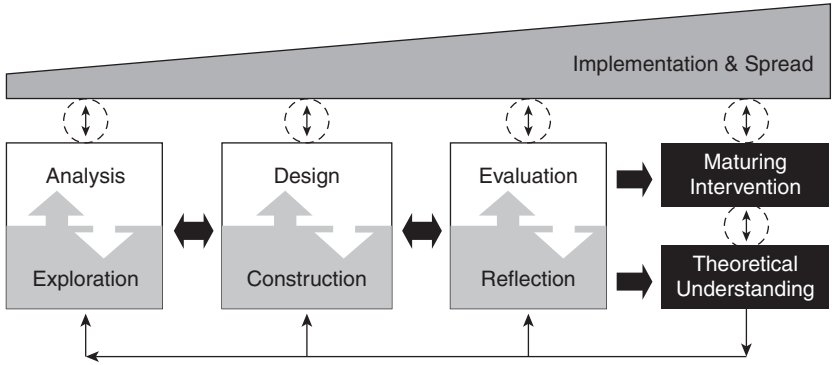

Figure 8.1. Circles highlight research practice interaction in educational design research. (Based on McKenney & Reeves, 2012).

convictions serve the mission?) and what to expect (common issues) with regard to analysis and exploration; design and construction; evaluation and reflection; and implementation and spread. Relevant considerations for the outputs (maturing intervention and theoretical understanding) are also given.

Analysis and Exploration

The main products resulting from this phase are practical and theoretical. From the practical perspective, this phase generates a clear understanding of the problem and its origins as well as specification of long-range goals. In addition, partial design requirements are determined by exploring the opportunities and boundary conditions present; and initial design propositions are generated based on contextual insights. From the theoretical perspective, this phase produces a descriptive and analytical understanding of the given class of problems, as manifested in this case within a particular context.

Key Processes

The analysis and exploration phase constitutes one empirical subcycle in the overall design research process. During *analysis*, in-house expertise is sought and a literature review is conducted to gain theoretical inputs that will shape understanding of the problem, context, and other relevant topics (e.g., subject matter content analysis or teacher professional

development strategies). The literature review is also important for developing a scientifically relevant angle for the study, where the problem in question can be seen as a particular instance of a research-worthy phenomenon. In addition, discussions are held with practitioners to shape a better understanding of the educational problem to be addressed, the target context, and stakeholder needs. As the understanding of the problem and setting begins to solidify, a more open-ended *exploration* takes place, where similar problems and their solutions are explored.

Common Roles

During analysis and exploration, practitioner involvement is geared primarily toward clarifying the problem and shaping understanding of constraints within which a design will have to operate. This includes anticipating how the design will align with the needs and wishes of practitioners and other stakeholders, as well as gaining a sense of important system factors related to the problem. Practitioners are considered owners of the problem(s) being investigated. They share their (emic) insights into key issues and causes, as well as sources of inspiration or concern (often from first- or second-hand experience). Even within practitioners, it is often the case that participants came from different subcultures; this implies that they bring varied views about the problems, how they are portrayed, and ways to more forward (Penuel, Coburn, & Gallagher, 2014). The role of researchers in the analysis and exploration phase is primarily to study the problem. Like detectives, they question if things are as they appear, why things are, and share sources of inspiration or concern (often from theory and research literature). Often, researchers coordinate the various activities during this phase.

Core Values

Activities in this phase are particularly insightful when researchers and practitioners value realism, critique, and open-mindedness. Realism means being grounded in the here and now. Critique refers to the rational exploration of problems, seeking to understand (and not avoid) pertinent issues, even sensitive ones. And open-mindedness relates to the willingness to explore or try on different perspectives or frames. Activities in this phase usually initiate longer term partnerships and are therefore served by open, bidirectional communication. Mutual respect is also important, so that researchers and practitioners have equal status. As such, the expertise

of both researchers and practitioners is actively solicited (Donovan et al., 2014). This is also visible through acknowledgment of mutual interests, if not curiosity about other roles or even desire to try them on. Penuel et al. (2014) refer to the work that connects lenses with values, interests, and beliefs of the groups to be mobilized as *frame alignment*, and how well they connect to stakeholder concerns is called *resonance*. Although these values are helpful for both parties, it is often the initiators job (usually researchers) to ensure that interactions are shaped accordingly.

