Chapter XX

Computer-Assisted Language Learning and Design-Based Research: Increased Complexity for Sure, Enhanced Impact Perhaps

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Abstract

As a distinct genre of educational research, design-based research (DBR) is especially appropriate for advancing the state-of-the-art of computer-assisted language learning (CALL). Since its emergence two decades ago, DBR has become increasingly adopted by educational researchers working in educational technology, the learning sciences, and several other areas. A few researchers have pioneered the application DBR in CALL, but there is a need for much more research of this kind across the CALL community. The paper describes the rationale for DBR in CALL but cautions prospective adopters to be prepared for unexpected challenges as they seek to accomplish three important outcomes of this research genre: (a) effective intervention(s), (b) enhanced theoretical knowledge, and (c) professional development.

Keywords
Computer-Assisted Language Learning (CALL), Design-Based Research (DBR), Complexity, Socially Responsible Research

1. Introduction

In his widely cited introduction to the philosophy of science, Chalmers (1990) sided with those scientists who recognize that the “search for a substantive universal, ahistorical [research] methodology is futile” (p. 20, cited in Nunan, 1997). Whereas a few authorities still argue for randomized controlled trials as the “gold standard” in educational research (see Torgerson & Torgerson, 2001), most researchers focused on computer-assisted language learning (CALL) acknowledge the value of multiple approaches to conducting meaningful inquiry (Egbert & Mikel Petrie, 2005; Stockwell, 2012).
However, not all genres of educational research are well represented in second language education research. The focus of this monograph, design-based research (DBR), is certainly underrepresented in the published literature as well as in existing language learning research guidebooks. For example, neither Ellis (2012) nor Mackey and Gass (2012) include any mention of DBR as a distinct genre of research in language acquisition or instruction. Instead, the authors of these and most other educational research methods books simply divide research into two broad categories, quantitative and qualitative, and in so doing, fail to make the critical distinction between research goals and research methods.

The goals of research refer to the rationale for or intent of a research initiative. A distinction has often been made between basic research focused on discovering new knowledge for its own sake and applied research focused on solving real-world practical problems, but this simplistic distinction does not adequately represent how research is actually conducted nor the multiple goals pursued by most researchers (Stokes, 1997). Educational technology researchers, including those working in the CALL space, often have a range of different goals, for example, theoretical, predictive, interpretivist, postmodern, design, and/or action (Reeves, 2006). Ideally, once CALL researchers have clarified their research goals and identified specific research questions, then they are ready to choose the most appropriate research approach or methodology. It is misleading to suggest that researchers should choose among quantitative, qualitative, or mixed methods before they have clarified the goals of their research agenda.

DBR is a genre of educational research that is most often represented as having two major goals (Barab & Squire, 2004): first, the iterative development of solutions (often referred to as interventions) to complex educational problems; and second, the refinement of theoretical understanding (often referred to as design principles) that can guide other researchers and practitioners focused on these same or closely related educational problems. Phillips and Dolle (2006), among others, have cautioned that the simultaneous pursuit of practical innovation and theory building is extremely ambitious and difficult. This partially stems from the fact that researchers pursuing design research work hand in hand with practitioners to grapple directly with the complex variation of real-world educational challenges. Although it increases the complexity, this collaboration can lead to accomplishing a third goal for DBR, which is professional development for all those involved.

2. CALL for Second Languages: A Wicked Problem

It is inevitable that DBR is a challenging enterprise because it is intended to solve serious, even seemingly intractable, problems within a given field. Learning a second language is a difficult task for most humans, especially when contrasted with the ease with which most children learn their first language (Birdsong, 2006). Research has shown that even adults who appear to have reached native fluency in a second language are not as proficient as native speakers of that language when confronted with complex grammatical interpretation tasks (Hyltenstam &
Abrahamsson, 2003). In general, language acquisition research studies indicate that learning a second language is very difficult for most adults, that learning outcomes are generally lower than desired by both the learners themselves and their teachers, and that there is great variability in the outcomes of any given language learning intervention that cannot be easily explained (Brown, 2006; Ortega, 2009). For these and other reasons, the design of effective second language learning education programs can be viewed as a “wicked problem.” According to Coyne (2005), wicked problems persist, and are subject to redefinition and resolution in different ways over time. Wicked problems are not objectively given but their formulation already depends on the viewpoint of those presenting them. There is no ultimate test of the validity of a solution to a wicked problem. The testing of solutions takes place in some practical context, and the solutions are not easily undone. (p. 6)

Kelly (2009) maintained that design-based research is recommended in the face of wicked educational problems. Specifically, he stated that design research is recommended when one or more of the following conditions operate to make the problem more wicked and open than simple and closed, for example:

