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Design Based Research vs. Mixed Methods:
The Differences and Commonalities
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Introduction

Design based research (DBR) has been compared with a number of different research methods that stemmed from different paradigms, such as action research, evaluation research, formative research, clinical trials, etc. Although there is no written evidence, at an AERA session held in San Diego, California, in 2004, it was even claimed that there is not any real difference between DBR and mixed methods (MM). Setting off from this claim, this paper aims to reveal the common and distinctive characteristics of the two methods in question in order to be able to present evidence to falsify this claim and to clarify the distinction between them.

Design-Based Research

Design Based Research Collective (DBRC) (2003, p.5) characterizes DBR as a *research paradigm* that “blends empirical educational research with the theory-driven design of learning environments,” whereas Wang and Hannafin (2005) define it as “a systematic but flexible *methodology* [italics added] 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” (p. 6). DBR aims to develop and refine theories via closely linked strategies rather than testing intact theories using traditional methodologies (Edelson, 2002).

Design Based Research Collective (DBRC) further states that instead of using “design experiments,” they coined the term *design-based research* “to avoid invoking mistaken identification with experimental design, studies of designers and trial teaching methods” (DBRC, 2003, p.5). Indeed, “design experiments,” which first appeared in the influential works of Brown (1992) and Collins (1992), were the foundation for DBR that was born in an attempt to:

- ✓ meet the need to develop a *design science of education*, similar to aeronautics or artificial intelligence, to determine how different learning-environment designs affect dependent variables in teaching and learning (Collins, 1992; inspired by Simon’s (1969, p. xi) “sciences of design”)
- ✓ construct a more systematic methodology for conducting design experiments that would involve co-working with teachers as co-investigators and help develop design theory to identify different variables that play a role in the failure/success of the innovation besides guiding implementation of innovations (Collins, 1992)
- ✓ bridge laboratory studies of learning with studies of complex instructional interventions that take place in rich, complex, and constantly changing classroom environments (Brown, 1992; Hoadley, 2004), i.e. to prevent the detachment of educational research from problems and issues of everyday practice
- ✓ close the credibility gap (Levin & O’Donnell, 1999),

- ✓ develop more “usable knowledge” (Lagemann, 2002) that connects the “how to” knowledge created by researchers to local context in which practitioners live.

Different researchers argue different characteristics that constitute design based research from tight researcher- participant relationship to continuously- evolving intervention and measurement methods, to highly informative and broad documentation about the process of design and its enactment, to tentative generalizations that might not fulfill universality (Collins, 1992; Brown, 1992; Kelly, 2003; Cobb, Confrey, diSessa, Lehrer & Schauble, 2003; Design-Based Research Collective, 2003; McCandliss, Kalchman & Bryant, 2003; Bannan-Ritland, 2003; Sloane & Gorard, 2003; Shavelson, Philips, Towne, & Feuer, 2003; Zaritsky, Kelley, Flowers, Rogers, & O'Neill, 2003; Hoadley, 2004; Sandoval & Bell, 2004). In light of these arguments, the main characteristics of DBR can be summarized as follows:

- DBR is Pragmatic. The aim of DBR is to address and solve practical problems by designing and enacting interventions, while extending theories or developing “prototheories” and refining design principles to promote fundamental understanding (DBRC, 2003; Wang & Hannafin, 2005), i.e. theory development and designing learning environments (practice) are intertwined (Brown & Campione, 1996; DBRC, 2003) to refine both theory and practice continuously (Edelson, 2002; Collins et al., 2004). The value of theory is assessed in terms of its sharability with the practitioners and other designers, or the “usable knowledge” it produces, i.e. how well it really works in practice (Greeno, Collins, & Resnick, 1996; DBRC, 2003; Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003).
- DBR is theory-driven and grounded in real-world contexts (Wang & Hannafin, 2005, p.9). “Interventions embody specific theoretical claims about teaching and learning” (DBRC, 2003, p.6). Theory is continuously developed and elaborated through research cycles and research is conducted in authentic, natural educational contexts, such as classrooms, contrary to isolated, controllable, laboratory settings (Collins, 1999; Collins, Joseph & Bielaczyc, 2004; Wang & Hannafin, 2005; O'Donnell, 2004).
- DBR processes are interactive, collaborative, iterative and flexible. DBR requires interactive collaboration of researchers, designers and practitioners (Cobb et al., 2003) (or interplay of these roles conducted by one person (Joseph, 2004)) to assure that the designed innovation reaches its goal (DBRC, 2003; Reeves, Herrington, & Oliver, 2005; Wang & Hannafin, 2005). In DBR, development and research take place through continuous and iterative cycles of “design, enactment, analysis and redesign” (Collins, 1992; Cobb, 2001; Bannan-Ritland, 2003; DBRC, 2003; Wang & Hannafin, 2005; Dede, 2004; 2005). Lastly, DBR processes are flexibly adaptive so that the newly emerging theoretical frameworks and implementation experiences of designers and practitioners are continuously fed back to the successive iterations to anticipate and implement changes throughout the process, when necessary (Collins, 1999; Edelson, 2002; Cobb et al., 2003). However, one should be careful about the compatibility of the “changes to one aspect of the design with other aspects of the design” (Collins et al., 2004, p. 19).
- DBR is integrative due to the richness and variety of different theories, research methods and procedures from both qualitative and quantitative research, which are utilized with respect to research needs. In other words, DBR utilizes *mixed methods* [italics added] as a means to analyze an intervention's outcomes and refine the intervention (DBRC, 2003; Bell, 2004). The integrative use of multiple methods during the iterative cycles results in multiple