Realistic Expectations

The analysis and exploration phase is critical to the overall study. It features inventorying expectations from research and practice perspectives. In the process, problems are framed in terms of diagnosis and prognosis, each facilitated by research knowledge. Determining the sources of problems and possibilities for addressing them is essential to being able to begin iterative design. Though challenging, local problems must be framed for relevance to a wide range of settings (Donovan et al., 2014). This often requires negotiations of what is desirable and feasible. For example, practitioners frequently decide on the focal problem, whereas researchers have ultimate authority in research design (Donovan et al., 2014). Although any researcher working in real-world settings makes choices about what to study (Joseph, 2004), the work of understanding (un)shared priorities, pressures, and concerns is particularly important in educational design research. It sets the stage for design, by aligning participant views of the problem definition (descriptive and explanatory), the long-range goal(s), key contextual considerations (e.g., boundary conditions), and initial ideas about design.

Design and Construction

The results of this phase from a practical perspective are obvious: the intervention is conceived of and assembled. From a theoretical perspective, the frameworks underpinning design as well as the justification for design decisions are articulated.

Key Processes

During design and construction, a coherent process is followed and documented to arrive at a (tentative) solution to the problem. Unlike the other

two main phases that follow empirical cycles based on a research chain of reasoning, the subcycle of design and construction resembles that of designing (not testing) a conceptual model. It involves rational, purposeful consideration of available knowledge, as well as puzzling over the relationships and arrangements of concepts that are both internally consistent and externally useful. During design, potential solutions to the problem are generated, explored, considered, and then mapped using a variety of techniques. In this stage, the core ideas underpinning the design – including their theoretical and practical grounding – are articulated, which enable the underlying design framework to be shared and critiqued. In addition, guidelines for actually building the solution are delineated. Construction refers to the process of taking design ideas and applying them to actually manufacture the solution. This generally takes place through a prototyping approach, where successive approximations of the desired solution are (re-)created.

Common Roles

During design and construction, practitioners can offer valuable ideas, serve as co-designers on a team, or even drive the endeavor. Having practitioners as co-designers is especially helpful, because they help develop the overall design team sense of empathy. This enables the team to anticipate how designs will play out in the classroom and the potential concerns teachers may have (Wang & Hannafin, 2005). Even if practitioners are not involved directly in design and construction, this work is informed by an implementation perspective – that is, the choices made reflect anticipation of the messy, varied realities of educational contexts. Four common roles in the design and construction phase are those of organizers (planning and management), consultants (expert opinions), designers (envisioning and planning the intervention), and developers (creating actual artifacts to be used). Table 8.2 depicts common (not necessarily recommended) roles for researcher and practitioner involvement during this phase.

Core Values

Activities in this phase are particularly productive and innovative when researchers and practitioners value the blend of analytical and creative mindsets (both are needed across educational design research, but particularly in this phase). The process is served when participants – from

Table 8.2. *Common roles for researcher and practitioner involvement during design and construction*

	Practitioners	Researchers
Organizers	Usually limited	Most often orchestrators
Consultants	Often	Sometimes
Designers	Sometimes	Often
Developers	Rarely	Rarely

the outset – value supporting design with research (Wang & Hannafin, 2005), while also considering the influence of school context and teacher epistemological beliefs and experiences in the design (Angeli & Valanides, 2005). The conviction that designs must rely on intrinsic motivators, local expertise, and existing budgets is productive for creating sustainable interventions. Activities in this phase are particularly served by skills in (facilitating) teamwork, communication, creativity, and orchestration.

