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Design-Based Research in CALL

Edited by
Julio C. Rodríguez and Cristina Pardo-Ballester

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Meg Sorensen
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Design-Based Research in CALL

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Chapter 1

Introduction

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The purpose of this volume is to expand and refine our understanding of the use of design-based research (DBR) in CALL by contributing to the growing body of literature in this area. We have tried our best to strike a balance between theoretical considerations and concrete examples of DBR. The first section of this volume focuses on theoretical perspectives and ideas that can inform the use of DBR in CALL. The second section contains studies that illustrate DBR through concrete instances of its operationalization. We hope this volume will be a useful source of information and inspiration for those considering to further explore DBR in CALL. For updates on DBR in CALL, please visit the companion site to this volume: <https://sites.google.com/site/designbasedresearch/>

The first chapter in this volume, by Thomas C. Reeves and Susan McKenney, presents a critical view of the current status of DBR in CALL. Their perspective from a sister discipline, educational technology, introduces this discussion by identifying plausible synergies between DBR and CALL based on their vast experience of how DBR has enriched research in educational technology. The authors provide a review of work in DBR and CALL and stress the need to consider professional development as an outcome of DBR.

We believe this piece makes an important contribution to the DBR literature by giving due value to the important role of professional development in any CALL context. Reeves and McKenney go as far as to include professional development as one of the goals of DBR in addition to the dual goals of theory building and improvement of practice. As the authors duly acknowledge, issues related to professional development are extremely difficult to avoid in DBR. Inspired by their contribution, we have given professional development a focal role in the second section of this volume.

Diane Larsen-Freeman’s thoughtful chapter shares her perspectives on how DBR, Complexity Theory, and CALL could make a powerful combination to advance our understanding of how technology can best support second language acquisition (SLA). She examines how the qualities of this triad make up a promising blend that offers the potential to address important aspects of CALL research, such as the need to acknowledge the complexity of natural instructional contexts, the possibility to adopt a reflective, retrodictive perspective to explain the success

or failure of an intervention, and not least, the flexibility to enact the refinement of pedagogical devices, tools, and theory in the same fashion effective practitioners do.

Mike Levy's contribution presents a unique in-depth reflection on normalization as a possible construct to anchor CALL research and explores some of the difficulties to define this construct as well as scenarios in which its use could be helpful. In order to better define the construct, he suggests decompressing the idea of "computer technology" by considering a number of levels, each of which represents different functions or components. In this way, "normalization" could be explored in relation to those functions or components rather than to the idea of "computers" as a whole. Motivated by the goal to increase the impact of research on CALL practice, Levy suggests ways in which CALL research could more closely inform practice through research approaches that are natively anchored in practice themselves, such as DBR. Drawing from McKenney and Reeves (2012), the author explores the idea of theories evolving from principles of local relevance toward high-level, generalizable ones.

In their reflective piece, Agnieszka Palalas and Debra Hoven build a strong case for how DBR could fit in the context of design, development, implementation, and research of instructional interventions for mobile-assisted language learning. Their chapter takes us behind the scenes of DBR and describes how a sophisticated DBR undertaking made a contribution to an emerging theory, Ecological Constructivism (Hoven, 2006), thereby materializing an essential aspect of DBR, such as is the requirement for theory creation or refinement as part of an iterative research process (Design-Based Research Collective, 2003). This chapter highlights the intrinsic need for collaboration present in most DBR projects, discusses some of the challenges presented by DBR, and offers practical recommendations for successful implementation.

The last chapter in this first section helps us imagine the possibilities of a synergistic approach to research in CALL that builds on foundational research on SLA and on research in applied linguistics. Drawing from Orrill, Hannafin, and Glazer's (2003) distinction, Hsiu-Ting Hung situates DBR at the confluence of foundational and applied research. Conceptualizing research from this perspective, the aim is not to necessarily subordinate applied linguistics research to SLA research or to rely solely on SLA research to provide the theoretical frameworks to gauge the success of an instructional intervention, but rather to take advantage of the convergence of SLA and applied linguistics research to further develop or refine both theory and practice through a principled approach that does justice to both.

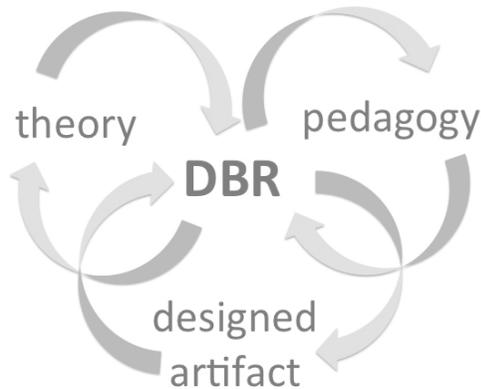
Hung's piece reflects on and makes a case for the centrality of design as a mediational artifact in the research process, a concept that will most probably resonate with many CALL researchers. She takes a look at the iterative process of design, showing us concrete examples of how the iterative nature of the process and the dual goals of DRB can be documented.

The second section of this volume capitalizes on the theoretical and reflective accounts presented in the first section by focusing on the operationalization of

DBR. Synergies between theory (e.g., applied linguistics, SLA, sociocultural theory, etc.), pedagogy (e.g., language teaching methodologies), and design artifacts (e.g., CALL tools, environments, etc.) create exceptional opportunities to advance theory and expand our understanding of how these three components can improve language learning and teaching through technology. The iterative nature of DBR makes it possible for each of these three components to also take advantage of refinement through iteration (see Figure 1).

Figure 1

The Iterative Nature of Theory-Building Research



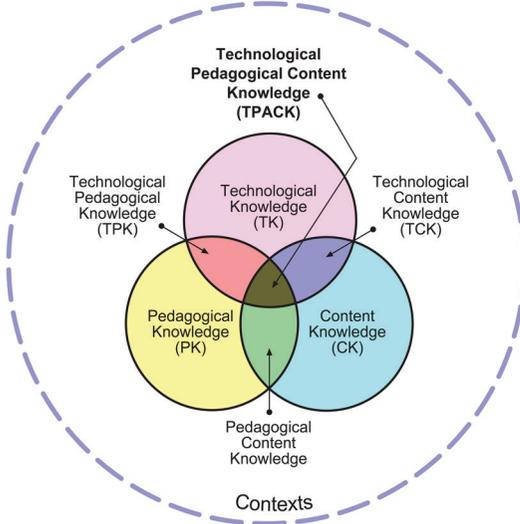
Many of the chapters in this second section clearly manifest how professional development issues play a role in the operationalization of DBR, thereby supporting Reeves and McKenney's assertion in the first chapter that professional development should constitute a DBR goal and should therefore be addressed in DBR interventions. Because of the saliency of professional development issues in all chapters in the second section, we would like our readers to consider a construct that can organize some of the most important aspects of knowledge construction in world language teacher development contexts.

Technological Pedagogical Content Knowledge (TPACK) is a construct that has emerged in the field of technology and language teacher development in the last decade (Hofer, Harris, Blanchard, Grandgenett, Schmidt, van Olphen, & Young, 2009; Rodríguez, 2006). The TPACK construct can be a useful advance organizer to help us understand the nuanced complexities in world language teacher development that emerge in most DBR implementations in this volume. The TPACK construct evolved from Lee L. Shulman's (1986) original construct: pedagogical-content knowledge (PCK). In his early work, Shulman (1986) defined PCK as "the ways of representing and formulating the subject that make it comprehensible to others" (p. 9). In other words, PCK is a particular type of knowledge that teachers construct through the dialogic interaction between pedagogy and discipline-specific content.

Koehler and Mishra (2005) later expanded Shulman's original construct by proposing the addition of technological knowledge, which in its basic form includes knowledge of how technology operates (e.g., knowledge of typing, knowledge of operating a piece of software, etc.). Following Shulman's model, they also used the concept of knowledge amalgamation, that is, the interaction between each of the three "core" bodies of knowledge with one another gives rise to blended types of knowledge, namely technology pedagogy knowledge (TPK), pedagogy content knowledge (PCK), and technology content knowledge (TCK) (for examples of these types of knowledge in world language teacher education contexts, see Rodríguez, 2006). The combination of these three blended types of knowledge results in a unique, highly contextualized type of knowledge: TPACK (see Figure 2). The assumption is that for effective technology integration to take place, instructors need to develop TPACK (Koehler & Mishra, 2005; Koehler *et al.*, 2004).

Figure 2

Technological Pedagogical Content Knowledge construct (www.tpack.org)



We open the second section with a contribution by Michael Bush and Meg Sorensen, who vividly describe the implementation of a complex instructional change. They recount the ESL learners' experiences with a customized social networking tool and the slow adoption process of the instructors. The authors delve into the complexity of the change by taking a closer look at learner perceptions and the role of the teacher in the intervention. This chapter highlights interesting nuances in the adoption of an innovation (see also Mike Levy's contribution in this volume) as well as in the slow and steady process of teacher development that leads to successful implementation. The authors' insights into the instructors' role reminds us of the complexity of technology and teacher development, or, as Johnson, Khoo and Campbell describe it in their contribution to this volume: "the messiness of complex teaching environments" (pp. 109). Although not

used explicitly in this chapter, the authors' description of the different factors influencing the teachers' decisions can often be related to the TPACK construct presented above. By Iteration 4, a TPACK-type of knowledge appears to have emerged prompting teachers to re-evaluate their initial stance and to see the potential for successful integration of the innovation and envision the possibilities beyond scripted practice.

E. Marcia Johnson, Elaine Khoo, and Lucy Campbell's case study is an excellent example of the enactment of the DBR in an online teacher development context. The authors zoom in on an online CALL course offered to preservice and inservice language teachers to take a closer look at how a tool designed for lecture-capture (Panopto) is integrated into a CALL course. They provide useful insights into designs for online learning in general and online teacher development in particular.

Paraphrasing Reeves, McKenney, and Herrington (2011), Johnson et al. state that a "deeper understanding of pedagogy, technology, and their interactions should lead to more robust instructional practice and deeper theoretical insights" (pp. 111). This not only summarizes the potential synergies between DBR and technology integration into teacher education contexts but also succinctly expresses the need to better understand how technological-pedagogical content knowledge (TPACK) is constructed in teacher education contexts.

Instructional contexts that blend the teaching of academic content with language instruction can be quite complex and thus challenging to explore. Patricia Martínez-Alvarez and Brenda Bannan take up this challenge by using a DBR approach to shed light on the integration of science, SLA, and literacy in instructional contexts designed for emerging bilinguals. As the authors state, these areas fall within the confines of different disciplines and are typically not explored in combination.

Martínez-Alvarez and Bannan highlight the issue of overlapping content areas, as it is common in language teacher education settings and explain how in their context of inquiry, the dual content of teacher development (i.e. language proficiency and linguistic awareness) is compounded by the need for teachers to also "demonstrate the necessary practical and theoretical expertise to provoke conceptual change in science while simultaneously enhancing SLA" (pp. 129). Drawing from Bannan-Ritland's (2003) Integrative Learning Design Framework (ILDF), the authors provide a rich description of the process of development of a tool that promotes both inquiry-based learning and SLA and simultaneously supports content learning in the sciences (geomorphologic processes in this case). The TPACK construct is useful to ponder the complexity of the knowledge the teachers need to acquire in order to successfully integrate technology.

The next chapter, by Seijiro Sumi and Osamu Takeushi, constitutes a fine example of how DBR can help build and operationalize theory through the development of an instructional method. They apply an adaptation of the DBR phases outlined by Amiel and Reeves (2008) to look into factors that prevent instructors from effectively using technology in language learning contexts. Based on the results of their research, they implement and further analyze a flipped model of

language instruction in which technology is used to extend the classroom. As the researchers show, making technologies and resources available online and repurposing spaces to facilitate social interaction and collaboration can result in a powerful combination to support language instruction. Their observations have implications for language resource centers in higher education.

Again, the TPACK construct is helpful to establish connections between some of the factors identified by Sumi and Takeushi which prevented instructors from using technology effectively. For example, two aspects that are identified by the researchers and that need to be overcome for the construction of TPACK to crystallize are (a) the mismatch between instructor expectations and the actual affordances of the system and (b) the complexity of operation of the technology system. Arguably, both of these technology factors need to be overcome before any meaningful integration of technology takes place. Aligning expectations with affordances and having adequate familiarity with the system's operation are precursors to meaningful integration.

The notion of developing instructors' TPACK as a means to improve technology integration is compatible with the ecological perspective that Sumi and Takeushi so well illustrate since the TPACK construct natively allows for content, pedagogical, and technological affordances to be taken into consideration. From this view, effective integration of technology depends on how well the teacher is able to use their TPACK knowledge in a given environment. It is assumed that the ability to identify affordances of the content, pedagogy, and technology is necessary for the operationalization of TPACK.

Cristina Pardo-Ballester and Julio C Rodríguez use a DBR approach to explore how Spanish language learners' experience and explore a synthetic environment used to teach a hybrid language course. Learners' experiences and perceptions are used to inform changes in task design and to extract a set of design principles for learning language and culture in multiuser virtual worlds. Sociocultural theory is used to analyze linguistic interactions between novice (language learner) and expert (native speaker) and to illustrate instances of interaction that may aid L2 development. Design principles for language learning task design in synthetic immersive environments are derived from the analysis of the data.

In the following chapter, Tasha Lewis describes a task-based, telecollaborative language exchange that was improved by using a DBR approach. The telecollaboration tasks, implemented in first- and second-year college Spanish, were supported by a synchronous, multimodal videoconferencing tool (Skype). Questionnaires answered by student participants guide the redesign of the original tasks. The analysis of the students' interaction with native speakers reveals the presence of language features that aid acquisition. Lewis identifies opportunities and challenges in the implementation of similar telecollaboration programs and provides advice for their expansion.

In closing this introduction, we would like to express how fortunate we have been to assemble such a diverse range of voices and perspectives on issues and topics related to DBR. This volume goes beyond what we could have ever imagined when we embarked on this journey a couple of years ago. We hope our read-

ers will enjoy interacting with and thereby learning from this modest contribution to our field just as much as we have enjoyed interacting and thereby learning from such a distinguished group of professionals.

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Chapter 2

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

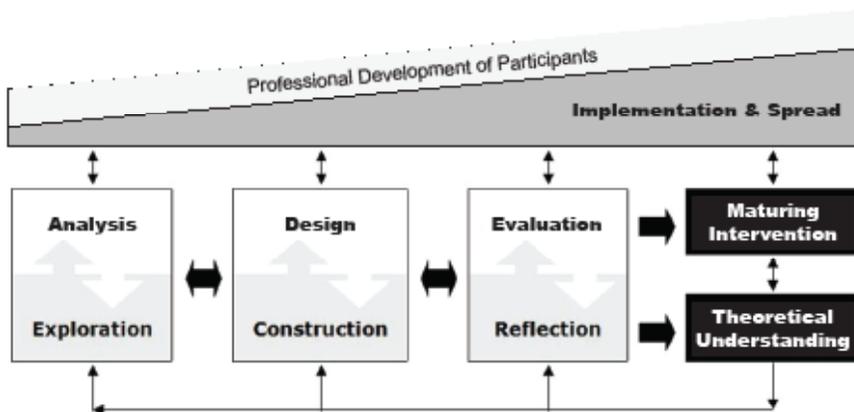
As noted above, the field of CALL struggles with no shortage of wicked problems, and yet, much CALL research is focused more on technological potentials for tomorrow than on addressing urgent problems today. For example, when a new technology like an Apple iPad comes out, there is a rush by educators 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 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.

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Chapter 3

A Promising Combination: Complexity Theory, Design-Based Research, and CALL

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Abstract

Complexity theory, design-based research, and CALL share a number of important qualities for research purposes. Their concern and/or capacity for interactivity, dynamism, iteration, and adaptability invite a focus on the process of learning. In addition, they support a view of learning that is not deterministic, but is rather complex and contingent. Instead of creating research designs that isolate a single variable, researchers can examine multiple variables in order to develop a qualitative account that links different instructional conditions with different effects on learning, all the while acknowledging the uniqueness of individual learners and of contexts. Finally, researchers can adopt a retrodictive view of learning and teaching, looking for the influence of prior activity on current outcomes. These qualities make complexity theory, design-based research, and CALL a promising combination for investigating matters of language learning and teaching.

Keywords

Complexity Theory, Complex Systems, Design-Based Research, CALL

1. Introduction

For some time I have been considering how complexity theory as a metatheory can help illumine issues of interest in the development of a second language (Larsen-Freeman, 1997). For almost the same period of time, I have been concerned with finding a suitable method or methods for implementing a research agenda in a way that is compatible with complexity theory (CT), for not all research methods align well with a complex systems view. Cameron and I (Larsen-Freeman & Cameron 2008a; 2008b) have discussed what CT-compatible research methods would entail. Three of the methodological principles we have identified for investigating complex systems are (2008a, p. 242):

1. Be ecologically valid, including context as part of the system(s) under investigation.

2. Honor the complexity by avoiding reductionism. Avoid premature idealization by including any conceivable factors that might influence a system.
3. Think in terms of dynamic processes and changing relationships among variables. Consider self-organization, feedback, and emergence as central.

One of the methods that we have pointed to as embodying these demanding principles is design-based research (DBR). However, the fact remains that there still needs to be a suitable means to implement the method. It seems to me that CALL is one way to do so. Therefore, a promising research combination is CT, DBR, and CALL.

Before going any further, I should make clear that I do not see CALL merely as a tool. I realize that it has its own principled approach. Nevertheless, given my own predilection, I start with CT in endorsing the combination by pointing to characteristics of CT, which are shared by DBR and CALL. Among them are interactivity, dynamism, iteration, and adaptability. Next, I discuss the applications of the combination with regard to education, in general, and to language teaching, in particular. Before concluding, I interject a brief note on the limitations of DBR as a caution against embracing any combination exclusively.

2. Complex Systems

Complex systems, the focus of CT, abound both in the natural world and in the human-made one. A weather system, a natural ecosystem, a city, and a language are all complex adaptive systems (Ellis & Larsen-Freeman, 2009). They evolve through a process of emergence, whereby novel macrolevel patterns arise from the microlevel interaction and self-organization of the multiple components which make up the complex system. I should quickly add that there are not always two levels in a complex system, but rather there can be many levels nested one in another. For instance, natural ecosystems minimally exist at the levels of genes, individuals, populations, and species. In any case, the same bottom-up dynamic applies, in which a level higher up emerges from interaction of components at a subordinate level. Change is central so the emergence is never complete. The emergence takes place recursively through iterative cycles. It is the iterative nature of complex systems which gives rise to their structure. Complex systems are not only dynamic, but they also have no end point. They continue to evolve over time, at a point far from equilibrium, provided that they are open to energy from outside the system. They may achieve stability, but never stasis. Complex systems are adaptive; their adjustments to feedback are contingent, not deterministic.

The components that comprise the system do not make a uniform contribution to the shape of the system. Some are more dominant at one time, but less influential at other times. In other words, it is highly unlikely that a single cause will explain the dynamics of a complex system. Rather, there are likely to be multiple and interconnected causes. The context of a complex system is not a backdrop to the main action, but is rather in dynamic interface with the system. Because of their dynamism and their nonlinearity, investigating such systems at a single point in time can lead to spurious findings. It is best to study such systems retrospectively by tracing the nonlinear path they leave as they evolve over time.

Much more could be said about complex systems, but perhaps what I have written will suffice to justify my endorsement of a CT/DBR/CALL combination. Let me turn now to a brief description of DBR.

3. Design-Based Research

Design-based research is a relatively new approach to conducting educational research. It seeks to counter the problem that decontextualized educational research often fails to influence teaching practice (Anderson & Shattuck, 2012). Therefore, one of DBR's distinguishing features is that it takes place within natural instructional settings; context is not treated as an extraneous variable (Barab & Squire, 2004). Furthermore, its focus is on learning as a process, and, therefore, it is typically longitudinal. Where it differs from other longitudinal, situated methods, such as ethnography for instance, is that rather than only observing, a researcher intervenes in normal operations, and the effect of the intervention is studied. Furthermore, the intervention is not a one-shot proposition but is rather "progressively refined" (Collins, Joseph, & Bielaczyc, 2004, p.18). Indeed, "DBR is an iterative methodology, [which] pairs the design of the learning environment with research on learning" (Hermes, Band, & Marin, 2012, p. 384). As Confrey (2006, p. 139) writes "Such studies support views of the classroom not as deterministic, but as complex and conditional. In these settings, instructional guidance is based on affecting the likelihood of certain events and outcomes by adjusting the conditions of instruction."

DBR researchers understand that there are many factors at play when seeking to address a research question. They acknowledge that an attempt to control all but one factor is not going to yield results that are particularly helpful in tackling real-world problems. This is because the instructional setting is a complex system, a united whole with parts that interact and influence each other (Hmelo, Holton, & Kolodner, 2000). DRB "deals with [the] complexity by iteratively changing the learning environment over time—collecting evidence of the effect of these variations and feeding it recursively into future design" (Barab, 2006, p. 155). In other words, DBR is characterized by an iterative cycle of design, enactment or implementation, analysis, and redesign, where "processes of enactment" can be related to "outcomes of interest" (Design-Based Research Collective, 2003, p. 5). Thus, outcomes from previously conducted designs provide "an explanatory framework that specifies expectations that become the focus of investigation during the next cycle of inquiry" (Cobb, diSessa, Lehrer, & Schauble, 2003, p.10).

Finally, DBR researchers adopt a retrodictive view, looking for the influence of prior activity on current activity. In fact, Shavelson, Phillips, Towne, and Feuer (2003, p. 26) quite explicitly state that any documentation during the research project "serves as the basis for a retrospective analysis of what happened during the design study."

4. CALL

While I am not a CALL expert, I have thought for some time that the dynamic

environment it presents for learning would be ideal for conducting research from a CT perspective. Then, too, its features align well with DBR. Its dynamic dimension is characterized by many of the same qualities that are present in CT and DBR, for example, interactivity and the provision of feedback in a way that is not possible through other media. Furthermore, information can be accessed nonlinearly. In addition, it would be relatively easy to relate “processes of enactment” to “outcomes of interest” (Design-Based Research Collective, 2003, p. 5). Moreover, although programmers might dispute this, features of CALL programs can easily be changed—certainly much more easily than with any print materials. Technology permits iteration. A particular function can be performed again and again with modifications each time. Through the use of technology, many variables can be tracked. As for context, when used in nonblended instruction, CALL constrains but does not fully determine it. Finally, technology can be used to trace ongoing developments, creating a record of activity that is conducive to retrodictive analysis.

5. Applications

Although DBR is relatively new, interest in it is growing. In a study of DBR to date, Anderson and Shattuck (2012), utilizing a data base of the 47 most widely cited articles for the period 2002-2011, report that while 88% of those published during the first half of the decade were mostly philosophical or expository articles, during the second half of decade most were empirical studies, indicating a shift from theoretical discussion to practice. In light of the theme of this special issue, it is interesting to note that the majority (68%) of interventions in these studies involved the use of online and mobile technologies. However, DBR has been used to investigate instructional issues in all sorts of subject domains; it has even been used to teach sixth-grade students about complex systems (!) (Hmelo et al., 2000).

Closer to home, Yudthana (2005) proposes the use of DBR in conjunction with CALL in the development of an ESL/EFL teacher training program, and Hoven and Palalas (2011; see also Palalas & Hoven, this volume) applied it in a 2-year study (2007-2009) on the use of mobile devices to promote language learning outside of the classroom, especially speaking and listening skills. Most relevant to this article, Pardo-Ballester and Rodríguez (2009; 2010) have applied DBR to ongoing development of a hybrid instructional program to teach Spanish. Using theory and research from SLA and CALL, they pointed to a number of benefits of DBR, not the least of which is optimizing learning by considering student perceptions and interests when developing CALL materials.

6. A Few Cautionary Notes

Lest I have painted too glowing a picture about the combination of CT, DBR, and CALL, let me interject a few cautionary notes at this point.

In order to be of use, the implementation of DBR must be as rigorous as any other form of research. Furthermore, one way that DBR is different from other types of contextualized practice-oriented research, such as action research, is that

while it addresses questions of practice, it aims also to contribute to theory development. Barab and Squire (2004, p. 6) explain that “A critical component of design-based research is that the design is conceived not just to meet local needs, but to advance a theoretical agenda, to uncover, explore, and confirm theoretical relationships.” Indeed, with regard to instructional technology research, Reeves, Herrington, and Oliver (2005, p. 103) remark that DBR requires “a commitment to theory construction and explanation while solving real-world problems.”

This requirement that DBR make a theoretical contribution is perhaps most evident in Hoven and Palalas’ (2011) discussion of ecological constructivism, a learning theory which shares a number of tenets with CT and could perhaps be a candidate object learning theory to complement CT as a metatheory. Hoven and Palalas came to ecological constructivism after initially embracing social constructivism. They found that the latter could not account for the dynamic creation of content on the part of learners in their study. In order to remedy this inadequacy, they proposed ecological constructivism, a theory that melds social constructivism, sociocultural theory, and ecological linguistics.

Questions have also been raised about the suitability of DBR for scaling up (Anderson & Shattuck, 2012) and about the time and resources needed to conduct such studies (Yudthana, 2005). Finally, there is a question having to do with the complications of context (Yudthana, 2005). As Pardo-Ballester and Rodríguez (2009) note, DBR is a context-sensitive methodology. Two considerations arise from this fact. First is the challenge to researchers to account for the many factors that construct the context, including not only the spatial context, but also the historical context and the particular participants. In this regard, as compared with other research methods, DBR may be better suited to investigate contextual factors by systematically altering them. A second complication stems from the recognition that each context is unique and that context is not an extraneous variable. As such, the generalizability of findings is limited. Nonetheless, that does not mean that we cannot draw transcendent lessons, using the description of one DBR/CALL study to illumine our own.

7. Conclusion

Research methods, not unlike theories, reflect a researcher’s philosophical orientation (Goodwyn, Fuller, & Green, 2012). I am sure that the methodological framing that is on offer through DBR and CALL resonates with me because of my theoretical commitment to CT and the way in which CT helps me understand the world.

I am also attracted to the combination because its approach is similar to what (good) language teachers do (Larsen-Freeman, 2009). They try something and then adjust it as need be, responding flexibly to their students. Indeed, a strength of DBR is that researchers try something and then watch what happens, progressively refining what they do in keeping with active innovation and intervention in classrooms (Kelly, 2003).

The combination of CT, DBR, and CALL portends well for future research en-

deavors. Indeed, it is exciting to contemplate research efforts that seek “to foster learning, create usable knowledge, and advance theories of learning and teaching in complex settings. Design based research also may contribute to the growth of human capacity for subsequent educational reform” (Design-based Research Collective, 2003, p. 5). If it accomplishes this, the combination about which I have written in this article will no longer be simply promising but will instead be powerful.,

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Chapter 4

Design-Based Research and the Quest for Normalization in CALL

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Abstract

This article considers the ways in which we might increase the impact of CALL research on language teaching practice. There are qualities in Design-Based Research (DBR) methodology that are particularly suited to this goal. The attraction of DBR for this brief is its commitment to informing broader practice, its commitment to incorporating the concerns of practitioners from the outset, and the mechanisms available for facilitating moves from the local and the particular to new contexts through the development of design principles or theory. DBR is discussed particularly with regard to the relationships it signifies both with practice and with theory development and use. Contemporary CALL approaches are then considered by looking first at descriptive labels associated with its recent history and then at the idea of normalization in CALL. In this discussion the work by Rogers (2003) on the diffusion of innovations is included to help clarify and enrich an understanding of the term. Bax's (2003) arguments for normalization as an end-goal for CALL and as an agenda for CALL research are also examined. Finally, the role of DBR in CALL is considered by looking at the ways in which this approach can be used to develop theory through close engagement with practice. Examples of system variables that may serve to function as impediments to normalization are discussed. An example is also given of how an inductive, cyclical approach may help inform theoretical understandings and the movement from local theory to middle range theory to high-level theory (McKenney & Reeves, 2012). The article concludes by making connections between DBR and ecological CALL and complex systems and describes how normalization is a useful concept in research even though it may be difficult to achieve over the longer term in practice.

Keywords

Design-Based Research, Normalization, Diffusion of Innovations

1. Introduction

Design-Based Research (DBR) has many distinctive qualities, but two of its most important lie in its commitments to research in real, authentic settings and the importance of outcomes with broader, practical value. In comparing psychological experimentation with design-based research methods, Barab and Squire (2004,

p. 4) stress how the key challenge is “to characterize the complexity, fragility, messiness and eventually solidity of the design and doing so in a way that will be valuable to others.” McKenney and Reeves (2012, p. 39) further emphasize this commitment to practice: “The primary practical contribution of educational design research is the intervention developed to solve a real problem in practice.” Researchers adopting DBR approaches work closely with practitioners and seek to understand the opportunities and constraints of the setting as practitioners themselves perceive them. Consequently, it is understood that many significant factors may not be clearly understood by the researcher a priori. As a result a flexible, iterative approach is adopted regarding new designs and interventions.

In aiming to engage very closely with the complexity of the setting, DBR also incorporates a wider range of variables than would normally be the case in psychological research. According to Barab and Squire (2004, p. 4), DBR aims to account for “climate variables (e.g., collaboration among learners, available resources), outcome variables (e.g., learning of content, transfer), and system variables (e.g., dissemination, sustainability).” This breadth of vision is reflected in how theory is formed and held to operate and develop. For example, The Design-Based Research Collective (2003, p. 5) says:

- The central goals of designing learning environments and developing theories or “proto-theories” of learning are intertwined
- Research on designs must lead to shareable theories that help communicate relevant implications to practitioners and other educational designers.

In endeavoring to connect the local with the distant, the anthropologist Clifford Geertz (1976, 1983) spoke of the importance of work having both *experience-near significance* and *experience-distant relevance*. Barab and Squire, citing Geertz, (2004, p. 11) illustrate this distinction through a research study where the focus was on the individual classroom and not the larger system through which the university classes and courses occur. As a result, while the study produced valuable insights into classroom practice, it did not adequately consider constraints that shaped the particular context of the intervention and, therefore, resulted in theory with limited experience-distant relevance. In my view, it is on experience-distant relevance that we might reflect upon further in contemporary CALL and where, I believe, DBR may be very well equipped to help. It is also one of the qualities that sets DBR apart from other research methodologies and approaches. Having set the scene for DBR, let us move now to CALL by looking at descriptions of its recent history and the idea of normalization.

2. Recent CALL History and Normalization

According to an historical perspective provided by Bax, (2003), we are currently experiencing Open CALL, and our goal should be to move from Open to Integrated CALL. He critiques Warschauer and Healey’s (1998) earlier conceptualization of the historical phases of Behavioristic, Communicative and Integrative

CALL.¹ Bax (2003, p. 22) continues, “The key point about Integrated CALL—which sharply distinguishes it from Warschauer and Healey’s—is that it does not yet exist to any significant degree, but represents instead an aim towards which we should be working. “Thus, integrated CALL is aspirational.”

This quest for a state of integrated CALL is worthy of further reflection. Previous historical phases or approaches were marked by an approach to learning (e.g., ‘Behavioristic’) or pedagogical orientation (Communicative), but the more recent label is of a different order altogether, that CALL should be integrated (see Bax, 2003). This idea is not new, dating at the very least from the late 1980s in CALL (Hardisty & Windeatt, 1989; for discussion, see Levy & Stockwell, 2006). Thus, it is probably not a particularly useful term to mark a historical phase or approach, but that does not diminish its possible importance as a goal. Further, Bax goes on to align the idea of integration with the now well known concept of ‘normalization’. For the present discussion, it is worth quoting Bax (2003, p. 23) at a little length here.

In order to understand the extent to which CALL is truly integrated into a classroom or into an institution or into a particular teacher’s practice, we can usefully draw on research into the diffusion of innovations (e.g. Rogers, 1995), looking at how an innovation comes to be accepted and effective in its new domain. However, let us start by identifying an end goal for CALL. In my view the clearest way of defining this goal is through the concept of ‘normalization’. This concept is relevant to any kind of technological innovation and refers to the stage when the technology becomes invisible, embedded in everyday practice and hence normalized.

I would like to discuss three points related to this extract each of which explores the idea and meaning of normalization in more depth.

Firstly, Bax draws upon the work of Rogers and the diffusion of innovations, a topic first made famous by his book first published in 1962 and now in its fifth edition (Rogers, 2003). Normalization derives from the term routinization, the label used by Rogers. For Rogers (2003, p. 428), routinizing is the fifth stage in the innovation process “in an organization.” Typically, it consists of a sequence of five stages, two of which comprise the initiation subprocess and three of the implementation subprocess. According to Rogers (2003, p. 428),

Routinization occurs when an innovation has become incorporated into the regular activities of the organization and has lost its separate identity. At that point, the innovation process is completed. Routinizing is not as simple and straightforward as it might seem at first glance.

¹ Note that while the label ‘integrative’ was employed in the 1998 paper by Warschauer and Healey as a third stage in the development of CALL, the term ‘sociocognitive’ was used by one of the authors in a publication two years later when characterizing “changes in language teaching” as “a more complex overlapping of three theoretical movements—structural, cognitive, and sociocognitive” (Kern & Warschauer, 2000, p. 3)

The last sentence is significant. Rogers goes on to discuss the closely related concepts of sustainability, participation, and re-invention, all of which, he claims, have a bearing on routinization and ultimately on whether the innovation really takes hold and is continued. The same may be said of normalization which also invokes the notions of sustainability, participation, and re-invention as the innovation diffuses.