sources and kinds of data, which increase the “objectivity, validity, credibility and applicability” of the findings (Wang & Hannafin, 2005).

- DBR is contextualized, i.e. it cannot be thought of as being independent from context, because “research must account for how designs function in authentic settings” (DBRC, 2003) and because the results are embedded in both design processes and the setting where it is enacted and research is conducted (Wang & Hannafin, 2005). Regarding the desire for research to have a practical impact by having clear relevance for the improvement of education; DBR focuses on the “development of sustained innovation in education.” (Bell, 2004, p. 251). To fulfill this desire, DBR studies should provide details about how the design outcomes/principles have worked or have **not** worked, how the innovation has been improved, and what kind of changes have been made, etc. (as reflected in many DBR studies (see Squire, 2005; Barab, Arici, & Jackson, 2005; Kafai, 2005; Hoadley, 2005 for examples).

Since DBR is relatively young and is still developing and evolving, there are also several articles that criticize DBR as a research method. For instance, Dede (2004) argues that there seems to be hardly any standards to decide whether a design should be dropped or sustained and further explores due to its promising nature by differentiating it from its “conditions of success” (p.109). However this is not possible, since the findings in DBR are strongly bounded with contextual variables shaping the design’s “desirability, practicality and effectiveness” (Dede, 2005, p.7).

Many DBR studies lack a sound theoretical foundation and do not add to the literature to refine and develop the theory (diSessa and Cobb, 2004). Dede (2004) argues that this may be due to the limited overlap between the skills of creative designers and the attributes of rigorous scholars. He further contends that effective DBR groups try to create a “cognitive ecology” between “freewheeling, “whatever works” innovation versus controlled, principled variation. People fascinated by artifacts also are often tempted to start with a predetermined “solution” and seek educational problems to which it can be applied, a strategy that frequently leads to under-conceptualized research” (p.107). Dede (2004) further asserts that DBR designs seem to be over-methodologized and claims that “only the five percent or so of the data collected were needed to induce the findings” (p.7). Similarly, Brown (1992) expressed concern over data selection as a possible limitation of DBR. Iterative nature of DBR might result in excessive data collection for designated research questions via interviews, surveys, observations, etc., which might only result in “tiny” contributions to theory.

There are also problems with the generalization or the ‘universality of the findings.’ Although Hoadley (2004) talks about tentative generalizations that are made from initial implementations, which make DBR a *local science* (diSessa, 1991 cited in Hoadley 2004), O’Donnell (2004) argues that due to the “very nature of the DBR,” in which changes and adjustments are continuously reflected to the intervention and its implementation; and the intertwined complexity of context, it is difficult to make generalizations across participants, contexts and findings (Kelly, 2004). Hoadley (2004) also notes the close relationship between researchers and practitioners so that the ‘objective’ researcher–participant distinction becomes blurred. Contrary to Shavelson, et al.’s (2003) statement about rigor maintenance to ensure the adherence to the discipline and scientific research standards, Hoadley (2004) argues issues of rigor in DBR, revealing treatment validity and systematic validity in terms of “usable knowledge,” which will inform theories that will, in turn, inform practice.

Lastly, the immaturity of the methodology is another criticism (Kelly, 2004; Wang & Hannafin, 2005), which consists of methodological challenges that need to be addressed if DBR is to be developed “from a loose set of methods into a rigorous methodology” (Kelly, 2004, p.116). He criticizes DBR on the grounds that studies are described primarily by using a set of process descriptors such as interventionist, iterative, theory-driven, etc. rather than describing the essential underlying conceptual structure.

