

The implications of the differences between design research and instructional systems design for educational technology researchers and practitioners

Eunjung Oh* and Thomas C. Reeves

Educational Psychology and Instructional Technology, The University of Georgia, Athens, USA

(Received 15 September 2010; final version received 20 October 2010)

Design research (DR) has been an emerging research paradigm in the field of educational technology as well as in education generally for two decades. Educational design research integrates design and research into a socially responsible approach to inquiry related to learning and teaching. Given its still relative novelty, design research requires further discussion regarding what it is and how it can be effectively executed. Instructional Systems Design (ISD) is one of the major activities carried out by educational technologists. Both ISD and design research deal with the enactment of design to improve educational practice. This paper describes the differences and similarities between these two activities and addresses the implications of these differences and similarities for educational technology researchers and practitioners.

Keywords: design research; instructional systems design

Introduction

Since its conception in the early 1990s (Brown, 1992; Collins, 1992), design research has slowly gained attention as an emerging research paradigm in the educational technology field as well as in education generally (Kelly, Lesh, & Baek, 2008; Richey & Klein, 2007). The definition, essential characteristics, and major processes of this approach have been discussed in the literature (van den Akker, Gravemeijer, McKenney, & Nieveen, 2006). Educational technology researchers have been actively discussing the new paradigm and sharing a few research cases using this approach (Bannan-Ritland, 2003; Jonassen, Cernusca, & Ionas, 2006; Plomp & Nieveen, 2009; Reeves, 2006).

According to Wang and Hannafin (2005, p. 6), design research is:

a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories.

Traditionally, in educational technology research, design and research have been two distinctive activities, in which the former yields craft-based practice and the latter

*Corresponding author. Email: graceoh@uga.edu

science-based theoretical principles. However, in educational design research, design and research are inseparable and synergistically interact to improve practice and generate refined design principles and theories.

The contribution of traditional educational technology research methods, both experimental and interpretive, to educational practice have been limited (Reeves, 2006). Many educational technology studies conducted and published for decades are media comparison research (e.g., e-learning vs. face-to-face instruction), despite strong arguments that such studies are ill advised (Clark, 1983). Whenever a new medium has been introduced, educational technologists, as well as other educationists, have rushed to conduct media comparison studies, but the results have most often tended to show “no significant differences” in students’ learning (Russell, 1999). Clark (1999) comments that moving away from media comparison research may require a “conversion” process that many cannot achieve. Meanwhile, over the past 20 years, there has been an enormous expansion of interpretivist approaches to educational technology research using qualitative methods such as case studies and ethnographies (Savenye & Robinson, 2004). These studies have produced numerous examples of descriptive knowledge, but this knowledge has not been shown to be very useful for solving the unique problems most practitioners confront (Maxwell, 2004; Reeves, 2006).

Given the sterility of both media comparison and interpretivist educational technology research, educational researchers aspire to conduct more “socially responsible research” (Reeves, 2000; Reeves, Herrington, & Oliver, 2005), which could actually improve the effectiveness, impact, and/or efficiency of real world teaching and learning. However, design research, as an emerging paradigm, requires further discussion and clarification regarding what it is and how it can be effectively executed. While a general consensus about the differences and similarities among design research and other research paradigms has been established to an extent, there is a lack of understanding regarding the design aspect of the design research. Educational technology is largely conceived of as a design field. Reiser (2002) proposed that the field be named Instructional Design and Technology, and Instructional Systems Design (ISD) is one of the field’s major activities. Clearly, both ISD and design research deal with enactment of design in educational settings, and design researchers regularly incorporate tools and strategies from ISD. However, design research and ISD are very different with respect to their underlying paradigmatic assumptions, as well as how they are practiced. Jonassen et al. (2006, p. 48) highlight just one of the many dissimilarities:

The design process that design researchers use is different from the one instructional designers use. Rather than beginning with task analysis, design research starts with a “thought experiment” (Cobb, 2001, p. 456), which uses instructional design theory and methods to develop a tentative, provisional, and revisable learning trajectory that describes both the potential learning routes and the means to support and scaffold learning along them.

With these and other distinctions in mind, it is important to clarify what ISD and design research have in common and how they differ so that practitioners and researchers can better understand the potential they have for collaboration. In this paper, the goals, assumptions, conceptualization of design, participation, methods/processes, implementation, role of evaluation, criteria for success, and scalability of ISD and design research are contrasted and compared to promote a better understanding among educational technologists of the differences and similarities between these two methodologies.