Secondly, normalization is considered a suitable “end-goal” for CALL. Bax (2003, p. 24) says planning for the normalized state and moving towards it might “structure our entire agenda for the future of CALL.” He argues for a kind of reverse engineering whereby through research we identify the factors that need to be accounted for in order to facilitate or lead to the normalized state. There is much to reflect upon here. For Levy and Stockwell (2006), normalization was a reasonable end goal for ‘established’ CALL but not for ‘emergent’ or emerging CALL. The authors felt a distinction had to be made to separate the latest innovation and the early adopters with more established technologies and widespread acceptance by a majority of users. These ideas parallel Rogers’ discussion concerning levels of expertise and interest, ranging from the specialist to the majority user. This is represented in his classic model of adopter categories: (a) Innovators, (b) Early adopters, (c) Early majority, (d) Late majority, and (e) Laggards (Rogers 2003, p. 282). Presumably, we would locate normalized or established CALL with the latter categories, those that concern the majorities, while emergent or emerging CALL would refer to the earlier ones, the innovators and early adopters. For ‘established’ CALL with its relevance to normalization, Levy and Stockwell (2006, p. 234; see also Bax 2010, p. 266; 2011, p. 2) concluded,

We believe that working towards normalization is a useful, or practical strategy. Language teachers are very much working within a complex system of opportunity and constraint. Normalization then becomes a process of understanding the infrastructure, the support networks, and the materials and working effectively within them.

Thirdly, for Bax, (2003) normalization refers to “any kind of technological innovation.” Bax also speaks of ‘CALL’ or the ‘computer’ as becoming normalized. In this discussion, the precise meaning of the term can be elusive. What does normalization mean exactly? And what exactly is being normalized?

In this regard, Bax argues that CALL should be analogous to the pen or book, and so completely absorbed into everyday practice that it “disappears” as a feature. PALL (Pen-Assisted Language Learning) or BALL (Book-Assisted Language Learning) are not employed as special acronyms because those two technologies are completely integrated into education, but CALL has not yet reached this normalized stage. While superficially convincing, what this argument overlooks—and it has been made by many others as well as Bax—is the exceptional nature of the computer as a technology. Suitably designed, a computer *can be* a pen or a book, or a whiteboard, or a dictionary or numerous other items and artifacts that have potential value in language education (e.g., SmartPen, E-book,

IWB, etc.). Further, the nature of these innovations and the forms a computer might take are more or less continually evolving in the current climate.

In her discussion of the topic, Lafford (2009, p. 690) says, “The use of CALL for computer-mediated oral and written communication has already been normalized ...” while “one of the most promising tools that can be used to promote the normalization of CALL is Web 2.0 technology.” (p. 691) What precisely is being referred to here is left unclear. It becomes especially confusing when one considers that technologies and terms such as blogs were in use at least three years before the term Web 2.0 was in wide circulation (see also Steel & Levy, in press). Again, what exactly is being normalized?

The subject or target of normalization is important. Is it, for example, material artifacts, like the computer, phone, or whiteboard that are normalized, or does it extend to software applications such as the word processor, online dictionaries, blogs, and the like? For that matter, can pedagogical practices, with or without a CALL component, become normalized, too? These are quite involved questions and there is insufficient space for a full discussion here. But one way forward, just covering one aspect, might be to separate out the technologies into layers as in Levy (2010) where “technology” was defined at five levels: a material level (e.g., laptop, tablet, phone, voice recorder), a management level (e.g., Learning Management System), an application level (e.g., word processor, blog), a resources level (e.g., online dictionaries, newspapers), and a component technology level whereby an application serves a “parent” program some way (e.g., spell checker). The sheer number of current technologies, and the parts a computer might play, undoubtedly complicate the idea of normalization.

For now, because the computer is the archetypal multifunctional device, it will remain challenging to differentiate satisfactorily all its functions and uses relating to language learning in ways that allow the concepts such as normalization to be managed and indeed researched meaningfully. Maybe initially we might limit our field of view to level one, the material objects such as the phone, tablet, or laptop. There are, however, other pathways leading to a deeper understanding of normalization and CALL integration, and some of the techniques and strategies of DBR can help.

Of the few explorations of the potential role of DBR in CALL, Yutdhana (2005) provides a useful introduction. She makes a number of salient observations about the value of DBR in CALL particularly, I feel, in relation to the importance of working to achieve a rich understanding of the “complications of context” (p. 176). Descriptive research cataloguing the broader factors impacting upon use is most valuable, including the “climate variables” and “system variables” mentioned by Barab and Squire (2004).

Chambers and Bax (2006) further this line of enquiry by discussing a wide range of impediments to normalization besides technology and software, including: teacher training, administrative and pedagogical support, syllabus and curriculum integration, teacher attitudes, school culture, physical setting and location of computers, funding, leadership, accountability structures, and so forth (see also Fishman, Marx, Blumenfeld, Krajcik, & Soloway, 2004; Levy, 1997; McKenney & Reeves, 2012). It is well worth noting that Chambers and Bax (2006, p. 477)

identify *syllabus integration* as the one overriding factor, whereas Fishman et al. identify time constraints as the number one obstacle arising as a direct result of the impact of *standardized assessment*.

To date, I believe Chambers and Bax (2006) have come closest to unraveling the complexities of normalization and context. They endeavor to divide normalization into some of its potential “constituents,” described in this article as “issues.” For normalization to occur, Chambers and Bax isolate 11 particular issues divided into four groups under the headings: (a) Logistics, (b) Stakeholders conceptions: knowledge and abilities, (c) Syllabus and software integration, and (d) Training, development and support. By way of example, consider the following issues in the first category, Logistics:

1. For normalization to take place, CALL facilities will ideally not be separated from ‘normal’ teaching space.
2. For normalization to occur, the classroom will ideally be organized so as to allow an easy move from CALL activities to non-CALL activities.
3. For teachers to ‘normalize’ computer use within their daily practice, they may need additional time for preparation and planning.

These prerequisites for normalization could, I believe, be quite easily converted into constructs and ultimately interventions for the purposes of DBR. The likely result initially through application of the issues would, I suspect, be a “reading” on a scale pinpointing to what extent the given setting was normalized together with a list of enabling and obstructing factors. By suitably accounting for these factors, interventions might then be conceptualized to further the movement towards normalization. In this way DBR methods are most helpful.

Rogers’ work complements these approaches, and it is relevant because I believe it can go a considerable way to providing a model for theorizing ‘normalization’ and the idea of integrated CALL. Seels (1997) provides a concise summary that shows how the main elements are connected with the constructs and operational definitions. She says (1997, p. 19),

Rogers’ theory provides a model which incorporates the four main elements of the diffusion process: channels of communication, characteristics of the innovation, phases in the process, and influence of the social system and personalities. These domain elements evolve from variables identified through research. Rogers provides definitions of each of the concepts used in the model... Each of the elements in the model has related constructs on a theoretical level. These constructs are linked to the operational definitions used in the research which Rogers reports through case studies. For example, a rate of awareness-knowledge and rate of adoption are defined as measured in the study. Concepts are related to principles (propositions) presented in the form of generalizations.

Seels (1997, p. 19) argues that Rogers “offers a theoretical system for educators,” in part by building a basis for research questions through classification of key stages in the diffusion process.

McKenney and Reeves (2012, p. 38) provide a valuable discussion on the contributions DBR can make to theory when they argue that design principles can be characterized at three different levels (p. 35). Given our earlier discussion on integration, they describe how DBR may be used to move from *experience-near significance* to *experience-distant relevance* (see Table 1).

Table 1 (extract): Theoretical Spaces of (Educational Design) Research: An Example (McKenney & Reeves, 2012, p. 38)

	Local theory e.g., applicable to a few teachers, using multiple iterations of the same ICT-rich curriculum	Middle-range theory e.g., builds on local theories, applies to multiple schools using varied but similar ICT-rich curricula	High-level theory e.g., builds on middle-range theories, applies to many contexts using the same class of curricula
Describe e.g., how teachers implement ICT-rich curricula	Teachers integrate on-computer activities with off-computer activities to varying degrees	Higher degrees of integration are found in schools where teachers co-design the activities	Curricular ownership is positively related to the level of technology integration

What is noteworthy here is the inductive, cumulative, cyclical approach that builds from the level of local theory through middle range theory to high-level theory. This does assume that local theory can be generalized outward so to speak. As Barab and Squire (2004, p. 11) explain,

The challenge is to develop flexibly adapted theories that remain useful even when applied to new local contexts ... the theory is supple enough to maintain its robustness even in the context of changing situational variables. Theory generated from design-based research, from this perspective must strike a balance between refinement and adaptability.

Whether this balance can in fact be accomplished has been challenged by some researchers. For example, Willis (2008), in discussing undesirable characteristics of DBR, questions whether local “theories” are generalizable in the way described. Perhaps local theory is so contextualized that it loses its identity and value when dissipated and expanded outward. On the other hand, advocates such as McKenney and Reeves (2012) believe that this process can be accomplished without losing the essential qualities of the original, local theory and add that small-scale studies can provide “the building blocks of theory” (see also Chambers & Bax).

I would like to round off this discussion with another telling quote from Barab and Squire (p. 12) whose work has heavily influenced my interpretation of DBR. They state,

Just as we create boundaries for the sake of control of explanation, we need to remember that the world does not divide itself at researcher-defined seams. These seams, rather than being black-boxed or ignored, must be problematized and examined as part of our design work, helping to lend both ecological and consequential validity to our work.

In conceptualizing CALL research, the seams are often woven around the single class, the teacher, one cohort of language learners, or possibly two groups interacting at a distance. In contrast to other approaches, DBR stresses the importance of also accounting for external factors that may impact upon the long-term functioning of the class or group, disrupting the possibilities of integration and normalization. Fishman et al. (2004, p. 43) suggest a conception of DBR that explores usability, scalability, and sustainability in terms of “gaps” between the culture, capability, and policy/management structures. This work pushes us to reconsider the boundaries of context and the need to “consider the larger systemic constraints in which the context of intervention is a part.” (Barab & Squire, 2004, p. 12)

3. Conclusion

According to Fishman et al. (2004), the primary reason research on technology innovations has had relatively low impact in everyday practice in K-12 schools is because it has not focused sufficiently on issues of how innovations function at the level of systems. Authors such as Bax argue that we need to investigate more fully the system barriers or constraints that impede the creation of a more normalized, integrated role for technologies in the language classroom. DBR can provide one pathway forward for CALL, particularly because of its engagement, from the outset, with the concerns of the practitioner and their interaction with systems. DBR also adds value with its adherence to advancing theory.

At the same time DBR is not a panacea. Other theoretical perspectives such as Activity Theory allow for boundary investigation and analysis with a focus on the realities of sustained application. There is further overlap with recent work on ecological CALL (see Lafford, 2009; van Lier, 1998) and complex systems (see Larsen-Freeman & Cameron, 2008; Larsen-Freeman, this volume) because a similar embedded stance is adopted. Studies that are simply longitudinal also tend to incorporate a richer appreciation and understanding of system features and effects. Further, in writing up their work, the DBR author should remain mindful of the needs of the potential reader/researcher, one who might wish to adopt the author’s project plan in a setting that shares some similarities but not others. Writing for the reader in this way helps to ensure experience-distant relevance. Adequate details should be provided of participants and procedures, including rich descriptions of context, obstacles and constraints, and possible solutions. The informed consumer of research has a very important role to play in the movement and transfer of research findings from the journal article or conference presentation to everyday practice.

As far as the concept of normalization is concerned, one can certainly understand why some stability may be appealing—particularly for administrators—because of the costs involved, in every sense. One high school principal I was talking too recently was weighing whether to spend a significant amount of school funds on a building upgrade urgently needed or a school-wide technology innovation that was expected. In this kind of decision-making, we are reminded that

our culture is highly susceptible to image and ownership of the latest technology. This applies to institutions as much as to individuals. Institutional identities and indeed personal identities are indelibly wrapped up in their display technologies. In schools and universities, parents and students expect their technologies to be state of the art. Unlike the pen or the book, perceptions of the newness of an institution's technologies so readily become a measure of its worth.

Ultimately, normalization may remain more of an ambition than a reality, more of a partial, transitory state perhaps, between periods of marked change and disruption. Technology innovation cannot accept all the blame for change since educational practices are similarly dynamic and are responsive at times to intensive curricula reform and innovation. This does not mean that normalization is not a worthy goal, nor that DBR might not assist, because DBR provides a mechanism for bringing systemic constraints and barriers of all kinds more fully into the picture when research projects are formulated and conducted. Approaches such as DBR help ensure the researcher remains connected, that research is designed to truly inform practice, and that research agendas do not seriously diverge from the realities and concerns of practicing language teachers and learners.

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Chapter 5

Implications of Using DBR to Investigate the Iterative Design of a Mobile-Enabled Language Learning System

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Abstract

This chapter explores challenges and opportunities of Design-Based Research (DBR) as a research approach for investigating mobile CALL solutions. The educational intervention deployed in this study employed mobile technology to expand learning beyond the classroom by enabling students to use their mobile devices to interact dynamically with people, content, and the real-life environment. These mobile tools also aided in the mediation of communication and creation of students' own language artifacts. DBR, as used here and elsewhere, is a multifaceted and complex endeavour, which often necessitates the coordinated effort of a team of researchers, practitioners, students, and experts. Because of the interventionist nature of DBR, the focus throughout a DBR study is on both the generation of new theoretical understanding and the positive impact on practice. In order to produce solutions to real problems, a DBR study needs to incorporate a combination of both research and design processes. Recommendations and suggestions for the optimization of a DBR methodological approach in CALL educational research are presented on the basis of these reflections.

Keywords

Mobile Language Learning, DBR, Research Methodology

1. Introduction

1.1 Overview of the Chapter

This chapter explores challenges and opportunities of Design-Based Research (DBR) as a research approach for investigating mobile CALL solutions. The chapter is divided into three main sections: (a) overview of the Mobile-Enabled Language Learning (MELL) system research project and its theoretical and practi-

cal implications, (b) discussion of the theory which emerged from the DBR study, and finally (c) a more in-depth account of the practicalities of the DBR approach as they emerged in this project. Since the focus of this chapter is to highlight the implications of using DBR, and one of these implications is that conducting a DBR study is necessarily broad and multilayered in scope, the themes presented here reflect this breadth of scope and the longitudinal nature of this particular study.

1.2 Background to the Mobile CALL Project

As Nation and Newton (2009) have pointed out, in spite of aural skills being acknowledged as a significant component of language learning, research studies investigating listening skills still comprise one of the least representative areas of the literature. At George Brown College (GBC), where the study in this chapter took place, listening has also been identified as the language skill requiring the second-most remediation efforts by second language speakers, after speaking (Palalas, 2009, 2012). Furthermore, taken together, fluency in speaking and listening were isolated as the best indicators of improved academic and professional success, as well as successful integration, for newcomers to the Canadian workforce (Palalas, 2009). During earlier studies conducted between 2007 and 2009 at GBC, English for Special Purposes (ESP) students had indicated their preference and need for more flexible scheduling of learning opportunities to better accommodate their personal lifestyle and professional commitments, including, for example, commuting and downtime. The findings of these studies were consistent with the general Mobile Assisted Language Learning (MALL) literature, indicating that learners appreciated the personalization, portability and convenience of mobile technologies, for learning across contexts and dynamically evolving life situations (Sharples, 2009). Preference was also expressed for the use of the audio rather than text-based capabilities of mobile devices, with listening identified as being the language skill best suited to practice using these devices. Participant responses were positive to questions about the effectiveness of interactive and engaging Mobile-Enhanced Language Learning (MELL) activities in their ESP instruction. At the same time, researchers elsewhere had also demonstrated that mobile technologies were perceived as helpful and appropriate for language teaching and learning (Demouy & Kukulska-Hulme, 2010; Kukulska-Hulme & Shield, 2008).

On the basis of the findings above, it was determined that the next step should be to investigate the kinds of MELL practice that would promote the acquisition of aural skills and to determine the technical and pedagogical requirements of learning within these parameters. However, searches of literature in field revealed no systematic process yet available that could incorporate the design, development, and testing of appropriate MELL instructional materials at the same time as developing a prototype system as an instantiation of the theory. Given the findings and constraints, DBR was chosen as the most appropriate research methodology to address this dual problem, because of its capacity to develop theory through a systematic process of iterative design and investigation (Wang & Hannafin,

2005). As a result, the three-phase DBR study, comprising Informed Exploration, Enactment, and (Local) Evaluation described in the following section, was implemented at the college.

2. Overview of the DBR Study

This section describes the DBR-driven iterative refinement of a mobile CALL solution. As discussed above, the project evolved to address the problem of inadequate aural skills acquisition for college ESP students. The 18-month process of data collection and analysis resulted in a set of MELL design principles generated through the iterative process of (re-)design, (re-)development and (re-)evaluation. Ten experts, four language professors and six IT design/programming experts, and 163 students actively participated in the cyclic refinement and reformulation of these design principles. The resultant Mobile-Enabled Language Learning Eco-System (MELLES) design framework highlights the essential elements of an effective MELL intervention as well as recommended operational procedures, all supported within an ecological system of learning networks. This MELLES framework thus represents a theory-driven or theory-evolved design, as advocated by Design-Based researchers (Wang & Hannafin, 2005).

DBR proved to be an appropriate methodology for this interdisciplinary study. The ensuing educational intervention employed mobile technology to expand language learning beyond the classroom by enabling students to use their mobile devices to interact dynamically with people, content, and the real-life environment. These mobile tools also aided in the mediation of communication and creation of students' own language artifacts. A more detailed description of the MELL intervention design and evaluation process is provided in the remainder of this section.

2.1 Overview of the DBR Methodology

Since Brown (1992) and Collins (1992) first introduced the term “design experiments,” design-based research, also referred to as design research, has evolved as a methodology for researching innovative educational designs in their naturalistic settings. The approach was originally conceptualized by Brown who posited that there was need for interventional research that would inform practice which, in turn, would inform the results of that research. Educational experiments and theory development would thus become more relevant and responsive to didactic practice, eventually leading to its improvement. Reeves (2006) also argued that technology-assisted teaching and learning could be successfully improved only through a longitudinal, collaborative process of iterative testing, reflection, and refinement of problems, solutions, methods, and design principles.

DBR has some features in common with another participatory and interventionist research methodology, namely Action Research. However, where DBR mainly differs from Action Research is the role of the researcher who, while cooperating with practitioners, takes the responsibility of a designer of both practical educational solutions and supporting the design theory. DBR, thus, aims to progressively improve learning and teaching by redesigning educational interventions

and revising theory in response to in situ feedback and evidence gathered from participants who are active students and practitioners in the educational situation under investigation. The naturalistic context of a study is a fundamental construct of the DBR method and it allows for revisions to be incorporated into the design under consideration in a flexible and responsive fashion (O'Donnell, 2004).

The following definition of DBR captures its salient characteristics:

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. (Wang & Hannafin, p. 7)

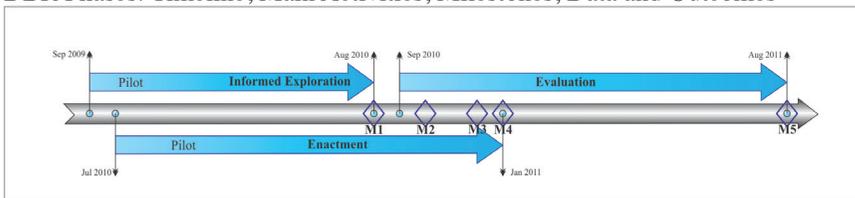
Thus, this practical interventionist method is both process- and theory-oriented (van den Akker, Gravemeijer, McKenney, & Nieveen, 2006) as well as participative in its nature. It invites feedback from practitioners and learners as they create and evaluate learning solutions. Accordingly, DBR “bridges theoretical research and educational practice” (Design-Based Research Collective, 2003, p. 8) with instructional design and often with innovative computer-assisted educational interventions.

2.2 Research Procedures

The research process was organized following a proven DBR framework, namely the Integrative Learning Design Framework (ILDF) model¹ (Bannan, 2009) which facilitated the coordination of all research activities into three phases of Informed Exploration (IE), Enactment (E), and Evaluation (E): Local Impact (with the last ILDF phase, Evaluation: Broad Impact being out of scope of the MELLES project). The four cycles of the IE-E-E process were completed over 18 months—not always in a linear fashion, but rather a particular phase of one cycle would intersect with a different phase of the subsequent cycle. This nonlinear iterative character of the process is illustrated in Figure 1.

Figure 1

DBR Phases: Timeline, Main Activities, Milestones, Data and Outcomes



¹ The ILDF model integrates processes from the domains of “instructional design, object oriented software development, product development and diffusion of innovations and educational research” to offer a DBR framework guiding researchers toward “more rigorous, research-based cycles within a technology-based instructional design effort” (Bannan, 2009, p. 53).

While data were collected and analyzed at numerous points of the study, there were five milestones at which all data gathered to-date were aggregated, analyzed, and incorporated into a successive refined version of the MELLES prototype. Mixed data were collected through “formal” meetings, focus groups, surveys, interviews, online exchanges, design documentation, as well researcher observations and reflections. At the same time, “informal” feedback exchange occurred whenever designers, developers, and the researchers worked on the MELLES system. This input entered the feedback loop in an agile and dynamic fashion, thus reflecting the advancing understanding of the needs of the end-user, the learning context, and the technological requirements of this mobile CALL intervention. Hence, the design was gradually evolving at small and larger leaps to respond to the changing requirements of all participants involved in the study. This interdisciplinary study included 163 students directly involved in the design, development, and testing of the MELLES design; 191 students who completed the Mobile Device survey (Phase 1) focusing on their general usage habits and preferences with respect to mobile technologies; eight professors from a variety of GBC programs (see Tables 1 and 2), as well as two IT and mobile programming experts from outside the college.

Table 1

Participant Profile: GBC Practitioners and External Experts

GBC Practitioner (P) or External Expert (E)	Gender	Main Area of Expertise	Program/School
P1, P2, P3, P5	F	COMM/ ESL/ESP	School of Computer Technology, School of Business, Centre for Hospitality and Culinary Arts, Intensive English Program (IEP)
E4, P7	M	Mobile Programming	School of Computer Technology, external expert
P6	M	Wireless Technologies	School of Computer Technology
P8	M	Mobile Interface Design	School of Design
P9	M	Mobile Design and Development	School of Design
E10	M	IT Programming	External expert

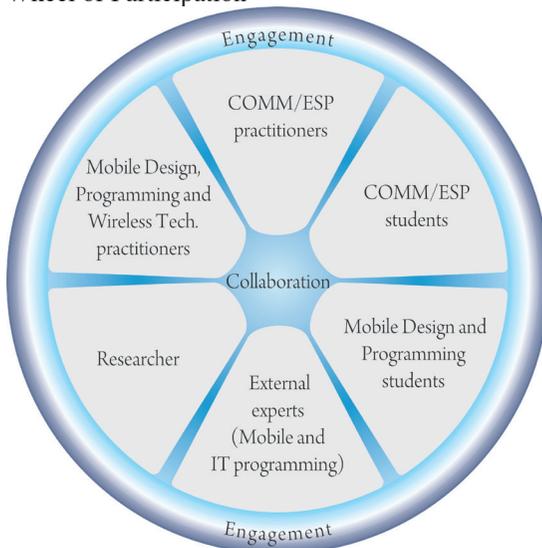
Table 2
Student Participation in DBR Phases and Their Program of Study

Number of Students	Program: <i>Course</i>	DBR Phase	Participation
21	Accounting pilot course (MALL Design Pilot) (n = 11) Digital Design - Advanced Digital Design (Postgraduate, 2 semesters): <i>Interface Design</i> (n = 6) Computer Programmer Analyst: <i>Mobile Application Development</i> (n = 4)	1	feedback
14	Digital Design - Advanced Digital Design (Postgraduate, 2 semesters): <i>Interface Design</i>	1, 2, 3	2 cohorts + 1 volunteer (outside his program of study)—design and evaluation of MELL prototypes
27	Computer Programmer Analyst: <i>Mobile Application Development</i>	2, 3	2 cohorts—design, development, testing and evaluation of MELL prototypes; 4 students volunteered their time and feedback outside their course work
191	Representatives from all GBC programs	1	Mobile Device Usage Survey: L2 students only
101	ESP college students: Business (2 programs), Design (1 program), Computer Technology (2 programs), Hospitality and Culinary Arts (2 programs), Intensive English Program (IEP) (1 program)	3	5 groups of IEP and COMM students, representing 8 college programs—pilots and evaluation of MELL designs

ESP student-participants at GBC were recruited by purposive sampling to be representative of gender distribution, age (Female 28 years; Male 23 years), and demographic and cultural background, including Russian, Ukrainian, Filipino, Chinese, Venezuelan, Indian, Polish, and Persian students. While the main design, development, and task piloting DBR activities were integrated into the curricula of the programs involved in the study, student participation in the feedback exchange and the Phase 1 online survey was entirely voluntary. In the case of the other data collection activities, the L2 students (from the COMM and IEP courses participating in the study) were invited by their professors to join the study for the length of one semester. Moreover, student volunteers from the School of Design (1) and the School of Technology (4) formed a team outside of their coursework to work on the MELLES design until the end of the project. All in all, the collaborative efforts of the students and practitioners were the foundation of this participatory study. The high levels of participant engagement were maintained thanks to the ongoing interactivity, the feeling of ownership of the design, and access to the

tangible results of the study in the form of the functional MELLES system. The regular communication amongst the participants was the key to maintenance of that engagement. The wheel of participation (see Figure 2) summarizes the various interdisciplinary groups involved in the study and accentuates the importance of their co-existence and cooperation in driving the study and supporting each other in moving it forward. Collaboration, the axle of the wheel of participation, remains at the center of the combined efforts. Engagement forms the rim of the wheel, holding it all together whereas participants form the spokes which share and distribute the effort.

Figure 2
Wheel of Participation



Overall, the data collection included 18 student and 26 expert interviews, 7 surveys and 12 focus groups. Table 3 below provides more detail regarding the timelines, milestones, main activities, outcomes, as well as data and participants of each DBR phase.

Table 3

DBR phases: Timelines, Main Activities, Outcomes, Data and Participants (modified with permission; Palalas, 2012, p. 108)

DBR Phases	Date	Main DBR Activities	Data and Participants	Key Outcomes
Informed Exploration (IE) <i>Analysis</i>	Jun-Aug 2010 Mobile Device Usage Survey (Jun 2010) MILESTONE 1 August 2010—all data and feedback of IE gathered and analyzed resulting in theoretical construct and preliminary design guidelines	<ul style="list-style-type: none"> • Educational problem formulation and analysis • Context and audience characterization (Mobile Device Usage survey) • Needs analysis • Literature review • Existing solutions and comparable design investigation • Preliminary design requirements formulation • Theoretical construct development (conceptual ideal to guide the design) • Theoretical framework development/validation (framework to guide the design) • Experts/language teachers interviews and meetings (COMM) • Student focus groups (3) (DATA) (COMM) • Data analysis (DATA) • Research project plan fine-tuning, roles assignment (PROJECT) 	<ul style="list-style-type: none"> • Pilot study data revisited-<i>mixed</i> • Experts (n = 7): 7 interviews and meetings-<i>qualitative</i> • Students (n = 21): 3 focus groups-<i>qualitative</i> • Mobile Device Usage Survey (n = 191)-<i>mixed</i> • Literature review, comparable solutions and technology investigation • Researcher observations and reflections-<i>qualitative</i> 	<ul style="list-style-type: none"> • Preliminary design guidelines • Theoretical construct (ideal to guide the design) • Theoretical framework - Ecological Constructivism • Evaluation questions for phase 2 and 3 interviews/surveys • Research project plan
Enactment <i>Design and Development</i>	Jul 2010-Jan 2011	<ul style="list-style-type: none"> • Design requirements revision/validation • Preliminary conceptual model(s) creation—screen mock-ups and descriptions of functionalities—prototype(s) 0 • Detailed design creation (user interface, technology integration and user experience)—prototype models and documentation (wireframes, user cases, system requirements charts, screen mock-ups) • Functional prototype 1 for testing design and development—MELLES • Educational intervention refinement – MELLES prototype 2-3 • Design principles/theory refinement • Participant interviews, focus groups, meetings, communication (DATA) (COMM) • Data analysis (DATA) • Research project plan adjustments (PROJECT) 	<ul style="list-style-type: none"> • Digital Design student (n = 14, 7 L1 + 7 L2): assignments, designer logs, 2 focus groups, 6 interviews-<i>qualitative</i> • Technology students (IT Programming): documentation (n = 27), meetings, 4 interviews (n = 4: 2 L2 + 2 L1)-<i>qualitative</i> • Experts (n = 6): 6 interviews, meetings-<i>qualitative</i> • All participants—data on Wiggio-<i>qualitative</i> • Researcher observations and reflections-<i>qualitative</i> 	<ul style="list-style-type: none"> • Preliminary MELL conceptual models • Detailed prototype design • Functional MELLES prototype: mobi-english.mobi (design specifications, instructional content, site architecture; technical specifications, user experience) • Refined design principles • Modified evaluation questions • Updated research project plan

<p>Evaluation: Local Context Implementation and Evaluation</p>	<p>Sep 2010-Aug 2011 Sep-Dec2011 <i>(Data collection completed in Aug 2011; summative data analysis and report in Dec 2011)</i> MILESTONE 2 2 Oct 2010—all data and feedback of IE and 1st E-E iteration gathered and analyzed; findings incorporated into prototype 1 MILESTONE 3 3 Dec 2010—all data and feedback of IE and 2nd E-E gathered and analyzed; findings incorporated into functional prototype 2 MILESTONE 4 Jan 2011—all data and feedback of IE and 3rd (final) E-E gathered and analyzed; findings incorporated into functional prototype 3 MILESTONE 5 Aug 2011—all data and feedback of IE-E-E gathered and analyzed; findings to be incorporated into future functional prototype 4</p>	<ul style="list-style-type: none"> • Summative evaluation of conceptual models—prototype 0 • Prototype 1-3 implementation: pilot of MELLES with the target audience (including training on the new tool) • Summative evaluation of functional prototype 1-2 (MELLES) on two levels: (1) internal feedback loop-code testing and debugging, and (2) external feedback loop-feedback on the effectiveness of the educational intervention • Summative evaluation of prototype 3 based on pilots of MELLES tasks • Summative evaluation of conceptual framework • Summative evaluation of design principles/theory • Participant interviews, focus groups, meetings, surveys, communication (DATA) (COMM) • Data analysis (DATA) • Research project plan adjustments (PROJECT) • Report writing and findings dissemination (COMM) (PROJECT) 	<ul style="list-style-type: none"> • ESL college students (n = 101): 6 surveys, 7 focus groups and 8 interviews-<i>mixed</i> • Experts (n = 10): 13 interviews-<i>qualitative</i> • Researcher observations and reflections-<i>qualitative</i> • All participants-<i>data on Wiggin - qualitative</i> 	<ul style="list-style-type: none"> • Refined MELLES educational intervention requirements • Refined design principles • Ecological Constructivist framework demonstrated • Research question(s) answered • Summative research report • Research findings disseminated • Finalized research project plan
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The following section summarizes the key findings of the MELLES study, which lead to the emergence of a new MELL intervention, a set of guidelines to support a creation of such a solution, and a theoretical framework guiding such development.

2.3 Summary of the Findings

As mentioned above, the Informed Exploration phase resulted in a theoretical construct, a model of an ideal design, which guided the subsequent refinements of the MELLES design. In response to participant feedback, a shift from designing a learning object (micro) to an ecological (macro) perspective marked the future direction of the project. In their comments on an effective MELL solution, respondents referred to several parallel components and their functional relationships rather than one specific characteristic of an effective pedagogically-sound learning object that they were asked to identify. They stressed the need to provide impromptu speech practice embedded in a real-life context supported by collaboration and combined with individual rehearsed utterances practice completed at a

flexible time and place to accommodate learner preferences and schedules. A general expression of the importance of relevance of the content of a learning task, a strong learning community and support from a teacher all emerged in relation to motivation. What these and the other themes of the feedback had in common was their focus on the desired content, procedures required to deliver that content, as well as the preferred time and technological context of the m-learning experience. Although a list of specific design essentials was distilled through the feedback analysis, it is important to view these elements in the context of their interconnectedness and to focus on their co-existence as parts of a whole as being the essence of the successfulness of this design. The participants themselves, in fact, emphasized this inter-connectedness as being essential to their engagement in this dynamic learning experience. Therefore, to enable genuine language practice in the real world, not only did the interconnections within the m-learning system have to be considered, but also the dynamic interaction of the learner, technology, context, and others within the learning setting had to be investigated. Feedback from respondents focused on both the communication support and access to resources, as well as the dynamic connections with the context enabled by the mobile technologies. They believed that the linguistic challenges and support offered by the real-life language situations engendered authentic language practice which was crucial in their acquisition of aural skills. Moreover, the respondents agreed that learning listening could not occur in isolation but had to be part of a holistic language practice integrating all four language skills.

This recognition of the holistic nature of respondents' learning and co-learning, together with the recognition that the mobile devices were the tools that enabled this kind of situated language learning to take place, led to a reconceptualization of the theoretical framework for the research project. At this point, an ecological perspective seemed most appropriate to conceptualize the interconnectedness articulated among the main themes, relating to pedagogic procedures, content, context, actors, and technology. The theoretical framework which thus emerged from the Informed Exploration phase—Ecological Constructivism—was then used as the lens through which to re-configure a more effective approach to MELL design.

Based on the main themes distilled from the qualitative feedback and validated by the quantitative data from the IE survey, a theoretical construct and preliminary design guidelines were generated and subsequently refined through the iterations of the Enactment and Evaluation phases. The modifications to the design of MELLES and the corresponding theory derived from the repetitive data analyses. The final set of main themes (see Table 4), streamlined during the last cycle of the Evaluation phase, encapsulated well what features and characteristics of the MELLES intervention were deemed necessary for this intervention to be an effective language learning system.