- When the content knowledge to be learned is new or being discovered even by the experts.
- When how to teach the content is unclear: pedagogical content knowledge is poor.
- When the instructional materials are poor or not available.
- When the teachers’ knowledge and skills are unsatisfactory.
- When the educational researchers’ knowledge of the content and instructional strategies or instructional materials are poor.
- When complex societal, policy or political factors may negatively affect progress. (p. 76)

Second language learning in general, and computer-assisted language learning (CALL) specifically, suffer from three or more of these conditions in most contexts. Hence, designing effective CALL deserves to be characterized as a wicked problem. Unfortunately, much CALL research appears to be conducted in ways that ignore the inherent “wickedness” of the challenge. Rather than seeking to confront the significant problems facing second language instructors, many articles in any given issue of language learning and technology journals (e.g., the CALICO Journal, ReCALL, Computer Assisted Language Learning, and Language Learning & Technology) appear to focus on the technologies de jour. For example, the May 2012 issue of the CALICO Journal includes papers about second language learning applications of Web-2.0 technologies (Wang & Vásquez, 2012), wikis (Arnold, Ducate, & Kost, 2012), and Facebook (Mitchell, 2012). Similar articles can be found in most educational technology journals published over the past fifty years (Clark, 2012). Typically these articles are exploratory
and descriptive in nature. Even when the “studies” described in these articles do include some sort of quasiexperimental research design, these articles most often report no significant differences in learning outcomes and conclude with calls for more and better research (Reeves, 2011).

This is not to dispute the inherent value in exploring innovative uses of emerging technologies. However, it is essential to keep educational needs and pedagogical issues ahead of technology. In the inevitable excitement that CALL researchers have in exploring what is possible tomorrow, insufficient research and development work appears to be focused on what is practical and needed today. As a result there is a significant gap between what could be effective CALL in theory and what can be effective CALL in practice.

3. The Potential of DBR in CALL

As noted above, the field of CALL struggles with no shortage of wicked problems, and yet, much CALL research is focused more on technological potentials for tomorrow than on addressing urgent problems today. For example, when a new technology like an Apple iPad comes out, there is a rush by educators to see how it might be used to improve educational practice and outcomes. Meanwhile, solutions to long-term persistent problems such as the inadequate development of second language fluency among soldiers in the U.S. military, English-speaking business people working in China and other countries, and providers of social services in rural areas of the USA where many Spanish-speaking immigrants live are not adequately addressed. Largely due to its central focus on tackling complex educational problems, DBR has the potential to yield three important outcomes within the context of second language learning and instruction: effective interventions, theoretical understanding/design principles, and professional development.

First, DBR ideally enables the development of robust effective interventions. The findings of a recent extensive review of second language acquisition (Dixon et al., 2012) highlighted well designed second language educational programs and sufficient time devoted to second language literacy instruction as essential to second language acquisition. Although Dixon et al. did not explicitly mention computer-based language education per se, CALL holds forth the promise, if not the desired levels of realization, of employing effective instructional strategies and increasing academic learning time (Beatty, 2010; Egbert & Hanson-Smith, 2007; Evans, 2009).

Although CALL has clearly not begun to reach its enormous potential, we believe that many researchers and practitioners alike would agree with Hanson-Brown (2003) who proclaimed “The debate is no longer over whether to use CALL, but only how best to do so” (p. 29). DBR fundamentally changes the focus of research from “what works?” questions to “how can we make this work and why?” intentions. CALL programs developed following DBR protocols are designed, tested, adopted, implemented, retested, and refined in authentic settings through iterative cycles of analysis and exploration, design and construction, and evaluation and reflection (see Figure 1). Ideally, DBR does not cease until the
desired levels of problem resolution are attained. This may even mean that the eventual mature intervention may not include CALL per se if the nature of the effective program yielded by DBR does not require it.

Figure 1. Generic model for educational design research (adapted from McKenney & Reeves, 2012).

The second major outcome of DBR concerns the development of theoretical understanding. Hubbard (2008) concluded that the theoretical foundations of CALL research over a twenty-five year period were diverse to say the least, and “there were none that could be legitimately labeled ‘dominant’” (p. 392). A similar dispersion of theoretical foundations and methodological orientations can be found throughout the educational technology literature (Spector, Merrill, van Merriënboer, & Driscoll, 2007), as well as across the entire spectrum of educational research (Moss et al., 2009). But DBR can contribute to a body of knowledge that is useful to others outside the immediate context of any given research project (Burkhardt & Schoenfeld, 2003). Ideally, DBR can foster the development of theories that are used to describe, explain, predict, or even mediate educational variables related to CALL. Particularly useful DBR yields theoretical insights of a prescriptive nature, often referred to as design principles (Kali, 2008). Design principles for CALL might include principles such as: “Learners should be given some level of control over the pace with which new vocabulary is added to an interactive learning environment” or “The cognitive load associated with the graphical user interface of a CALL program should not exceed the cognitive load of the language learning tasks inherent in the program.” These principles can be applied to specific types of problems across a wider range of settings.