Mixed Methods Research

Mixed methods research is the processes and procedures for collecting, analyzing and inferring both quantitative and qualitative data in a single study or in sequential studies, based on priority and sequence of information (Green, Caracelli, & Graham, 1989, Tashakkori & Teddlie, 1998; Creswell & Plano Clark, 2006; Creswell, Plano Clark, Guttman, & Hanson, 2003). Teddlie and Tashakkori (2003) define truly mixed approach methodology as a methodology that incorporates multiple approaches in all stages of research from problem identification to research questions, data collection, data analysis, and final inference; and includes a transformation of the data and their analyses through the other approach (i.e. quantification and qualitization of data). Tashakkori and Teddlie (2003) argue that “mixed methods designs evolved from the notion of ‘triangulating’ the information from different data sources” (p. x). However, mixed methodology evolved as a “third methodological movement” originated from the “paradigm wars,” in which each camp was criticizing the other’s methods of study, rigor of its procedures and the validity of its outcomes.

There are some essential theoretical assumptions that should be taken into consideration and adhered to when conducting a mixed methods study. These are the pragmatist philosophy, compatibility thesis and fundamental principle of mixed methods research (Teddlie & Tashakkori, 2003; Creswell & Plano Clark, 2006). The pragmatist philosophy keeps the researchers away from pointless philosophical arguments and enables them to mix the research components in the way they believe to work for the given research problem and context. This is also consistent with the fundamental principle of mixed methods research, since this principle expresses that the “methods should be mixed in a way that has complementary strengths and nonoverlapping weaknesses” (Johnson & Turner, 2003, p. 299; Creswell & Plano Clark, 2006). Lastly, as for the compatibility thesis which refers to the assumption that quantitative and qualitative methods are compatible and can be mixed (Teddlie & Tashakkori, 2003; Creswell & Plano Clark, 2006). It would be impossible for any researcher to even propose such a study, if this thesis were not assumed.

In addition to the above mentioned fundamental assumptions, Creswell, et al. (2003) state four additional assumptions or criteria implicit in the design of the studies:

1. Implementation of data collection referring to the sequence in which the researcher collects qualitative and quantitative data, which also affects data analysis and written report. Both qualitative and quantitative data collection might occur either concurrently or sequentially. This implementation approach also raises an issue of iterative cycles, where researcher may go back and forth between qualitative and quantitative data collection. In addition to the sequencing, researchers can also mix different qualitative and quantitative data collection techniques by utilizing *intra-* or *inter-method mixing*. Intra-method mixing is defined as concurrent or sequential use of a *single* method, e.g. using both open- and close-ended items in a questionnaire, whereas inter-method mixing utilizes *two* or *more* methods concurrently or sequentially, e.g. using questionnaires and interviewing (Johnson & Turner, 2003). These two

different kinds of method mixing are also called “data triangulation” and “method triangulation” respectively (Denzin, 1989). As for the data analyses, the collected data can be analyzed simultaneously or separately. However the important thing is to report the findings in an intertwined manner in order to support the qualitative findings with the quantitative ones (or vice versa) to enhance understanding (Morse, 2003) and to establish convergence of findings (Creswell et al., 2003)

2. Priority refers to which method, either quantitative or qualitative or both, is given more priority, weight and attention in the study.
3. Stage of integration, which stands for the phase in the research process where the mixing or connecting of the quantitative and qualitative data occurs. It might occur in different phases of the study, e.g. problem description, research questions, research methods, data collection and analysis, and inference processes (Creswell et al, 2003; Teddlie & Tashakkori, 2003).
4. Theoretical perspectives is used by Creswell et al. (2003) to refer to researchers’ personal stances toward the topics they are studying based on their personal history, gender, experience, culture and class (p. 222). This theoretical lens, which often informs the purpose of the study along with the questions, “may be explicit or implicit within a mixed methods study” (p. 223).

Based on these criteria Creswell et al (2003) specify six different types of major mixed methods research: sequential explanatory, sequential exploratory, sequential transformative, concurrent triangulation, concurrent nested, and concurrent transformative. Tashakkori and Teddlie (2003b) define a more extensive typology of mixed methods (p. 62) regarding their “degree of mixedness:”

- I. Multiple Method Designs (more than one method or more than one worldview)
 - A. Multimethod Designs (more than one method but restricted within one worldview (e.g. using two or more different quantitative methods)
 1. Multimethod Quantitative studies
 2. Multimethod Qualitative studies
 - B. Mixed Methods Design (use of both quantitative and qualitative data collection procedures and research methods)
 1. Mixed Method Research (occurs in the research methods stage of a study)
 2. Mixed Model Research (can occur in several stages of a study)

Enabling researchers to simultaneously answer exploratory and confirmatory questions and thereby verifying and generating theory about complex social phenomena in the same study is emphasized as the major advantage of the mixed methods (Teddlie & Tashakkori, 2003).