Table 4
 Evaluation Qualitative Findings—Main Themes (modified with permission; Palalalas, 2012, p. 238)

Codes (NVivo Nodes)	Ref Freq Stdnts ^a	Reltv Freq Stdnts (n = 101) ^b	Ref Freq Practn ^c	Reltv Freq Practn (n = 8) ^d	Ref Freq Total ^e	Reltv Freq Total (n = 109) ^f
PEDAGOGY						
PEDAGOGIC PROCEDURE-How	444		38		482	
Grouping	164	33%*	14	35%*	178	33%*
group work	120	40%*	13	54%*	133	41%*
collaboration and peer support	71	70%	5	63%	76	70%
interaction and communication	33	33%	4	50%	37	34%
share learner-generated artifacts	16	16%	4	50%	20	18%
individual practice	31	31%	0	0%	31	28%
pair work	13	13%	1	13%	14	13%
Motivation	67	34%*	2	13%*	69	32%*
motivating factors	30	30%	0	0%	30	28%
fun-enjoyment	37	37%	2	25%	39	36%
Scaffolding-help from teacher	55	54%	6	75%	61	56%
Feedback	47	16%*	4	17%*	51	15%*
need for feedback	18	18%	1	13%	19	17%
classmate feedback	18	18%	1	13%	19	17%
teacher feedback	11	11%	2	25%	13	12%
Listening practice	38	38%	0	0%	38	35%
Recording own voice	31	31%	4	50%	35	32%
Pre and post activities	28	28%	6	75%	34	31%
Integrated skills	14	7%*	2	16%*	16	7%*
need for integrated skills	6	6%	1	13%	7	6%
speaking supports listening	8	8%	1	13%	9	8%
CONTENT-What	250		9		259	
Authentic speech	58	29%*	0	0%*	58	27%*
need for authentic speech	51	50%	0	0%	51	47%
accents	7	7%	0	0%	7	6%
Vocabulary	31	31%	3	38%	34	31%
Directions and explanations	28	28%	1	13%	29	27%
Communication skills	22	22%	0	0%	22	20%
Support materials & resource	23	23%	1	13%	24	22%
Sociocultural knowledge	22	22%	2	25%	24	22%

Pronunciation	16	16%	1	13%	17	16%
Relevance-work & program related	15	15%	0	0%	15	14%
Listening skills	22	11%*	1	7%*	23	11%*
listening skills-general	14	14%	0	0%	14	13%
listening comprehension	8	8%	1	13%	9	8%
Task length	7	7%	0	0%	7	6%
Variety of topics	7	7%	0	0%	7	6%
CONTEXT-When and Where	127		10		137	
Real-life practice	59	58%	4	50%	63	58%
Outside classroom	42	21%*	4	25%*	46	21%*
outside classroom practice	25	25%	2	25%	27	25%
blended classroom and outside	17	17%	2	25%	19	17%
Context affordances	26	26%	2	25%	28	26%
ACTORS-Who	38		2		40	
Learning community	38	38%	2	25%	40	37%
TECHNOLOGY						
FUNCTIONALITY-How	75		2		77	
Audio player functionality	31	31%	0	0%	31	28%
Audio files quality	13	13%	0	0%	13	12%
Mobile and computer	12	12%	1	13%	13	12%
Text support	12	12%	0	0%	12	11%
Inherent device affordances	7	7%	1	13%	8	7%
TECH CONTEXT-When and Where	23		8		31	
Flexible on-the-move access	19	19%	0	0%	19	17%
Cross-platform	4	4%	8	100%	12	11%

^aRef Freq Stdnts = reference frequency for students

^bReltv Freq Stdnts = relative reference frequency for students

^cRef Freq Practn = reference frequency for practitioners

^dReltv Freq Practn = relative reference frequency for practitioners

^eRef Freq Total = reference frequency for both students and practitioners

^fReltv Freq Total = relative reference frequency for both students and practitioners.

Note. Percentages with an asterisk (*) are the averages of their subcategories.

While the other aspects of the system were stressed as well, feedback also emphasized real-world language learning. These comprised Real-life practice (58%), Authentic speech (27%), Context affordances (26%), as well as Group work (41%): collaboration and peer support (70%) and Feedback (15%). The notion of Learning community (37%) surfaced more frequently relative to other aspects of MELLES design, as did Motivation (32%). The identified vital elements of MELLES, their interconnections and relationships were mapped and captured in the design principles which are presented in the next section following the discussion of the theory emerging from the MELLES research.

3. Theory Evolution

The discussion in this section focuses on the gradual emergence of a new learning theory, in keeping with the tenets of DBR, through the process of design, development, and evaluation of successive MELL prototypes. This new learning theory, Ecological Constructivism, guided further refinement of the design principles of the MELL educational intervention, leading to the new substantive and procedural knowledge embodied in the MELLES design guidelines.

3.1 MELLES Design Principles

The final MELLES design principles consisted of 10 pedagogical and seven technological guidelines. They were all distilled from the feedback collected over the 18 months of tests and evaluation of the interim designs and the four prototypes of the MELLES system (as illustrated in Table 3 above). These design guidelines capture the essential characteristics of MELLES (substantive emphasis) and the strategies required to operationalize them (procedural emphasis). An example of a full description of a design principle is presented in Appendix A along with the rationale for the inclusion of these substantive and procedural recommendations.

The following are the ten essential pedagogic characteristics of MELLES, as they emerged from the data collected in the Evaluation phase:

1. Balanced combination of individual and collaborative (group work) tasks;
2. Learner-generated linguistic artifacts (audio, video, photos, images);
3. Game-like real-life communicative tasks;
4. Expert facilitation: scaffolding, feedback, and coordination;
5. Feedback mechanism (immediate and delayed);
6. Focus on authentic listening tasks in the dynamic real-world communicative situations;
7. Support of self-paced individual audio tasks feeding into/preparing learners for the real-life tasks;
8. Integrate all four language skills but focus on listening outcomes;
9. Linguistic resources (task-related): relevant vocabulary, dictionaries, pronunciation, clear task directions and explanations, examples of language usage;
10. Support of out-of-class learning with in-class (face-to-face) instruction and practice (a blend of in-class and out-of-class context).

These key features of an effective MELL solution need to be built in by means of appropriate procedural strategies. These substantive (Table 5, Column 2) and corresponding procedural guidelines (Table 5, Column 1) are mapped out to demonstrate their relationships. For instance, by implementing the first strategy “Ensure communication and interaction with others in-person and via mobile-enabled channels,” the designer enables both balanced combination of individual and collaborative tasks (essential characteristic 1) as well as scaffolding, feedback, and coordination from an expert (essential characteristic 4).

Table 5

Selected Pedagogical Substantive and Procedural Guidelines (for the full list see Palalas, 2012)

Strategy (Procedural Emphasis)	Essential Characteristic (Substantive Emphasis)
1. Ensure communication and interaction with others in-person and via mobile-enabled channels	1. 1, 4
2. Include discourse with diverse interlocutors including L1 speakers	2. 1, 3, 5, 6
3. Incorporate language problems requiring negotiation of solutions	3. 1
4. Inject fun, enjoyment and challenge	4. 1, 3
5. Ensure dynamic meaning-making and negotiation	5. 1
6. Maintain regularity of group/class activities	6. 1
7. Build individual tasks to feed into the group tasks	7. 1
8. Include audio recordings (video, images, photos) created by students in response to communicative tasks	8. 2
9. Share and showcase learner-generated linguistic artifacts	9. 2
10. Provide tools for recording, editing, upload and viewing/listening on-the-go (or demonstrate the usage of device built-in tools)	10. 2, 6, 7, 10
11. Offer personalized evaluation and feedback: both in-person, immediate and post-task delayed as well as mobile-enabled recorded, both immediate (messages, alerts, tips, clues) and delayed (include expert feedback)	11. 3, 4, 5, 10
12. Ensure dynamic feedback in real-world communicative situations	12. 5
13. Build in a rating system for artifact evaluation tic resources	13. 2, 5
14. Accompany peer evaluation by expert feedback (displayed on the website)	14. 2, 4, 5
15. Document feedback through audio recordings posted on MELLES site	15. 5
16. Build in self-evaluation of learner audio recordings	16. 5, 7
17. Encourage creativity	17. 2
18. Include elements of educational games (challenges, awards, bonus system, competition, engaging visual interface, progress record keeping)	18. 3
19. Build in interactivity with others, content, technology, environment (context affordances)	19. 3
20. Provide/point to clear audio directions and instructions for tasks, including directions on creating artifacts	20. 2, 3, 4, 6, 7, 9
21. Include relevant linguistic resources	21. 3, 5
22. Assist with the perception of, and interaction with the context linguistic affordances	22. 3, 5, 6, 7
23. Ensure direct or indirect (mobile apps) access to MELLES and its resources	23. 3, 5
24. Include task goals aiming at carrying out linguistic functions in real-life situations in response to audio instructions	24. 3, 6, 7
25. Draw on context affordances and point to them through instructions and directions	25. 3, 5, 6, 7
26. Reflect or include real-world communication tasks (communicative goals)	26. 3, 6
27. Allow for interrupted episodic learning – modular design with each audio podcast not exceeding 5 or activity within a task not exceeding 10–15 mins	27. 3, 6, 7, 9
28. Include contextualized listening challenges aimed at spontaneous communication	28. 3, 5, 6
29. Point to web-based and mobile-based resources	29. 4
30. Include pre-task instruction—vocabulary work, review of task directions, appropriate grammar points, task-related questions (with a lesser need for in-person presence during collaborative field activities and post-task)	30. 4
31. Moderate the MELLES website (for instance, step in when the instability is apparent)	31. 4
32. Ensure constant inflow of information and exchange of ideas	32. 4
33. Facilitate the artifact construction	33. 4
34. Develop new or modify existing mobile tasks and activities	34. 4
35. Maintain a steady flow of information and interaction	35. 4
36. Offer learning activities coordination through schedules, timelines, alerts, reminders	36. 4

A detailed discussion of both pedagogical and technological design principles and their interplay are discussed in Palalas (2012). The next two paragraphs present the MELLES prototype built using the above guidelines.

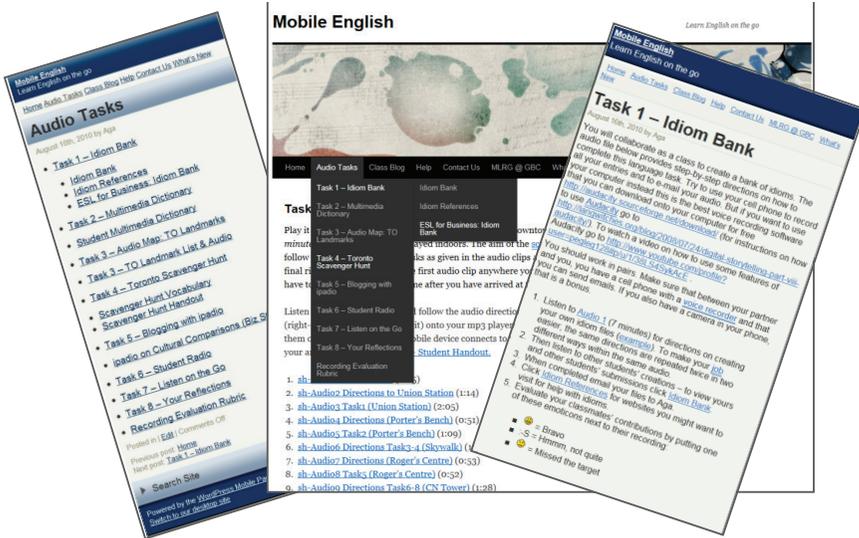
3.2 MELLES Solution

MELLES is an educational intervention built to support the acquisition of aural skills outside the classroom. It focuses on the development of listening skills at an intermediate to advance language proficiency level, and, while focusing on listening, it also integrates the other language and sociocommunicative skills to promote learning of listening. MELLES is a collection of linguistic resources, audio tasks as well as communication and evaluation tools. It leverages mobile technologies to mediate flexible on-the-go communication among learners and facilitators and to provide portable access to resources and scaffolds. More importantly, through a combination of individual and collaborative language tasks integrated into the system and accessible through mobile devices, this MELLES system mediates interaction with real-life language situations by providing audio and written directions to language activities, pointing to language affordances in the context (e.g., illustrations of a meaning of a word), providing tools to capture those linguistic supports (e.g., a voice recorder to create an audio reflection), and then sharing them with others (using connective capabilities of this networked system).

Through the MELLES portal (see Figure 3) students can access the audio tasks which are designed and coordinated to encourage authentic communication with peers and native speakers in the streets and at the landmarks of Toronto. Learners can choose from eight audio tasks (e.g., Scavenger Hunt, Student Radio, Audio Dictionary) which combine place- and time-independent activities with those that have to be completed at a particular location, but at a flexible time (with an exception of one group task requiring learners to gather at a particular place). Such flexible learning practice is “guided from the side” by facilitators and the system that incorporate a couple of set-time and place milestone activities which steer the language acquisition process by providing recommended timelines and deadlines. Accordingly, the individual and collaborative activities are interwoven, yet coordinated, to meet at these milestone points, thus motivating learners and guiding them progressively through the module. Likewise, class instruction is worked into this blended-learning solution to provide additional facilitation and guidance in the learning process.

Figure 3

Screenshots of mobi-english.mobi Audio Tasks (Mobile and Desktop Interface)



The MELLES mobile website is a portal or gateway into the MELLES network that connects people and resources. It comprises a web of interlinked features and solutions: a language learning ecosystem encompassing mobile, web-based and face-to-face environments, that incorporates both pedagogical and technological elements. The critical element in this whole system, however, is the use of mobile devices to enable the interaction among all actors and processes and to mediate individual cognitive processes, relationships, and co-constructing of meaning. In addition, it is the presence and use of these mobile devices that provides the necessary link in the learning eco-system between in-class and out-of-class learning by facilitating situated language practice in the form of real-world listening contingent on affordances in the out-of-class environment. Context affordances, one of the significant elements of the real-world MELL experience, are introduced in the context of Ecological Constructivism discussed in the following section.

3.3 Ecological Constructivism

In keeping with the findings that emerged from the various phases of this study, as well as the feedback and discussions among the researchers and diverse participants, the ecosystem of learners, developers, individually and co-created content persisted as the dominant metaphor used to frame the MELLES network. Ecological Constructivism (EC), as a theory of learning, encompasses a more holistic notion of learners who are situated and embedded within their learning contexts (including their nonformal and informal lives) than merely focusing on their language learning in isolation. Whereas in sociocultural theory (SCT) the focus for learning is more on situated learning and responsiveness, EC goes fur-

ther to explain learning that takes place through exploitation of the affordances of the whole real-world environment of learning. This ecological perspective on learning therefore encompasses formal, informal, and nonformal experiences that lead to learning, as well as the range of learning groupings or configurations that can occur or arise, including individuals working or experiencing learning alone, individuals working cooperatively in pairs or groups, and individuals working collaboratively to co-create meaning and knowledge. EC thus expands the field of SCT by adding “a new dimension to the SCT emphasis on the interaction and co-creation of knowledge amongst groups and networks of human learners,” that is to say, it encompasses “the significance of the dynamic real-life context offering potential supports and affordances” (Palalas, 2012, p. 146).

EC has been developed over a period of several years (Hoven, 2006, 2008; Jakobsdottir, McKeown, & Hoven, 2010; Hoven & Palalas, 2011), and this DBR project represented the first real application of the theory by providing a uniquely rich opportunity to focus on emergent facets and refinements through the three phases. The melding of several streams of thought as well as the work of researchers and philosophers in diverse fields of human intellectual activity have informed the conceptualization of EC. The ecological aspects derive principally from research in the areas of sociocultural theory and linguistics, namely by van Lier (2000), Lantolf and Appel (1994), Lantolf (1994, 2000), Hoven (1999, 2007) and more recently, Lafford (2009), all of which drew, in turn, from the theories of Bakhtin (1981) and others, following Vygotsky (1978).

Aspects of SCT that particularly inform EC are the concepts of mediation and the Zone of Proximal Development (Hoven, 1999, 2007). Within the MELLES environment discussed here, the mobile devices were crucial in mediating both the language and the learning that students were experiencing. As students moved between their homes, modes of transport, face-to-face classes, out-of-class mobile-enabled tasks and used their mobile devices for general nonformal and informal listening practice and communication in real-world activities, it was the mobile devices that provided the continuity and mediated this movement. The concept of the Zone of Proximal Development encapsulates learners’ capacity to expand their learning and where and how to move their learning and understandings further forward. Within EC, affordances that learners perceive, notice, and act upon in their learning and life environments represent the actualization mechanism for their Zones of Proximal Development, while their Zone or range of learning capacity is represented by the learning ecosystems in which they live, interact, and learn.

The term constructivism in tandem with ecological in this theory is used to represent the best English approximation of the French term *construire*, which, as Davis and Sumara (2002, p. 412) discuss, can be interpreted in English as either “construct” or “construe.” Since the general area of constructivist theory can be traced in part back to some of the theorizing about learning contributed by Piaget and written in French over his long career, the distinction between the two English translations becomes critical, not only to an understanding of how constructivism has diverged today (von Glasersfeld, 1998; Davis & Sumara, 2002, 2003; Proulx,

2006), but more importantly for the insights that can be found through the application of “construe” to learning processes. Furthermore, as Davis and Sumara (2002, p. 415) mention, it is possible that the Marxist philosophy of collective, “shared labor,” which appears as a dominant influence in Vygotsky’s work, also contributed towards the uptake of the building-related term “construct” in English rather than “construe” with its more open and nuanced interpretations. In Ecological Constructivism, construe better embodies the connections that can be made in situated and context-embedded learning, both through the perception and construing of individuals in their learning and real-life environments, as well as through the co-construing of a group or network of individuals as they create novel understandings and knowledge made possible only through their collaboration. This co-construing of knowledge, as well as the phenomenon of individuals learning alone, were both evident in this MELL project.

Critical to an understanding of EC is the concept of affordances, first used by the psychologist, Gibson (1979) and later developed further for the field of second language learning by van Lier (2000, 2004), Hoven (1999, 2007), and Hoven and Palalas (2011). As van Lier described this concept:

What becomes an affordance depends on what the organism does, what it wants, and what is useful for it. In the forest a leaf can offer very different affordances to different organisms. It can offer crawling on for a tree frog, cutting for an ant, food for a caterpillar, shade for a spider, medicine for a shaman, and so on. In all cases, the leaf is the same: its properties do not change; it is just that different properties are perceived and acted upon by different organisms. . . . In Gibson’s ecological theory of perception, an affordance is a property of neither the actor nor of an object: it is a relationship between the two. (van Lier, 2000, p. 252)

The leaf envisaged in van Lier’s forest offered diverse affordances to different individual organisms. However, by taking the ecological metaphor further, a network or ecology of networked systems of diverse individuals can be envisaged in which the perception of affordances made by individuals form micronodes, which then interconnect, much like synapses firing in the human brain, with those of other individuals working in a collaborative endeavor. Such ecologies of networked systems are also increasingly being found in nature.

These facets of Ecological Constructivism were illustrated quite strongly in the findings of the earlier phases of this DBR project, leading to further refinement of the theory as iterative analysis in later phases revealed additional confirmation of ecological components.

4. DBR, Implications, Recommendations, and Suggestions

This section provides a retrospective and pragmatic perspective on implementing DBR in a mobile-enabled CALL context. Design-based research is a multifaceted and complex endeavor which often necessitates the coordinated effort of a team of researchers, practitioners, students, and experts. Because of the interventionist nature of DBR, the focus throughout a DBR study is on both the generation of new

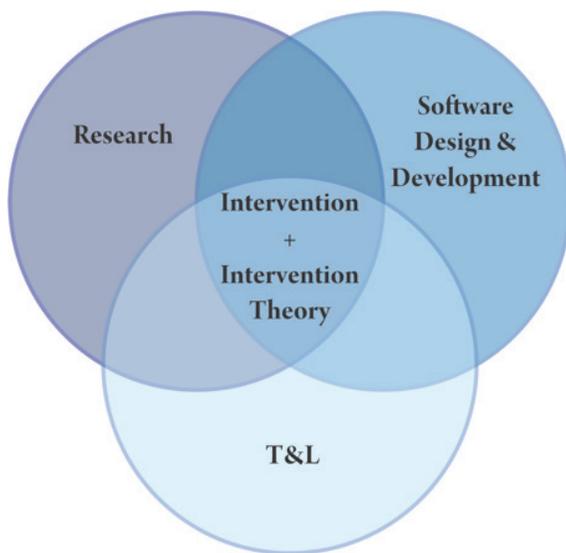
theoretical understanding and the positive impact on practice. In order to produce solutions to real problems, therefore, a DBR study needs to incorporate a combination of both research and design processes. Recommendations and suggestions for the optimization of a DBR methodological approach in CALL educational research are presented on the basis of these reflections.

4.1 Opportunities

DBR provided a holistic framework to integrate software design and development (programming) with the interventionist participative research process and with learning that both the software and the research target. It provided a stage for theories of instructional design and software development to interplay with theories of learning resulting in novel interventions and intervention theory (see Figure 4). Above all it was grounded in the needs of specific learners in a unique educational setting with its culture, habits, interactions, and constraints.

Figure 4

Intersections of DBR Processes and Outcomes



One of the key benefits of the DBR method was the rich feedback: ongoing evaluation enriched by the diverse perspectives of the interdisciplinary team and including the responses/reactions of the target population to the functional prototypes of MELLES piloted in the naturalistic setting /real-life context.

The DBR method enabled user-centric design of the MELL solution by incorporating the end-user feedback throughout the study via input from the active participants (teachers and language students) during the actual programming process. Not only did our learners and teachers evaluate the consecutive prototypes of the MELLES system, they also participated in the design and testing of the constituent parts of the whole solution. While collaborating closely on the design

placed the participants (the potential end-users) in direct ownership of the results, their active participation also facilitated better representation of their language needs. Indeed, thanks to the fact that English was the L2 of many of the software designers and developers, the design benefitted from a heightened understanding of the target population needs. Moreover, the participants engaged in social interaction and communication thus gaining additional opportunities to practice their language skills. Students thus became designers of their own learning, teacher-designers of the teaching materials and context. “We are moving away from a passive information age towards an active participation age” (Farmer & Gruba, 2006, p. 149), and DBR provides a venue for language learners to inform and advance the design of their own learning materials. Learners are thus helping to build a learning context that reflects their cognitive and communicative behaviors.

In addition, the participation of experts representing a number of MELL-related fields enriched the design with applied interdisciplinary knowledge, contributing diverse perspectives and innovative ideas. Through that collaboration, the MELLES practitioners acquired a broader understanding of the requirements and application of mobile-enabled CALL solutions in student practice. Hence, the emerging knowledge and feeling of ownership among participants promoted the adoption of the innovation within the project and the understanding of its affordances in a broader CALL context. The ensuing professional development can therefore facilitate the creation and adoption of innovative CALL solution in the future.

As already mentioned, the richness of feedback gathered from the language learners and teachers working in the naturalistic context demonstrated to be one of the key benefits of DBR. The complex multi-dimensional and messy language learning context did not have to be recreated or simulated; instead the authentic communicative situations, providing a real-life rather than a lab environment, could be experienced and analyzed first hand. Thus, the analysis of the combined in situ feedback of various ELLs engendered an enhanced understanding of the many factors the holistic MELL learning environment brings with it, including the actual demands and interplay of the learners and the context mediated by mobile technologies.

Such close and persistent observation of situated learning, afforded by any longitudinal DBR, provides a fertile ground for developing and testing of new theory. Accordingly, new theoretical principles emerged from the observation of MELLES student m-learning behaviors and from their account of their own learning experience. A new theory and corresponding new language were needed to reflect the novel learning behaviors observed during MELL pilots and expressed through participant feedback. Student responses and reactions to the MELL activities, their approaches to mobile task completion and artifact creation, as well as interactions with the context, engendered a theory of learning which would emphasize interaction with the environment and interdependencies of the various components of MELLES. All in all, the close study of the MELL intervention promoted the emergence of a refined learning theory: the intervention “embod[ie]d

specific theoretical claims about teaching and learning, and reflect[ed] a commitment to understanding the relationships among theory, designed artifacts, and practice. ... research on specific interventions can contribute to theories of learning and teaching.”(Design-Based Research Collective, 2003, p. 6)

4.2 Implications and Recommendations

As Farmer and Gruba (2006) observed, “[r]equirements in CALL are socio-technical, and are therefore ill defined and multifaceted” (p. 155), therefore the contextual and integrative character of the DBR method made it the most appropriate approach for the pragmatic study of MELL instruction provision. This multidiscipline, multiplayer, and multipart educational research process promoted an in-depth investigation and validation of mobile CALL theory. Nevertheless, certain limitations resulting from the complex nature of the DBR methodology should be mentioned. The key problems with the conduct of a DBR study include discriminating among the various different roles of the researcher, coordinating the numerous research and design activities, and the need for rigor including treatment validity and systemic validity. Related to these are the issues of the overwhelming amounts of data and the need for consensus-reaching and interaction among the many actors involved (Dede, 2004). Hence to ensure, as much as possible, the thoroughness of data collection and credibility of the findings, procedures have to be put in place in terms of the soundness of data collection, regular communication with all stakeholders, appropriate data analysis techniques, as well as findings documentation and reporting (more specifics on the methods employed in the MELLES project are reported in Palalas, 2012). Accordingly, a DBR study is most productive when a variety of different data collection processes, techniques, and tools are used. These can include

- mixed data collection and analysis;
- interviews with participants and between participant-researchers;
- focus groups;
- regular formal and frequent informal meetings (face to face and online);
- feedback from formal data collection points combined with feedback shared in a more agile fashion during the intervention design, development, and testing activities;
- detailed notes and recordings from meetings and online discussions;
- educational intervention design and development documentation;
- researchers journaling their thoughts, processes, points of interest, points of change, or tangential departures;
- observation notes;
- regular sharing and discussion of journal entries;
- ongoing communication and exchange of materials/documentation among the research team;
- exchange of all project documents and reports through an online portal; and
- milestone reports (leading to next-phase refinements).

Moreover, the scope of typically lengthy and multilayered DBR projects requires a sound conceptual framework, clear deadlines and deliverables, “flexible” adjustments to academic schedules, as well as solid project management efforts. To a large extent, all the above problems can be addressed by forming a collaborative DBR research group combining complementary expertise and diverse perspectives. Both students’ and practitioners’ voices should be represented in such a DBR team, but most importantly SLA practitioners have to collaborate with CALL and technology experts by engaging in research activities at the same time as systematic communication. Team effort is necessary in order to share the tasks of a DBR project and to ensure its rigor: “If a researcher is intimately involved in the conceptualization, design, development, implementation, and researching of a pedagogical approach, then ensuring that researchers can make credible and trustworthy assertions is a challenge” (Barab & Squire, 2004, p. 10). From the experience of this MELLES project, therefore, it became clear that the many roles that were fulfilled by the principal researcher would be better split among a group of members of a team. These roles would ideally include investigator, research processes coordinator, instructional designer and theorist, mobile CALL software designer and developer, evaluator and implementer, mobile learning subject matter expert, negotiator, and project manager. The resulting participant engagement would achieve higher levels of agency and ownership which are invaluable for the attainment of the project goals.

5. Conclusion

As discussed earlier and illustrated through this study, Design-Based Research has the capacity both to explore, investigate, develop and refine learning interventions, as well as to test and refine theory. Taking a DBR approach in this study therefore richly illustrates the observations and recommendations of Otto and Puck (2009, p. 786),

Sound CALL practices arise from the way knowledgeable teachers notice or imagine the capabilities of technology in the context of informed teaching practice. Development is neither strictly bottom-up nor top-down but both: It is an act of examining the potential of technology through the lens of SLA theory. Because good language teaching involves a vast panoply of challenges, we conclude that we will need to aspire to the creation of an equally wide array of extremely flexible tools.

DBR and EC provide such flexible tools to continue to research the full spectrum of CALL instances, including mobile-enabled CALL, as well as other manifestations of which the field has not yet conceived. While offering an incredibly productive and generative approach to investigating the multifarious contributing elements in an educational context, to find solutions to gaps in learning, and to identify and refine possible interventions, DBR is not a research approach to be undertaken by the faint of heart. To be effective, a DBR study, especially in CALL environments, is best conducted by a collaborative group of participating researchers, each with complementary skills, backgrounds, and perceptions of the

context and the issues pertaining to it. DBR renders best results when, while combining systematic, yet flexible, cycles of research and software developments; it reflects the dialogue among students, teachers, and researchers.

Design-Based Research Collective (2003) suggested that “the value of design-based research should be measured by its ability to improve educational practice” (p. 8). Applying this criterion, the MELLES study demonstrated the DBR methodology to be effective and suitable for investigating and creating mobile CALL interventions which reflect the real needs of our second language learners in their naturalistic learning environments.

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Appendix A

Essential Characteristic (<i>Substantive Emphasis</i>)	Strategy (<i>Procedural Emphasis</i>)	Rationale (<i>in order to ...</i>)
<p>3</p> <p>Game-like real-life communicative tasks</p>	<ul style="list-style-type: none"> • Include element of educational games (challenges, awards, bonus system, group or individual competition, engaging visual interface, progress record keeping) • Inject fun, enjoyment and challenge • Build in interactivity with others, content, technology, environment (context affordances) • Provide clear audio directions and instructions • Include relevant linguistic resources • Assist with the perception of, and interaction with, the context linguistic affordances • Ensure direct or indirect (apps) access to MELLES and its resources • Facilitate immediate feedback (messages, alerts, tips, clues) • Include task goals aiming at carrying out linguistic functions in real-life situations in response to audio instructions • Draw on context affordances and point to them through instructions and directions • Reflect or include real-world communication tasks (communicative goals) • Allow for interrupted episodic learning—modular design with each audio podcast not exceeding 5 mins or activity within a task not exceeding 10-15 mins • Include discourse with diverse interlocutors including L1 speakers • Include contextualized listening challenges aimed at spontaneous communication 	<ul style="list-style-type: none"> • Enhance individual and group motivation • Support cognitive processes through communication with others • Promote cognitive processes interaction with others, content, technology, environment (context affordances) • Blend creativity and competition in learner-generated artifacts exchange • Encourage abstract and creative thinking leading to engagement and motivation • Enable authentic assessment of linguistic skills • Promote learning by blending cognitive, social and teaching presence • Prepare students for real-world communication tasks • Accommodate interrupted episodic learning on the go • Promote active learning • Advance dynamic language usage, including impromptu communication and meaning-making • Provide learning support through context affordances • Offer a whole language experience

Chapter 6

Capitalizing on the Dual Goals of Design-Based Research in Computer-Assisted Language Learning Contexts

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Abstract

This chapter builds on the categorization of research methods presented by Orrill, Hannafin, and Glazer (2003) to align the methodological approach of design-based research (DBR) with that of theory-building research. It is argued that educational researchers adopting a DBR approach to theory-building must design their interventions with an explicit commitment to simultaneously pursue the dual goals of (a) enacting learning theories and refining the practice in real-world settings and (b) contributing to existing theories or developing new theoretical insights based on the outcomes of enacting these theories. To this end, researchers are encouraged to focus on the role of design, which can be broadly conceptualized as a methodological framework to systematically guide the research process, or as a mediational artifact that is situated and evolved in the DBR process. This chapter thus places an emphasis on a holistic view of design thinking in DBR interventions, and some empirical DBR examples are discussed to demonstrate how this research method can be carried out in CALL contexts.

1. Introduction: Understanding the Dual Goals of DBR

Methodological diversity is abundant across all disciplines. As a fruitful method for exploring the use of technology in education, design-based research (DBR) has attracted much attention from educational technology researchers. To understand what counts as DBR, it is helpful to see what type of method it is in a broad sense. Orrill, Hannafin, and Glazer (2003) provided a framework to understand the wide variety of research methods by considering the fundamental research goals. They identified three major types of educational research related to technology: foundation research, application research, and theory-building research, each of which have distinct research goals and address different methodological concerns. Based on this framework, DBR falls into the theory-building category.

The goal of foundation research is to develop fundamental knowledge about learning and technology independent of setting. Foundation researchers are in-

terested in establishing baseline evidence of why and how a technology works best to reveal potentially generalizable principles for subsequent researchers who are concerned with practical applications of the focal technology. Foundation research is often conducted under controlled conditions using experimental or quasiexperimental methods. In contrast, application research shifts the focus from the development of the technology itself to learners' experiences with it. Application research aims to understand practical issues related to the implementation of a technology (such as user satisfaction, instructional strategies, and learning effects) to determine whether it is worth more widely adopting. Educational researchers with this goal usually employ case studies, action research, or evaluation research methods to address issues of practice, with the aim of improving the implementation of a technology in a specific context.

Theory-building research has a twofold aim that converges with the objectives of application and foundation research to develop technological innovations in context that are guided by learning theories, while at the same time aiming to refine the fundamental knowledge about the technology and its use, in order to guide future developments in other settings. It is this dual nature of theory-building research that characterizes the emerging method of DBR. Although in some theory-building research interventions the focus may be more on one goal than the other, educational researchers adopting a DBR approach to theory-building must design their interventions with an explicit commitment to simultaneously pursue the dual goals of (a) enacting learning theories and refining the practice in real-world settings and (b) contributing to existing theories or developing new theoretical insights based on the outcomes of enacting these theories.

For simplicity, the concept of theory in DBR can be understood on two levels. Local theories involve design principles or guidelines, teaching beliefs, instructional strategies and the like that are closely tied to practical aspects and are applicable to other, similar implementation sites. Global theories, on the other hand, are often rooted in conceptual frameworks and established models drawing from domain-specific disciplines or general education. Researchers can choose to frame their DBR interventions by using either one or both levels of theory, depending on to what extent they intend to share the outcomes beyond the immediate contexts in which the studies are conducted. Regardless of the level that DBR researchers are concerned with, it is through iterative design that the enactment, refinement, and advancement of theories are realized. How exactly this is accomplished poses a general methodological question that this chapter attempts to explore.