A third major outcome of DBR is professional development, although this outcome has not been as widely acknowledged in existing DBR research handbooks (see Kelly, Lesh, & Baek, 2008). DBR has the potential to provide powerful insights for educational researchers, practitioners, and all others involved in a given initiative, driven by the data that flows from the various iterative cycles of testing.
and modifying the intervention as well as by the frequent exchanges that occur when project participants come together to discuss the implications of the findings for intervention refinement and the synthesis of design principles. While professional development may not be a sine qua non of educational design research, we view it as a goal worth pursuing and explicitly frame our own DBR work to facilitate this process. Serious DBR initiatives typically last years rather than months, and although a small cadre of the participants may remain the same, it is likely that various people will move in and out of the research project over time. This is particularly the case with doctoral students who may need to carve out a significant, but manageable, piece of an on-going DBR agenda for their dissertation research (Reeves, McKenney, & Herrington, 2011).

4. Applications of DBR in CALL

There is a paucity of DBR found in the CALL literature. Anderson and Shattuck (2012) presented an analysis of the 47 most-cited DBR articles published in educational research journals during the decade extending from 2002 through 2011. According to the supplemental materials associated with their article, two of the 47 most-cited articles were focused on DBR applied to language education or CALL: Echevarria, Short, and Powers (2006) and Lund (2008). However, Anderson and Shattuck limited their analysis to “5 most cited articles of each year that either explicitly used DBR or focused on the description, critique, or review of DBR methodology” (p. 19). (There are 47 articles instead of 50 because they were only able to find two articles that met their criteria published in 2002.)

Given the specificity of the Anderson and Shattuck (2012) search criteria, it is not surprising that their analysis did not include more papers describing the application of DBR in the context of CALL. Indeed, there have only been a few pioneering applications of DBR in the language education sector and CALL specifically. For example, Yutdhana (2005) described how as a doctoral student she applied DBR in the context of developing a teacher-training model for improving how teachers use the internet in teaching English as a foreign language (EFL) in Thailand. She concluded her chapter with the statement that “DBR provides us with a lens for understanding how we can enhance students’ language learning through the use of technology (p. 177).

Echevarria et al. (2006) described how their sheltered instruction observation protocol model “was developed through a cyclical process, wherein researchers and project teachers designed, used, analyzed, and redesigned features of the model” (p. 200) using a version of design-based research called a “design experiment” (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003). They acknowledged the complexity of conducting DBR in the “messy settings” (p. 207) that are actual classrooms in schools but maintained that it is precisely this type of long-term design research that is required to enable the development of high-quality instruction for English language learners.

Lund (2008) described one phase within a longitudinal DBR initiative focused on the representing and enhancing the “collective cognition” enabled by wikis
used by EFL learners in Norwegian secondary schools. Rather than merely describing the use of a new technology with second language learners, Lund applied DBR to produce a more effective intervention as well as to develop a refined understanding of how the sociogenetic aspects of collective language production can enhance second language learning. This research project yielded a model for wiki use in EFL classrooms, enriched theoretical understanding of “linguistic expansion (lexico-grammatical and semantic) when engaging in collective [learning] practices” (p. 51), and insights into how to provide better professional development opportunities for EFL teachers interested in CALL. Lund’s work clearly demonstrates the three major outcomes that can emerge from DBR.

Wang, Song, Stone, and Yan (2009) also focused on EFL learners. This unique international DBR project was carried out by researchers and teachers in China and the USA in which the collaborator sought to foster the development of enhanced language proficiencies of college level EFL learners in China using a multiuser virtual environment (MUVE), specifically Second Life (Warburton, 2009). The research team intentionally adopted DBR because of a desire to improve the relationship between CALL research and EFL teaching practice. Although the international nature of this project intensified the complexity of this DBR project, Wang et al. concluded that it also provided “tremendous opportunities for both the participants and the researchers” (p. 19). Their work points out the powerful capacity of the CALL research and development community to bring together learners from diverse cultures around the globe.

Pardo-Ballester and Rodríguez (2009; 2010) described multiple pilot tests of the interface design of CALL materials for beginning and intermediate Spanish language learners. This DBR project had two specific goals: first, enhancing the user interface of multimedia glosses provided in online reading materials; and second, refining understanding of how Spanish language learners interact with and react to the interactive materials. Emphasizing the enormous potential of DBR to improve both practice and theory in CALL, Pardo-Ballester and Rodríguez (2010) concluded that “DBR not only helps advance the development of instructional materials to higher ground, but may also become a powerful force in the generation of theory grounded at the deepest levels of practice” (p. 550).