Realistic Expectations

Design and construction is often a surprising and energizing phase in educational design research. This is because participation in creative processes can engender ownership. At the same time, teams negotiate their identities and habits. And gradually, participants see group ideas coming to life. This phase is also typically quite challenging to participants because this kind of work is new for most. As Donovan et al. (2014, p. 422) put it, "Those with interest and expertise in design are, for the most part, orphaned in school systems and research universities." The design orientation means that the researcher is intentionally aiming to intervene, which is quite different from objective goals that intend to understand the phenomenon in its own right (Barab & Kirshner, 2001). It can also be quite difficult to coordinate activities of research and development (Penuel et al., 2011). This is difficult in any case, but also because the theories and findings that emerge from design research help shape not only the evolving design, but also the evolving research apparatus (Joseph, 2004). Eventually the work conducted in this phase provides the foundation for evaluation of designs (products and prototypes describing ideas) and constructed interventions (products and prototypes embodying ideas).

Evaluation and Reflection

From a practical perspective, the activities in this phase lead to ideas for redesign and conclusions about a particular intervention. From a theoretical perspective, the knowledge produced by the combined activities in this phase contributes to a broader theoretical understanding concerning either the type of intervention being studied (e.g., design principles for educative multiuser virtual environments) or phenomena engendered by the intervention (e.g., a theory of teacher learning).

Key Processes

Like the analysis and exploration phase, the evaluation and reflection phase constitutes an empirical subcycle. The term evaluation is used in a broad sense, to refer to the empirical testing that is done with a design (that is, the – not yet applied – frameworks that underpin the intervention) or a constructed intervention (that is, the embodiments of design in initial, partial or final form). Depending on various factors including long- or short-term goals, the type of intervention, and a project's stage of development, *evaluation* may study soundness, feasibility, local viability, broader institutionalization, immediate effectiveness, and long-term impact. Early evaluation may be conducted through developer screening or expert appraisal, whereas more mature interventions are evaluated through pilots (field testing under near-to-normal circumstances) and tryouts (field testing under fully normal circumstances). *Reflection* involves active and thoughtful consideration of what has come together in research and development (including theoretical inputs, empirical findings, and subjective reactions) with the aim of producing theoretical understanding. The results of empirical findings as well as critical reflection are then used to accept, refine, or refute the conjectures, frameworks, or principles that are portrayed in design documents (e.g., design frameworks) or embodied in actual (prototypes of) interventions.

Common Roles

While early design work may be evaluated outside of the target setting, eventual testing in context is essential. Across various forms of evaluation (screening, expert appraisal, pilots, and tryouts), researchers and practitioners typically take on different roles. Practitioners tend to take on the

roles of expert, user, client, and stakeholder during field-testing. In contrast, researchers are more frequently data collectors or process facilitators. Other common groups roles during this phase include that of users (e.g., children); experts (e.g., subject matter, technology, professional development); stakeholders (e.g., parents, school board). While the descriptions above portray the most common roles, it should also be noted that practitioners are sometimes both respondents and researchers, as they may also facilitate processes or collect data. In fact, some projects strategically seek *boundary crossers* (e.g., researchers to teach or teachers who research) for certain activities (Penuel et al., 2014). As for designers, familiarization can help lesson the obtrusiveness of their presence in the learning environment (Wang & Hannafin, 2005).

Core Values

Wang and Hannafin (2005) argue that a paradigm shift is needed to share and extend conventional evaluation approaches. For example, the work of this phase is well served if value is placed not only on reasoning but also on empathy, especially for top-down and bottom-up analyses (deduction and induction). In addition, the process of association is especially helpful for supporting systematic reflection on findings and connections to phenomena that are relevant to, but outside of, the immediate research setting. Results from this phase may be particularly robust if participants prioritize tight alignment between goals and methods; transparent and well-justified frameworks for data analysis; and openness to the unforeseen.