Goals

To identify the differential goals of ISD and design research, it is vital to define these terms. The literature contains multiple definitions and interpretations of both terms. Regarding ISD, Reigeluth (1983a) views instructional design as a discipline that “prescribes optimal methods of instruction to bring about desired changes in student knowledge and skills” (p. 4) and distinguishes instructional design from instructional development. In his perspective, instructional design is concerned with constructing optimal “blueprints” to prescribe how learning should occur to produce desired outcomes in instructional settings, whereas instructional development constitutes the application of those blueprints in an actual instructional context. However, Dick, Carey, and Carey (2005) describe instructional design both as an “umbrella term” (p. 3) that encompasses the entire ISD process and as one sub-phase during the ISD process. Considering the purpose of this paper, the broader umbrella interpretation by Dick, Carey, and Carey is more appropriate. ISD is used in diverse settings such as K-12 schools, higher education, and corporate training. Regardless of the area in which it is utilized, the ultimate goal of ISD is to develop effective instruction to reduce the deficiency in learners’ knowledge and skills in those particular educational settings.

Like ISD, design research is also employed in diverse areas. However, its goals remain consistent across those areas. First of all, design research deals with design of innovative interventions for improving educational practice similar to ISD. However, an important difference is that design research also aims to generate and instantiate empirically grounded theories and identify new generalizable design principles during its iterative process (Bannan-Ritland, 2003; Barab & Squire, 2004; Design-Based Research Collective (DBRC), 2003; Edelson, 2002; Gravemeijer & Cobb, 2006; Kelly et al., 2008; van den Akker et al., 2006). The integrated theoretical goal of design research and its application in a local context is the most apparent difference in comparison to the goal of ISD of creating innovative solutions for the practical needs of clients at the local level without consistent concern for application of, or refinement of, theory.

Assumptions

According to Dick (1995, p. 13), “At the most general level, ISD is a process for determining what to teach and how to teach it”. This statement reveals several underlying assumptions. First, ISD is goal-oriented (Gustafson & Branch, 2002), and that goal is assumed to be instruction. ISD has a pragmatic goal because it generally begins with a needs assessment focused on what learners need to learn or instructors need to teach in a particular context. The instructional designers and/or their clients believe that instruction is required to fill gaps caused by deficiencies of knowledge and skill. In that sense, ISD also has a prescriptive goal because it aims to produce optimal outcomes to fulfill specific needs in specific contexts (Reigeluth, 1983a).

Second, while many different ISD models exist, they share common processes, although these processes are modified according to the context. The processes they have in common typically involve five core components: analysis, design, development, implementation, and evaluation (ADDIE) (Branch, 2009). Each ADDIE component has a set of sub-activities depending on their context of use. Early ISD models demanded a more rigid process with designers following steps from analysis to evaluation in a linear way; however, newer models tend to be more flexible, circular, and iterative (Gustafson & Branch, 1997).

Third, as seen in its name, ISD is grounded on the systems approach (Dick et al., 2005; Gagne, Briggs, & Wager, 1992; Gustafson & Branch, 2002). Dick et al. (2005, pp. 1–2) stated the following:

A system is technically a set of interrelated parts, all of which work together toward a defined goal. The parts of the system depend on each other for input and output, and the entire system uses feedback to determine if its desired goal has been reached. If it has not, then the system is modified until it does reach the goal.

The ISD process is a systems approach as it involves a number of inputs, steps, and outputs that are interdependent. The output of one step influences the decisions of the next step and often becomes input for the next step. These inputs and outputs interact with each other to achieve defined goals (Gagne et al., 1992).

Finally, ISD is almost always a collaborative and integrative process (Gustafson & Branch, 2002). Although the scope and context of projects may differ, ISD requires diverse expertise including subject matter, instructional design, management, media production, and evaluation. ISD is usually a team effort with different types and levels of know-how coming into play throughout the integrative process.

Design research also has fundamental assumptions. Based on a literature review, Wang and Hannafin (2005) proposed the following five characteristics of design research: *pragmatic; grounded; interactive, iterative and flexible; integrative; and contextual*.

First, design research has more pragmatic goals than traditional educational research. Design research has an interventionist nature that aims to solve problems in educational practice by designing innovative interventions and enacting and refining theories and design principles (DBRC, 2003; van den Akker et al., 2006; Wang & Hannafin, 2005). The nature of the problems tackled by design researchers is clarified by close and on-going collaboration with practitioners. While the practicality of ISD is gained from designing the most effective instruction for given situations, design research produces numerous kinds and levels of innovative practices to enhance learning. Designing instruction per se may not always be the single or most appropriate solution in design research.