Briefly, this chapter builds on the categorization of research methods presented by Orrill, Hannafin, and Glazer (2003) to align the methodological approach of DBR with that of theory-building research. Fundamental to DBR are its twin objectives of advancing theory and refining practice through holistic design thinking. The following sections will elaborate the central role of design in DBR to illustrate, using empirical examples, how this research method can be appropriately carried out.

2. Conceptualizing the Role of Design in DBR

DBR has been known by a variety of names since it was first introduced in the 1990s. These interchangeable labels, such as design experiments (Brown, 1992; Collins, 1992), design research (Reeves, Herrington, & Oliver, 2005; Reeves, 2006), and educational design research (van den Akker, Gravemeijer, McKenney, & Nieveen, 2006; Reeves, McKenney, & Herrington, 2011), all reflect the central role of design in this approach. Design is a complex construct, and based on a preliminary review of recent literature, it appears that design can be broadly conceptualized as a methodological framework to systematically guide the research process or as a mediational artifact that is situated and evolved in the DBR process.

Design conceptualized as a framework is prescriptive in nature, serving as an overarching guide for conducting DBR. A number of scholars and researchers have attempted to characterize DBR in the past two decades (e.g., Brown, 1992; Bannan-Ritland, 2003; Reeves, 2006), and most often this involves a description of the related processes and procedures. Inspired by the influential work of Brown (1992) and Collins (1992), most researchers in the field believe that DBR is best conducted through a continuous cycle of design, enactment, evaluation, and redesign. While other researchers may frame the implementation of DBR differently, they consistently focus on its characteristic of iterative design and development. For instance, Bannan-Ritland (2003) articulated four broad phases to describe a typical DBR process that include informed exploration, enactment, evaluation of local impact, and evaluation of broader impact. Pervading all four phases is a process of iterative design. According to Bannan-Ritland, none of the design efforts in DBR are isolated by the boundaries of each phase, but instead are dynamically related and can be profitably referenced across all phases. In a similar vein, Reeves (2006) outlined a four-stage cycle of DBR processes, featuring refinement of problems, solutions, methods, and design principles. These refinement activities are iterated until satisfying solutions to the identified problem and explanatory principles to interpret the learning phenomenon have been derived empirically from multiple investigations of the design innovation. To sum up the process-oriented aspect of DBR, Amiel and Reeves (2008) put an emphasis on “an iterative research process that does not just evaluate an innovative product or intervention, but systematically attempts to refine the innovation while also producing design principles that can guide similar research and development endeavors” (pp. 34-35).

Another conceptualization of design focuses on product orientation, in contrast to the process-oriented view of design as framework. Here, design can be seen as a mediational artifact developed to support learning. From the outset, the notion of mediational artifacts has been rooted in cultural-historical psychology, which is made manifest by a fundamental assertion that all human activities are mediated by artifacts. These mediational artifacts take different forms and may consist of concrete materials (e.g., technologies) or abstract entities (e.g., culture, language, and semiotic tools). Cultural-historical theorists and researchers maintain that mediational artifacts of any form can provide affordances and constraints that

both shape and are shaped by the learning context from which the artifacts are originally employed (cf. the work of Lev S. Vygotsky and his followers). In light of this perspective, conceptualizing design as a mediational artifact implies that DBR proceeds on the basis of perfecting the designed artifact to minimize its constraints and to expand its affordances for learning. In practice, this may only be achieved through an iterative design process that often results in long-term refinement. Therefore, DBR researchers taking this view are most concerned with how learning is mediated by the designed artifact and how this artifact can be refined to support learning. As the Design-Based Research Collective (2003) argued, “The intention of design-based research in education is to inquire more broadly into the nature of learning in a complex system and to refine generative or predictive theories of learning” (p. 7). This intention means that while design can be viewed as an artifact, DBR goes beyond merely designing a particular product.

Conceptualizations of design, both as a methodological framework or a mediational artifact, reflect researchers’ intended prioritization of design with regard to different purposes for conducting and presenting DBR. These two concepts of design shed light on one another and, in practice, cannot be realized separately. The Quest Atlantis project, led by Sasha Barab at Indiana University in the United States, is one notable example of DBR that conforms to a holistic view of design thinking. Quest Atlantis is a 3D multiuser virtual environment (MUVE) designed to engage children in game-based learning tasks. On the surface, this research project set out to develop a practical application of a virtual learning platform based on motivation theories, thus reflecting the view of design as artifact. At its core, the researchers were interested in developing deeper theoretical underpinnings of why and how the designed artifact works in the innovative context. Together, these two goals were achieved through an iterative DBR process in which design served as a framework for guiding the iterations of design and redesign. Based on this DBR project, Barab, Arici, and Jackson (2005) successfully developed the promising Learning Engagement Theory.

Although DBR is still by no means the prevalent approach (Reeves, McKenney, & Herrington, 2011), a few rigorous examples of its use are emerging in the field of educational technology in general, and computer-assisted language learning (CALL) in particular. The Quest Atlantis project mentioned above is just one prominent initiative that has demonstrated the value of this method. To elaborate on the central role of design in DBR, the following sections present fairly typical projects in the fields of educational technology and CALL, respectively.

3. Design as a Methodological Framework

DBR provides a legitimate condition for conducting research related to technology in “an iterative design process featuring cycles of invention and revision” (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003, p. 10). The section above explained how different researchers have visualized this process in various ways (e.g., Brown, 1992; Collins, 1992; Bannan-Ritland, 2003; Reeves, 2006), but there is a consensus that a typical DBR process consists of a number of interre-

lated stages. That is, data gathered in each stage of the process should be informed by and inform other parts of the project. Together, all the data collected during the research process are thus used to achieve the twin objectives of DBR.

Several researchers have attempted to document how they applied iterative design in context, and Table 1 provides a summary of three selected DBR projects in the field of educational technology research.

Table 1
A Summary of Three DBR Projects in the Field of Educational Technology Research

	Roschelle et al. (2010)	Mantei (2008)	Hakkarainen (2009)
Dual goals of the DBR project	<p>1) <i>Theory-enacting and practice-refining aspect:</i> To integrate a Computer Supported Collaborative Learning (CSCL) tool developed in Chile, called Eduinnova, into a mathematics curriculum in the United States</p> <p>2) <i>Theory-advancing aspect:</i> To contribute to the field of Mobile Computer Supported Collaborative Learning (M-CSCL)</p>	<p>1) <i>Theory-enacting and practice-refining aspect:</i> To develop effective authentic learning tasks</p> <p>2) <i>Theory-advancing aspect:</i> To refine a set of principles for the design of effective authentic learning tasks</p>	<p>1) <i>Theory-enacting and practice-refining aspect:</i> To design a digital video production course</p> <p>2) <i>Theory-advancing aspect:</i> To advance design principles based on the pedagogical models for Teaching and Meaningful Learning (TAM) and Problem-Based Learning (PBL)</p>
Participants and settings	<ul style="list-style-type: none"> • Three schools in the first design cycle and another three schools in the second design cycle • A three-week classroom module for primary school mathematics in the United States 	<ul style="list-style-type: none"> • A group of early career primary teachers and experienced classroom teachers • A learning community of professional development for primary teachers in Australia 	<ul style="list-style-type: none"> • Two pilot students and 10 students enrolled in the course • A digital video production course for a media education curriculum at the University of Lapland in Finland
Data collection	<p><i>Experimental Study:</i></p> <ul style="list-style-type: none"> • Year 1: A pilot testing experiment • Year 2: A randomized experiment 	<p><i>Qualitative Inquiry:</i></p> <ul style="list-style-type: none"> • Interview • Observation • Teaching and learning artifacts from the participants (e.g., weblog entries) 	<p><i>Qualitative Inquiry:</i></p> <ul style="list-style-type: none"> • Interview • Questionnaire • Students' performance results (e.g., DVs) • Video recordings of classroom observations • Teacher-researcher's observational journal • Course commissioners' feedback

Framework of the research process	<i>Bannan-Ritland's (2003) Integrative Learning Design (ILD) framework:</i> <ul style="list-style-type: none"> • Informed exploration phase • Enactment phase • Evaluation of local impact phase • Evaluation of broader impact phase 	<i>Reeve's (2006) model of DBR process:</i> <ul style="list-style-type: none"> • Phase 1: Analysis of practical problems by researchers and practitioners in collaboration • Phase 2: Development of solutions informed by existing design principles and technological innovations • Phase 3: Iterative cycles of testing and refinement of solutions in practice • Phase 4: Reflection to produce "design principles" and enhance solution implementation 	<i>A self-adaptive DBR process:</i> <ul style="list-style-type: none"> • Developing stage • Testing stage • Investigating stage • Refining stage
Research output and dissemination	<ul style="list-style-type: none"> • A report on two complete cycles of the DBR project • Journal article (with partial findings presented in advance at a conference) 	<ul style="list-style-type: none"> • A work in progress (the third phase of this DBR) • Conference proceedings 	<ul style="list-style-type: none"> • A report on the first cycle of the DBR project • Journal article

In the study of Roschelle, Rafanan, Estrella, Nussbaum, and Claro (2010), the research process was guided by Bannan-Ritland's (2003) Integrative Learning Design (ILD) framework. The four stages (i.e., informed exploration, enactment, evaluation of local impact, and evaluation of broader impact) allowed Roschelle et al. to investigate how a Computer Supported Collaborative Learning (CSCL) tool developed in Chile, called Eduinnova, could be transformed and integrated into a mathematics curriculum in the United States to support effective practice of CSCL pedagogy in primary schools. The research project underwent two cycles of design, with one serving as a test of the pilot design in the first year and the other acting as an actual application of the refined design in the second. In terms of the ILD framework, the DBR process of the first cycle started at the informed exploration stage with three primary schools, proceeded to the enactment stage of developing classroom modules and collaborative learning activities, and ended with preliminary results derived from the evaluation of local impact stage. Based on the outcomes of the first pilot study year, the DBR process of the second cycle continued with the enactment stage to improve the initial design, followed by two consecutive stages of evaluation to examine local and broader impacts of the intervention.

Alternatively, Mantei (2008) adopted Reeves' (2006) model of DBR process to guide her investigation into primary school teachers' understanding and practice of authentic learning. Mantei also used this process model to organize the report on her research implementation and findings as follows: "(1) Analysis of practical

problems by researchers and practitioners in collaboration; (2) Development of solutions informed by existing design principles and technological innovations; (3) Iterative cycles of testing and refinement of solutions in practice; (4) Reflection to produce ‘design principles’ and enhance solution implementation” (pp. 132-134). Through the DBR process, the study sought to identify effective practices for authentic learning tasks and to advance the original set of authentic learning principles from which the study was drawn.

Instead of applying an existing framework or model for the DBR process, as in the above examples, Hakkarainen (2009) conducted a study that emphasized the iterative feature of the research process in an adaptive way. The project set out to design a digital video production course to help university students produce and use educational videos meaningfully based on the pedagogical model for teaching and meaningful learning (TAM) and the problem-based learning (PBL) approach. She thus organized the research process into developing, testing, investigating, and refining stages to systematically amend both the learning environment designs (i.e., the digital video production course) and the theoretical constructs (i.e., the PBL and the TAM models) of the DBR project. As a result of Hakkarainen’s study, a set of design principles were generated to meet the local needs of curriculum development and, on a broader level, to provide a better understanding of the two pedagogical models that underlie the intervention.

It is apparent that a central characteristic among the three empirical studies presented above is iterative design, although the specific processes and procedures involved in these research projects varied in detail. As demonstrated in the studies of Mantei (2008) and Roschelle et al. (2010), Bannan-Ritland’s (2003) ILD framework and Reeves’ (2006) model of DBR process provide a comprehensible, yet flexible, way to organize the planning, construction, and dissemination of DBR interventions, so they are often used among educational researchers. The various DBR processes proposed in the literature are often adapted to meet local needs, as in Hakkarainen (2009). It is also not uncommon for DBR researchers to assume and simply use the defining feature of an iterative research process without making explicit claims about how they conducted the research. While not necessary, DBR researchers are encouraged to clarify the actual research processes adopted in local contexts, particularly with regard to major differences and improvements in each stage, in order to enhance the comprehensibility and applicability of the methodology.

4. Design as a Mediational Artifact

According to the Design-Based Research Collective (2003), DBR interventions “embody specific theoretical claims about teaching and learning, and reflect a commitment to understanding the relationships among theory, designed artifacts, and practice” (p. 6). This point of view builds on cultural-historical accounts of artifact-mediated human activity and implies that designed artifacts, acting as forms of mediation, help to establish relations between theory and practice. Designed artifacts can refer to things as broad as the design of learning environ-

ments or as narrow as the design of a particular technological product. They can take various forms, such as objects, tools, concepts, curricular activities, or the innovative learning environment as a whole. When not specified, the designed artifacts in DBR are generally conceived as the focal learning environments that are often mediated with technology. This is because any design intervention essentially embraces conjectures about learners engaging with designed artifacts within learning environments. Cobb et al. (2003) used an ecology metaphor to visualize designed learning environments as interacting systems involving a complex web of sociocultural elements rather than merely a collection of separate artifacts. It thus follows that DBR researchers must go beyond “what is” and respond to the fundamental question of “how these elements function together to support learning” (Cobb et al., p. 9). Arguably, this will require DBR researchers to design and refine mediational artifacts with the notion of affordance in mind in order to maximize their mediational potential in a learning ecology.

In one form or another, design efforts are obligated to be theory driven to “embody specific theoretical claims about teaching and learning” in design, as argued by the Design-Based Research Collective (2003, p. 6). It is thus imperative for DBR researchers in the field of CALL to make direct references to second language acquisition (SLA) theories or the theoretical underpinnings of applied linguistics. Although there is relatively little DBR in CALL contexts, a few initiatives have been undertaken to advance technology integration in language education from an SLA perspective. Table 2 outlines the core theoretical concepts of two DBR projects in CALL contexts.

Table 2

An Overview of Core Theoretical Concepts of Two DBR Projects in CALL Contexts

	Hung (2011)	Pardo-Ballester and Rodriguez (2009)
Theoretical stances for the DBR	<p><i>SLA suggestions proposed by Chapelle (2005):</i></p> <ul style="list-style-type: none"> • Make key linguistic characteristics salient. • Offer modifications of linguistic input. • Provide opportunities for comprehensible output. • Provide opportunities for learners to notice their errors. • Provide opportunities for learners to correct their linguistic output. • Support modified interaction between the learner and the computer. • Provide opportunities for the learner to act as a participant in L2 tasks. <p><i>Multimedia learning principles suggested by Moreno (2006):</i></p> <ul style="list-style-type: none"> • Students learn better from words and graphics than from words alone. • Students learn better when explanations are personalized rather than non-personalized. 	<p><i>SLA hypotheses identified by Chapelle (1998):</i></p> <ul style="list-style-type: none"> • Salient input may promote SLA processes. • Assistance in comprehending linguistic input creates opportunities for acquisition. • Opportunities to produce the target language are good for acquisition. <p><i>An initial set of design principles for this DBR project based on Chapelle's SLA hypotheses include:</i></p> <ul style="list-style-type: none"> • Target input needs to be made salient. • Learners need help comprehending linguistic input. • Providing opportunities to produce target language output. <p><i>A taxonomy of glosses outlined by Roby (1999):</i></p> <ul style="list-style-type: none"> • Gloss authorship in this case refers to professional glosses (i.e., glosses written by teachers and materials developers).

	<ul style="list-style-type: none"> • Novice students learn better when given principle-based explanations than they do when asked to infer principles by themselves. • Students learn better by manipulating the materials rather than by passively observing others manipulate the materials. • Students learn better when given opportunities to reflect during the meaning-making process. 	<ul style="list-style-type: none"> • Gloss function in this case refers to declarative glosses (i.e., learners have access to factual knowledge or linguistic explanation). <p><i>Accordingly, the multimedia glosses embedded in the online readings were designed by the instructors in terms of the affordances to help the Spanish learners:</i></p> <ul style="list-style-type: none"> • Focus on the form and vocabulary. • Increase their motivation to read in Spanish. • Interact with the text. • Better learn and retain linguistic input.
<p>Theoretical insights or design principles derived from the DBR</p>	<p><i>Six design principles for effective reflective tasks derived from this DBR project:</i></p> <ol style="list-style-type: none"> 1. The input principle: The learning task requires learners to comprehend the input with the guidance of teachers or others, and technology is employed to make key linguistic characteristics salient through modification or visual representation of the input. 2. The output principle: The learning task requires learners to produce comprehensible output through negotiation of meaning with others, and technology is employed for learners to modify their use of the target language for greater comprehensibility. 3. The noticing principle: The learning task requires learners to attend to the target forms and functions of language, and technology is employed for learners to monitor their learning and notice their errors. 4. The reflection principle: The learning task requires learners to reflect on their learning experiences, and technology is employed for learners to visualize the learning process and to articulate what they have learned. 5. The interactivity principle: The learning task requires learners to participate actively by social interaction with others as well as direct manipulation of information, and technology is employed to support interactivity among learners (i.e., interpersonal interactivity), between learners and learning materials (i.e., informational interactivity), or between learners and computers (i.e., human-computer interactivity). 6. The multimedia principle: The learning task is focused around learners' exposure and participation in multimedia-rich contexts where multimedia is embedded to provide inherent scaffolding for learning. 	<p><i>Four design principles for CALL materials development derived from this DBR project:</i></p> <ol style="list-style-type: none"> 1. Sensitivity to the mode, context, and content of language instruction. 2. Attention to needs of diverse learners. 3. Consideration of learners' interest in particular discourse domains. 4. Interfaces which are optimized for language learning.

Focal design artifacts	Reflective tasks mediated by digital video technology	Online instructional materials embedded with multimedia glosses
Target language skills	English presentation skills	Spanish reading and vocabulary

To provide a more focused discussion, the two empirical studies described in this chapter are both grounded in interactionist SLA theory.

Hung (2011) conducted a DBR project to systematically improve a course design, featuring a reflective task for language learning in a multimedia environment. She adopted Chappelle's (2005) language learning principles and Moreno's (2006) multimedia learning principles as the theoretical framework to develop the theory-driven designed artifacts in the research. The participants were a total of 89 university students enrolled in three English language classes taught by the same instructor for three consecutive years. Through iterative research cycles of design, enactment, and redesign, the task design evolved with regard to task-completion formats (from self-reflection to collaborative reflection) and task-completion tools (from video-playing software, to a video analysis program, and up to a web-based video annotation tool). With the well formulated DBR design, Hung (2011) not only enhanced the initial implementation of the reflective task, but also blended Chappelle's and Moreno's principles to generate an integrative set of guidelines for the design of reflective tasks in multimedia learning environments.

Pardo-Ballester and Rodríguez (2009) adopted a DBR approach to the development of CALL materials. In developing instructional materials for hybrid Spanish courses for university students, they integrated three basic hypotheses about SLA from Chappelle (1998) with Roby's (1999) taxonomy of glosses into the design of the instructional materials. Significant to the development of the online readings was an embedded multimedia gloss interface. Pardo-Ballester and Rodríguez defined this gloss as "an instructional aid used to promote learner independence by supporting learning during the interaction with a text" (p. 95). Accordingly, the multimedia glosses embedded in the online readings were designed in terms of the affordances to help the Spanish learners "(1) focus on the form and vocabulary; (2) increase their motivation to read in Spanish; (3) interact with the text; (4) better learn and retain linguistic input" (p. 95). The construction of the instructional materials underwent multiple iterations of design-prototype-testing, which together contributed to a synergy between practice and theory, thus producing well designed online readings and a set of design principles for guiding the development of CALL materials.

Drawing from interactionist SLA and multimedia learning literature, the above-mentioned DBR projects focused on the affordances of the focal designed artifacts (i.e., the reflective learning tasks and the online instructional materials) to create engaging experiences for foreign language learners in quality CALL environments. Certainly, these artifacts do not operate in isolation, and the pro-

cess of design evolution inevitably involved many contextual factors, such as instructional strategies, participation structures, and multimedia integration. In this regard, the artifacts were apparently brought into being through the design of the learning environments as a whole. This chapter argues that such an encompassing view with respect to the design of learning environments holds for all DBR interventions.

5. Conclusion: Meeting the Dual Goals of DBR with Design Thinking

While a complex set of characteristics have been identified by many educational researchers in the recent literature (e.g., Wang & Hannafin, 2005; Reeves, 2006; Sharma & McShane, 2008), this chapter has argued for attending more closely to the dual goals of DBR that distinguish this promising method from other approaches. With its twin objectives, DBR provides an effective way to better understand and forge a nexus between theories and practices in real-world contexts. As explained here, DBR can be understood as a contextualized theory-building method for examining the relationships among educational theories, designed artifacts, and pedagogical practices (Design-Based Research Collective, 2003; Orrill, Hannafin, & Glazer, 2003). It is also worth noting that, in terms of methodological practice, DBR “is not so much an approach as it is a series of approaches with the intent of producing new theories, artifacts, and practices that account for and potentially impact learning and teaching in naturalistic settings” (Barab & Squire, 2004, p. 2).

In order to meet the dual goals of refining practice and advancing theory, researchers have to capitalize on the role of design in DBR. This chapter has claimed, in broad terms, that design can be conceptualized as a methodological framework and a mediational artifact. Both the process- and product-oriented aspects of design are best viewed as two sides of the same coin. Pulling together these two conceptualizations of design yields a holistic picture of a robust methodology for the study of technology in education and allows researchers to leverage the value of DBR to undertake more rigorous explorations of various issues in this field.

When designing a DBR project in CALL contexts, it is important for researchers to be explicit about how the designed artifacts situated in the learning environments (e.g., technological tools and associated suggestions for teaching and learning) are designed to allow for the development of what specific language skills or areas (e.g., communication skills, reading comprehension, vocabulary acquisition, or cultural literacy) based on which domain theory perspective in applied linguistics (e.g., interactionist SLA theory). Throughout the project implementation, researchers should document both the process and outcome data in each research stage and design cycle to reveal how the designed artifacts have been systematically refined to gradually support the teaching and learning of the targeted language skills or areas. More importantly, in addition to disseminating research findings concerning CALL practice, researchers adopting a DBR approach must revisit the original theoretical underpinnings upon which their work was based

and seek to provide new theoretical insights of interest to CALL researchers. All in all, placing holistic design thinking at the top of DBR will strengthen it as a coherent methodology that leads to theory-driven and empirically grounded improvements with regard to integrating technology in education.

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Chapter 7

An Alternate Reality Experience for Language Learning: A Design-Based Evaluation

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Abstract

With the rise of technology use in and out of the classroom, educators are feeling an increasing demand for instruction that takes advantage of the benefits that new tools provide. They see that technology-based tools are not only becoming economical and practical, but also that their use outside the classroom can enable teachers to focus more on communication in the classroom. What educators do not see is clear guidance as to the best ways to implement these technologies in the instructional process. This chapter reports on research relating to a learning environment designed to take into account the involvement that today's students have had and continue to have with technology. Many have had access to computers from very early childhood, and use with various forms of social networking continues to increase. The chapter addresses the gap in current research with respect to student attitudes toward CALL materials and how those materials are implemented in a social networking setting and an Alternate Reality Experience for Language Learning (ARELL). Using a design-based research framework, we were able to observe changes in a number of variables over four separate iterations of the ARELL environment, providing interesting insights into student attitudes toward the experience. The most significant finding of this study was the observation that more than all other implementation variables, the manner in which the teacher presented the material had the greatest impact on how students reacted to the new learning setting.

1. Introduction

Given the complexities of language, some scholars and practitioners have turned to computer-assisted language learning (CALL) as a means for improving the language learning process. Unfortunately, these efforts have at times resulted in a situation where technology drives the selection of tools as they have become available. An alternative and inherently more interesting approach is to identify a pedagogical need in the language acquisition process and then adapt technology to address that need.

One often hears that “the most effective way to learn to communicate in a language is to live in the country where the language is spoken.” Teachers are sen-

sitive to the value of in-country experience to facilitate the language learning process, but they also recognize that most of their students will likely not have that opportunity. Seeking ways to bring a glimmer of that type of experience to their classroom, some teachers and textbook writers have turned to social media platforms such as Facebook and Twitter as a substitute of sorts for the in-country experience. Prensky (2001) essentially explained an additional aspect of the attractiveness of this approach for today's students, labeling them as "Digital Natives," and thus acknowledging that they have been raised in a world in which they have encountered digital technology almost since birth.

Unfortunately, as attractive as social media might be for providing meaningful opportunities for communication in the target language, simply telling students to "go communicate online" constitutes an inadequate level of guidance. Also, although teachers might provide students with well conceived assignments for tasks to be carried out in the target language, it is virtually impossible to verify the quality of each individual experience and how well connected it is to course objectives. In addition, this sort of open-ended approach does not provide opportunities for providing systematic and targeted feedback. By capitalizing on the background knowledge and personal habits of the student participants in these new areas, it should be possible to open the door to more meaningful and active learning than is typically present in many classroom-based language-learning experiences.

Although social media used on the scale that is possible today is a relatively new phenomenon, it can actually be considered to be a new instantiation of the area of computer-mediated communication (CMC), a technology that has occupied a place of interest in language arts for over three decades (Burns, 1984). Beauvois (1997) summarized the advantages of one particular form of CMC, observing that it can be "both linguistically and socially effective for the student and as a powerful tool for the instructor in the ongoing endeavor to enhance the language acquisition process" (p. 182).

In that same vein and discussing their more recent work, Savignon and Roithmeier (2004), write,

CMC is a contemporary medium of communication in its own right, offering new possibilities for intercultural exchange and collaboration. For FL environments, in particular, the incorporation of network-based CMC seems a significant addition to the long-established practices of procuring pen pals and watching news clips and films. Moreover, the opportunity for interpersonal interaction afforded by CMC can take place between persons for whom the language serves as an additional language as well as between learners and those for whom it is a primary language. (p. 285)

The most prevalent form of CMC available today is social networking, as exemplified by commercial systems such as Facebook, which has been most recently investigated in language learning settings by a few other researchers such as Muhammad, Ahmad, & Abidin (2010), Shih (2011), and Mitchell (2012). These researchers noted various weaknesses and challenges with settings based on Face-

book, for example, the difficulty in making new friends who speak the target language (Mitchell, 2009) and the reliance on incidental acquisition of vocabulary (Muhammad et al.). The latter group of researchers suggested that future research “should examine learners’ interaction and engagement with others in various pre-planned and pre-determined language learning tasks with specific objectives within the online environment” (p. 195).

1.1. The Purpose and Approach of this Study

To increase the quality and level of student engagement and to address the limitations of commercial systems such as Facebook, this project implemented two specific design principles. First, developers implemented a simulation-based setting in which a fictional story takes place and in which students become participants in a novel way. Instead of students communicating solely about themselves via blog posts or status updates, they experienced a story presented on a social network by fictional characters with which the students emulate the sort of interaction they would have with friends on a platform such as Facebook. The preconceived storyline provides the context for preplanned and predetermined tasks with specific objectives. Second, to provide the necessary level of control over the environment, the team turned to an open-source, social network engine called ELGG (see <http://elgg.org/>).

The software development necessary to make this experience possible involved student developers and professors collaborating to develop characters and storylines that had the potential to facilitate classroom activities through a controlled environment in which students followed the lives of several fictional characters over the course of three weeks. During their experience with the system, students saw status updates by the characters, read blog posts, viewed photos, and received private messages from the characters. They also responded to the characters’ questions and posted their own thoughts directly to the site.

The study described here thus involved the exploration of differences attributable to learners, teachers, the learning environment, and the curriculum to which was added the interaction of the nature of language and the process required for its acquisition. The resulting complexity in the variables explored suggested that design-based research methodologies would provide the most suitable framework for the study. Because some variables cannot be manipulated, it is possible within this framework to implement both quantitative and qualitative measures to investigate changes over time according to the application of important design principles (Barab & Squire, 2004). Using this approach, it was possible to begin with an instructional design strategy that could yield an interesting and pedagogically sound environment for learning and then to make changes based on the outcomes observed during each iterative cycle.

Such a study holds significance at various levels. The first has to do with what can be learned relative to the changes made in the instructional setting itself. From the lessons learned in that mode, it is possible to derive useful principles that inform instruction. Second, not only do these principles contribute to our field’s

understanding of specific CALL implementations, but they also hold important implications for better understanding the language acquisition process itself. Finally, although many studies have been conducted to investigate how the internet is being incorporated into the classroom as well as the pedagogical implications and teacher attitudes toward technology (McFarlane, Green & Hoffman, 1997), little has been done to determine student attitudes toward the type of learning explored in this project (Levy & Stockwell, 2006).

1.2. Research Questions

This study sought to address the following two questions:

1. What were the effects of changes in the study's instructional environment upon student attitudes towards the learning experience?
2. What, if any, effect did implementation differences have upon the relative success of each iteration of the ESL program?

2. Review of the Literature

Over the years, technology in various forms has consistently shown the potential to play an important role in a wide variety of applications for learning (Kulik & Kulik, 1987; Glennan & Melmed (1996); McArthur & Lewis (1998). In addition, applications have extended to address diverse needs in language acquisition (Bush & Browne, 2004). For a very brief historical review, perhaps the first empirical study to demonstrate that technology could play a role for language learning was published as far back as 1971 (Bunderson & Abboud, 1971) and showed how computers could facilitate the teaching of the Arabic writing system. Other seminal software applications have followed in the intervening years, such as those that explore various types of glossing that can be made available for online reading (Chun & Plass, 1996, Pardo-Ballester & Rodríguez, 2010), computer-mediated communication (Beauvois, 1997), and interactive video (Lys, 2010). As technology has advanced, so have the applications that address language-learning needs, which will be discussed in the next section.

2.1 Evolving Technologies for Language Learning

The most prevalent function of technology in classes today is that of presenting information. Outside of the classroom, accessing information via Google has turned into a tool that the average student finds increasingly indispensable. Information, however, is not the only thing available through the internet. In fact, the current generation of the web provides a wealth of multimedia resources that can be accessed much more interactively than in the past.

As one example, teachers look to the internet in a way akin to how people use Google in other aspects of their lives: as a source of immediate and varied samples of language content for use in the language classroom (Conole, 2008; Mitchell, 2009). Through the example of their teachers and no doubt through their own means, language students have also discovered that the internet today pro-

vides an incredibly large repository of centrally located, quickly accessible information, certainly the largest that has ever existed. Indeed the varied combinations of resources and interactivity that have become possible enable the development of a plethora of exciting new tools for language learning and practice (Lomicka & Lord, 2009).

The development of these capabilities comes with the implication that they are constantly evolving with no end in sight. In the last ten or fifteen years, the power and mobility of technology has increased exponentially, making its way into users' homes, cars, classrooms, and even their pockets.

2.2 Addressing the Needs of Digital Natives

The age group on which these incredible advances in digital technology have had the most impact are those young adults for whom technology has been an integral part of their lives since birth. The presence of digital technology has provided them with an innate ability to understand, adapt to, and utilize both existing and emerging technologies (McBride, 2009; Stockwell & Tanaka-Ellis, 2012). The connection implied with that involvement with technology has led one researcher to refer to them as "Digital Natives" (Prensky, 2001) and another to call them the "iGeneration" (Mills, 2011). This group's use of technology has involved virtually all aspects of their lives including time management, entertainment, and communication with others.

One side effect of this constant electronic barrage that students encounter in their everyday lives is that they have become accustomed to a very high level of stimulation. Educators who encounter these young people in their classrooms must find a way to connect with their young charges, despite the abundance of other signals directed at them. Instead of trying to force students into an environment that is at odds with the rest of their lives, however, educators can perhaps use the same technology that students already use as a way to counter the opposition, so to speak. Because students like obtaining information in new and innovative ways, this approach can bring an added level of engagement to the learning process (Antenos-Conforti, 2009; Kinginger, 2007). A wonderful side effect of connecting with these Digital Natives is that the type of technology making this connection is also capable of connecting them with the language and culture (Stockwell, 2007; Wang, 2005).

2.2.1 The importance of story

Stories are important for everyone, not just Digital Natives. As Schank (1990) points out, they are not just something that we enjoy, but they are an integral part of cognition itself. As he wrote,

People think in terms of stories. They understand the world in terms of stories that they have already understood. New events or problems are understood by reference to old previously understood stories and explained to others by the use of stories. (p. 219)

Thus the nature of stories, or narrative in the strictest manner of speaking, becomes important for much more than motivation. Stories become a key element of how our minds process language in the world around us.

2.2.2 Using technology to connect students with language and culture

Knowing what students need and what technology can do, educators are beginning to use the tools that students are already using in their everyday lives to assist them in the acquisition of language skills. One example of an innovative tool in use are apps for smartphones and tablets that go beyond a basic paper dictionary and provide interactive drills and quizzes on vocabulary, grammar constructs, and culture. Tools such as these capitalize on the capacity that computers have to perform repetitive actions and track results, and they can be effective when working on bottom-up skills in a language.

Another major issue in language instruction is that it can be difficult to get the full “in-country” experience necessary to truly improve language and culture skills. To solve this dilemma, we must turn to the ability the internet has to immerse users in a rich world through images, video, and, most importantly, story or narrative. Teachers have been using the idea of story to teach language for a very long time, but advances in technology now allow users to experience and take part in a story rather than just passively receiving it. This participatory experience plays off the strengths that technology has in presenting information in a variety of interactive ways, in addition to taking advantage of the students’ inherent ability to use innovative tools to learn, thereby increasing the effectiveness of their learning experience. Because multiple users would be accessing these tools with the same goal in mind, the next logical step would be to connect these users with each other so that they might assist one another in practice, provide assistance when possible, and motivate each other as they participate in the simulation.