Realistic Expectations

The evaluation and reflection phase is typically humbling and insightful. It teaches participants about what works; what fails; and, if we are lucky, why. It commonly engenders social and emotional reactions to designs, alongside more objective considerations. The results of evaluation begin to produce practical and scientific outcomes. From a practical perspective, recommendations are generated for (re-) design of the intervention and possibly also strategies through which it is implemented. From a scientific perspective, theoretical understanding is generated by answering research questions and, sometimes, exploring data in light of different paradigms. The use of multiple paradigms to help the effort at hand has been referred to as "theoretical pluralism" (Bell, 2004).

Implementation and Spread

As depicted in the generic model, each of the three main phases of research and development is approached from an implementation perspective; that is, from the mindset of working toward actual use. From the very start, real contextual opportunities and constraints are taken into consideration (cf. Hickey & Schafer, 2006). The involvement of educational professionals begins early, and this involvement generally increases over time. This can include many kinds of professionals whose work relates to educational practice, such as teachers, administrators, teacher educators, examination agencies, inspectorates, policymakers, and textbook publishers.

Key Processes

Regardless of the intervention's scale, the implementation process consists of three main phases: adoption (the choice to engage with the intervention), enactment (the intervention is actually used), and sustained maintenance (the intervention is continued even if support is not). Even on modest scales, the two main processes through which interventions and their ideas spread are dissemination and diffusion. Dissemination is more of a one-way broadcast of information (e.g., informational video, conference paper), whereas diffusion is the process through which interventions are pulled into practice from within (e.g., practitioner exchange, interactive demonstrations).

Common Roles

Common roles during implementation and spread, which may be taken on by practitioners or researchers, include those of implementer, facilitator, and/or program champion. The roles are served by individual and team capacity to initiate and support collaborative interaction, master details of local context, nurture relationships and good will, communicate effectively with various types of partners, and identify challenges to be addressed and opportunities to be pursued (Donovan et al., 2014). Knowledge of research and practice, as well as tools of persuasion, is particularly important to being able to fulfill these roles effectively.

Core Values

Core values that serve the work in this phase include the desire to make a difference or solve a real-world problem. This may be linked

to a *socially responsible research* agenda (Reeves et al., 2005). It may also be driven by an education professional's *sense of moral purpose* (Fullan, 2001). This process can also be supported when participants share the conviction that designed innovations can yield productive change. It is especially useful when those involved also feel self-effective and responsible for certain outcomes (such as pupil learning or educator professional growth).

Realistic Expectations

The processes of implementation and spread are rarely predictable. Strategies must evolve with actor needs and emerging insights about those needs. Blending push and pull mechanisms is typically important (especially for spread), as well as attending to factors that influence the rate of adoption (Zaritsky et al., 2003). It can be useful to remain mindful of the fact that change takes time – it is often characterized as a process, not an event. Because adaptations during implementation are inevitable, they must be supported during design and during implementation (DeBarger et al., 2014). The demand of the public and of school stakeholders for quick success often makes researchers uneasy (Penuel et al., 2011) and the instable contexts of many present hurdles for research and implementation. Additional portrayal of the interactions during this phase of design studies have been offered through analyses using Cultural Historical Activity Theory (CHAT). For example, Yamagata-Lynch (2007) used CHAT to analyze interaction between activity systems in a year-long teacher professional development program designed to foster technology integration into rural schools.

Outcomes

As previously described, two main outputs arise from educational design research: maturing interventions and theoretical understanding. Both outputs ripen over time and can be more locally relevant or more broadly applicable. The development of each is often in service of the other.