Second, design research is grounded in both theory and real world settings. Design research is theory-driven (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003; diSessa & Cobb, 2004; Reinking & Bradley, 2008; van den Akker et al., 2006). It begins with problem definition arrived at in concert with practitioners and integrated with in-depth investigation and analysis of the current literature to enact conjectured initial theories. These enacted theories are continuously elaborated throughout the intertwined processes of design and research, and they also function as a design framework for interventions throughout the process (Cobb et al., 2003; van den Akker et al., 2006). Since the purpose of design research is improvement of educational practice, all these processes are embedded in naturalistic settings where complex variables associated with real problems and complicated dynamics of multiple stakeholders exist (Collins, 1992; Reinking & Bradley, 2008; Wang & Hannafin, 2005). ISD is also grounded in real-world settings, and ideally it can be grounded in theory. However, ISD is typically conducted by people who do not pursue theoretical goals or who may not be knowledgeable enough to apply, much less generate, theory.

Third, design research is interactive, iterative, and flexible. Design research requires intensive interactive collaboration among researchers and practitioners (Reeves, 2006) whereas ISD usually involves collaboration among various types of

experts and their clients. Design research involves the continuous iterative cycle of “design, enactment, implementation, analysis, and redesign” (DBRC, 2003, p. 5). This iterative cycle comes from the “prospective and reflective” nature of design research (Cobb et al., 2003, p. 10). Design researchers design and implement their interventions constructed on theory based conjectures. These “embodied conjectures” (Sandoval, 2004, p. 215) are refined through the process of implementation and analysis along with reflection (Cobb, et al., 2003) to support the revision of design. This prospective and reflective nature also makes design research flexible. At the same time that enacted designs are implemented, data continuously collected, and initial conjectures tested with designs, design and research plans can be modified flexibly based upon changing needs and conditions. As noted above, ISD traditionally tends to be somewhat linear, although newer approaches are more iterative. In addition, ISD is likely to be less flexible in instances where it tends to stick to the plans that are determined based on the decisions from the previous stages or data from evaluation.

Fourth, design research is integrative since researchers utilize multiple research methods and approaches from multiple sources to enhance the “objectivity, validity, and applicability of the ongoing research” (Wang & Hannafin, 2005, p. 10). Compared to other methodologies, which utilize certain dominant methods to collect and analyze data, any approach can be appropriate, depending on the design researcher’s needs and justification (Reinking & Bradley, 2008). That is, design researchers may use different methods and approaches at different stages to address emerging needs and issues as the focus of research is adjusted. Instructional designers also collect data from multiple sources and use multiple methods. In typical ISD practice, those data are collected mostly in the analysis and evaluation phases to identify needs, revise the current design, and estimate the effectiveness of the designed program. The purpose of data collection in ISD is not to conduct research that produces useful design knowledge and artifacts, but to support the design of instruction. ISD data collection methods tend to be simpler, less exhaustive and less rigorous. Also, the analysis of data in ISD tends to be simpler than in design research.

Finally, design research is contextual because “research results need to be connected with both the design process through which results are generated and the setting where research is conducted” (Wang & Hannafin, 2005, p. 11). Design research is conducted in naturalistic settings in which the designed intervention is implemented and researched in an environment in which complex dynamics, interactions and variables exist. Design researchers co-design interventions and learning environments with practitioners, study them deeply throughout implementation of interventions, experience the learning contexts, and gain insights into how best to employ, revise and adopt interventions in new settings (Kelly et al., 2008). They become a part of the research context while also playing many roles.

Conceptualization of design

Educational technology is an applied design science in which the foremost goal is to improve educational practice. The essential way the field of educational technology can improve educational practice is through design of innovative interventions to resolve educational problems and produce design knowledge (Reeves, 2006). Rowland (1993, p. 80) defines design as:

a disciplined inquiry engaged in for the purpose of creating some new thing of practical utility. It involves exploring an ill-defined situation, finding – as well as solving – a problem(s), and specifying ways to effect change. Design is carried out in numerous fields and will vary depending on the designer and on the type of thing that is designed. Designing requires a balance of reason and intuition, and impetus to act, and an ability to reflect on actions taken.

Rowland views instructional design (ID) as a type of design focused on designing new instruction of practical utility. He identified two perspectives in ID. The rational view regards ID as a “logical rational and systematic” process following a certain set of “rules, principles, and procedures,” while the creative view regards ID as “intuitive, creative, or artistic” (Rowland, 1993, p. 88). Viewing ID as a rational process that is prescriptive and scientific is the more dominant perception of ID in the field (Dick et al., 2005; Reigeluth, 1983b). In ID, design is a strategic “goal-directed process” (Rowland, 1993, p. 80) and a knowledge application process to produce optimal instruction for target learners. Although design is used as knowledge in the ISD process, producing design knowledge is neither an intended goal nor an outcome of ISD. Rather, research as a knowledge construction activity and design as a knowledge application activity are usually separated (Cobb et al., 2003).