2.2.3 Using technology to connect students with students

Not only is the use of technology an excellent way of connecting students with information, but new developments in telecommunication have also made it a highly effective means of connecting students with each other (Kurata, 2010). Tools such as video conferencing, instant messaging, and email were originally designed to connect people, and with appropriate guidance, they can effectively connect students as well (Kinginger, 2007). Students who are learning a language need others for the practice that is essential for them to improve their skills, and new technologies have the capacity to connect them to those who can help make that practice a reality, regardless of former hindrances such as distance or time (Stockwell, 2010).

2.3 *Computer-Mediated Communication*

Because of the important role that communication plays in the language learning process and the ability that computers have to foster communication, we can use emerging technologies to increase the effectiveness of the process. In addition

to being able to communicate in new ways, the use of computer-mediated communication (CMC) can do a great deal to enhance the language learning process. Although not initially conceived as a language learning tool, one of the earliest computer-based tools to be implemented for learning is CMC (Burns, 1984). CMC adds a layer of enhancement to conventional net-based communication because the interactions can be observed, recorded, and tracked.

Compared to what we can consider to be classic CMC, the internet is the newcomer on the scene, but it especially allows for interactions that would not have been possible in the past (Kurisak & Luke, 2009). Indeed, early CMC implementations required terminals connected to mainframe computers or a networked lab. Today's tools such as email, video chat, forums, blogs, instant messaging, and so on are becoming an essential part of life for many people for basic communication. Interestingly, each of these tools can also benefit language students when used properly and offer various strengths that enhance the CMC process. For instance, the internet can be a less intimidating forum for conversation because there is not a face involved, and speakers can take the necessary time to plan communications (Kurisak & Luke, 2009), which is not possible when communication takes place in person. That fact alone can take away a great deal of the anxiety many language learners might have in the typical classroom.

2.4 Social Networking

One specific type of CMC are social networking sites, such as Facebook, Twitter, MySpace, LinkedIn, among others, through which people are able to connect and communicate with each other in a public or semipublic forum. Social networking has become extremely popular and has infiltrated many students' lives, and it is now making its way into the language classroom (McBride, 2009). Social networking brings together the optimal combination of technologies for various types of communication and thus is a highly effective tool for language practice. For example, by offering both synchronous (e.g., instant messaging) and asynchronous (e.g., wall postings) tools for communication, social networking activities for language learning can elicit different skills, depending on the platform and purpose for communication. This also means that the various skills can be targeted at different levels (Stockwell, 2010). In addition to providing the opportunities to exercise a variety of skills, social networking sites can also provide extensive, authentic material for students (Stockwell & Tanaka-Ellis, 2012). All of these tools combine to foster socialization in the language, and they engage learners in language practice that is both motivating and linguistically appropriate (Mills, 2011).

The high level of use of social networking sites by college students leads teachers to believe that they could be an effective language learning tool, especially with respect to finding resources for interaction (Kurisak & Luke, 2009; Kurata, 2010). Not only are these sites familiar to most students, social technology is always available and peoples can always be connected, rather than being limited to exchanges that take place in the classroom, which greatly enhances the language

learning environment (Antenos-Conforti, 2009). Not only that, but students tend to appreciate the opportunity to interact outside of class through a social network (Kurisak & Luke, 2009), and self-directed learning via a social network can complement classroom interaction very well (Mills, 2011). Nevertheless, teachers cannot simply instruct their students to go onto a social networking site and hope that they will simply absorb language. More direction than this is essential, which is where the idea of CMC can assist.

2.5 Implementing CMC and Social Networking for Language Learning

As explained above, the level of engagement that CMC and social networking sites provide to students makes the use of these types of tools quite enticing for second language teachers. Because of this, several researchers have already used CMC and social networking sites in various ways for language learning, and they have laid out specific strengths of these types of programs. For example, one key advantage is that social media can provide a great means of self-expression, which leads to a higher level of output. Social networking sites can be very motivating because students can discuss common interests, popular topics, and share their own experiences, thereby creating highly personalized content (Stockwell & Tanaka-Ellis, 2012; Antenos-Conforti, 2009; Vesisenaho, Valtonen, Kukkonen, Havu-Nuutinen, Hartikainen, & Karkkainen, 2010). Social networking sites force students to “take an active role in their learning” because they are the creators of the content, not merely consumers (McBride, 2009). By sharing their own stories, learners express themselves, build community, and help establish identity (Nicholas, Rossiter, & Abbott, 2011; McBride, 2009).

One of the biggest advantages of social networking is the community it creates where interaction and communication is encouraged. Students form relationships in social networking sites, which then lead to increased meaningful interaction (Evans, 2009; Mills, 2011). This community then becomes a great avenue for informal negotiation of meaning (Antenos-Conforti, 2009).

2.6 Principles for Guiding Implementation

Although it is important to recognize what functions any given type of technology or application can have to aid the learning process, it is equally necessary to understand how the technology should be used for maximum efficacy.

As a powerful tool, technology has the potential to lead to the development of dynamic learning environments, support cross-cultural communication, foster critical thinking, and engage and motivate learners, but in and of itself it does not guarantee successful learning. Like all tools, the utility of technology ultimately depends on how, when, and why it is implemented—on both how it is presented to learners and how they respond to it (Kurisak & Luke, 2009).

Several factors relating to the creation and implementation of a new curriculum can influence its effectiveness:

1. participant buy-in,
2. complete classroom integration,

3. close observation and adaptation, and
4. pedagogically based usage

The idea of participant buy-in is that all participants, including curriculum designers, teachers, students, and administrators, must be fully invested in the curriculum to make it work (Kurisak & Luke, 2009). Dedication to the program is necessary if the program is to be adequately integrated into the classroom. Students need to feel like their work is part of a normal curriculum; otherwise, they may become biased against it (Blake, 2008). We also need to pay attention to how both students and teachers respond to technology and adapt curriculum accordingly (Hamilton, 2009). Because there can be ups and downs in motivation throughout the implementation of something new, we must be sure to observe interactions throughout the entire program (Kurisak & Luke, 2009).

The other important variable in the effectiveness of a new technology-based program is extent to which it is based on sound pedagogical principles. Educators need to focus more on the technology's pedagogical implications for language learning rather than the fact that the technology seems "cool" (Burston, 2003; Chapelle, 2010; Evans, 2009; Hamilton, 2009; Kern, 2006; Stockwell & Tanaka-Ellis, 2012). The technology has to do more than just replace pencil-and-paper homework; it has to provide something valuable that was not there before (Kurisak & Luke, 2009; Markee, 2005). We know that technology can be great, but it can also fail miserably. What is important now is that we differentiate between effective and ineffective uses of technology in the classroom and then act accordingly (Kern, 2006; Quinn, 2005).

3. Procedures

The framework created for carrying out this study's exploration involved the creation of an Alternate Reality Experience for Language Learning (ARELL) which involves a social network that is similar to Facebook. The team augmented the basic social networking functionality with added capabilities made possible by the ELGG Open Source Networking Engine mentioned earlier. Using this system, students are able to create a personal profile page and interact with one another as well as with fictional characters as a story unfolds in real time. The characters of the story appear as normal members of the students' social network (i.e., their "friends"). The characters seemingly share aspects of their lives in various ways and according to a predetermined schedule using status updates, communications among characters and with the students, photo postings of fictional trips, as well as normal blog posts. Students read the characters' status updates and blog posts as well as receive personal messages from the characters. While the system allows for automation of most of the posts, it is possible for a native speaker of English, posing as one of the characters, to write an improvised post to one or more of the students.

The result involves bringing elements of a story into the real world and making it a part of the lives of the students and providing opportunities not only for online activities but also for activities that can take place in the classroom under

the guidance of the teacher. In order to construct a story, developers took a syllabus for an English grammar class and used it as the starting point in the creation of a scope and sequence appropriate for the target students. The developers then wrote a narrative that followed the course syllabus as a means for aiding students and teachers in achieving the goals described in the scope and sequence. Over the course of the various iterations, the story was revised for both content and linguistic appropriateness. Thus, although the pilot iteration revolved around nine characters, the final story as implemented centers on five. These five characters are college-aged students, with four being American and one Japanese. The program begins with one character, who has just arrived in Park City, Utah, on a search to find people who knew her recently deceased grandfather. Her hope is that someone she meets will be able to help her identify a mystery woman who appears in pictures she discovered in her grandfather's attic. The narrative explores the lives of the various characters, which include her and four other people she comes in contact with as they navigate common issues that young adults face, including, for example, academic life, the ups and downs of employment, living with roommates, making decisions, living in a new area, and dealing with misunderstandings.

Using this system, christened "ESL Silver" for this study, four iterations of the experience were conducted at the English Language Center (ELC) at Brigham Young University (BYU). The ELC is a lab school supported by BYU whose aim is to provide students with curriculum in line with research at the forefront of the fields of linguistics and language acquisition. It strives to give teachers the chance to do a language teaching practicum where they may use a variety of methods for instruction. Classes at the ELC fall into six different proficiency levels, Foundations A, B, and C, which are classes teaching English basics, and Academic A, B, and C, which seek to prepare the students for a university environment. When students are admitted to the ELC, they take a placement test to determine their level of English proficiency, and each semester they move up to the next level, assuming they pass their final exams. It should be noted that ESL Silver was originally based upon the syllabus for the Foundations C level.

Although the number of students varied across the four iterations conducted, the types of students were fairly equal across the groups. They were of differing nationalities speaking various native languages, but they were all at roughly the same English proficiency level. There were both males and females mostly ranging from 18 to 30 years old, with a few outliers up to 42 years old.

Before beginning the program, students took a survey designed to discover ways they might use technology in their daily lives, their attitudes toward technology, their attitudes towards homework, and their experiences with language learning. Students then participated in the social networking experience, which lasted between 2 and 4 weeks depending in the iteration. Starting with the second implementation, the server on which the site was hosted tracked student activity, storing information on the time students spent on the site as well as the actions they took. Finally, upon completion of the experience, students took a survey identical to the preproject survey, with the addition of questions relating to their experience with

the social networking site. The researchers also conducted interviews with the instructors in the classroom as a means for determining the teachers' views on the experience and thus gain a broader sense of how the program was implemented and the ways in which students participated. Table 1 presents a summary of the several implementation variables.

Table 1
Differences in Implementation of ESL Silver Across Iterations

	Iteration						
	1		2		3		4
Class							
Level	Foundations B	Foundations C					
Type	Reading	Reading	Reading	Reading	Reading	Reading	Writing
# of sections	1	2	1	1	1	2	1
Teacher	A	B	C	D	B	E	F
# of students	16	28	15	17	17	31	16
Implementation							
Semester	Fall 2010		Winter 2011		Summer 2011	Fall 2011	
Length	1 week		4 weeks		3 weeks	3 weeks	
Concurrent with other material	Yes		No		Yes	Yes	
# of weekly lab visits	3	1	0-3	0-2	3	2	1
Story							
# of characters	9		8		5	5	
Main storyline	Romance		Romance		Mystery	Mystery	
Completed	No		Yes		Yes	Yes	

3.1 Iteration 1

Because the ELC wished to do a pilot study of ESL Silver before deciding to move forward with the full project, ESL Silver was implemented in Fall Semester of 2010 in three classes: one section of Foundations B Reading and two sections of Foundations C. There were 16 students in the Foundations B Reading class and 28 students in the two sections of Foundations C Reading classes. In the Foundations B class, students spent 2 to 3 days a week in the computer lab working on ESL Silver. Initially, students were scheduled to work on ESL Silver once a week in class but because the content was too difficult for the Foundations B students, additional days in the lab were added. Foundation C students, on the other hand, spent 1 day a week working on ESL Silver in class. Both levels spent 30 minutes in class working on assignments and activities.

For this first implementation, the story was not yet fully developed, so the students were only exposed to portions of the story. There were nine characters, and the students were to focus on two main stories: one narrating a romance, and the other a mystery. Because the content was incomplete, the classes ran ESL Silver concurrently with their regular homework, which consisted of reading novels and completing the accompanying assignments. Also, the correction tool had not yet been developed, and so the teachers were unable to use it to edit student posts.

3.2 Iteration 2

Between the first and second implementations of ESL Silver, the story was revised and completed, resulting in 4 weeks of material. One character was eliminated from the story, and the secondary characters were given their own plot lines, which resulted in six overlapping stories among eight characters.

Because the team had determined that the content was too advanced for the Foundations B students, the second implementation of ESL Silver was conducted in two Foundations C reading classes. There were two new teachers for this iteration, so we trained them on how to use the ELGG Web site and the error correction tool. We also provided them with a rationale for the concept of ESL Silver as a teaching tool. The teachers were given copies of all site postings 3 weeks before the program began so that they would have time to prepare lesson plans and familiarize themselves with the plot lines before the program began. We also sent possible homework assignments, in-class activities, and quizzes for the teachers to use throughout the month.

Rather than doing ESL Silver at the same time as other homework, ESL Silver took the place of a novel so that students would have more time to focus on the material. They met in the lab three times early during this iteration and were then required to do the rest of their studying at home. Daily comprehension quizzes were given as informal assessments, but students were only given points based on their reporting of whether or not they did the assigned reading. There was occasional brief discussion of the answers to questions on the quizzes, but, other than that, the teachers did not work on ESL Silver in class. The teachers also did not use the error correction tool, although it was available for this iteration.

3.3 Iteration 3

Based on feedback received from the teachers and students of Iteration 2, the developers made several edits to the material during the time between the second and third implementations. The number of characters was reduced from eight to five, and the entire romance storyline was eliminated. All posts were edited for appropriateness for the students' proficiency level, and the duration of the program was reduced to 3 weeks.

For this implementation, ESL Silver was used in one Foundations C class taught by one of the teachers who had been involved in the program from the first iteration. Because of this previous involvement, the teacher received no special training other than updates on the program and information on the results from the

second iteration. On average, the class visited the computer lab three times a week for 15 minutes to look over the content together, and then they would discuss the story in class about twice a week. However, other activities in class were related to topics and grammar patterns that appeared in the ESL Silver content on a daily basis.

3.4 Iteration 4

Because student reactions to the story in Iteration 3 had been fairly positive, we decided to focus more on implementation of the material rather than the material itself in Iteration 4. Thus, all content was kept the same as in the third iteration and teacher training became a focus, with both teachers for this iteration receiving one-on-one instruction on the purpose and possibilities of ESL Silver.

ESL Silver was used again with two groups of Foundations C students at the ELC, but this time, students in one of those groups used ESL Silver in both their reading and writing classes. The other class only discussed the material in their reading class. One teacher taught both reading classes, and the other taught one writing class. In the reading classes, students spent 15 minutes twice a week in the lab and other time in class discussing the material. The students in the writing class went to the lab once a week for 10 minutes and were assigned to write their own blog posts outside of class relating to topics discussed in class. Both classes used the same ELGG site rather than using separate sites as had been done in previous iterations.

3.5 Survey Instrument

The main purpose of the postproject survey was to ascertain student attitudes toward ESL Silver. Students were asked a number of questions relating to several aspects of ESL Silver. The questions were presented as statements with Likert-type responses where students would indicate how much they agreed or disagreed with each statement. The main topics of the questions referred to

1. the program as a whole,
2. their teacher's participation in the program,
3. the story and characters, and
4. the English learned as a result of the program.

In order to compare Iteration 1 with the other iterations, the 6-point scale was condensed to 4-point scale. For the recoding, *slightly disagree* was merged with *disagree* and *slightly agree* was merged with *agree*. The goal was to preserve the underlying nominal nature of the Likert items while yielding a conversion that would be as accurate as possible. Table 2 contains the values of the 4- and 6-point scales and their equivalences.

Table 2:
Equivalences between 4-Point and 6-Point Scales

4-Point Scale	6-Point Scale
1 – Strongly Disagree	1 – Strongly Disagree
2 – Disagree	2 – Disagree
2 – Disagree	3 – Slightly Disagree
3 – Agree	4 – Slightly Agree
3 – Agree	5 – Agree
4 – Strongly Agree	6 – Strongly Agree

As mentioned above, the questions all centered around four main topics. In order to compare student reactions to ESL Silver, we chose to combine questions that would indicate attitudes for each topic. To ensure a valid measurement of each attitude, we used only questions on each scale that were highly correlated with the other items on each scale, which resulted in the exclusion of some items. Table 3 lists the main comparison topics and the questions that make up each scale for the 4-point Likert items.

Table 3
Scale Items Based on the 4-Point Items

Scale	Cronbach's Alpha	Items included in scale
Overall Attitudes toward ESL Silver	0.945	Q2. I liked the story on ESL-Silver .
		Q3. The English I learned on ESL-Silver is relevant to my life.
		Q4. I think ESL-Silver is fun.
		Q5. ESL-Silver helped me learn English.
		Q8. I liked the characters in ESL-Silver.
		Q9. I want to know more about the characters in ESL-Silver.
Attitudes toward teacher involvement	0.823	Q10. The characters in ESL-Silver were believable.
		Q12. My teacher prepared me to use ESL-Silver.
		Q14. My teacher helped me when I had questions.
Attitudes toward story	0.915	Q2. I liked the story on ESL-Silver.
		Q8. I liked the characters in ESL-Silver
		Q9. I want to know more about the characters in ESL-Silver.
		Q10. The characters in ESL-Silver were believable.

Attitudes toward English learned	0.841	Q3. The English I learned on ESL-Silver is relevant to my life.
		Q5. ESL-Silver helped me learn English.
		Q6. I still remember words and phrases I learned on ESL-Silver.

The revision to the survey also included the addition of a question asking students whether or not they preferred ESL Silver to their regular homework. The difference in scale and questions required separate scales to be created to more accurately compare Iterations 2-4, which used the updated survey instrument.

After the pilot of ESL Silver, the researchers revised the survey to better understand the attitudes of the students themselves. The main goal of the revision was to determine whether differences in the students might affect the ways in which they react to the program. As part of this revision, the developers decided to switch from 4-point Likert scale items to 6-point items in an effort to increase the variance found in student attitudes toward ESL Silver. Table 4 lists the items in each scale in along with the values of Cronbach's Alpha estimate of reliability for each scale.

Table 4
Scale Items Based on the 6-Point Items

Scale	Cronbach's Alpha	Items included in scale
Overall Attitudes toward ESL Silver	0.962	Q2. I liked the story on ESL-Silver.
		Q3. The English I learned on ESL-Silver is relevant to my life.
		Q4. I think ESL-Silver is fun.
		Q5. ESL-Silver helped me learn English.
		Q8. I liked the characters in ESL-Silver.
		Q9. I want to know more about the characters in ESL-Silver.
		Q10. The characters in ESL-Silver were believable.
Attitudes toward teacher involvement	0.837	Q11. I prefer ESL Silver to my regular English homework.
		Q12. My teacher prepared me to use ESL-Silver.
		Q14. My teacher helped me when I had questions.
Attitudes toward story	0.933	Q2. I liked the story on ESL-Silver.
		Q8. I liked the characters in ESL-Silver.
		Q9. I want to know more about the characters in ESL-Silver.
		Q10. The characters in ESL-Silver were believable.

Attitudes toward English learned	0.895	Q3. The English I learned on ESL-Silver is relevant to my life.
		Q5. ESL-Silver helped me learn English.
		Q6. I still remember words and phrases I learned on ESL-Silver.

4. Results

4.1 Quantitative Analysis

Because this study implemented methods of design-based research, we measured student attitudes toward ESL Silver over time and compared iterations using the scales mentioned above. We compared the means of each scale across iterations using ANOVA and then performed a Tukey post-hoc analysis to assess the significance of any differences between the various groups.

Comparing Iteration 1 to the rest using these measures, the only significant difference is with the second iteration. As shown in Table 5, although the attitudes toward teacher involvement in the program of the students who participated in Iteration 2 were not significantly different from the rest of the iterations, their overall attitudes toward ESL Silver were lower than the others. Using Tukey's post-hoc test of significance, Iteration 2 proved to be significantly different from Iteration 1, Iteration 3, and Iteration 4 ($p < .01$) on overall attitudes toward ESL Silver, attitudes toward the story, and attitudes toward the English learned throughout the program.

Table 5
ESL Silver Attitudes Across Iterations on a 4-Point Scale

	Iteration				
	1 <i>n</i> = 21	2 <i>n</i> = 19	3 <i>n</i> = 15	4 <i>n</i> = 28	1, 3, & 4 <i>n</i> = 64
Overall Attitudes Toward ESL Silver	3.0136	2.0526*	2.7810	2.8214	2.8750
Attitudes Toward Teacher Involvement	3.3095	3.1579	3.4333	3.5000	3.4219
Attitudes Toward Story	3.0000	2.0395*	2.7667	2.8214	2.8672
Attitudes Toward English Learned	2.9683	2.1930*	2.7333	2.7500	2.8177

* $p < .01$

In comparing Iteration 2, 3, and 4, the 6-point scale was used in order to provide a more accurate measurement of the student attitudes. There was also an additional question added to the postproject survey asking whether or not the students preferred ESL Silver to their regular homework. Table 6 contains the mean responses.

Table 6
ESL Silver Attitudes across Iterations on a 6-Point Scale

	Iteration		
	2 <i>n</i> = 19	3 <i>n</i> = 15	4 <i>n</i> = 28
Overall Attitudes Toward ESL Silver	2.6711*	4.0250	4.1071
Attitudes Toward Teacher Involvement	4.9474	5.4000	5.3393
Attitudes Toward Story	2.7368*	4.0167	4.1339
Attitudes Toward English Learned	2.8947*	3.9111	3.9524
Preference of ESL Silver Over Regular Homework	2.2600*	3.6000	4.0400

* $p < .01$

The results shown on the 6-point scale are similar to those from the 4-point scale in that Iteration 2 was the only one with any significant difference. On average, students from the second iteration preferred their regular homework to ESL Silver and they did not react positively toward the program. The other two iterations, however, had more students who preferred ESL Silver, citing that they enjoyed the story and they believed it helped them learn English. Also like the 4-point table, a post-hoc analysis using Tukey's post-hoc test of significance indicates that the differences on Iteration 2 were significant ($p < .01$). There was no significant difference in attitudes toward teacher involvement in the program.

4.2 Qualitative Analysis

Before beginning ESL Silver, each teacher received a document with the full program's content, a list of which posts were relevant to storylines and which were not, assignments and quizzes that they could use in conjunction with the program, and instructions on how to interact with the ELGG website. Although teachers were given the same material and instructed in roughly the same way, because of teacher differences, the implementation of the program varied quite a bit from semester to semester. Also, each successive teacher was able to learn from the experiences of previous teachers, which influenced the way that ESL Silver was presented. The following is a narration of differences in implementation between iterations. This information was gathered from the teacher interview protocols after ESL Silver had been completed.

4.2.1 Iteration 1

Because Iteration 1 was the pilot, no teacher interview protocol had yet been devised, and so we do not have specific information about how the program was presented.

4.2.2 Iteration 2

According to Teacher C from Iteration 2, there was a prevailing attitude of disdain toward the ESL Silver portion of her class. She expressed that a few students in particular would speak out against the program when it was time to take quizzes in class and that students who generally did all of their readings were not keeping up with the ESL Silver material. She also made a guess that the students may have been talking poorly about the program outside of class.

When questioned about how they ran ESL Silver in their classes, it was discovered that neither Teacher C nor Teacher D used the resources given to them, and there was very little discussion of ESL Silver in the classroom. After the first few days of getting used to the software, students were told to simply read everything and that they would be quizzed on it. There were no specific assignments, nor did the teachers mention ESL Silver in class other than to give them occasional comprehension quizzes. According to Teacher C, when the students asked why they were doing the program, she responded that it was an experiment to see if something like this could work, and they “just had to.”

In order to understand the teachers better and why they implemented ESL Silver the way they had, they were asked about their own “digital nativeness.” Both teachers of this semester fully admitted to not being as familiar with technology as others—that they used it when necessary but were not the type to use it in every aspect of their lives. Teacher C also discussed being skeptical of a program like this at first, and, although her opinions had changed by the end, her actions in regards to ESL Silver had already taken effect.

4.2.3 Iteration 3

This semester was the closest that ESL Silver came to running as originally intended with regular assignments and quizzes. The teacher who taught during this iteration had used ESL Silver during the pilot study the previous Fall Semester and was thus very familiar with the program. Students routinely were allotted in-class time to spend in the lab, and there was consistent discussion of the story as well as use of blog posts to teach specific language skills (e.g., reading strategies and grammar principles). The teacher saw a great deal of value in this type of program as a means of presenting authentic language samples in an informal setting. She stated that several students seemed to enjoy it, though there were a few who did not grasp the point of it. Unfortunately, the ESL Silver server crashed twice during the semester, causing the site to be inaccessible for a few hours on each of those occasions.

4.2.4 Iteration 4

During this semester, schedules and teachers worked out such that there were two different reading classes using ESL Silver, and one of those classes used the website for their writing class as well. In previous iterations when there was more than one class, each class would use their own version of the website. In this iteration,

however, students indicated that they would all like to be on the same site, and the teachers obliged. The students who worked on the program in their writing class received regular assignments to write their own blog posts. Because the teachers had other material to cover in their classes, they offered up ESL Silver more as a fluency activity that was to be enjoyed and not be stressful. There were assignments and in-class lab time for the program, but the implementation was not as structured as previous iterations. The teachers used the site as fun practice, and Teacher E made sure to post regularly, which resulted in an increase of posts responding to her. Teacher E also mentioned that because there were so many posts from other students, they did not follow the story very closely but used student posts as reading practice.

According to both of the teachers, students enjoyed writing back and forth to each other, which resulted in a number of posts above that which they were required to make. Although Teacher E reported mixed reviews in her class from the students about ESL Silver, Teacher F mentioned that students were asking to work on ESL Silver in class if there was time and in her words, "They loved it! It was fun." Other student responses from the survey indicated that the only things they would change about the experience were related to the aesthetic design or features of the website rather than about the nature of the experience itself.

5. Discussion

The purpose of this study was to investigate the use of a social medium platform (ELGG), implemented with CMC principles. The resulting software features combined to form the delivery mechanism for a sort of simulation that was christened ESL Silver and involved the unfolding of a basic storyline with several threads. As shown in the previous section, the results across four iterations were generally quite positive, with the second being something of an outlier. Because the results of that iteration were generally not on the same level as the others and failures often provide more learning than successes, it is there that we begin this discussion.

5.1 Iterations 1 and 2

At the beginning of each iteration, the researchers trained the teachers on the system and provided them with a document containing the full program's content and a list of the posts that would appear as the simulation unfolded. Each post was clearly marked as to which ones were relevant to the various threads of the storyline and which were not. This document also contained assignments and quizzes that the teachers could use in conjunction with the simulation.

Although teachers were given the same material and instructed in roughly the same way, the implementation of the second iteration differed significantly from the others. Indeed, in reviewing the responses to open-ended questions, a few students responded that they disliked or even hated ESL Silver. This strong reaction was the impetus for creating a teacher interview protocol that could explain the

students' reactions. Discussion with the teachers revealed three types of issues, each crucial to the success of such a program of instruction:

1. the story itself,
2. lack of classroom integration, and
3. a less than ideal presentation of the program as a whole.

The story had only been partially developed for the pilot (Iteration 1), but by Iteration 2 it was complete and fairly long with eight different, overlapping threads. The reaction of the students was to state that they had been confused as to who was who and what was going on. Some also commented that the story was boring, which could have contributed to a lack of engagement on their part. The interviews with the teachers also revealed that the students did not relate well to the story and that they believed it to be too "gossipy." This comment was primarily related to the romance-based thread involving two of the characters, which was largely told through private messages to the students individually.

Through what was probably no fault of their own, it seems clear that some of the students were not sufficiently engaged in the simulation aspect of the experience and thus were not in the place to be receiving messages of a personal nature from someone they felt they did not know. While it might not be uncommon for friends to discuss romantic interests with each other, when such information comes from someone who is not a close friend, the communication may seem like gossip. This reaction could also be very much related to cultural differences. All aspects of the story related to the regular lives of college-aged Americans and the issues they dealt with were common ones taken from the lives of and written by college-aged Americans. Thus, it is quite possible that these elements of the story were too far outside the realm of experience of the foreign students, so they had trouble relating to and becoming engaged in what happened in the simulation.

Another issue with this iteration was related to classroom integration. The teachers did not use the resources that had been provided, and there was very little discussion of ESL Silver in the classroom. After the first few days of getting used to the software, students were simply told to read everything and that they would be quizzed on the reading. There were no specific assignments, nor did the teachers mention ESL Silver in class other than to administer occasional comprehension quizzes. When the students asked why they were doing the program, the teachers responded that it was an experiment to see if something like this could work, and they "just had to." With this comment the teachers were in effect telling the students that it might not work and thus perhaps even a waste of time. Attendance at the ELC requires a significant financial engagement, and students have the right to experience instructional techniques that have been shown to be effective. For the teachers to simply state that participation is required without providing any rationale as to why the experience is beneficial is a tacit admission that the experience has no specific purpose. This was especially unfortunate, given that ESL Silver was created specifically to correspond to the ELC curriculum and its stated objectives to help students achieve their goals in learning English.

The teachers' efforts to implement the system may be related to an aspect of this

research not specifically explored in this chapter, which is the concept of “digital nativeness.” With respect to the instructors, it is interesting to note that each of the two teachers who were part of this second iteration stated quite clearly in interviews that they were not as familiar with technology as they felt others were. They basically said that they used technology when necessary but that they were not the type to use it in every aspect of their lives. Teacher C also admitted that she had been skeptical at first of the value of the experience in which the students were to engage, but she also stated that her opinions had changed by the end of the experience. Unfortunately, it appears that by the time she understood the value of ESL Silver, the teachers’ actions and attitudes seem to have had already had a negative effect on the outcome.

5.2 Iteration 3

The next two iterations turned out much differently, reflecting what had happened during the first iteration. Positive reactions notwithstanding, the ESL Silver crashed twice during the third semester, causing the site to be inaccessible, which may have influenced some of the students’ perceptions of the program as a whole. During Iteration 3, Teacher B, who had helped conduct ESL Silver during the pilot study, returned to participate. Her familiarity with the program no doubt contributed to its success with her attention to such simple elements as giving regular assignments and administering quizzes. Students routinely accessed the system in the lab during class time, and there was frequent discussion of the story as well as use of blog posts to learn and practice specific language skills (e.g., reading strategies and grammar principles). During the interview after this iteration, the teacher expressed her belief in the significant value in this type of experience. This may have prompted her to promote its use to her students in a way that was most likely more motivating for her students than for those who had participated in Iteration 2.

This positive experience underscores the obvious conclusion that teachers who are well trained and experienced with the implementation of any particular instructional technique will be more effective in putting it into practice. Although all of the other teachers had received training and guidance, there is no substitute for experience. Nevertheless, it is worth pointing out this same teacher began the first iteration with basically the same preparation as the others. One main difference, however, was that she had reviewed the design of the system for the ELC training directors as part of their decision to participate in the study. In that role she also provided guidance for the alignment of scope and sequence for ESL Silver with the curriculum at the targeted level.

5.3 Iteration 4

The fourth iteration of ESL Silver was the most successful with respect to student attitudes toward the program as measured by their responses on the postproject survey as well as their observed use of the website. The biggest difference between this and previous iterations was the way in which the system was presented,

addressing an important lesson learned from the second iteration. An important element in the teachers' preparation for this iteration essentially amounted to encouragement to the teachers to keep the program fun. The end result was that both teachers found a way to fit ESL Silver into their classes in a way that they felt would benefit the students. They kept the program structured, as it was designed to be and as was reaffirmed by the results received from Iteration 3, but they did not push it so hard that it became drudgery for the students.

To implement these principles and in response to the fact that the teachers had other material to cover in their classes, they introduced ESL Silver more as a fluency activity that was to be enjoyed and not one to increase their stress level. The teachers assigned work for out-of-class activities and also provided some in-class time in the lab, although the overall experience was not as structured as previous iterations. All things considered, it appears that the primary purpose of the teachers' assignments for this iteration was meant to encourage the students to engage in enjoyable practice using the target language. One of the teachers even posted regularly to the site, which resulted in an increase of posts in response to her comments.

When asked what they would improve in ESL Silver, students mainly provided feedback on system mechanics (complicated URL and the need for more attractive design). It seems like a positive development that these suggestions dealt more with superficial aspects of the program rather than the content or implementation. Indeed, in the writing class students on more than one occasion asked the teacher if it was time for ESL Silver yet, demonstrating a fairly high level of anticipation for the program.

The fact that two different classes used the same website meant that the story unfolded at the same time for both classes. Interestingly, it would appear that this approach created a sense of community that had a significant positive impact on the students' attitudes towards ESL Silver. We are inclined to conclude that the combined classes added to that sense of community, as did the personalization through the creation of blog posts by at least one of the teachers. Because the students did not follow the ESL Silver story as much during this semester as for the other iterations, it is possible that creating their own stories was more valuable to them.

5.4 Lessons Learned and Recommendations for Future Research

Some of the lessons learned in this project were unanticipated, yet nonetheless important. Concerning the technology itself, system crashes during Iteration 3 demonstrate that it is impossible to plan for everything that might happen when using technology, but the importance of reliable software and hardware cannot be overstated. Basically, this means that not only should systems be thoroughly tested before actual implementation, but also that adequate support for the technology must be present in the event that something does go wrong so that it can be fixed without delay.

No doubt the most important lesson learned in this study is the confirmation of

the well known fact that any instructional technique is only as good as its implementation. The teacher's commitment and preparation are the crucial keys to any instructional innovation.

Another very important consideration has to do with the basic design of the system to avoid the overload that was an issue that prompted the need to simplify the story. Essentially, three options present themselves:

1. drop the story all together and focus on building the community,
2. stress the story a bit less and devise ways to increase the sense of community as was experienced by students involved in Iteration 4, and
3. improve the quality of the story and increase the engagement required by the simulation and the roles that students play therein.