Maturing Intervention

The intervention itself contributes directly to practice (by addressing the problem at hand) and indirectly to theoretical understanding (as one example of how specific, articulated, design frameworks can be

reified). Interventions can take varied forms, as the following examples demonstrate:

- Program: Professional development program for mathematics teachers (Swan, 2007)
- Product: Multi-User Virtual Environment (MUVE) curriculum River City (Clarke & Dede, 2009)
- Process: Learning-for-use process model (Edelson, 2001)
- Policy: Organizational restructuring as a prerequisite to change (Raval, 2010)

Theoretical Understanding

The theoretical understanding is produced through multiple subcycles of design research. The empirical findings and resulting conjectures provide important building blocks for theory, and can also contribute indirectly to practice as these ideas may be shared among professionals and used to build new interventions. The theoretical understanding produced by educational design research can serve different purposes, as the following examples demonstrate:

- Describe: Contextual factors that foster or inhibit para-teacher professional
- Development (Raval, McKenney, & Pieters, 2011)
- Explain: How and why games position person, learning content, and context (Barab, Gresalfi, & Ingram-Goble, 2010)
- Predict: Instructional strategies that work well in inclusive science classrooms (Palincsar et al., 2001)
- Prescribe: How to design Web-enhanced case-based learning (Kim & Hannafin, 2008)

Engagement with the Outcomes

How individuals engage with the various outcomes of educational design research varies tremendously. Nevertheless, given their professions, it is not surprising that practitioners commonly engage more with the intervention, for example, owning the problem, the solutions, and possibly resources that they co-designed or adopted. Although practitioners are sometimes publication coauthors, it is typically researchers who engage more with the theoretical understanding, for example, working to refine conclusions and disseminate new knowledge beyond the research setting.

Ideally, and in many documented cases, participating in educational design research also fosters professional development for all involved, for example, researchers, teachers, subject-matter experts, developers, and so on (Bannan-Ritland & Baek, 2008; Reeves, Reeves, & McKenney, 2013; Reinking & Bradley, 2008).

Discussion

As described earlier, researcher–practitioner interaction varies across phases of educational design research. Different facets of interaction become more and less prominent at certain moments in the life cycle of a project. This is visible through changes in the key processes, common roles, core values, and expectations during analysis and exploration; design and construction; evaluation and reflection; and implementation and spread. Table 8.3 summarizes the key points made throughout the body of this chapter. The remainder of this section briefly considers three themes that cut across each phase and are important to understanding researcher–practitioner interaction in educational design research: status, crossing boundaries, and relationships.

Status

For researchers and practitioners, status and authority shape interaction dynamics in educational design research. It is important to define clear roles and lines of authority for action (Penuel et al., 2014), but this may also seem like a moving target, as status from expertise, authority, and shared commitments is continuously renegotiated through routine interaction (Donovan et al., 2014). Those with authority have a greater range of tools for negotiation and thus greater influence than those with little authority (Coburn, Bae, & Turner, 2008). Individuals with authority and status have been most successful in influencing the direction of collaborative work (Penuel et al., 2014). For more information on status and authority in this kind of research, please refer to the description by Penuel and colleagues (2014) of their investigation based on frame theory.

Crossing Boundaries

Many design research projects involve teams with researchers, designers and implementing teachers, each of whom is primarily responsible for maintaining commitments to his or her particular role (Joseph, 2004).

Table 8.3. *Key considerations during each main phase of educational design research*

	Analysis and exploration	Design and construction	Evaluation and reflection	Implementation and spread
Key processes	Literature review Field study Site visits and networking	Exploring solutions Mapping solutions Constructing solutions	Screening Expert appraisal Pilots Tryouts Structured and organic reflection	Adoption Enactment Sustained maintenance
Common roles	Problem owners Consultants Detectives	Organizers Consultants Designers Developers	Expert User Client Stakeholder Data collectors Facilitators	Implementer Facilitator Program champion
Core values	Realism Critique Open-mindedness	Analytic and creative mindsets Supporting design with research Designs rely on intrinsic motivators	Reasoning Empathy Association Goal–method alignment Transparency	Moral purpose Belief that change is possible Self-efficacy
Expectations	Diagnostic and prognostic problem framing Descriptions and explanations of existing situation	Energizing Challenging Team negotiation	Social, emotional, and data-driven reactions to designs Recommendations for revision/use Theoretical understanding	Push and pull efforts Attention to adoption Long-term vision