In design research, design also functions as both a type of knowledge and a strategy. Design knowledge derived from the literature guides the design research process, and enacted design grounded in the real world provides a basis for developing and refining multiple theories such as design frameworks and design methodologies (Brown, 1992; Edelson, 2002). Design researchers constantly engage in design and redesign, striving to maximize the possibility of designing better solutions to the problems of practitioners while seeking opportunities to better understand the implication of design theory and principles.

Participation

Both design research and ISD require collaboration among professionals. As both are driven by real-life problems in various domains, the people involved in and influencing the process may differ from context to context. The clear difference between the two approaches is that specialists with different areas of expertise collaborate in ISD, while academic researchers and practitioners (e.g., teachers) collaborate in design research. In ISD, designers tend to be professional instructional designers; however, in design research, educational researchers often deal with the design process by playing dual roles as researchers and designers (Bannan-Ritland, 2003). Additionally, both approaches commonly engage subject matter experts, media specialists (if technology-enhanced environments are involved), and learners. Regarding learners, as design research is actually conducted in naturalistic real-world settings, researchers collect data from actual learners. However, in ISD, much data is collected from more or less representative learners rather than the actual target learners, particularly in formative evaluations. The design research literature also identifies policy makers, administrators, graduate students, curriculum developers, and assessment experts as primary actors in the process (Bannan-Ritland, 2003; Joseph, 2004). One clear difference in design research from ISD is that professional development of participants during the design research process is an important outcome in design research (McKenney, Nieveen, & van den Akker, 2006). Through collaboration or participation in the

design and data collection process, practitioners or participants have the opportunity to reflect more on their teaching and learning. In design research, data collection methods “can be structured to stimulate dialogue, reflection or engagement among participants” (McKenney et al., 2006, p. 74).

Methods/processes

Discussing the methods/processes that ISD and design research employ also helps our understanding of the extent to which they are similar and different. From a macro view, Reeves (2000) distinguishes between design research methods and traditional predictive research methods. According to Reeves (2006, p. 59), design research goes through the following stages: “analysis of practical problems by researchers and practitioners in collaboration,” “development of solutions informed by existing design principles and technological innovation,” “iterative cycles of testing and refinement of solutions in practice,” and “reflection to produce design principles and enhance solution implementation” whereas traditional predictive educational research involves “hypotheses based upon observation or existing theories,” “experiments designed to test hypotheses,” “theory refinement based on test results,” and “application of theory by practitioners”. The principal failure of traditional educational research is in the last stage: Practitioners are rarely able to apply theory in their practice for a host of reasons, but primarily because the theory is under-informed by substantial and practical understanding of the contexts in which practitioners practice.

While different design research models exist, the Integrated Learning Design Framework (ILDF) by Bannan-Ritland (2003) and Bannan-Ritland and Baek (2008) provides valuable insight into understanding design research process as well as perceiving how the process of design research differs from other approaches. Instead of introducing an entirely new set of methods, the ILDF integrates several existing design and research traditions. The stages of ISD are also included in the procedures of her model. She divides the process into four phases: “informed exploration, enactment, local impact evaluation, and broader impact evaluation” (Bannan-Ritland, 2003, p. 22).

First, in the informed exploration stage, researchers identify problems through needs analysis, investigate literature, develop a conjectured theory, and characterize the audience. Design researchers conduct performance/needs analysis, context analysis, survey experts, and employ other appropriate research methods to explore the learning environments and establish initial design theories and principles. In ISD, during this kind of exploration stage, designers usually conduct needs analysis activities including identifying instructional goals, conducting instructional analysis, and analyzing learners and contexts (Dick et al., 2005). Compared to ISD, in design research “more intensive and systematic preliminary investigation of tasks, problems, and context is made, including searching for more accurate and explicit connections of that analysis with state-of-the art knowledge from literature” (van den Akker, 1999, p. 7).

The second stage is enactment, in which researchers design and develop design interventions. The initially designed prototypes are articulated, refined, and developed toward a more substantial design (Bannan-Ritland, 2003). Evaluations conducted in the next stage (local impact) significantly influence development of design. Also, design is influenced by ongoing data collection from the discussion and analysis among participants (researchers and practitioners). This stage goes through a number of micro-cycles of design and analysis for a considerable time period (Gravemeijer & Cobb, 2006). In ISD, designers design and develop instruction by identifying performance

objectives, developing assessment instruments, choosing instructional strategies, and producing instructional materials (Dick et al., 2005).