The interviews with the teachers from Iteration 4 produced options 1 and 2, the first being suggested by the writing teacher. Because she did not deal with the story side of ESL Silver at all in her class, she proposed using the site through which the program was presented simply as a class blog.

There would be no storyline to follow, but rather the students would become the sole creators of the content. The teachers during Iteration 4 took it on themselves to implement this strategy, and the students who worked on the program in their writing class received regular assignments to write their own blog posts. They thereby became the creators of the story, not simply observers or participants. According to the teachers, students enjoyed writing back and forth to each other, which resulted in a number of posts beyond those that were required by the teachers. All of these factors contributed to a classroom community that brought students together in and out of the classroom where they could interact while simultaneously practicing language skills. That approach notwithstanding, one of the teachers did indicate that she would still have liked to use the ELGG site rather than Facebook because she liked the amount of control it afforded to her as the teacher.

Another possibility for a future iteration of ESL Silver was proposed by the reading teacher of Iteration 4. She stated that it would be nice to have a few days' worth of ESL Silver content on ELGG that would serve as a model for the students to follow. They could read the material as they became familiar with the format of the website, and once they were comfortable in the digital setting, the students would take over the content creation for the site. Both of these options would continue to take advantage of the communicative capabilities of the site, although they would take away a large portion of what makes ESL Silver what it is.

The third possibility would be to improve the story recounted through the experience. The simulation was initially designed to contain two primary storylines involving three of the characters. In addition, students learned about aspects of the lives of six other characters. This proved a bit overwhelming to the students in two ways. First was the sheer number of details relating to a total of nine people. Second was the fact that many of these details were related to the lives of American students, elements of a culture to which international students had significant

trouble relating. Although the simulation was later simplified in Iterations 3 and 4 to focus on the primary storyline, it appears that the number of details was still too overwhelming for students not familiar with American culture. Future projects of this sort should address this important area. The teacher in the pilot indicated in her report, “Overall I highly recommend ESL Silver. It is a tool that can help students learn authentic language, while meeting the objectives of the reading curriculum. It can also meet the objectives of the Oral Communications and Oral Accuracy Class.”

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Chapter 8

Cycles of Teacher Reflection: Using Course-Cast Software to Enhance Fully Online Language Teacher Education

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Abstract

This chapter focuses on a case study of a fully online graduate Computer-Assisted Language Learning (CALL) course in a language teacher education program. The case was part of a 2-year funded study involving eight instructors from one university but based in different faculties, subject-areas, and instructional levels (predegree to graduate). As the research focus was on technology as a process rather than as a goal, a design-based research (DBR) approach was pivotal for capturing the messiness of complex teaching environments. It afforded multiple opportunities to shape pedagogical practice through iterations of planning, reflection, and change. The findings from the CALL case are centered on issues of pedagogy and reinforce the importance of curriculum design and development—particularly when students are studying in a fully online environment, using a variety of new software tools, and shaping their use to their own classroom teaching.

1. Introduction

The ubiquitous adoption of eLearning software and tools has raised concerns about how to help practitioners design more supportive learning environments. In New Zealand, as in other developed nations, the tertiary sector is experiencing challenges to teaching and learning practice due to the increased diversity of the student body (Johnson, 2008), changes to the ways in which universities are funded (Russell, 2007), issues relating to student retention and completion (Ministry of Education, 2012), and student satisfaction with learning opportunities (Australian Council for Educational Research, 2010).

This chapter describes a two-year government-funded research project (*Exploring eLearning Practices across the Disciplines in a University Environment*) that was undertaken at the University of Waikato, Hamilton, New Zealand. The research had the primary goal of documenting, developing, and disseminating effective and innovative practice in which information and communications technology (ICT) played an important role in leveraging pedagogical change, closing

participatory gaps for students and instructors, and developing and enhancing a cross-university educational research culture to inform teaching practices (Johnson, Cowie, & Khoo, 2011).

The overall research design was novel in New Zealand in that it involved case studies of eight different instructors teaching within one university across different faculties, subject-areas, instructional levels (predegree to graduate), and class sizes. Funded projects usually involve researchers from a single discipline, but located within or across different universities. Thus, while the physical learning place remained the one institution in this project, the learning spaces, both physical and virtual within which students and instructors functioned, were varied and reflected differing pedagogical and technological needs across disciplines and cohorts. Our research focus was on technology as a *process*, rather than as a goal in itself. A design-based research (DBR) approach to studying technology implementation in situ afforded us multiple opportunities to understand and shape pedagogical practices (Amiel & Reeves, 2008).

During the first year of the research project, there were four case studies. In the second year, four additional cases joined, with the first-year participants serving as role models and mentors to the second-year case study participants. In addition, the first-year participants were able to reshape their courses, based on shared reflections and refinements of their pedagogy, for the second-year iterations of their courses.

This chapter focuses on one of the second-year case studies—a fully online (no face-to-face meetings) graduate Computer-Assisted Language Learning (CALL) course in a second language teacher education program. The course, *Issues in Computer-Assisted Language Learning (CALL)*, is an optional 12-week course that presents a conceptual overview of computing, but also provides multiple opportunities for students to experience and experiment with different language teaching software environments. The overall objective of the course is to provide students with a range of reflective online learning tasks so that they can develop critical insight into a Web 2.0 eLearning approach (Anderson, 2007) to language teaching. There is no assumption that students already possess computing expertise (Kolikant, 2010) although, as the course was fully online, it was assumed that students had access to a computer and the Internet.

2. Conceptual Framework

We believed that a DBR approach, with its iterative cycles of data collection, synthesis, and research reporting (Collins, Joseph, & Bielaczyc, 2004) could function well within our diverse research environment. DBR, with its emphasis on practice, allows researchers to examine what has occurred within actual functioning classrooms. It explicitly considers and values the “influence of contexts, the emergent and complex nature of outcomes, and the incompleteness of knowledge about which factors are relevant for prediction” (The Design-Based Research Collective, 2003, p. 5). Further, within technology-enhanced learning environments, DBR provides a flexible methodology through its iterative processes of design, data collection, analysis, and refinement of implementations within col-

laborative, team-based teaching and research environments (Wang & Hannafin, 2005). It is important to note that deeper understanding of pedagogy, technology, and their interactions should lead to more robust instructional practice and deeper theoretical insights, aspects which are fundamental to a DBR approach (Reeves, McKenney, & Herrington, 2011). As such, DBR was appealing and appropriate for this research project, including as it did multiple case studies, different classroom-based implementations of technology, varying class sizes, content areas, and instructional levels.

It is noteworthy that none of the case studies was an intervention, that is, no external ideas were introduced into courses in order to see what might happen. Instead, each case represented the types of ICT and pedagogical changes the individual lecturers wanted to implement in their courses. Evaluative (quantitative and qualitative) data were systematically collected within each case study, yet group reflections and interpretations within and across the findings were shared and discussed before, during, and after case study course iterations (Sharma & McShane, 2008). As such we would characterize our DBR research approach as involving instructor-driven refinements of pedagogy in order to interpret, inform, and improve practice and contribute to better understanding of student learning processes within technology-enhanced teaching (Amiel & Reeves, 2008; Garrison & Akyol, 2009; Reeves, Herrington, & Oliver, 2005).

3. Methodology and Data Collection

An interpretivist methodology framed the research data collection and analysis process (Maykut & Morehouse, 1994). Reeves, McKenney, and Herrington (2011), in their discussion of educational design research, state that interpretivist research is characterized by descriptions and interpretations of key phenomena related to teaching and learning processes and focuses “on the bigger picture of lessons learned and not just the immediately developed results” (p. 61). Interpretive methodology, as is afforded by DBR, is therefore consistent with the intention of uncovering the significance of events as experienced by research participants (Bell, 2004; Joseph, 2004) so that worthwhile improvements to learning can occur. This epistemology is further congruent with a sociocultural framework that values the social and cultural contexts for how knowledge is co-constructed through interaction between individuals and tools through joint activity (Wertsch, 1998).

In the CALL teacher-education course, qualitative (descriptive text-based) data were collected through student interviews, teacher interviews, the instructor’s reflective journal, and notes from the regular teacher-researcher team project meetings. In addition, through the university’s course appraisal system, students answered specific questions related to the effectiveness of having ideas and the clarification of assignment instructions available in Panopto (audio-visual course capture software). The iterative cycles of data collected from these various sources highlighted the processes of refining, reconceptualizing, and transforming the instructor’s teaching practice as she became more comfortable and confident teaching in an eLearning environment enriched by Panopto.

A constant comparison approach to analyzing the qualitative data was followed in which the text-based data were read and reread (Lincoln & Guba, 1985). Through a process of inductive reasoning, emergent themes were identified (Braun & Clarke, 2006) and then reported, discussed, and debated by the entire research team at the regular project meetings. However, a limitation of this case study is that the participants represent a convenience sample of an instructor and students in one university context and are not representative of possible participants across different university settings. Also the enrollment in this course was small (7 students), but findings were integrated into cross-case comparisons in the main study in which approximately 800 students participated (Johnson, Cowie, De Lange, Falloon, Hight, & Khoo, 2011). Thus the case results could be related to studies conducted elsewhere although replication of the research with a larger student sample could enrich our knowledge of CALL teacher-education. Finally, the study received formal university-level human research ethics approval and all respondents participated on a strictly voluntary basis.

4. The Research Context

4.1 The Instructional Program and the CALL Course

The overall design of the course was characterized by frequent small assignments in which students interacted with the types of CALL software they might themselves use for teaching. Students also used Google apps (Docs and Sites) and the university's learning management system (Moodle) to collaborate, share information about interesting language teaching applications, and reflect on how eLearning could be adapted to their own instructional contexts. Then, for their final course assignment, students applied the knowledge they had gained to the design, implementation, and evaluation of a CALL environment within Moodle. This pedagogical approach is consistent with that described by Wozniak, Pizzica, and Mahoney (2012) in which they stress the importance of creating learning environments in which students are provided with "opportunities to experiment with the technology and to make mistakes in a supported environment" (p. 897).

From previous course appraisal feedback, it was clear that students enjoyed the range and scope of assessed activities and had critically engaged with course content and peer feedback. However, they had also experienced initial difficulty learning how to use the different Google apps and Moodle and how to understand assignment requirements presented as they were in text-based form. The instructor believed that by using Panopto to include step-by-step audio-visual guides, the fully online learning environment could be personalized. The Panopto software had recently been made available to our university community and provided integrated access to audio, video, and textual support.

The aim of the case study then was to gain deeper insights into whether or not Panopto actually *was* effective, to reflect on how its use could inform CALL language teacher pedagogy, and to refine our understanding and practice based on what had been learned during the research.

4.2 The Instructor

The instructor had over 15 years of classroom teaching experience both in New Zealand and overseas. Her content area focus during that time had been either English as a Second (or Subsequent) Language or academic literacy preparation for undergraduate international students. All of her teaching had been done in face-to-face or blended mode (Brine & Franken, 2006). Experienced as she was with blended learning, however, the instructor was a novice in the use of audio-visual tools in general and Panopto in particular.

In addition, the instructor was not originally a CALL specialist but had volunteered to assume responsibility for the department's online CALL course a few years earlier when the opportunity to do so had presented itself. Suffice it to say, it had been a somewhat steep learning curve for her to master the course content and personalize the existing structure of the online course. In that regard, the instructor redesigned how content was organized and presented, and she also changed the course pedagogy to include a larger variety of group-focused, small- and medium-sized assignments in which students shared knowledge about CALL resources within their own and each other's particular instructional contexts.

4.3 The Students

The students in the course were all studying toward a postgraduate diploma in second language teaching (PGDipSLT), which is a 1-year degree program at the university. This meant that all students had already completed an undergraduate first degree in some discipline, although not necessarily in Education or in Applied Linguistics. Many of the students were already working full-time as language teachers but wanted to acquire a formal, specialized language teacher qualification. In this implementation of the CALL course, some students were based on-campus in New Zealand, while others were studying at a distance (two were in Asia).

It seemed, however, that students in the degree program generally preferred a face-to-face instructional environment to an online one. From anecdotal and formal course appraisal feedback over several years, students reported that they had selected the CALL course, not necessarily because of an inherent interest in the content, but because the fully online mode suited their need to study at a distance. Also, it was sometimes the only optional course offered that they had not already taken. As a result, the CALL course class size was usually small (fewer than 10 students), and we would characterize the CALL cohort as being conservative and/or reluctant in their attitude toward ICT and its use.

4.4 The Software

In this case study, it was envisioned that Panopto could personalize the course learning environment and reduce students' misapprehension about studying online. Panopto has a variety of software features that can aid instruction. While primarily a lecture capture tool, it also provides a useful supplement to text-based documentation through its screen capture capability. Within our university con-

text, Panopto has been made generally available so that teachers can record course content in their offices as well as in lecture rooms. In addition, Panopto has been integrated into Moodle, which makes it easy for lecturers to create recordings that are automatically available to their students within their Moodle courses.

Using Panopto, the instructor provided an initial audio-visual self-introduction and explained the course goals and objectives. On a weekly basis, she recorded herself talking through the requirements for the individual (small) assignments and for the larger writing assessments. The small tasks included, for example, reading and discussion of academic articles related to CALL, exploration of on-line language teaching software tools and approaches, and regular sharing and written discussion amongst students over what they had discovered. The larger tasks included website evaluations and then the final design, development, and evaluation of a teaching episode within Moodle.

For the smaller assignments that included use of new hardware or software, the instructor's Panopto videos guided students in a step-by-step manner. She also included screenshots so that students who did not want to watch the videos could still work through the necessary background information needed to complete the task.

5. Findings Emerging From the Data

The findings illustrate the socioculturally relevant and key role that DBR played in generating a robust understanding of the *messiness* of real-life teaching and learning processes and contexts (Hoadley, 2004), particularly within the CALL teacher-education instructional environment. Themes emerging from the data will be discussed and will illustrate how the first cycle of implementation findings influenced the second cycle as well as the instructor's final evaluation of the course and plans for subsequent course design. Students' evaluations are also included as well as learning points that emerged for the next cycle of implementation.

5.1 The First Cycle of Implementation

Findings from the initial setup cycle focused on the instructor's interaction with the university's eLearning technical team, the Waikato Centre for eLearning (WCeL), as she learned how to install and use Panopto and her affective responses to these tasks.

Over a 2-month period prior to the beginning of the teaching term, the instructor exchanged six detailed email messages with different members of the WCeL team and all of her questions related to the installation and use of Panopto. In one of the exchanges in particular (15 February 2010, p. 1-3), the instructor posed 18 procedural questions about the software, all of which received lengthy and detailed written responses from the WCeL learning advisors. She also indicated in that email that for some of the questions she had already received verbal responses from WCeL, and thus we know that assistance had been offered in both oral and written forms.

In addition, the instructor's reflective notes (25 February 2010, p. 1-2) indicate that she learned how to use the software through a careful process of trial and er-

ror. For example, she had a mental picture of how the software *should* function, which was at odds with how it *did* function. She wrote that she was “initially confused about actual recording. In my mind I thought I saw myself, but in actual fact you don’t.” She stated that she felt very embarrassed at her initial Panopto attempts but upon checking with one of the WCeL team found that she was “doing everything right,” which added to her growing sense of confidence about using the software.

In summary, the first cycle focused on the instructor’s learning and was characterized by extensive face-to-face and written support from the WCeL team around the setup and use of Panopto; it was also marked by the instructor’s growing sense of confidence with tool use. The project team meeting notes from this time indicate that all case study participants received and discussed the descriptions of each other’s case studies. All participants, including the CALL teacher, shared insights into what was working well within their case and received overall feedback and suggestions from the other team members.

5.2 The Second and Subsequent Cycles of Implementation

As stated earlier, the instructor wanted to use Panopto to personalize her online teaching environment. In particular, and based on previous student course feedback, she wanted to provide audio-visual supplements for her text-based assignment descriptions.

As the course progressed, the instructor found that her approach to recording changed from scripted, to prompted, and then to what she deemed “free range” (Campbell, 2011). For the first three recordings, she relied entirely on a prepared (scripted) text which she read verbatim in front of the camera. The university’s eLearning staff had recommended that for technical and pedagogical reasons a suitable recording time limit should be 10 minutes (maximum), and the instructor strictly observed that limit (initially). After the third recording, the instructor felt more comfortable using Panopto and decided that full scripting was not necessary. Instead she relied on thematic prompts for guidance as she prepared the assignment guides. Toward the end of the 12-week course the instructor recorded “free range”—talking about assessments without the use of any prepared texts.

5.3 What Occurred: The Instructor’s Growing Confidence and Comfort Using Panopto

The instructor reported that the mechanics of using Panopto were straightforward and simple and that the tool afforded easy creation of audio-visual resources (Campbell, 2011). However, it is worth noting again that she had received considerable face-to-face and written support from the WCeL team.

It was a dream really. The Panopto “Getting Started” guide was clear and straightforward to follow; the personal help that I got, especially hands-on help from [person] at my desk, was invaluable to run through any initial glitches. ... Once I understood the tool and how to make recordings, how to save them, share them and embed them within my Moodle site, there were

really no problems at all. It was simply a matter of sitting at my desk, being ready, pressing “record” and getting going. (Campbell, 2011)

More interesting was the transformation of teacher behavior around the recording approach. In fact, Panopto’s ease of use eventually became a constraint, at least as regards the instructor’s intention of providing clear assignment instructions to personalize online learning.

The difficulties were all centered around personal issues. The main being embarrassed—if you are not used to being filmed/videoed, then you have no idea what you actually look or sound like, and for the first time that you do it, you are acutely aware of how you think you are looking. . . . You also have to be aware of all the body language traits that you have—the normal ones that you have in ordinary life—the gestures, the eye contact, the facial expressions—but you also see, as large as life, the more negative annoying ones, playing with your hair, scratching your ear, clenching your hands in a nervous manner! (Campbell, 2011)

In fact, videos of the instructor’s initial instructions (entirely scripted) showed her presentation as “wooden” but she kept strictly to 10 minutes. As the instructor became more comfortable using Panopto and became less reliant on a script, she appeared more visibly relaxed and conversational, but an unanticipated outcome of technology implementation (Ragsdale, 1997) was that the recordings became longer and longer. By the end of the course, the videos of assignment instructions lasted for 35 minutes or more. Upon reflection (Campbell, 2011), the instructor stated that she “fell in love” with the technology; in a face-to-face course she would never have spent so much time delivering assignment instructions to students.

5.4 Teacher’s Overall Evaluation of the Course

The instructor believed that Panopto had been effective in promoting higher levels of learning and student interaction although she acknowledged that students could choose to watch none of the videos and still achieve a passing grade. In fact, only three of the seven students actually watched the videos, and interestingly those students did achieve higher grades than the others who had not engaged with the Panopto material. We report this finding as a correlation, for there could certainly have been factors (other than Panopto use) that affected student engagement and performance. For example, as reported earlier, the CALL cohorts tended to be technologically conservative.

The instructor felt somewhat dispirited that not all students were watching the videos but instead chose to write to her directly for assistance. This was in spite of the fact that all of the explanations they needed were provided in Panopto and through the screenshots. The instructor also reported some discouragement around the relatively low uptake of Panopto particularly in the final assignment as no student used Panopto in their own course designs. She wondered if she should have provided more video recordings, but also reported that preparation of such

material was time consuming. By Week 9 of the 12-week course, she stopped providing any video material because she felt it was a wasted effort. In any case, since students were already preparing for their final assignments, she felt that there was little additional guidance that she could provide.

5.5 Students' Overall Evaluation of the Course

Feedback from student interviews on the use of Panopto was predominantly positive, although they also discussed some of the challenges that Panopto presented. Students reported that the videos of the instructor did personalize the learning environment; they liked seeing her face and felt that she was talking to them. For example, one student reported that as he was watching the instructor, he felt that he was communicating with her even though he was fully aware that he was not *actually* engaged in anything interactive.

I like to see her [instructor's] face—sometimes I have to erase her face when I have to enlarge the text in order to see instructions but then I go back to seeing her face. (Student 1 interview)

As regards helping students to better understand course requirements and reduce anxiety about online learning, students reported that Panopto was valuable.

The wealth of [assignment] instructions overwhelmed me so it was super to see someone [instructor] confirm (or not) my understanding of these instructions. At the first viewing I experienced palpable relief when I had recourse to the video. Yes, it gave a more personal feeling to the course. (Student 2 interview)

By the end of the course two students reported in their interviews that Panopto had helped them better understand the collaborative, reflective tasks, which had changed their thinking. For example, one student stated that the course transformed her belief that she could adopt an eLearning approach in her own language teaching. Another student felt more confident about studying online.

I gain confidence in using computer features. When I started I was reluctant and didn't like learning online, but I've had my mind changed. I didn't think I could setup a teaching plan using computers but now I'm really thinking that I can. ... It's been really useful; to lose the fear and use the computer as a research tool. Before it was really my last option but now I can find things and it's really good. (Student 1 interview)

However, and related to the finding about the instructor having “fallen in love” with the technology, the long recordings did affect students' attention span.

The second one [Panopto recording] was over half an hour long. I had to split it into 2 parts. I know half an hour is not a long time to sit in a lecture theatre but it's a long time to sit listening to someone talking to you. Seems to me there is a definite cut-off point in terms of the technology and your attention span. ... It's a fixed relationship between you and the camera, between her and the camera. So half an hour was just too long. (Student 3 interview)

Also noteworthy is that no student posed any questions through Panopto when they viewed the recordings, nor did they ask questions about their graded assignments although the facility to do so existed in the software. The students who watched the videos viewed the instructions, but they did not interact with the software or with the instructor through the software.

6. Discussion and Conclusion

There has been limited published research in CALL teacher education, although more generally in teacher education there have been studies that examined teachers' attitudes to ICT use (Divaharan & Lim, 2010; Löffström & Nevgi, 2008; Palmer & Holt, 2009; Teo, Chai, Hung, & Lee, 2008). In this section we will explore both the significance of our case study findings, and also the strength that the DBR research approach had for uncovering them.

6.1 ICT within CALL Teacher Education

A few exceptions to the lack of CALL teacher education research are relevant here. Kessler (2007), in his overview of CALL preparation in language teacher education programs, reported that not only were there few MATESOL programs that included explicit CALL training, but also those that did so were deemed less than satisfactory by the majority of respondents in his web-based survey. He found that language teachers more often obtained information about ICT through their own informal web searches, which Kessler argued was unsatisfactory and could preclude teachers being able to "exploit the resources and learning opportunities available to them as CALL continues to evolve" (p. 184). This finding argues for precisely the type of training that was offered in our CALL course, focusing as it did on academic reading tasks, online collaborative activities, use of a variety of software tools, and students' creation of their own instructional environments.

Perhaps even more salient for this argument is Kessler and Plakans' (2008) finding from their study of language teachers' use of audio in teaching that the highly technologically confident language teachers did not necessarily integrate audio into their own classroom instruction. Moreover, even when it was used, there appeared to be a lack of prior detailed curricular planning. A key restriction cited by teachers in that study was a lack of time to become fully conversant with the audio software and develop pedagogically meaningful tasks for their students. Less experienced teachers reported a lack of high-quality documentation as one main reason for not using audio or creating audio resources for classroom use. In more recent research, Duncan-Howell (2012) found that Australian Education students, while competent computer users in text-based environments, still had limited skills in the creation of audio-visual materials. Most of these students' multimedia experiences had been in gaming environments, with a majority of students being completely unfamiliar with podcasts, for example.

Although the use of instructor-made videos and their availability to students through the web is not new, much research has focused on the way that different

presentation formats could change student perceptions about learning subject-area *content* in an online environment (Preston, Phillips, Gosper, McNeill, Woo, & Green, 2010; Rose, 2009). In contrast, no content was presented through the videos in this case study, but enhanced help for using technology and better understanding assigned tasks was the focus. The instructor believed that better understanding of the technology could reduce non-specialist students' stress levels and contribute to their more positive feelings about studying online. As such, the case study's goals more closely resemble those of Wozniak et al. (2012) in which a DBR research approach was used to study students' orientation to online study. We would concur with their finding that "encouraging students to access and progress through the module content, and also participate actively in the related tasks is a key challenge" (p. 905).

In our case study, although Panopto did personalize the fully online teaching environment, it did not transform learning in any exciting or stimulating manner. Rather, Panopto reinforced a transmission model of teaching, albeit one that was more interesting from the students' perspective than reading text-based assignment instructions. In brief, Panopto afforded a reduction in transactional distance (Thorpe, 2008) between students and the instructor and minimized their stress levels concerning assessment requirements. However, no student integrated synchronous communication tools into their own Moodle course designs as had been an anticipated outcome of the example of Panopto use. We had hoped that students would shift in their final assignments from creating a text-based Moodle environment to one that included (at least) a trial of some synchronous communication tools.

This finding is consistent with that of Teo et al. (2008) who examined teachers' beliefs about technology in Singaporean pre-service teacher-education. Within their participant group, it was clear that the pre-service teachers were "more inclined towards the view of teaching as transmissionist rather than teaching as an act of facilitating students' construction of knowledge" (Teo et al., p. 169). Thus, although Panopto was an effective tool for helping fully online students understand course requirements, it did not stimulate creativity, exploration, or experimentation with synchronous communication in their own course designs.

Students reported that although they could have used Panopto, it had been technically too difficult an environment in which to work, and that time and other life constraints had precluded it. This finding echoes Divaharan and Lim (2010), who cite a lack of time as one of the key factors influencing (school) teachers' decisions about the integration of an eLearning approach. We would conjecture that the lack of student uptake and use of Panopto reflected more than lack of time or interest, however. For this we would return to the initial instructor reflections about her installation and use of Panopto. It is worth remembering that the instructor enjoyed a high level of on-site, hands-on technical support; she was part of a research team whose focused discussions around technology were frequent and on-going, and she was experienced in teaching online.

6.2 Changes to Curriculum Design and Assessment

The case study format helped the instructor to reflect on the overall structure and outcomes from the course and to consider changes to its next iteration. For example, she believed that a rearrangement of course material and a staggered approach to the use of the Panopto recordings could be beneficial for CALL practitioners and she planned to link Panopto much more closely to the timing of assignments. In this manner, students would not experience such a steep learning curve at the end of the course when they were creating their own Moodle courses. Further, the instructor planned to have students working in the Moodle environment from the very beginning of the course and using it as their own test site rather than introducing Moodle as new software for them to master for their final assignment.

The instructor also did not believe that students' lack of engagement with Panopto was time-related – there had been ample time within the course structure to install and trial it and she had posted frequent reminders. In subsequent course offerings she planned to introduce activities that would involve students creating Panopto recordings right from the beginning of the course, and she also wanted to redesign additional activities around the use of Google Sites and Docs. In short, she planned more transparent and normalised use of ICT within her online CALL teacher-education environment (Chambers & Bax, 2006).

6.3 DBR and its Contribution to Understanding CALL Teacher Education

The findings from this CALL teacher education case study are consistent with those reported generally elsewhere (Blin & Munro, 2008; Garrison & Akyol, 2009) and are centered on issues of pedagogy. All of the findings indicate the importance of curriculum design and development, particularly when students are studying in a fully online environment, using a variety of new software tools, and shaping their use to their own classroom teaching.

What was different about our context was the multidisciplinary nature of the wider research team and our regular face-to-face meetings. Through the sharing, debating, and reflecting upon teaching, participants' awareness of possible pedagogical refinements was raised as we had hoped would be the case through using a DBR approach (Sandoval & Bell, 2010). Iterations and refinements helped us delve more deeply into the “within case” and “across case” meaning of findings and led to a number of pedagogical insights and improvements (Johnson, Cowie, De Lange, Falloon, Hight, & Khoo, 2011).

We would argue that the first of the global findings emerging from the project is particularly relevant for CALL teacher-education, as it involves the critical importance of curriculum design and monitoring. Overall, we found that ICT and eLearning did provide effective means for supporting the students, but considerable thought, reflection, discussion, and reshaping of instruction to suit the technological tools, particular student cohort needs and intended learning outcomes were needed (Johnson, Cowie, De Lange, Falloon, Hight, & Khoo, 2011). A key implication of the research is that although ICTs provide the tools to develop and represent knowledge, teacher and student understanding of affordances and

constraints constitutes an essential pedagogical and research context for realizing technological potential. Reflection and planning need to be carefully managed through the design of complementary curriculum and assessment activities that provide students multiple opportunities (and time) to master the software tools that can assist their learning and internalize the software's application to their own language teaching contexts.

Although better and more effective computing tools can facilitate completion of course requirements, the nurturing of independent exploratory thinking within a Web 2.0 environment is still an elusive goal in many university environments (Crook, 2008). As Mayes, Morrison, Mellar, Bullen, and Oliver (2009) illustrate in their comprehensive overview of the transformation of university education through technology, our focus and reflections must remain on *learning* so that the strategic development of *eLearning* is based on the needs and demands of students and the quality of their experience. This, in turn, needs careful curriculum design, monitoring, reflection, and discussion which can be facilitated through research approaches that are sensitive to the *messiness* of complex teaching environments (Hoadley, 2004). It can also be argued that gaining deeper understanding of the range of literacies, skills, and experiences needed to shift from the deeply engrained, paper-bound publication environment of higher education to one focused on digital collaboration, sharing, and cultural identity formation will require profound changes to educators' thinking and their academic expectations of students (Convery, 2009).

Such practice is consistent with Patel (2010) who emphasizes the importance of environments in which practitioners engage in ongoing critical reflective practice about teaching, within a public interdisciplinary forum and with the explicit goal of designing and redesigning teaching activities such that meaningful learning can occur—arguably the intended objective of all pedagogical undertakings. For this goal, design-based research can provide an effective means to understanding and improving the use of ICT within CALL teacher education.

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Chapter 9

Blending Practices: DBR and CALL to Enrich Emergent Bilingual Learners' Concept and Language Development

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Abstract

This chapter integrates DBR with expansive learning theory to create a CALL system named GoInquire for effective conceptual and language acquisition for emergent bilinguals. The Integrated Learning Design Framework (ILDF) model is the DBR approach used to design and test the GoInquire CALL system within an instructional sequence on geomorphology. Several rounds of data collection are presented to illustrate the gradual progression of the design.

1. Introduction

According to Kelly (2009), design-based research (DBR) is best employed when there is limited direct and usable theory. The practical knowledge, research, and theoretical perspectives that emerge from DBR can be leveraged to generate, revise, and test an innovative approach to a complex educational situation. DBR is characterized by (a) iterative cycles, (b) use of authentic contexts, and (c) use of methods to draw connections between enactment and outcomes (Design-Based Research Collective, 2003; Anderson & Shattuck, 2012).

The participatory nature of DBR and the myriad of iterative cycles it encourages may result in products readily applicable to complex educational settings. DBR affords excellent opportunities for the development of computer-assisted language learning (CALL) materials to support the dynamic progression of an instructional sequence in a blended or integrative instructional unit. Through the implementation of DBR, improvement in one outcome may potentially facilitate improvement in other outcomes when exploring complex educational contexts (Bannan, 2012). Operationalizing theories of second language acquisition (SLA) and conceptual change in a technology-based system to support instruction allow

for testing of that system and corresponding instructional theory and activity to determine if any improvement in identified language and concept learning targets takes place (Walker, 2006).

This chapter presents the process of implementing DBR to generate a web-based system component of a blended unit for conceptual and language acquisition in geomorphology for upper elementary Spanish-English emergent bilingual learners.

2. Definition of a Complex Educational Problem

In the United States there is evidence of rapid growth of second language learner students in bilingual programs, who speak a language other than the instructional one at home and whose proficiency in that instructional language, while progressing, is not sufficient to comprehend the curriculum without additional support. The U.S. education system has to respond to the challenge of serving these second language learners, whom we refer to as emergent bilingual students which encompass two groups of learners, those learning the majority language and those learning the minority language.

Between 1998 and 2009, the school enrollment for English as a Second Language (ESL) students (ESL in the US grew by 51% (NCELA, 2011). Schools are demonstrating limited ability to serve this population of learners effectively. This situation is resulting in sizeable achievement gaps in reading and science for ESL students. Specifically, the recently released 2011 NAEP test results show that 71% of ESL students performed at the below basic level in reading. In science, the 2011 eighth-grade science test results show 83% of ESL students performing at the below basic level (U.S. Department of Education, 2011).

In addition, in our globalized society, proficiency in one language is not enough for economic, societal, and educational success for all children. In fact, in our globalized reality as Ofelia García puts it, “bilingual education is *the only way* to educate children in the twenty-first century” (2009, p. 5). Bilingual education has historically focused on using the language as a medium of instruction, rather than teaching the language as a subject and so “bilingual education is a way of providing meaningful and equitable education as well as an education that builds tolerance towards other linguistic and cultural groups” (García, 2009, p. 6). Parents and those involved in decision making for young children’s education are realizing that there are growing numbers of speakers of English enrolling in bilingual programs where they are expected to learn content in a developing second language. These students also experience difficulties when confronting highly complex content in a language they have not fully mastered.

Furthermore, teaching science to emergent bilingual students who come from diverse socioeconomic backgrounds and who may possess science conceptions differing from the country’s norm requires blending or integrating effective research-based learning principles. This is the case related to the potential integration of science, SLA, and literacy, which while evidencing a reciprocal and synergistic relationship (Stoddart, Pial, Latzke, & Canaday, 2002), each academic

focus falls under different educational research lines and are rarely investigated in combination.