Another strength of mixed methods is that the fundamental assumptions, typologies, “how to” conduct different types of mixed methods studies, along with the detailed processes and procedures, issues related with scientific rigor and quality, have been defined and well-established with a number of articles besides a “handbook” (Tashakkori and Teddlie, 2003). There is even a subject-specific journal, namely, “Journal of Mixed Methods Research,” which is indexed in SSCI (Social Science Citation Index). The journal provides researchers with an opportunity to share their mixed methods studies on a variety of different subjects. However, there are still questions about whether it might qualify as a “rigorous methodology,” since mixed methods is still suffering one fundamental criticism. It is criticized on the basis of “incompatibility thesis,” which argues that quantitative and qualitative research paradigms should not be mixed and that multimethodology is inherently wrong (Onwuegbuzie and Leech, 2005).

Conclusion

Design-based research (DBR) and mixed methods research are two different entities. DBR is more of a generic paradigm rather than a method in the way that mixed methods research is. DBR offers a new worldview of theory development and refinement along with design to construct design sciences of education. However, it also offers a newly-emerging research methodology, which draws from different fields of design and education and even includes mixed methods approach, driven by this worldview. It is a *wicked paradigm* due to the “wicked problems” that it deals with (Rittel & Webber, 1973). It produces dynamic, glocal¹, and usable knowledge. It offers *usable knowledge* that informs theories which in turn inform real-world practices. It produces *dynamic* knowledge that changes dynamically in relation to context, which is a dynamic, winding structure that is shaped by time, place (space), actors and actions that take place. It offers, *local* knowledge, since it produces tentative generalizations that are drawn from initial implementations, which makes DBR a *local science*. However, I believe that it is possible to globalize these tentative, local generalizations to produce, *glocal* knowledge, with studies that have similar contexts, which might be offered as a resolution to the ‘universality’ conflict.

On the other hand, mixed methods research is a “third” methodology that rose from qualitative and quantitative paradigm wars. Although it provides an extensive and detailed set of processes and procedures, it is also criticized on the grounds of its theoretical foundation, by raising “the incompatibility thesis.”

¹ With the inspiration from cultural theory, which defines **glocalization** as “the global production of the local and the localization of the global,” (Robertson, 1992, p.175), we defined “the glocal knowledge.”

The following table summarizes the differences and similarities between design-based research and mixed methods research:

Table 1 <i>The differences and similarities between Design-Based Research and Mixed Methods Research</i>	
Design-Based Research	Mixed Methods Research
Differences	
A research paradigm to meet the need for “design sciences of education”	A “third” research methodology that resulted form “paradigm wars”
Interventionist in nature	Eclectic in nature
Aims to develop and refine theories (or “prototheories” in one study	Aims to verify and generate theory in the same study
Collaboration among researchers, designers, and practitioners in real-world settings	Collaboration among researchers, and “participants” real-world settings
Blurred “objective” researcher–participant distinction	Objectivity and Subjectivity in the same study (due to “Compatibility Thesis”)
Produces <i>dynamic, glocal</i> , and usable knowledge inform theories that inform real-world practices (“local science”)	Produces complementary, divergent knowledge that results in stronger inferences and understanding
Similarities	
Employs a pragmatic approach for its aim	Employs a pragmatic (or transformative-emancipatory) philosophy
Theory-driven and grounded in real-world contexts	Theory-driven (both theoretical lens and researcher’s personal stance based on their personal history, culture, gender, etc.) and conducted in real-world settings.
Continuous and iterative cycles of “design, enactment, analysis and redesign”	Iterative cycles due to “implementation of data collection,” where researcher may go back and forth between qualitative and quantitative data collection.
Intertwined theory development and learning environment design	Intertwined research methods and techniques
Integration of different theories, research methods and procedures. It utilizes <i>mixed methods</i>	Integration of different research methods and procedures in different phases of the study (e.g. data collection, analysis, etc.)
Criticized for not having a sound theoretical foundation and rigorous methodology	Criticized for not having a sound theoretical foundation on the basis of “incompatibility thesis”

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