In the third stage of Bannan-Ritland's (2003) ILDF, evaluation of local impact is conducted to see whether the designed interventions fulfill the practitioner needs. Researchers conduct formative evaluations of the enacted designs, refine conjectured local theories and systems, and implement interventions. This stage also includes iterative processes. As previously mentioned, results of formative evaluations impact the enacted designs from the prior stage, and connect design and theories in interaction with each other for refinement throughout the implementation of interventions. In ISD, designers conduct formative evaluation of developed instruction, and the results of this evaluation influence the revision of instruction (Dick et al., 2005). Depending on the outcomes, designers may revisit the previous steps from analysis through development, but this is rare. After revision, the redeveloped instruction is implemented. Summative evaluation of ISD is conducted after implementation to verify the effectiveness and efficiency of the instruction designed for clients (Dick et al., 2005; Morrison, Ross, & Kemp, 2001). Results from summative evaluations are used for making decisions on maintenance of programs (Dick et al., 2005; Morrison et al., 2001). This process is not usually a part of the design process, and an external evaluator typically conducts this evaluation (Dick et al., 2005).

The final stage in the ILDF, evaluation of broader impact, results in the dissemination of outcomes from the research. The major steps are publishing results and adoption/adaptation/diffusion of designs and theories from the local level to the broader context. Design researchers document the design process continuously, systematically, and comprehensively (Edelson, 2002; Gravemeijer & Cobb, 2006). This cumulative documentation throughout the design research process is critical in retrospective analysis, publication, and eventually application in broader contexts. The results of design research are used for the needs analysis in the next iteration of the same project or as underlying information for needs analysis of other projects. In ISD, the final stage is the summative evaluation, which is more similar to an evaluation of the local rather than broader impact. Sometimes, well-designed educational programs are commercialized to target learners in broader settings; however, evaluation of the broader impact is not usually a focus of ISD and the results of summative evaluations are rarely published.

Implementation

Implementation of interventions also differs in design research and ISD. The nature of intervention varies, as instruction may not be the intervention developed in design research, whereas instruction is always the intervention in ISD. Also, the types of data collected during the implementation process differ. Various data are used to improve conjectured theories and to establish generalizable design principles and methodologies in implementation of design research. By contrast, learners' outcomes are the primary data gathered in implementation of ISD, and these data will be used with other data from summative evaluations to determine the effectiveness of the instruction developed (Wang & Hannafin, 2005). Another significant difference is that, whereas in design research researchers remain actively engaged during implementation, in ISD instructional designers usually assume a more hands-off stance with respect to implementation of the program by their clients.

Role of evaluation

In both ISD and design research, evaluation plays an essential role. Formative evaluation is important because its goal is to identify gaps, issues, and problems that need to be revised for the design to be more effective and useful (Bannan-Ritland, 2003; Dick et al., 2005; Gagne et al., 1992; Morrison et al., 2001; van den Akker, 1999). Typically, formative evaluation deals with local level design issues (Edelson, 2002; Reigeluth & Frick, 1999; van den Akker, 1999; Wang & Hannafin, 2005) and seeks to enhance the design for implementation through iterative cycles of revision. Both approaches collect formative data using various methods and sources. In general, formative evaluation as applied by instructional designers does not deliberately pursue theory refinement; however, in design research, formative evaluation eventually contributes to theory refinement during the iterative process.

In ISD, the purpose of summative evaluation is to identify weaknesses and strengths of the designed instruction and to help clients make decisions about further use of the instruction (Bannan-Ritland, 2003; Dick et al., 2005; Gagne et al., 1992; Morrison et al., 2001). Summative evaluators usually are brought in from outside of the project so that they can be more objective during the evaluation. These experts collect data and evaluate whether the materials and programs actually fulfill the goals of organizations and whether they are effective for learners to achieve intended learning outcomes (Dick et al., 2005). Design researchers rarely conduct summative evaluations as such; instead, they engage in ever more rigorous forms of formative evaluation. The results of the increasingly thorough evaluations are used to refine design principles as well as improve the local solutions. Also, the process of design research and the results of evaluation are shared through publications in both academic and practitioner journals (Bannan-Ritland, 2003).

Criteria for success

Whether or not an activity is successful depends on its goals. The goal of ISD is to develop effective instruction, and the results of summative evaluation inform whether the developed instruction is successful. Since determining the effectiveness of the instruction is not an easy task, evaluators conduct numerous analyses, such as congruence analysis, content analysis, feasibility analysis, design analysis, current user analysis, and outcome analysis (Dick et al., 2005). Information gathered from these various analyses determines the success of design from ISD.