Both science and language must be addressed when teaching science to emergent bilinguals. In fact, limited language proficiency may inhibit students' science achievement when learning in their weakest language (e.g., Curtis & Millar, 1988; Tobin & McRobbie, 1996; Torres & Zeidler, 2002). Even high quality inquiry-based instruction is not sufficient to help emergent bilinguals learn concepts while learning language in science (August, Artzi, & Mazrum, 2010). There is indication in the work with emergent bilinguals in science that interventions must also take into account the language and cultural backgrounds of the learners (e.g. Lee, Deaktor, Enders, & Lambert, 2008; Lee, Maerten-Rivera, Penfield, LeRoy, and Secada, 2008). Learning science involves using emergent bilinguals' dual language and structure concepts and the way in which concepts are developed, organized, and communicated (Kaplan, 1986; Lemke, 1989).

This complex educational problem is compounded by the fact that content area teachers are now responsible for providing comprehensible instruction to this diverse array of emergent bilinguals. The conflict that exists is that teachers, while bilingual themselves, are being asked to demonstrate the necessary practical and theoretical expertise to provoke conceptual change in science while simultaneously enhancing SLA. This conflict is evidenced by the teachers' limited background in each area and the special consideration of the integration of each field's research-based practice in combination, presenting a challenge and a true complex problem for bilingual teachers and for teacher preparation programs that can be enlightened using DBR.

3. The Complexity of Teaching Emergent Bilinguals and the Applicability of DBR and CALL within Expansive Learning

The theory of expansive learning presents a historical analysis aimed at identifying the conflicts that need to be resolved in an educational (or other) setting and at depicting the historically possible zone of proximal development that must be facilitated in order to move beyond existing contradictions (Engeström & Sannino, 2010). Employing the theory of expansive learning can potentially lead to the formation of a new theoretical concept that evidences itself through a new instructional activity that may result in an expanded object and pattern of activity in the classroom.

When viewed through the theory of expansive learning (Engeström, 1987), the conflict of providing educational experiences that address emergent bilinguals' conceptual and language acquisition becomes the driving force for new educational experiences. The core idea in expansive learning is different from acquisition and participation: it is expansive because learners learn something and that something is not yet there (Engeström, & Sannino, 2010).

Our research involves the emergence and evolution of a new object. We, as learners, construct approximations to the ever evolving object and concept from our collective activity, and following expansive modes we implement this ap-

proximation of the new object and concept in practice. The theory of expansive learning is object oriented and as such the concept of the object is implicitly contained in the concept of activity. The object, as explained by Leont'ev (1978), is the raw material and the purpose of the activity,

The object of activity is twofold: first, in its independent existence as subordinating to itself and transforming the activity of the subject; second, as an image of the object, as product of its property of psychological reflection that is realized as an activity of the subject (p. 52)

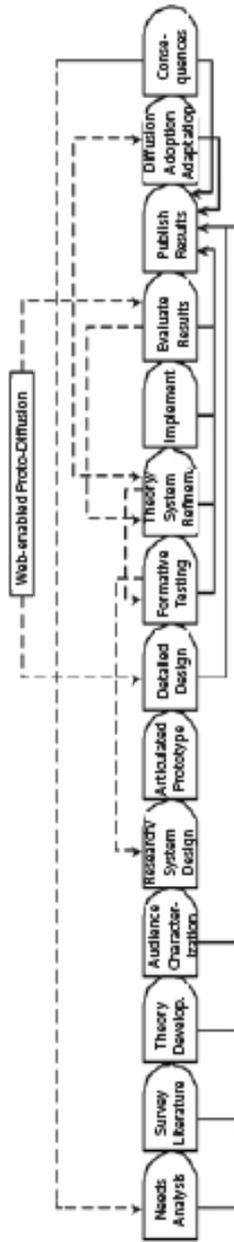
Specifically, approximations to the new object and pattern of activity in the classroom relate to lines of research-based practice in geoscience and SLA, among others, that are far from being considered conjunctively. Integrating DBR and CALL as a platform for teacher inquiry results in our new object and activity, namely the design of CALL environments to support effective conceptual and language acquisition for emergent bilinguals.

Expansive learning offers a theoretical model for considering different perspectives in an identified conflict, while permitting space for ambiguity in generating and testing novel educational approaches. The different perspectives provide a well known theoretical lens through which researchers can examine the double bind of complex educational situations. DBR then supports these lenses with a concrete approach to, in our particular case, the dynamic development and progressive testing of a web-based system to support an evolving research-based instructional sequence.

The synergistic relationship between expansive learning and DBR is advanced by examining Bannan-Ritland's (2003) Integrative Learning Design Framework (ILDF). This approach "positions design research as a socially constructed, contextualized process for producing educationally effective interventions with a high likelihood of being used in practice" (p. 21). It involves teachers and students in design and evaluation and is a proven approach that has been used successfully in other investigative works (e.g. Bannan-Ritland, 2003; Bannan, 2012; Hoven & Palalas, 2011). The ILDF is the adopted framework for this investigation and also provided a professional development experience during which teachers participated in the role of teachers as well as researchers and designers (Bannan-Ritland & Baek, 2008).

Drawing from traditions of instructional design, product design, and educational research, Bannan-Ritland (2003) proposed four stages (informed exploration, enactment, evaluation of local impact, and evaluation of broader impact) to guide research and development leading to a "mature innovation" that can be successfully adopted by teachers to support specific learning goals (see Figure 1).

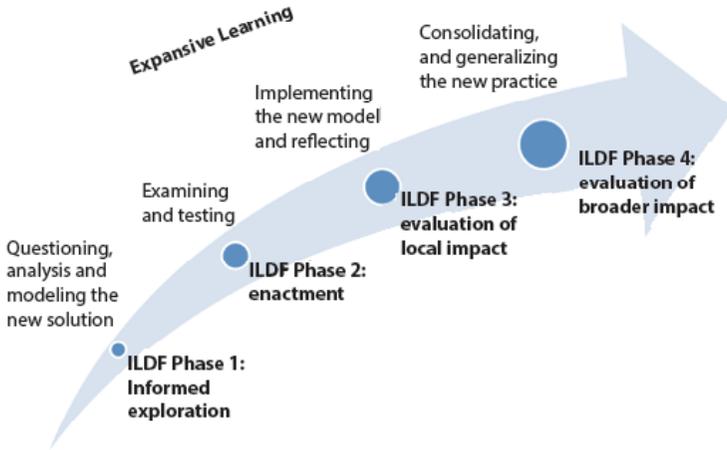
Figure 1
Overview of ILDF (Bannan-Ritland, 2003)



	Informed Exploration	Enactment	Evaluation: Local Impact	Evaluation: Broader Impact
ILD	<p>Questions:</p> <ul style="list-style-type: none"> What are identified gaps/problems in theory, practice, and/or the marketplace? What information can be gleaned from existing data or research? How can we characterize the problem or learner need? What are the systemic, social, cultural, and organization influences or constraints on design? What are characteristics of the audience? <p>Methods:</p> <ul style="list-style-type: none"> Benchmarking Performance/needs analysis Interviews Survey of Experts Focus Groups Observations/Role Modeling Case Studies 	<p>Questions:</p> <ul style="list-style-type: none"> What are the learning targets for innovation? What design principles or strategies may be applicable? How to identify and operationalize cognitive and performance processes in design? To what extent does the design embody the theoretical model? <p>Methods:</p> <ul style="list-style-type: none"> Task Analysis Contextual Analysis Designer Logs Expert Review Audience Review 	<p>Questions:</p> <ul style="list-style-type: none"> Is the enacted design usable, valid and relevant? Is the design instance accessible and efficient in delivering instruction or supporting learning? What is the local impact or effectiveness of the design instance? How effective is the design solution in achieving learning targets at its highest fidelity in full context? <p>Methods:</p> <ul style="list-style-type: none"> Usability Testing Expert Review Observation or Video records Interviews Formative Evaluation Pre/post Comparative Studies Quasiexperimental studies 	<p>Questions:</p> <ul style="list-style-type: none"> What factors influence diffusion, adoption, and adaptation of innovation? What are the pragmatic demands of the learning environment that influences adoption of design? What policies and cultures shape participants use of innovation? <p>Methods:</p> <ul style="list-style-type: none"> Analysis of computer log files Multisite Interviews, Surveys and Observations Data mining Correlational studies Quasiexperimental studies
Guiding Questions for Research				
Applicable Research Methods				

Following Bannan (2012), DBR can be structured to include data collection and analysis about children and teachers in a specific context, and the sequence of epistemic actions parallel those in an expansive cycle (see Figure 2).

Figure 2
Model Integrating ILDF and Expansive Learning



Thus, embedded in an expansive learning perspective we implemented a DBR framework for developing a CALL environment supporting an instructional sequence based on conceptual change and SLA theory (our ever-evolving object). Through our research work, we learned that the motive of collective activity for this expanded object becomes effective for an individual by means of personal sense (Engeström, & Sannino, 2010): “sense expresses the relation of motive of activity to the immediate goal of action” (Leont’ev, 1978, p. 171). The generative nature of the proposed conceptual integration suggests that synergies between DBR and CALL may serve as platform for teacher inquiry, motivated by personal sense, and is a powerful model for professional development. Reported here are the data sources collected and analyzed by the DRB model evidenced by the ILDF in cycles of design research and their design outcomes.

4. Conceptualization of the Study: Informed exploration phase

The informed exploration phase of the ILDF attempts to identify, describe, and analyze the state of the problem to generate novel theoretical perspectives. This initial phase of the ILDF attempts to integrate and analyze data and literature from various sources. The main outcome of this phase, as reported elsewhere, is locating the problem in context; integrating theory, practice, and research perspectives; and improving understanding of the context, audience, and problem (Bannan, 2012). In the present study and following the ILDF, this exploration took the form

of the needs analysis and a survey of the literature. The needs analysis resulted in our decision to focus on soil erosion to contextualize the integration of content and language teaching. The survey of the literature elaborated on our needs analysis by bringing to light the research-based body of information on SLA and conceptual understanding of processes of erosion. We identified similarities across research findings in the fields of SLA and CALL, and these are documented in the following sections. We also reviewed the research on conceptual understanding of geomorphology.

As a result of the needs analysis and the review of the literature, the informed exploration phase clarified our focus for the CALL system and helped us define the complexity of our identified problem. We then engaged in gaining a more elaborate understanding of our audience by writing teacher-research-based emergent bilingual personas. A more detailed description of the steps in this phase follows.

4.1 Theoretical Proposition for Designing the CALL System Supporting an Instructional Sequence

The survey of the literature clarified our focus for the CALL system we needed to generate. Furthermore, we invited a geomorphologist to explore the type of skills and strategies he used in the field with the goal of replicating these for the children.

The literature and the subsequent theoretical proposition conceptualized in the informed-exploration phase of the ILDF helped the team define the complexity of the problem and helped to identify the relationship amongst the different identified elements.

4.2 Audience Characterization

4.2.1 Participants.

For our DBR work, we entered two fifth grade classes from a bilingual U.S. school and one fifth grade class from one bicultural school in Lima, Peru (with some bilingual features but not a fully bilingual environment). The total number of students who tested the developing materials was 81. Fifty-seven students were in the U.S. school and 24 were in the Peruvian school.

To better understand this audience as well as a larger group of students who could share the characteristics of our participants, the six teachers in the research team each interviewed three of the participating children, read a piece of science text with them, and then wrote what are called personas (Cooper, 2004). Each teacher targeted one emergent bilingual student who was successful academically, one who was average, and one who was struggling. This work resulted in emergent bilingual personas.

4.3 Needs Analysis

In collaboration with practitioners, we reviewed the science standards and the literature, and we identified the topic of geomorphology as a highly complex edu-

cational topic and in need of appropriate instructional approaches. Specifically, in our investigation of the processes of erosion and how these processes reshape the surface of the earth, we saw a highly abstract concept which is expected to be taught starting in elementary school.

Soil erosion is an essential factor in assessing ecosystem health. A variety of documents of state and national science standards reflect the importance of this topic for upper elementary students. For example, the Common Core State Standards (CCSS), the recently released Framework for K-12 Science Education by the National Research Council (2011), and the New York Department of Education's Standards of Learning all include erosion as a learning standard.

The integration of language and content is predicated on the idea that students best learn language in meaningful contexts (Echevarria, Vogt, & Short, 2004; Genesee, 1999). For emergent bilinguals, vocabulary has been found to be one of the most challenging components of both literacy attainment (August & Shanahan, 2006; Goldenberg & Coleman, 2010) and geoscience education (Cheek, 2010; Dove, 1997).

In summary, vocabulary arose from our exploration as an important aspect in science learning for bilingual children. As our survey of the literature below shows, there is relevant literature about the development of vocabulary from everyday knowledge to technical vocabulary both in first and second languages (e.g., Lubliner & Hiebert, 2011; Putman & Kingsley, 2009; Silverman & Hines, 2009; Graves, 2006; Lambert & Whelan-Ariza, 2008; Carlisle, Fleming & Gudbrandsen, 2000). Water erosion was identified as an area in need of additional research and instructional models, as well as an area involving complex terminology that needs to be interpreted within a specific context.

Consequently, in this design research effort, the broad goal of attempting to support emergent bilinguals and their teachers for conceptual and language acquisition was specified, based on the survey of the literature related to the integration of language and content. Furthermore, based on recent research presented in the next section, showing both the effectiveness of using multimedia for language learning with bilinguals (Silverman & Hines, 2009; Verhallen, Bus, & de Jong, 2006), and using Web 2.0 technologies to support vocabulary through discussion (e.g. Putman & Kingsley, 2009), the DBR team decided to investigate the creation and testing of a web-based system in the classroom to support an instructional sequence, integrating vocabulary learning and the acquisition of concepts of water erosion.

4.4. Survey of Literature

The design research team, consisting of six teachers, three researchers, a visual designer, and a computer programmer, reviewed the existing research-based literature to attempt to elaborate on our needs analysis. Within this review we aimed to explore the areas of SLA, specifically as it related to vocabulary learning and conceptual understanding of processes of erosion. We identified several features from the literature connecting science and SLA (see Table 1).

Table 1
Common Features from the Literature on Science and SLA

Second Language Acquisition and CALL Literature	
Science	SLA
<p>Model-based Reasoning (MBR; Rea-Ramirez, Clement & Núñez-Oviedo, 2008)</p> <ul style="list-style-type: none"> - Draws upon both cognitive theories of conceptual change (Piaget, 1950, 1970; Kuhn, 1993) and social learning theory (Vygotsky, 1978, 1986) - Learners construct and revise explanatory mental models about phenomena - Apply their models to diverse situations 	<p>Sheltered Instruction (SI; e.g. Chamot & O'Malley, 1996; Echevarria et al., 2004)</p> <ul style="list-style-type: none"> - Includes activities providing support for emergent bilinguals to access the academic content while enhancing their language acquisition
Learning Strategies	
<ul style="list-style-type: none"> - Self-monitoring is used in science and reading (Greeno & Riley, 1987): involves evaluation and regulation (Otero, 1998) - Questioning is a regulation action (Costa, Caldeira, Gallástegui, & Otero, 2000) 	
<ul style="list-style-type: none"> - Generating questions is one of the characteristics of inquiry-based science - Bilinguals and monolinguals use the same strategies, but bilinguals also use resources: Cognates, translation and transference (Jiménez, García, & Pearson, 1996). 	<ul style="list-style-type: none"> - Self-monitoring central to sheltered instruction (Chamot & O'Malley, 1996; Echevarria, et al., 2004) - Asking questions helps comprehension (NRP, 2000) - Cognitive strategy instruction has been represented by different models (e.g. Brown, Pressley, Vanmeter, & Schuder, 1996; Chamot & O'Malley, 1994) - Reciprocal teaching (Palincsar & Brown, 1984)
Co-construction	
<ul style="list-style-type: none"> - Discussion-based instruction for acquisition of scientific vocabulary (Carlisle, Fleming & Gudbrandsen, 2000; Stahl & Clark, 1987) - Teacher and the students both contribute ideas for model (Rea-Ramirez et al., 2008) - Conceptual change through interactions among students and the instructor (Glasson & Lalik, 1993) 	<ul style="list-style-type: none"> - Use of multiple learning modalities for teaching vocabulary (Beck, McKeown & Kucan, 2002; Graves, 2006) - Web 2.0 technologies used to support vocabulary through discussion (e.g. Putman & Kingsley, 2009) - Using multimedia is useful for emergent bilinguals (Silverman & Hines, 2009; Verhallen et al., 2006)
Funds of Knowledge	
<ul style="list-style-type: none"> - Emergent bilinguals less likely to encounter ways of talking, thinking, and interacting—compatible with what they bring from home (Lee & Buxton, 2008) - Access to the language of science while respecting cultural & linguistic norms (Stoddart, Pinal, Latzke, & Canada, 2002; Torres-Guzmán & Howes, 2009) 	<ul style="list-style-type: none"> - Learning is a process of participation in community of practice (Lave & Wenger, 1990; Moll, 1998; Scribner & Cole, 1981) - “Funds of knowledge”: Connect classroom literacy and students’ cultures (Moll, Amanti, Neff, & González, 1992) - Literacy as the transmission and understanding of significant cultural events mediated through symbolic artifacts & language (Cummins, 2004; Dixon-Krauss, 1996; Freire, 1973; Vygotsky, 1997)
Vocabulary	
<ul style="list-style-type: none"> - Using multimedia-based vocabulary instruction effective for ELLs (Silverman & Hines, 2009; Verhallen, Bus, & de Jong, 2006). 	<ul style="list-style-type: none"> - For native Spanish speakers: focused on using cognates (Carlo et al., 2004; Lambert & Whelan-Ariza, 2008; Lubliner & Hiebert, 2011)

4.4.1 Conceptual Understanding of Geomorphology Literature

A few studies have been conducted to investigate students' conceptual understanding about erosion and weathering (see Table 2), but, in general, very little is known about how students progress toward expertise in geoscience, what alternative conceptions they hold, and how traditional instruction does or does not support the development of more sophisticated and scientifically accurate mental models (Libarkin, 2005; Petcovic, Libarkin, & Baker, 2009). One related finding that has come out of the research on geosciences is the importance of vocabulary and the challenge that scientific terms pose to students, particularly second language learners. In her review of the literature, Cheek (2010) noticed that misapplication of terminology is a serious factor in the study of Earth processes.

Table 2
Prior Work on Students' Geomorphological Conceptual Understanding

Study Population and Data Collection	Relevant Findings	Reference
236 students (16-19 years) Survey	<ul style="list-style-type: none"> - Weathering occurs in situ, whereas erosion involves transport - Weathering as solely related to atmospheric elements - Human actions perceived as types of accelerated erosion - Uncertainty on animal activities: bioerosion or biological weathering 	Dove 1997
115 students (7-11 years) Drawings, questions and interviews	<ul style="list-style-type: none"> - Protoscientific ideas in weathering - Students recognized a natural cause for an eroded pebble - Failed to recognize abrasion with other rocks (more scientific reason) 	Blake 2005
24 college students In-depth interviews and Demographic data	<ul style="list-style-type: none"> - Students held incomplete scientific conceptions of river topics - More alternative conceptions for processes, causes, and difficult-to-observe features - Hispanic students held incomplete scientific-alternative and alternative conceptions more often than White students 	Sexton 2008
196 college students enrolled in introductory geology classes In-depth interviews and Questionnaires	<ul style="list-style-type: none"> - Students have the idea that things do not change - Students do not have a good grasp of deep time - Students place humans, and animals into roles of moving sediments - Students have difficulty picturing the wearing away of layers of rock, so they describe quick catastrophic events as the cause for moving rocks 	Kortz and Murray 2009
Geoscience Research Review: The reported studies sampled 10-14-year-olds (in the US, earth science is typically taught in middle school)	<ul style="list-style-type: none"> - Poor conception of scale when it is outside of their ability to observe - Children have difficulty perceiving slow changes over time (Ault, 1998) - Link between scientific vocabulary and scientific conceptual knowledge when looking at children's perceptions of landforms (Milburn, 1972; Platten, 1995; Lunnon, 1969) 	Cheek 2010

4.5. Theoretical Proposition for Designing the CALL System Supporting an Instructional Sequence

The survey of the literature clarified our focus for the CALL system we needed to generate. Furthermore, we invited a geomorphologist to explore the type of skills and strategies he used in the field with the goal of replicating these for the children. The geomorphologist taught several sessions to the team both in the class and in the field (nearby stream and natural spaces). The lessons sought to model the behavior of geomorphologists so that we could (a) identify characteristic behaviors of geomorphologists and (b) replicate ways of acting as a geomorphologist for the children.

The conflict of providing educational experiences to result in emergent bilinguals' conceptual and language acquisition in science continued to be the team's driving force. Our imagined new object, the CALL environment with an accompanying instructional sequence, was to be built on an initial theoretical proposition arising from our survey of the literature. Our proposition included the following principles: (a) integrating concept and language learning, (b) addressing metacognitive thinking (using learning strategies), (c) exploring initial funds of knowledge and mental models to inform instruction, and (d) facilitating the co-construction of concept and language. These identified elements were all inter-related. In fact, the literature and the subsequent theoretical proposition, conceptualized in the informed-exploration phase of the ILDF, helped the team to define the complexity of the problem and to identify the existing relationships among the enumerated elements above (a through d).

The literature combined with the direct experience of the practitioners on the team, as well as interviews with science and literacy experts, supported our initial theoretical proposition. Think Alouds with children at different levels in the learning path as well as interviews with young emergent bilinguals continued to add to the team's understanding of teaching concept and language acquisition. In the next section we learned to characterize our population and reveal the face and character of our target audience.

4.6. Audience Characterization

To better understand our audience, each of the six teachers involved in the research team interviewed three children, read a piece of science text with them, and then wrote what are called personas (Cooper, 2004). Each teacher targeted one emergent bilingual student who was successful academically, one that was average, and one who was struggling. The level of each participant was identified based on their test results and the teacher's knowledge of the students. Following is a sample summary of one of the generated personas.

An Emergent Bilingual Persona: Manuel. Manuel was born outside the U.S. but has been living here for two years. His mother tongue is Spanish, and he has mastered conversational English as well as some academic English. He often chooses to write and work in Spanish to make meaning of complex information, and he feels most comfortable if tests and questions are expressed in his mother tongue.

When working solely in English, Manuel can function only when provided with extra processing time. His performance in English is impacted when under pressure. When reading informational text, Manuel does not have the language and practice to explain what is going on in his head. He often relies on illustrations and prior knowledge to help him make sense of the text. He frequently speaks in Spanish as he tries to comprehend a science text loaded with content. Manuel can generate questions in relation to the content of the text when he is explicitly asked to do that. He asks questions about the meaning of certain academic words, even when he has encountered those words in a different context. Manuel tends to avoid reading science texts at his grade level because it takes very long for him to get an idea of the purpose of the text and to extract the ideas presented in it. This is particularly evident when he is unfamiliar with the content of the text. Finding answers to pre-established questions also helps Manuel to more fully engage with science texts.

5. The Enactment Phase

During the enactment phase, the ILDF proposes the integration and operationalization of what has been learned in the informed exploration phase into a design concept. Integrating multiple streams of data and its analysis, including personal experience and existing research, are part of this phase. According to Bannan (2012), the designed intervention is embedded in the emergent theoretical proposition, which, through several iterative cycles of feedback, progressively evolves from a low-fidelity prototype to a high-fidelity prototype as both the theory and the design are revised when they are tested in the user's hands.

In this design-based research example, we built upon our original theoretical proposition in which we included four elements (concept and language integration, metacognitive thinking, exploring students' funds of knowledge and models, and facilitating co-construction).

5.1 Articulated Prototype

Building both the instructional sequence and accompanying CALL environment based on the integration of the different data sources, we enriched the theoretical proposition by establishing two main goals at these initial steps in the research process. Working on delineating these goals was an initial attempt to explore the extent to which the design met the theoretical model. The first focus was to keep the elements and processes involved in moving through the designed CALL system closely connected to those in the designed instructional sequence. The second focus was to carefully document users' reactions to the system and instructional sequence and to make changes based on the feedback in order to make the resulting materials usable and authentic.

During the iterative cycles of testing the instructional sequence and supporting CALL system, our goals were to investigate

1. How well do the elements and processes involved in working through the CALL system, based on the integration of theories and strategies, parallel

and support those elements and processes involved in the instructional sequence?

2. What is the social validity (usability and authenticity based on users' perception) of the instructional sequence and resulting CALL system?

5.2 Instructional Sequence and CALL Environment (INSCIREAD and GoInquire Web-based System)

The combination of data findings during the Informed Exploration Phase, as well as the initial steps of the enactment phase, resulted in the development of a pilot "Instruction in Science and Reading" instructional sequence (INSCIREAD) which was supported by the CALL prototype we designed together and which was called the GO Inquire System (e.g. Geological Observational Inquiry System). We next describe these initial materials.

5.2.1 INSCIREAD

The Instruction in Science and Reading (INSCIREAD) arose from our work with the six practitioners. The practitioners included two elementary science teachers, one middle school reading teacher, two middle school reading teachers, one elementary science bilingual teacher, and one elementary bilingual special education teacher.

The design of INSCIREAD was based on the rationale that children should be provided with an opportunity to express their own ideas about phenomena and that the intervention activities should facilitate the development of an understanding which is closer to the current scientific perspective (Rule, Graham, Kowalski, & Harris, 2006).

Due to the specific context of geomorphology that is usually taught in about a week at the elementary level, we decided to shape INSCIREAD into six consecutive sessions. Three of the sessions focused on science and three on reading and on connecting science and reading more explicitly. The instructional sessions presented students with activities focusing on science or reading on alternative days. Based on the literature and after exploring the strategies most used in both science and reading, we decided to emphasize the strategies of questioning and self-monitoring in the INSCIREAD intervention.

For the three sessions which focused on collaborative inquiry-based science, we envisioned students' work centered on the CALL web-based system GoInquire.

The other three sessions of INSCIREAD, which focused on reading, provided students with explicit instruction in the questioning and self-monitoring reading strategies based on the method of reciprocal teaching (Palincsar & Brown, 1984). Students' use of bilingual strategies, such as transferring, translating, and the use of cognates (Jiménez, García, & Pearson, 1996) was emphasized throughout the instructional sequence. The intervention was conducted in Spanish, but students were encouraged to formulate their understanding and thinking using either linguistic resource (English or Spanish) they had available.

The established focus of the INSCIREAD instructional sequence was to engage students with academic vocabulary and concepts in an authentic manner. Moreover, respecting our initial theoretical proposition, the INSCIREAD sequence aimed at (a) using the strategies of questioning and self-monitoring in science and in reading, (b) emphasizing the interdependence between both science and reading and the parallelism of processes and strategies when they work in both contexts, and (c) the elicitation of students' ideas with the goal of informing instruction and inductively and deductively addressing and/or building on students' initial ideas.

5.2.2 The CALL Prototype: GoInquire

The aim of the GoInquire prototype was to develop students' prior knowledge on slow geomorphologic processes and support language learning by improving their reading comprehension, using a collaborative inquiry-based science approach.

The system was designed to encourage collective rather than individual construction of meaning from texts while activating strong student motivation as they construct their own meaning of the content and the texts. The strategies emphasized throughout the GoInquire system parallel those used in reciprocal teaching (Palincsar & Brown, 1984), specifically two strategies: questioning and self-monitoring. In GoInquire students observe and analyze the geomorphological features of school grounds photographs, generate and try to answer questions, monitor their understanding while answering metacognitive prompts and reading other students' ideas, and identify unfamiliar words. As part of the three science lessons students engaged in a field experience in which they were asked to compare the photographs they had analyzed in the GoInquire system with the actual place where the photograph was taken.

Cooper, Reinmann, and Cronin (2007) identified two categories of interface: sovereign interface (kept open) and a transient interface (activated only temporarily). Following Pardo-Ballester and Rodríguez's (2010) interface description, the initial GoInquire included the following interface components:

1. A sovereign interface

This interface showed the main page with a photograph from the school's playground. On the right side of the photograph, the interface included a collaborative synchronic communication platform where students were able to read the comments that other students in the class had entered.

2. A transient interface with stamps and metacognitive prompts

Below the main photograph there were two agents related to water erosion. Initially we used the words, high and low. As students selected one of the words, a stamp came on the screen. Students moved the icon around and then stamped it on a selected section of the photograph. The GoInquire then generated a prompt asking students to explain their choices. Once students entered their answers to the metacognitive prompt, Go Inquire displayed everyone's answers on the dialogue box.

5.3 Task and Contextual Analysis

Keeping in mind our expansive learning perspective, we address the proposed goals through the initial theoretical model but still allow space for ambiguity in finding and testing our educational approach. We addressed two goals during the enactment stage. The first one was to figure out how well the elements and processes involved in working through the CALL system parallel and support those elements and processes involved in the instructional sequence. The second one involved exploring the social validity (usability and authenticity based on users' perception) of the instructional sequence and resulting CALL system. These goals were globally documented through the following test.

The Initial INSCIREAD sequence and accompanying GoInquire prototype were tested with a group of 28 linguistically and culturally diverse fifth graders. We use the phrase “linguistically and culturally diverse children” to identify children from homes and communities where English is not the primary language of communication (García, 1991). We walked teachers and students through the INSCIREAD sequence, and we asked participating children to interact with the interface in groups of two and three. The class worked with the materials for 6 hours in the course of a week. Two researchers recorded students' work with the computer and collected field notes as they moved around the class. We engaged students in a final group discussion where we asked for their feedback.

The results from this implementation, as well as continued meetings with the practitioners involved in the design process resulted in changes to the initial GoInquire prototype (see Table 3).

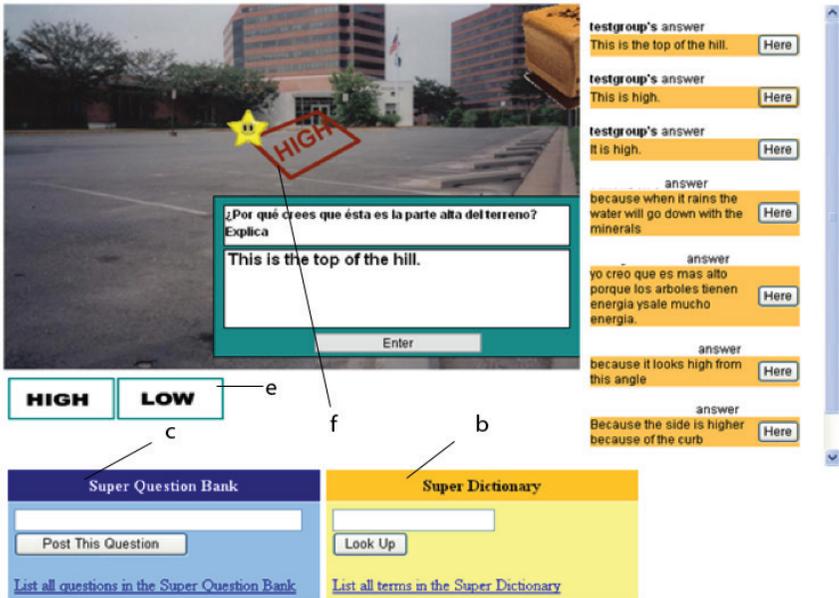
Table 3
Needs and Proposed Changes for the Initial GoInquire Prototype

GoInquire Identified Needs	GoInquire Proposed Changes
1. Teachers to have background information about the content to be taught	1. Added a sovereign interface with all research documents and papers as well as resources for teacher
2. The system to scaffold students' vocabulary learning and use	2. Added one transient interface: A collaborative Super Dictionary where students could explore the meaning of words via visuals and create their own collaborative definitions of the terms
3. The system to include more direct practice with the strategy of questioning	3. Added a Super Question Bank where students entered their questions and could add ideas to others' questions
4. The system to include more direct practice with the strategy of self-monitoring	4. After students had worked with several photographs and stamps, they encountered a new sovereign interface, which we named Synthesis Page. As part of self-monitoring, students were able to see all the comments others had typed in the system at the same time. They were asked to cut and paste the important ideas/words in the text. They then used those words and ideas to create a summary of the discussion.

<p>5. The system to include more agents related to erosion</p>	<p>5. Identified four agents which were included as stamps in consequent pages: High/low; soft/hard; compact/loose; and steep/shallow</p>
<p>6. Students were able to read each other comments but did not know where the students who had made the comments had placed the stamp</p>	<p>6. Added a feature to show where the student who made the comment had placed the stamp. Students who wanted to see where the stamp was placed clicked on the "here" word next to the original comment</p>
<p>7. Teachers to have more flexibility in the sequence of instruction</p>	<p>7. In this final version the user was able to modify the following: Metacognitive prompts (questions and language); upload user's photographs; alter the sequence of the pictures, stamps, and synthesis page to match the group's needs; and add terms, definitions, and user's images to the initial Super Dictionary</p>
<p>8. Students expressed difficulty at identifying when they were using the strategies of questioning and self-monitoring (from the INSCIREAD) in the system</p>	<p>8. Included a computer-generated message stating the name of the strategy in use (e.g. when students looked up a word in the Super Dictionary, the message they saw stated "you are self-monitoring your understanding")</p>

The resulting sovereign interface is shown in Figure 3.

Figure 3
GoInquire System Main Screen



We also made changes to the INSCIREAD instructional sequence to address some of the issues we encountered during these first stages of data collection (see Table 4).