Hung (2011) described a multiyear DBR effort aimed at developing digital video technology to support university level EFL learners. Hung noted that DBR is both “time- and money-intensive,” but maintained that “its results are worth the effort” (p. 159). As one of the major outcomes of this DBR project, Hung synthesized six major design principles based on the data from the study itself and the relevant literature underlying its conceptual framework (see Chapelle, 2005; Moreno, 2006). Hung ended this paper by recommending that DBR be more widely adopted in CALL as well as in other fields, arguing that this would be a way to make educational research a much more socially responsible enterprise.

Zheng and Newgarden (2012) described a DBR initiative aimed at nothing less than “rethinking language learning” in light of recent developments in cognitive and sociocultural learning theories and availability of MUVEs such as Second Life. The researchers concluded that “language learning requires more than a con-
trolled, rule-governed, well-sequenced curriculum; it requires design of a learning environment where learners can participate, interact, select, and evaluate the effect of language actions” (p. 27). Zheng (2012) extended the rich discussion of this DBR project and concluded that virtual technology such as Second Life “not only allows designers to provide learners with social, historical, and cultural materials to augment action and interaction across space and time, but also, in a much more tangible way, it allows researchers to re-experience learners’ trajectories” (p. 557).

5. Discussion

The seven DBR studies focusing on CALL briefly described above are notable for both their pioneering nature and for the positive examples they provide to show what is possible in this area. Of course, DBR will not resolve arguments about the best ways to conduct educational research, and indeed any convergence on a single method is not warranted given the humble findings of research deemed educational (Hostetler, 2010). However, these studies as well as the work described in this monograph should encourage us to renew our commitment to enhancing the relationship between educational research and practice.

Some of our own work has centered on how computers can contribute to the development of early literacy (Cviko, McKenney & Voogt, 2012; McKenney & Voogt, 2009). In addition, many of our other DBR projects have concerned CALL-related areas such as professional development for teachers in India (Raval, McKenney, & Pieters, 2010) and effective online learning environments (Oh & Reeves, in press). In McKenney and Reeves (2012), we synthesized two decades of DBR conducted by ourselves with various doctoral students and colleagues. We are convinced that DBR provides a viable, perhaps the most viable, route that educational researchers can follow to improve educational practice and develop useful theoretical insights and/or design principles.

As we conducted our review of the CALL literature for this chapter, we were encouraged by the efforts of the DBR pioneers referenced above. Curiously, as we searched the internet for DBR related to CALL, our web browser detected a pattern in our interests, and we began to be deluged with advertisements for various commercial versions of CALL. This led us to reflect about the state of the art of commercial CALL in reference to the status of fad diets. Some of these programs promise that we can learn a foreign language in “only ten days,” much like fad diet plans that claim to help people “lose ten pounds in a week.” Other advertisements suggest that our love lives will be enhanced when we speak another language! The CALL research literature includes almost no serious studies of these commercial programs, and the few researchers who have examined commercial language software show similar outcomes to studies of fad diets including poor outcomes and high attrition (see Nielsen, 2011).

Not surprisingly, the websites for these popular commercial products present virtually no valid studies supporting their effectiveness. If this is an indication that members of the CALICO community prefer to work in educational settings where
the fruits of their labor are more urgently needed, then we applaud it wholeheartedly. As they do so, it will be up to them to respond to the dire need to make CALL research and educational research in general both rigorous and relevant (Reeves, 2011).

Members of the CALL community picking up this challenge must enter into DBR with their eyes wide open and sleeves rolled up, aware of the enormous complexity of DBR. This unique research genre requires long-term in-depth collaboration among researchers, practitioners, and others. It requires a strong commitment because, as several of the CALL researchers reviewed above have specifically noted, DBR is rarely fully finished!

In addition, it can be difficult to obtain funding because the evolving nature of the typical DBR initiative prohibits specifying everything in advance. Many refereed journals are reluctant to publish DBR reports because such papers often exceed the typical 6,000 to 8,000 word limits. This last point is especially worrisome for untenured researchers working in research intensive universities. A survey of established CALL researchers conducted by Smith and Lafford (2009) concluded that “CALL experts in this study identified publishing scholarly articles in refereed journals as the most important form of published creative activity for junior faculty” (p. 880). It behooves tenure and promotion committees to look for evidence of impact beyond refereed journal publications (Park, 2012).

Despite the complexity and inherent challenges of DBR, we would argue that the potential impact makes it all worthwhile. Desforges (2001) wrote “The status of research deemed educational would have to be judged, first in terms of its disciplined quality and secondly in terms of its impact. Poor discipline is no discipline. And excellent research without impact is not educational” (p. 2). The CALL literature is replete with reports of rigorous research, but the impact of CALL research must increase. We hope this special CALICO monograph is a first important step on several decades of DBR research to advance this field.

References


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CALL AND DBR: INCREASED COMPLEXITY