For example, researchers are involved but cannot be direct causes of change (Wang & Hannafin, 2005) because that is not sustainable, helpful, or ecologically valid. Engagement is about meaningful participation in the knowledge practices that define domains of expertise (Hickey & Schafer, 2006). Yet, crossing boundaries (e.g., researchers who teach or teachers who collect data or join academia) can be insightful in ways that also help fulfill one's primary role. Boundary crossing takes place at *trading zones* where participants occupy distinct and partly autonomous cultures, yet share a clear basis for working together (Penuel et al., 2014). Boundary crossers require a special kind of competence: being able to span the boundaries of one or more communities and align priorities and practices across them (Akkerman & Bakker, 2011).

Relationships

Different views of research as well as personal preferences and local conditions strongly influence the researcher–practitioner cooperation in educational research. This is true of many genres of inquiry, and particularly relevant for educational design research. While some design studies may embrace "radically new relationships between researchers and practitioners" (Donovan et al., 2014, p. 5), others may find ways to structure productive relationships that are more conventional. Wagner (1997) refers to shaping the researcher–practitioner relationship as the *social design* of research projects. Key to shaping relationships is recognizing different forms of cooperation, and the capacity to choose one based on the research questions being asked, the people involved, and the context in which the study is being carried out. Wagner (1997) identifies three different forms of researcher–practitioner cooperation: data-extraction agreements; clinical partnerships; and co-learning agreements. Table 8.4 presents an overview of design research relationships based on Wagner's (1997) three forms of researcher–practitioner cooperation.

When considering researcher–practitioner relationships specific to educational *design* research, it can also be helpful to examine the various roles practitioners play in the creation of educational interventions. Teacher involvement in educational design can yield multiple benefits, including more practical designs (Doyle & Ponder, 1978), co-ownership of the designed intervention (Fullan, 2003), improved understanding of its intentions (Handelzalts, 2009), and/or teacher professional development (Kali, & Ronen-Fuhrmann, 2011). Each of these can, in turn, contribute to improved implementation (Penuel et al., 2007) and sometimes

Table 8.4. *Design research relationships based on Wagner's (1997) three forms of researcher–practitioner cooperation*

	Data extraction agreement	Clinical partnership	Co-learning agreement
Research process	Direct, systematic inquiry designed, conducted and reported by researcher	Systematic inquiry, cooperatively designed and reported by researcher and practitioner	Reflexive, systematic inquiry, stimulated in part by ongoing collegial communication between researchers and practitioners
Context and stance	Researcher is outside the schools and engaged in reflection; practitioners are inside the schools and engaged in action.	Researcher is outside the schools and engaged in reflection; practitioners are inside the schools and engaged in action and reflection.	Researchers and practitioners both participate through action and reflection in processes of education and systems of schooling.
Expert roles	Researcher as researcher; practitioner as practitioner	Researcher as researcher and collaborator; practitioner as practitioner and collaborator	Researcher as researcher–practitioner and practitioner as practitioner–researcher in their home institutions.
Educational design research example	Design of an electronic support system to help teachers create science lesson materials (McKenney, 2008)	Designing for productive adaptations of curriculum interventions (DeBarger et al., 2014)	Co-learning for mathematics teaching (Jaworski, 2003)

even improved student learning outcomes (Fishman et al., 2003; Gerard, Spitulnik, & Linn, 2010).

In a study on the affordances and constraints of differing teacher roles during the design of technology-rich early literacy learning activities, Cviko (2013) identified three common roles teachers assume during design: enactor, re-designer, co-designer. The enactor role involved teachers in implementing ready-to-use ICT-rich early literacy activities, making only subtle adjustments, mostly on the fly. The re-designer role and the co-designer role each involved teachers in designing activities before implementing them. In the re-designer role, teachers collaboratively adapted ready-to-use activities and materials for their current curriculum. In the co-designer role, teachers collaboratively designed completely new learning activities and materials for their classes. The enactor role requires teachers to invest time and effort in implementation, the re- and co-designer roles require teachers to invest their time and efforts in collaborative design as well as implementation. Although pupil learning gains were significant in the classes of all teachers, the co-designer group experienced the greatest sense of ownership and continued use of the designed materials on their own, even after the study had been completed (Cviko, 2013; Cviko, McKenney, & Voogt, 2014).