The goals of design research are to generate useful design interventions and refine theories. Edelson (2002) views the criteria for successful design research as the “novelty and usefulness” (p. 118) of designs and theories to resolve defined problems. The outcomes of design research should be innovative and should produce “demonstrable changes at the local level” (Barab & Squire, 2004, p. 6). Methodological criteria, such as objectivity and validity of data, and rigor and credibility of the research process, are critical to meeting criteria and standards for scientific educational research of any kind, including design research (Wang & Hannafin, 2005). Design researchers usually actively support the implementation of designed innovations with the practitioners with whom they have collaborated (Fishman et al., 2004). However, sustainability of interventions is important so that interventions continue to impact educational practices of practitioners in the local context without the support and the presence of researchers. Finally, generalizability of the findings is a vital criterion as

design research aims to utilize interventions and apply theories in broader contexts (Gravemeijer & Cobb, 2006).

Scalability

Both ISD and design research projects aim to fulfill local needs. ISD often involves clients who seek design and development of instruction to fill an identified gap in their own context. Unless either designers or clients desire to expand their solutions into broader settings, typically local needs are the major focus. In the case of design research, although it focuses on problems identified by practitioners in local settings, application of its outcomes in a broader setting is a major goal (Edelson, 2002; Gravemeijer & Cobb, 2006; Wang & Hannafin, 2005).

Often, design researchers need to document and maintain detailed records of their research process and results regarding how they have designed and enacted interventions and theories, how the interventions have or have not worked, and how they have been refined in relation to the research context (DBRC, 2003). This extensive documentation illustrates how those processes and outcomes are related to each other and how they have progressed. This same documentation eventually guides other design researchers and ultimately contributes to the scalability of the intervention (Gravemeijer & Cobb, 2006).

In addition, established theories and design principles help design researchers not only support improvement in local practice, but also enhance adaptability and scalability of solutions in broader settings. Design principles with context-rich descriptions help scalability of design research outcomes. ISD is applied at many levels of scale ranging from an individual trainer developing better training materials to large-scale projects funded by huge corporations or large government agencies. Design researchers usually tackle projects of an intermediate scale because of the intensive effort required to: (1) establish an explicit conceptual framework; (2) document context-rich descriptions of the research context, designs, and process during both design and retrospective analysis phases; and (3) analyze data in a way that enhances reliability and validity (McKenney et al., 2006).

Implications for educational technology researchers and practitioners

Educational practice requires various kinds of design endeavors for its improvement. Ideally, educational technologists should desire to contribute both to the design of innovative interventions and to their associated learning theories. Some educational technologists focus primarily on the design of effective instruction through the processes inherent in ISD. Other educational technologists have focused on the application of educational research methods, both quantitative and qualitative, to the programs and products that result from ISD, albeit with woefully little impact on practice. Fortunately, a new generation of researchers in our field is attracted to design research as an approach that combines both innovative design and socially responsible inquiry.

Some important benefits may be realized through greater interest in design research among educational technology researchers and practitioners. For example, the theories generated from design research can guide “craft-based” ISD (Burkhardt, 2006, p. 122), advance associated research on ISD (Richey & Klein, 2007), and improve ISD practice (Edelson, 2002; Reigeluth & Frick, 1999; Richey & Klein, 2007). In contrast to traditional research, design research creates outcomes “to be

transformed into educational practice” (Reeves et al., 2005, p. 107). Learning designs and learning theories synergistically respond to real-world problems at the local level and eventually produce changes in broader contexts. Design research could also be applied to the problems faced by instructional designers just as they are now being applied to the problems of teachers and other practitioners.

Another issue that simmers just below the surface of many discussions among educational technology practitioners and researchers alike is that ISD may simply be an insufficient approach in many of today’s complex teaching, learning, and performance contexts. Increasingly, practitioners realize that the straightforward delivery of instruction is rarely enough to be a successful solution to the challenges they face. From the onset, design research has the advantage of getting its metaphorical hands dirty in the complexities of real world practice and maintaining hands-on engagement throughout the process of designing innovative interventions based upon design principles that in turn remain as open to refinement as the interventions themselves. This is not to suggest that design research should replace ISD as the primary method applied by educational technology practitioners. But it does seem reasonable to suggest that in particularly complex contexts where ISD has failed to transform practice, design research may ultimately have more impact. At the same time, we urge educational technology researchers, especially doctoral students and their mentors, to consider design research as a research approach that has considerably more potential as a socially responsible enterprise than more traditional experimental and interpretive approaches.

Design research is still in a state of development (Plomp & Nieveen, 2009). Some progress has been made in the adoption of design research by educational technology researchers, but many challenges remain. Various terminologies and definitions proliferate, and there remains a lack of consensus among researchers about how design research should be conducted. More specifically, the literature regarding how to actually conduct design research has been rapidly growing, but as yet is insufficient to guide young educational technology researchers and graduate students who aspire to learn about and conduct it (Joseph, 2004). As described above, design research requires intensive, long-term collaboration among researchers and practitioners to design and refine prototype learning environments, as well as enhanced design principles. Doctoral students often face formidable barriers with respect to time and resources to engage in design research agendas. More guidance is needed concerning how these challenges can be met so that the positive opportunities of design research can be realized by doctoral students and their academic advisors alike. To provide this guidance, design researchers must put more effort into publishing not only the findings of their research, but also the process through which those findings were obtained and the challenges encountered along the way. As noted above, scalability is another major challenge that design researchers continuously need to address. Meeting these and other challenges will not be easy, but the educational technology research community must tackle them to ensure the continued relevance and viability of this field.

References

- Bannan-Ritland, B. (2003). The role of design in research: The integrative learning design framework. *Educational Researcher*, 32, 21–24.
- Bannan-Ritland, B., & Baek, J.Y. (2008). Investigating the act of design in design research. In A.E. Kelly, R.A. Lesh, & J.Y. Baek (Eds.), *Handbook of design research methods in*

- education: *Innovations in science, technology, engineering, and mathematics learning and teaching* (pp. 299–319). New York: Routledge.
- Barab, S., & Squire, K. (2004). Design-based research: Putting a stake in the ground. *Journal of the Learning Sciences*, 13(1), 1–14.
- Branch, R.M. (2009). *Instructional design: The ADDIE approach*. New York: Springer.
- Brown, A.L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of the Learning Sciences*, 2(2), 141–178.
- Burkhardt, H. (2006). From design research to large-scale impact: Engineering research in education. In J. van den Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds.), *Educational design research* (pp. 121–150). London: Routledge.
- Clark, R.E. (1983). Reconsidering research on learning from media. *Review of Educational Research*, 53(4), 445–459.
- Clark, R.E. (1999). Foreword: Bloodletting, media, and learning. In T.L. Russell (Ed.), *The no significant difference phenomenon* (pp. i–iv). Raleigh, NC: North Carolina State University Press.
- Cobb, P. (2001). Supporting the improvement of learning and teaching in social and institutional context. In S. Carver & D. Klahr (Eds.), *Cognition and instruction: Twenty-five years of progress* (pp. 455–478). Mahwah, NJ: Lawrence Erlbaum Associates.
- Cobb, P., Confrey, J., diSessa, A., Lehrer, R., & Schauble, L. (2003). Design experiments in educational research. *Educational Researcher*, 32(1), 9–13.
- Collins, A. (1992). Towards a design science of education. In E. Scanlon & T. O'Shea (Eds.), *New directions in educational technology* (pp. 15–22). Berlin: Springer.
- Design-Based Research Collective (DBRC). (2003). Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher*, 32(1), 5–8.
- Dick, W. (1995). Enhanced ISD: A response to changing environments for learning and performance. In B.B. Seels (Ed.), *Instructional design fundamentals: A consideration* (pp. 13–20). Englewood Cliffs, NJ: Educational Technology Publications.
- Dick, W., Carey, L., & Carey, J.O. (2005). *The systematic design of instruction* (6th ed.). Boston: Allyn and Bacon.
- diSessa, A.A., & Cobb, P. (2004). Ontological innovation and the role of theory in design experiments. *Journal of the Learning Sciences*, 13(1), 77–103.
- Edelson, D.C. (2002). Design research: What we learn when we engage in design. *Journal of the Learning Sciences*, 11(1), 105–121.
- Fishman, B., Marx, R., Blumenfeld, P., & Krajcik, J. (2004). Creating a framework for research on systemic technology innovations. *Journal of the Learning Science*, 13(1), 43–76.
- Gagne, R.M., Briggs, L., & Wager, W.W. (1992). *Principles of instructional design*. (4th ed.). New York: Holt, Rinehart and Winston.
- Gravemeijer, K., & Cobb, P. (2006). Design research from a learning design perspective. In J. van den Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds.), *Educational design research* (pp. 17–51). London: Routledge.
- Gustafson, K.L., & Branch, R.M. (1997). Revisioning models of instructional development. *Educational Technology Research & Development*, 45(3), 73–89.
- Gustafson, K.L., & Branch, R.M. (2002). What is instructional design? In R.A. Reiser & J.V. Dempsey (Eds.), *Trends and issues in instructional design and technology* (pp. 16–25). Upper Saddle River, NJ: Merrill Prentice Hall.
- Herrington, J., & Oliver, R. (2000). An instructional design framework for authentic learning environments. *Educational Technology Research and Development*, 48(3), 23–48.
- Jonassen, D.H., Cernusca, D., & Ionas, I.G. (2006). Constructivism and instructional design: The emergence of the learning sciences and design research. In R. Reiser & J. Dempsey (Eds.), *Trends and issues in instructional design and technology* (pp. 45–52). Columbus, OH: Merrill/Prentice-Hall.
- Joseph, D. (2004). The practice of design-based research: Uncovering the interplay between design, research, and the real-world context. *Educational Psychologist*, 39(4), 235–242.
- Kelly, A., Lesh, R., & Baek, J. (Eds.). (2008). *Handbook of design research methods in education*. New York: Routledge.
- Maxwell, J.A. (2004). Causal explanation, qualitative research, and scientific inquiry in education. *Educational Researcher*, 33(2), 3–11.