Facilitating Researcher–Practitioner Collaboration in Educational Design Research

What Kinds of Material Infrastructure Does Design Research Require?

Although much is known about researcher-practitioner interaction in educational design research, fine-tuning the social design of such studies remains notoriously challenging. Current infrastructure for educational research in most countries is insufficient for supporting the kinds or cooperation and collaboration involved. The infrastructure needed concerns material and societal elements. From a material standpoint, funding is needed to support integrated research and development. But with a few exceptions (notably National Science Foundation's Discovery Research in K–12 settings program), most agencies support research or development, but rarely the combination. Further, funding for these kinds of projects is difficult as most donors value clearly articulated aims, methods, and outcomes beforehand (Donovan et al., 2014). Also, funding cycles are typically short, so ongoing funding for building capacity is rare (Penuel et al., 2011).

What Kinds of Societal Infrastructure Does Design Research Require?

Societal infrastructure is also needed, in the form of policies and programs that encourage long-term field site partnerships with school districts, networks, and capacity to build work systematically over time, deliberately linking efforts across sites so that progress and knowledge accumulation would be accelerated (Donovan et al., 2014). This is especially important because sustained interaction creates development opportunities that could not be taken on in new partnerships. Reminiscent of Havelock's linkage system (Havelock, 1969, 1971), experts articulated the need for intermediary organizations to the establishment and maintenance of partnerships (Penuel et al., 2011). Ideally, these organizations would support the development of much-needed researcher capacity to learn from practitioner-initiated innovations (Lewis et al., 2006), as well as the establishment of relationships, trust, norms of interaction, and shared commitments. These are not encouraged or facilitated by the current incentive structures in universities or school systems (Donovan et al., 2014).

How to Make the Case for Infrastructure?

Lobbying for infrastructure can be bolstered by the provision of evidence that such infrastructure can make a real difference. This calls for participants in educational design research to share their interaction stories. Several attempts to portray educational design research interactions based on literature reviews are currently available (Anderson & Shattuck, 2012; Ormel et al., 2012). But additional evidence is needed, to demonstrate the value of such infrastructure, for example, for sharing design rationales (Penuel et al., 2011), collecting and reflecting on documentation of design decisions (Joseph, 2004), and making design principles accessible to others (Kali, 2008). As noted elsewhere (McKenney & Reeves, 2013), empirical studies are needed not only through design research, but also on design research.

Closing Remarks

Many learning scientists have positioned their work in what Stokes (1997) referred to as "Pasteur's quadrant." Pasteur's quadrant does not refer to only basic or only applied research, but to both, through "use inspired basic research." It is named after Louis Pasteur, a French chemist and microbiologist who sought fundamental knowledge within the context of

solving real-world problems such as the spoilage of milk and treatment for rabies. In working to solve real-world problems – a fundamental characteristic of their field, learning scientists seek collaboration with practitioners to develop robust, effective, sustainable interventions.

Productive and meaningful researcher-practitioner interactions are beneficial for both professions. In educational design research, these can be sought through synergies, but also by attending directly to conflicting concerns of different participant groups. This requires understanding and acceptance of varying personalities, processes and convictions present in a particular project. As described throughout this chapter, awareness of potential variation is crucial to being able to structure a fruitful process. This pertains especially to the issues described for each main phase of educational design research: key processes, common roles, core values and realistic expectations. Researcher-practitioner interactions are further enhanced by knowledge of one's own (personal and organizational) stance; the overall design research process (with tight adherence to fundamental principles and loose accommodation of practicalities); and clear goals for developing maturing interventions and theoretical understanding.

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