- McKenney, S., Nieveen, N., & van den Akker, J. (2006). Design research from a curriculum perspective. In J. van den Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds.), *Educational design research* (pp. 67–90). London: Routledge.
- Morrison, G.R., Ross, S.M., & Kemp, J.E. (2001). *Designing effective instruction* (3rd ed.). New York: John Wiley & Sons.
- Plomp, T., & Nieveen, N. (Eds.). (2009). An introduction to educational design research. Enschede: SLO. Retrieved April 16, 2009, from http://www.slo.nl/downloads/2009/Introduction_20to_20education_20design_20research.pdf
- Reeves, T.C. (2000). Socially responsible educational technology research. *Educational Technology*, 40(6), 19–28.
- Reeves, T.C. (2006). Design research from a technology perspective. In J. van den Akker, K. Gravemeijer, S. McKenney & N. Nieveen (Eds.), *Educational design research* (pp. 52–66). London: Routledge.
- Reeves, T.C., Herrington, J., & Oliver, R. (2005). Design research: A socially responsible approach to instructional technology research in higher education. *Journal of Computing in Higher Education*, 16(2), 96–115.
- Reigeluth, C.M. (1983a). Instructional design: What is it and why is it? In C.M. Reigeluth (Ed.), *Instructional-design theories and models: An overview of their current status* (Vol. 1, pp. 3–36). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Reigeluth, C.M. (Ed.). (1983b). *Instructional-design theories and models: An overview of their current status* (Vol. 1). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Reigeluth, C.M., & Frick, T.W. (1999). Formative research: A methodology for creating and improving design theories. In C.M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional technology* (Vol. 2, pp. 633–651). Mahwah, NJ: Lawrence Erlbaum Associates.
- Reinking, D., & Bradley, B.A. (2008). *Formative and design experiments: Approaches to language and literacy research*. New York: Teachers College Press.
- Reiser, R.A. (2002). What field did you say you were in? Defining and naming our field. In R.A. Reiser & J.V. Dempsey (Eds.), *Trends and issues in instructional design and technology*. Upper Saddle River, NJ: Merrill Prentice Hall.
- Richey, R., & Klein, J.D. (2007). *Design and development research: Methods, strategies, and issues*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Rowland, G. (1993). Designing and instructional design. *Educational Technology Research & Development*, 41(1), 79–91.
- Russell, T.L. (1999). *The no significant difference phenomenon*. Montgomery, AL: International Distance Education Certification Center.
- Sandoval, W.A. (2004). Developing learning theory by refining conjectures embodied in educational designs. *Educational Psychologist*, 39(4), 213–223.
- Savenye, W.C., & Robinson, R.S. (2004). Qualitative research issues and methods: An introduction for educational technologists. In D.H. Jonassen (Ed.), *Handbook of research for educational communications and technology* (pp. 1045–1071). Mahwah, NJ: Lawrence Erlbaum Associates.
- van den Akker, J. (1999). Principles and methods of development research. In J. van den Akker, N. Nieveen, R.M. Branch, K.L. Gustafson & T. Plomp (Eds.), *Design methodology and developmental research in education and training* (pp. 1–14). The Netherlands: Kluwer Academic Publishers.
- van den Akker, J., Gravemeijer, K., McKenney, S., & Nieveen, N. (2006). *Educational design research*. London: Routledge.
- Wang, F., & Hannafin, M. (2005). Design-based research and technology-enhanced learning environments. *Educational Technology Research & Development*, 53(4), 5–23.

Copyright of Educational Media International is the property of Routledge and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.