Table 4

Needs and Proposed Changes for the Initial INSCIREAD

INSCIREAD Identified Needs	INSCIREAD Proposed Changes
<p>1. Students needed help understanding the context for their work in the system</p> <p>2. The science lessons only involved working with the GoInquire, more diverse activities to transfer what students were experiencing in the system to the other contexts was needed</p> <p>3. Students enjoyed working in the reading activities when in the whole group and in small group, but they felt they needed more time to move to reading the texts individually</p>	<p>1. Added an Introductory Simulation: Teacher presented students with a tray with solids (twigs, leaves, pebbles, sand) and stimulated a group discussion by demonstrating agents related to erosion using water and moving the tray.</p> <p>2. Added three components to the science lessons: Two Field Experiences a. Observation: Students received an observation sheet with small versions of the photographs they analyzed through the system, and space for notes. Teacher took the class outside and students were to find where each photograph had been taken. The class engaged in a discussion based on their observations in the field. b. Uploading of photographs: In small groups and guided by the teacher, students decided areas in the field to photograph that represented interesting geomorphological aspects, and then these were uploaded to the system and analyzed, and Picture Assembling c. Extra large versions of the photographs were distributed. Students worked in groups to first highlight important aspects of the photograph and then cut these out to create a “synthesis” of the essential elements from the photograph</p> <p>3. Decided to have students work in groups throughout the INSCIREAD and eliminated individual practice at the end, but had them complete an exit brief text recall daily to monitor use of strategies and comprehension</p>

Additionally, to figure out how the CALL system GoInquire supported students’ language acquisition, we identified and analyzed how language was stimulated in ways that privileged the bilingual learner in particular. The analysis is presented in the proposed materials. The sequence and accompanying system we had created helped linguistically and culturally diverse students with language development through different elements. These elements, their emphasis in language aspects, and the particular relevance for our participants are presented in Table 5.

Table 5
Elements for Language Development in GoInquire

CALL Elements	Language Emphasis	Suitability for Bilinguals
1. Computer-generated Metacognitive Prompts	1. Promotes self-monitoring and reflection, and generates metacognitive scientific language	- Some bilinguals might show strengths in self-monitoring related to their ability to constantly monitor their language choice (e.g., Bialystok, 1999)
2. Collaborative Synchronic Bilingual Communication Platform	2. Students read children-generated science text, and we observed how they started implementing science language in this context and using both English and Spanish	
3. Super Dictionary	3. Promotes self-monitoring of comprehension and collaborative academic vocabulary development as students attempt to cogenerate definitions using English and Spanish	- Diverse children need as much time as possible for comprehending and using the English language in a low-risk environment (e.g., Holt, Chips, & Wallace, 1991), and utilizing on-line collaborative learning opportunities allows for this differentiation to naturally take place.
4. Super Question Bank	4. Promotes questioning (a self-monitoring regulation strategy), science inquiry, and generation of language as students attempt to answer each other's questions using both English and Spanish	
5. Synthesis Page	5. Scaffolds self-monitoring and generates bilingual language as students create a synthesis from all the communication exchanges from the platform (students chose whether to write in English, in Spanish, and at times they chose to use both within single responses)	- Knowledge and literacy competences in bilingual children's both languages support each other's development (e.g., Genesee, 2002). In this case the use of both English and Spanish exposes emergent bilinguals to science vocabulary and concepts in English while they continue to utilize a more familiar language.

While all these elements may also help children whose primary language of communication is English, they were identified as most relevant for our diverse participants who, as presented in the section on funds of knowledge and mental models, hold initial interpretations of the terminology heavily impacted by their diverse prior experiences and their shared sociocultural background.

Social validity was investigated as the teams explored the areas in need for improvement. Several salient ideas came up in the exit conversation with teacher and students.

Students explained that they generally enjoyed the INSCIREAD and accompanying system. Although they thought it was not always easy, they expressed that it was worth the effort and they had learned from it. Isabel commented,

Bien, me ha ayudado hacerlo. Me ha ayudado a aprender como el autocontrol, y cuando no comprendo, como trato de entender o mi compañera me ayuda a veces... como el primer texto era un poquito difícil, pero entonces me acostumbré a hacerlo, haciéndolo. También mucho más como vocabulario, erosión y todo eso.

'Good, it has helped me. It has helped me learn like the self-monitoring, and when I don't understand, I try to understand or my partner helps me at

times...like the first text was a little harder, but then I got used to doing it, doing it. Also much more like vocabulary, erosion and all that.'

Students also talked about the strategies. All but one student expressed having had the most difficulty with understanding and self-monitoring, but they also indicated that they had made progress as a result of the intervention. Following are two sample explanations. The first one shows how the students progressively improved monitoring their understanding and their work. The second one shows that some of the tools we encouraged them to use (e.g., the highlighter) were not necessary because they automatized their use of the strategy.

Yo entendía preguntar muy bien, pero no me, en el comienzo yo no entendí autocontrolar, y después yo ya se autocontrolar.

I understood questioning very well, but I didn't, at the beginning I didn't understand self-monitoring, and then, later, I knew self-monitoring.' (Laura)

Yo puedo ver unas cosas y decir, ésta es la parte importante y no es solo highlighting el text, porque yo puedo entender y mantenerlo en mi cabeza.

'I can see things and I can say, this is the important part and it is not only highlighting the text because I can understand and keep it in my head.' (Maya)

Students expressed how they enjoyed their work in the computer. They specifically mentioned they really liked generating and entering questions in the system, working with a partner or in small groups, working with pictures of a familiar place, using the GoInquire stamps before going out to the field, interacting with the familiar photographs of GoInquire, and working with the computer because *¡era divertido!* 'It was fun!'

One thing for which the children expressed a dislike was the Super Dictionary tool. As one student explained,

Porque es como, es un poco aburrido porque tienes que pensar en una palabra.

'Because it is a little boring because you have to think about a word.'

In summary, the data from the interviews show that students generally enjoyed participating in the intervention and they found it useful and wanted to continue using the materials, particularly the GoInquire.

6. Evaluation of Local Impact

After coming up with the revised version of the INSCIREAD and the accompanying GoInquire CALL system, we were ready to flesh out the relevance of the materials by evaluating the system at the local level. The goal was to collect formative data on the effectiveness of the materials to meet the learning goals (concept and language development), with additional input from target audiences, and analysis of improvement on our new object. Our proposed theory continued to take shape: to integrate conceptual and language acquisition by (a) addressing metacognitive thinking (learning strategies), (b) allowing for the exploration of

initial funds of knowledge and mental models, and (c) facilitating the co-construction of knowledge and language.

In order to explore students' funds of knowledge and initial mental models and how the materials impacted students' concept and language development, we researched the following questions,

1. What are students' mental representations of the academic vocabulary involved in the teaching and learning of processes of erosion caused by the movement of water?
2. In what ways might students' mental representations of this academic vocabulary change as a result of their interaction with the INSCIREAD and GoInquire?

6.1 Data Collection

The research design of this test consisted of two phases: pre-/postinstruction elicitation of students' ideas and student participation in INSCIREAD/GoInquire.

6.1.1 Pre-/postinstruction elicitation

The research team, in cooperation with a geomorphologist, created four open-ended general questions to stimulate the participants' generation of prior ideas. The questions were based on the content objectives related to slow changes in geomorphology at the elementary level in Virginia (see Table 6). The teacher-researcher read all questions to the participants and then asked them to write (in English or Spanish) and/or draw on four blank pieces of paper, one per question, to show their thinking.

Table 6

Questions to Explore Mental Representations Vocabulary

1. Explain how the Grand Canyon was formed (visual provided).
2. Explain what water erosion is.
3. Explain why the water in rivers does not move in straight lines, but curves as it moves.
4. Explain the relationship among erosion, deposition, and transportation caused by water.

6.1.2 Student participation in INSCIREAD/GoInquire

As students interacted with the materials, the research team collected data from three of the elements used for language development: (a) students' comments from the Collaborative Synchronic Communication Platform (answers to metacognitive prompts), (b) students' attempts to define terms in the Super Dictionary (initial definitions and ideas), and (c) questions recorded in the system via the Super Question Bank. Field notes were also collected and analyzed.

6.2 Data Analysis

The data collected in this test is primarily qualitative (Erickson, 1986). The information from the pre-/postinstruction elicitation was analyzed by a bilingual researcher using methods of inductive analysis (Patton, 1987, 1990). The analysis started by looking at the work of the children. The researchers read the text students had written and looked at their drawings and representations. Notes describing what the researcher noted were handwritten on post-it sticker notes. After generating this initial classification, patterns started to emerge in the data versus the imposing of predetermined codes to the data; thus codes and categories emerged from students' drawings, and explanations by reading, classifying, and naming students' general categories. For example, ideas on students' drawing of rivers as moving or static bodies of water or as curving or going straight were noted.

From the first reading of the data, initial codes (emergent interpretation of terminology) were constructed reflecting the students' ideas about erosion. This initial coding allowed us to conduct an interpretation of the students' work and to create an emergent list of ideas in reference to vocabulary.

Revision of the emergent codes occurred during a second reading from searching for those examples that fit within the uncovered categories. Then, we organized all the analyzed data under the question being addressed (within the four questions used for data collection), showing a minimized version of students' work for reference. This was done to be able to continue to search for commonalities in students' ideas that were communicated through writing, drawing, and symbols. The analysis ended by looking at each one of the answers and finding commonalities that became more and more specific with every round of analysis.

A general list of related themes was generated and then used to reanalyze the data. In this way, we went through a second round of classification to validate the themes. The data from the field notes and from the elements for language development were analyzed following a similar process, but categories were different as the data were not in the form of drawings and were not part of students' answers to such specific questions.

6.3 Findings of Evaluation of Local Impact: Implementing and Reflecting

For the purposes of this test, we report here the findings in reference to the interpretation of vocabulary words to answer the two proposed questions.

Question #1

What are students' mental representations of the academic vocabulary involved in the teaching and learning of processes of erosion caused by the movement of water?

Our summarization in relation to vocabulary is that students had personal mental representations which were far from the geomorphological context. However, we found that their interpretations, even though made in a non-landform context, were correct and that identifying students' interpretations prior to instruction helped with creating a bridge for the teaching and learning process with the ma-

terials. We grouped students' mental representations of academic vocabulary as follows: (a) in a context other than geomorphology (e.g., transportation as a boat transporting people), (b) inserting a similar word whose meaning is completely different (e.g., erosion for explosion, circle for cycle, or transformation for transportation), and (c) limited scope of word definition (e.g., erosion is not associated with the movement/removal of solids but with any change).

In addition, data from the group of Peruvian participants was revealing in that we noticed that children's prior linguistic and cultural experiences shaped their interpretation of the terminology. Peruvian children shared a common origin and common dominant/first language (Spanish) with the American participants. However, the sophistication of the Spanish language in the Peruvian children allowed them to make better sense while working in answering the questions and discussing visual aspects in the field. Nonetheless, participating children in the US demonstrated translanguaging practices that helped them to better communicate their thinking. As previously documented by other researchers, we noticed that the translanguaging practices are not necessarily negatively related to children's level of bilingualism or to children who were considered more advanced.

Question #2

In what ways might students' mental representations of this academic vocabulary change as a result of their interaction with the INSCIREAD and GoInquire?

Answers from the postassessment show that students were capable of an interpretation closer to that of a geomorphologist, such as the following:

Erosion is when rocks erode, transportation caused by water carries sediment and rocks. Deposition the same thing. They all have things to do with rocks and dirt. (Marta)

The analysis of erosion on still pictures combined with field explorations with deep discussion about their observations helped students in revising their interpretation of the terms. This is relevant because research has shown these representations are generally tiered.

The pictures students analyzed in the computer, taken months before the intervention took place, permitted them to directly observe differences and encouraged exploration of their initial hypotheses. In addition, the groups' online and in-field discussion based on their observations proved to be necessary for providing information about children's underlying mental interpretations of the terms. The presented materials seemed to provide an opportunity for the enrichment of mental interpretations of the terminology since it provided opportunities for the reinterpretation of students' presuppositions (Vosniadou & Brewer, 1992). The combination of learning experiences helped students form rich mental model representations from which greater inference about the domain could be done.

This expansive work demonstrates the connection between language proficiency and conceptual learning. Students interpreted the content terms in contexts other than the expected one. The role of the misapplication of terms in Earth

processes has been explored in the literature (Dove, 1997; Shepardson, Harbor, & Wee, 2005; Cheek, 2010). The fact that some children explained transportation by drawing a car is not surprising. As explained in the literature review, the use of everyday language in a scientific context in Earth Science has been identified in several other studies as a potential source of students' misconceptions (e.g., Happs, 1982; Kortz & Murray, 2009).

It is clear in the data that language creates different images for different students. Teachers need to first explore students' interpretation of words and then help them bridge everyday language to scientific discourse (Torres-Guzman & Howes, 2009). Furthermore, educators need to confront everyday language in the classroom to ensure they use the words in scientific contexts (Dove, 1997).

7. Implications of this Study for DBR and CALL

This chapter has utilized a blended approach with DBR and CALL within an expansive learning theoretical frame to address the complexity of teaching emergent bilinguals conceptually while enriching their linguistic resources. We have attempted to present a step-by-step progression of a DBR model, the ILDF, using a specific context through the Local Impact Phase. Our proposed theory has been explored with students, teachers, experts, and researchers, and we have been able to integrate conceptual and language acquisition by addressing metacognitive thinking through the operationalization of specific learning strategies embedded in the GoInquire system.

As illustrated by this example, design research contains multiple test, analysis, and design cycles. This layered approach is necessary when attempting to address the complexity of many educational contexts. Children's drawings show that understanding slow changes takes time (Ault, 1998).

We hope this chapter will expand the literature on blending DBR and CALL by adding a new theoretical framework. The integration of conceptual and language acquisition addresses (a) metacognitive thinking (learning strategies), (b) funds of knowledge and mental models, and (c) co-construction and its integration within an instructional sequence. This theory leverages the expansive learning in DBR and CALL within the more concrete ILDF model in order to get closer to the ever-evolving contradictions in bilingual education. The proposed approach serves as a model of one of several different ways of collecting and integrating data streams to analyze, create, and test innovative instructional materials for many diverse learners and contexts.

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Chapter 10

The Cyclic Model of Learning: An Attempt Based on the DBR in an EFL context

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Abstract

The purposes of this paper are to (a) elaborate on the Cyclic Model of Learning (CML; Takeuchi, 2007), which was formed based on the four phases of the design-based research (DBR) framework (Amiel & Reeves, 2008); (b) to put the model into practice through use of technology in the field of EFL teaching; and (c) to examine how the CML-based teaching practice influences students' English ability and the instructor's teaching methods. Based on the four phases of the DBR framework, a qualitative investigation was conducted to identify the problems that impede teachers' use of technology in EFL teaching (Sumi, 2011). To ameliorate the problems, following the second phase of the DBR framework, the CML was created and applied to a research project. The most distinctive feature of the CML is its integration of in-class practices with students' out-of-class self-learning with aid of CALL technology. The CML was put into practice and tested on 19 first-year undergraduate students of EFL over the course of one year at a university in Japan. Data were collected, both on- and off-line, in a variety of ways including quizzes, weblog, video recording, questionnaires, and classroom observation. Findings confirmed that CML-based teaching practice contributed to the improvement of both students' English abilities and the instructor's teaching methods.

Keywords

The Cyclic Model of Learning, Design-based Research, Ecological Perspective, EFL, Integration

1. Introduction

Studies of CALL have been experiencing a transitional shift consisting of three stages. According to Warschauer and Healey (1998), CALL research has developed from drill-based "structural CALL" via communication-based "communi-

cative CALL” to content-based “integrative CALL,” which has a sociocultural perspective as its background. In addition, Warschauer and Healey noted the importance of incorporating technology use into teaching practices. Bax (2003), in this connection, pointed out the significance of developing an integrated practice that puts students at the center and enables tutors and students to use technologies for foreign language teaching and learning in a natural educational environment.

Influenced by the aforementioned trend of integrative CALL, many researchers have proposed design-based research (DBR). To the best of the authors’ knowledge, Yutdhana’s (2005) overview is one of the first publication of DBR in CALL, and since then, its potential for CALL has drawn considerable attention. The most distinctive feature of DBR is that it bridges the gap between theoretical research and educational practice (The Design-Based Research Collective, 2003) and is expected to advance theories of learning through actual teaching practices (Sandoval, 2004). Additionally, the current direction of CALL research and the concept of DBR share many common features. Despite this, however, only a handful of studies have been conducted based on DBR in the field of CALL (Hung, 2011).

2. DBR in CALL

The origin of DBR is most closely associated with Brown (1992) and Collins (1992). At this stage of development, DBR was labeled as design experiment (DE) in consideration of research focus, practice, and underlying epistemology (Bell, 2004). DE focuses on understanding of a “learning ecology” (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003), which consists of complex elements of an interacting system of teaching and learning with different types and levels. In contrast to other research methodologies that reduce complex teaching and learning practices to a simple cause-and-effect model with a list of separate factors, DE aims to give a holistic explanation to a design-based practice and has greatly influenced educational studies.

Since DE first appeared in the field of educational studies, it has grown in diversity. As a result, it has become difficult to find theoretical or methodological coherence among efforts purporting to be design experiments (Bell, 2004). In light of the widespread nature of DE, the Design-Based Research Collective (2003) proposed DBR by newly configuring theoretical and methodological advantages of the design-based approach. Their work clearly underlined the character of DBR and showed the direction of ensuring educational studies based on DBR.

With its flexible and practical characters and implications (Cobb et al., 2003), which are beneficial to educational settings that face the new challenges brought on by technological innovation, DBR has begun to be practically applied to teaching practices. Although the number of such teaching practices is quite limited (Hung, 2011), their variety is growing. For example, in the field of mathematics education, Gravermeijek and Cobb (2006) applied a DBR framework to teaching practice and contributed to identifying a local instruction theory. Additionally, in order to respond to the demand of undertaking scholarly inquiry into university teaching and learning practices, Sharma and McShane (2008) administrated

workshop tutorials based on DBR. Yutdhana (2005) introduced DBR as an effective alternative to CALL research and described its two key features as follows:¹

1. designing learning environments, and
2. developing theories of learning

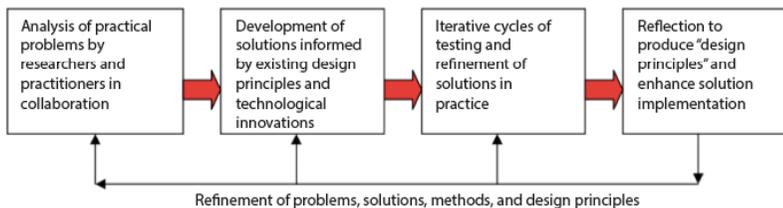
In the next section, we describe a teaching method that was designed based on the DBR framework and implemented in an EFL context.

3. The Cyclic Model of Learning

The four phases of the study are shown below according to the DBR framework (see Figure 1) illustrated by Amiel and Reeves (2008). Following the four phases described in the DBR framework, we conducted a qualitative research study, designed a solution, tested it, and documented the results along with our reflection on their theoretical and practical implications.

Figure 1

The Design-Based Research Framework (adapted from Amiel & Reeves, 2008, p. 34)



3.1 Phase 1: Analysis of Practical Problems by Researchers and Practitioners in Collaboration

In Phase 1, interviews were conducted to evaluate instructors' use of technology in the Japanese EFL context and to identify practical problems that impede instructors' use of technology in foreign language teaching (Sumi, 2011).

The interviews were carried out with 24 participants (12 males and 12 females), all of whom were English instructors experienced in using Language Laboratory (LL) or CALL facilities in the Japanese EFL context. Except for one who was teaching at a junior high school, all were teaching at tertiary institutions. They were selected because of their broad teaching experience and their experience using LL or CALL facilities and computers. Their average length of teaching career was 14.79 years ($Max = 30$, $Min = 1$, $SD = 8.64$ [year]) and experience of using computers was 17.79 years ($Max = 30$, $Min = 5$, $SD = 7.11$ [year]). Nineteen of them had experience using LL facilities, and 16 had experience using CALL facilities.

¹ For more details about the history of DBR and the connection between DBR and CALL research, see Pardo-Ballester and Rodríguez (2009).

A part of the Grounded Theory Approach procedure (Corbin & Strauss, 2008, Chapters 8 and 9) was used in the analysis of the data collected through the interviews.² According to Corbin and Strauss, the Grounded Theory Approach is “a specific methodology developed by Glaser and Strauss (1967) for the purpose of building theory from data” (p. 1), and the analysis in the approach is “a process of examining and interpreting data in order to elicit meaning, gain understanding, and develop empirical knowledge” (p. 1).

MaxQDA 2007 (Kuckartz, 2007) was utilized as a tool for analyzing the data. This software was developed especially for qualitative analysis (Corbin & Strauss, 2008; Lewins & Silver, 2007).

The results revealed three factors that seemed to impede the use of technology in the Japanese EFL context:

1. technology (4 subfactors)
2. environment
3. institution (2 subfactors)

3.1.1 Technology factor

The technology factor includes (a) gaps in intention between system developers and instructors, (b) system instability, (c) operation complexity, and (d) constrained technology settings. The first problem cited by most instructors was the gap between what system developers thought instructors wanted to do and what the instructors actually wanted to do. In addition, the instructors complained about the instability of CALL systems. This problem tends to occur when students log in all at the same time or the instructor sends out large amounts of data. As a result, CALL operating systems become unbearably unstable when processing data traffic, and they sometimes freeze. A number of instructors also reported that operation complexity is another problem. The problem of operation complexity especially occurs when an instructor alternately uses several devices in succession. The last factor, the constrained technology settings of CALL classrooms, prevents instructors from using technology. For example, internet access is limited at one institution for security reasons.

3.1.2 Environment factor

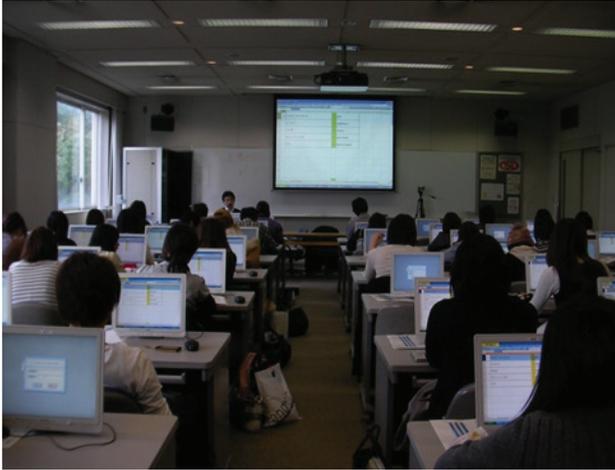
The environment factor contains no subcategories. Most of the instructors' comments centered on the CALL/LL classroom size. In the Japanese context, CALL classrooms are usually designed to accommodate a large number of students. The classroom size, therefore, is often bigger than usual. In addition, the classrooms are crammed with a maximum number of desks, chairs, and computers. The room size and equipment obstacles can impede smooth interaction between the instructor and students. Figure 2 shows an example of a CALL classroom. The classroom

²According to Corbin and Strauss (2008), there are four steps in the process of the Grounded Theory Approach: open coding, axial coding, comparative analysis, and conceptual saturation. In this study, the steps from open coding to comparative analysis were applied.

was designed to accommodate about 60 students, and each student had an individual computer, leaving almost no space available for instructor-student interaction.

Figure 2

A CALL Classroom



3.1.3 Institution factor

Lastly, the institution factor, which includes the lack of (a) teacher support and (b) teacher training, should be explained. These factors were also identified in Chambers and Bax (2006). Most of the instructors interviewed reported they would like to have some sort of support or teacher training in the use of technology in foreign language teaching.

3.1.4 Summary of interviews

Through the interviews, three impeditive factors emerged: (a) technology, (b) environment, and (c) institution. Instructors use facilities in a limited way, adjusting their teaching styles or lesson plans to the environmental and technological settings of the classroom. Many instructors believe that using computers for foreign language education is effective, but LL or CALL facilities are not necessarily utilized as intended and are often regarded as impeding face-to-face interaction between the instructor and students. Instructors also tend to be fearful of using technologies for teaching because of the complexity of the system features and interface design of CALL facilities.

The authors suspect that the instrumental perspective (Warschauer, 1998), which views technology in isolation from its users and their contexts (G. E. Kersten, Kersten, & Rakowski, 2004), can be a root cause of these problems. If we base our teaching approach on that perspective, we can easily presume the usefulness of new technology and adopt it without considering the classroom contexts wherein teachers actually use technology in language teaching. Similarly, Bax

(2003) criticized the instrumental perspective as the “Sole Agent fallacy” (p. 26), which means that neglecting the factors indispensable for successful CALL implementation discourages its use in teaching. The following instructor’s comment seems to summarize succinctly a dilemma that may be shared by many instructors in the Japanese EFL context:

If I could use technology appropriately during lessons, it could help my students understand better and I could make my lessons more appealing. But, in reality, I am just worried about using it in a way that goes beyond my current skills. I do not want to waste my time just on handling devices during lessons, so I use them as far as I can handle them.

3.2 Phase 2: Development of Solutions Informed by Existing Design Principles and Technological Innovations

3.2.1 Ecological perspective

In Phase 2, an instructional model and learning environment were designed as a solution with design principles and technological innovations. In the previous phase, three factors were identified (i.e., technology, environment, and institution), and we concluded that the instrumental perspective can cause problems that impede instructors’ use of technology in foreign language teaching. We believe, however, these situations can be improved by taking an alternative perspective, namely, the ecological view, into account in designing and implementing technology for foreign language teaching (Bax, 2000, 2003; Chambers & Bax, 2006; Tudor, 2002, 2003).

According to Tudor (2003, p. 4), “an ecological perspective involves exploring language teaching and learning within the totality of the lives of the various participants involved, and not as one sub-part of their lives which can be examined in isolation.” Therefore, an ecological perspective on the use of technology for foreign language teaching involves exploring language teaching within the totality of the context in which it actually occurs (Warschauer, 1998).

From the ecological perspective of second language acquisition, van Lier (2004) proposed ecological linguistics and argued that language learning emerges from the context in which language learners are engaged and wherein they draw on affordance. According to him, affordance for language learning means “a relationship between an organism (a learner, in our case) and the environment that signals an opportunity for or inhibition of action” (p. 4). In this sense, the person and the environment are inseparable in a context (Thorne, 2003; Zukow & Ferko, 1994). Applying this idea to CALL research, it can be said that persons (i.e., teachers and learners) and technology are interrelated in the classroom context.

Bronfenbrenner (1989, p. 188) defined human development as “a joint function of person and environment” and formulated the theory based on Lewin (1935) as follows:

$$D = f(PE)$$

According to Bronfenbrenner (1989), *D* refers to “development,” *P* to “person,” and *E* to “environment.” *D* is a function of both personal and environmental factors. In a similar vein, we believe that technology use in foreign language teaching cannot be discussed separately from the context and should be integrated into the teaching context. To put into effect an ecological perspective with the foregoing in mind, we present an extended version of Bronfenbrenner’s formula as a design principle for developing a teaching model:

$$U = f(PCT)$$

In this formula, *U* refers to the “use of technology in foreign language learning,” *P* to “person,” including teachers and learners, *C* to “classroom context,” and *T* to “tools.” The process of technology use in foreign language teaching can be described as a joint function of person, classroom context, and tools. By looking at technology use in our field by means of this formula, we think that technology can obtain a “field of meanings” (Wenger, 1990) and be integrated into the classroom context (cf. “normalization,” Bax, 2003).

3.2.2 The Cyclic Model of Learning (CML)

Based on the ecological perspective, CML (Takeuchi, 2007) was designed with a special focus on the local context, namely, Japanese EFL classrooms. The most distinctive feature of the CML is that it integrates in-class teaching practices with students’ out-of-class self-learning with the aid of technology. In addition, the CML attempts to elicit student participation in lessons and to promote self-learning outside the classroom, both of which are considered to be indispensable to successful EFL learning (Takeuchi, 2002).

In CML, the process of foreign language teaching cannot be divided into a series of single in-class lessons but rather is considered to be a cumulative result of each in-class lesson and students’ out-of-class self-learning. As van Lier (1998, p. xv) argues in reference to Breen (1985), “a genuine second-language learning environment in which language development primarily occurs outside the classroom, but can be intensified and consolidated inside it.” Further, van Lier (1996, p. 43) insists, “The more lessons I observe, the more I become convinced that language development occurs *between* lessons rather than *during* lessons” (original italics). These remarks seem to support the main idea stipulated in CML that two distinctive but interrelated flows are essential in the teaching process. These two flows are (a) a teaching flow within the lesson, which refers to how an instructor conducts one lesson, and (b) a teaching flow between lessons, which connects one in-class lesson with the next via technology. These two teaching flows create the classroom context in which actual language teaching and learning occur. Figure 3 presents an overview of the classroom context in CML.

In CML, furthermore, preparation and reflection phases are implemented before and after each lesson (a) to facilitate the teaching flow within the lesson, (b) to reinforce the teaching flow between lessons, and (c) to connect these two flows (see Figure 4). In the preparation phase, technology is used to provide resources related to the lesson in order to activate students’ schema and prepare them for

the lesson. Then, in the lesson, the instructor facilitates students' use of the target language and elicits their participation in classroom activities. Afterward, in the reflection phase, students are guided to review the lesson through the resources provided via technology.

Figure 3
Overall Picture of the Classroom Context

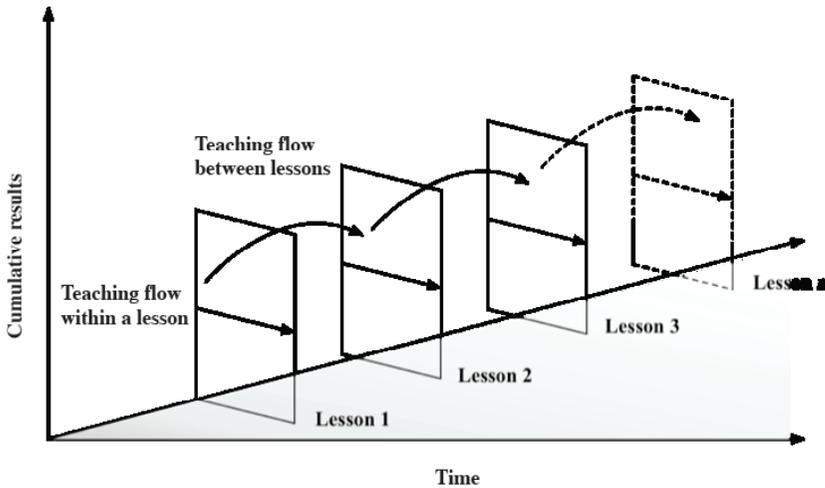
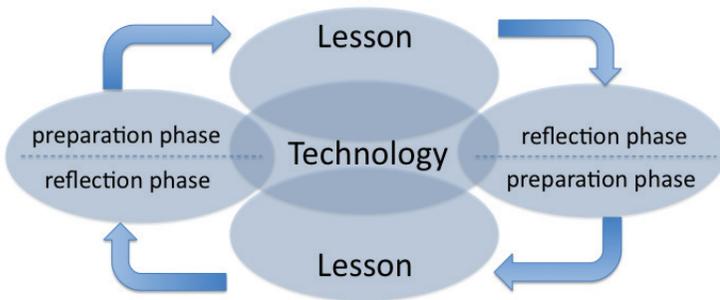


Figure 4
Cyclic Model of Learning



CML also makes it possible to expand time and space for teaching (Sumi, Takeuchi, Yamamoto, & Nabei, 2005). This extension can often reinforce students' commitment to the class and thus facilitate their voluntary learning out of the class. To learn English in the Japanese EFL context, self-learning beyond school lessons is essential. According to Saegusa (1985, 1993), in order to reach Level 3 on the Foreign Service Institute Scale, students must spend 1,920 to 2,280 hours

learning English. This means that if a student starts learning English in the first year of lower secondary school (seventh grade) and finishes at the end of university, the number of learning hours needed to reach Level 3 would be 2.5 times that required in schools in the Japanese EFL context. However, by effectively utilizing time between lessons and using the resources provided by means of technology outside the class, students can significantly expand their learning hours. Thus, we believe the CML can be an effective solution for ameliorating the major disadvantage of learning English in the Japanese EFL context, that is, a dearth of learning hours.

3.2.3 Technological innovation

To integrate in-class teaching practices with students' out-of-class self-learning and to implement the preparation and reflection phases before and after each lesson, we decided to use web technology such as a learning-management system (LMS) because it has become extremely difficult and unnatural for instructors to limit the use of technology to the inside of the classroom. Warschauer (2005) said that students now use new technology *outside* rather than *inside* the classroom. Similarly, Taylor and Gisaki (2003) mentioned that the traditional CALL lab is no longer the only place where students are exposed to authentic resources for language learning through the use of technology.

From a technological viewpoint, the advancement of research on CALL has allowed web-based technologies such as LMS or CMS to be considered as an integration tool. The advantage of using such web-based technologies is that they allow tutors to supplement in-class instruction and to incorporate student self-learning into classroom activities (Kung & Chuo, 2002). For example, van Deusen-Scholl, Frei, and Dixon (2005) identified the advantage of using online resources, stating

One in-class activity determines its continuation online, and the online activity determines the following in-class activity. This cycling—or spiraling—builds the foundation for on-going reflection of language production and complexity. (p. 664)

Similarly, Levy and Kennedy (2004) employed web-based audio-conferencing tools as a means of allowing students to speak in the target language outside scheduled class time. More recently, Stickler and Hampel (2010) provided a Moodle-based intensive online German course, and Sumi and Takeuchi (2010) conducted blended learning practices using an LMS in junior high school and university environments. These features and advantages of using web-based technologies soundly fulfill CML's precepts and ameliorate problems found in the first phase.

3.3 Phase 3: Iterative Cycles of Testing and Refinement of Solutions in Practice

3.3.1 Implementation of CML

In Phase 3, to test the solution proposed in Phase 2, a teaching practice based on CML was designed, and it was tested on 19 (4 male and 15 female) first-year un-

dergraduate students over the course of one year. The class was an elective course open to students interested in advanced English lessons. Their English ability was relatively high for college students (TOEIC Test score range of 500 to 600),³ and they were highly motivated.

The course instructor had over 20 years of teaching experience and held a Ph.D. and two M.A. degrees in language teaching and its related fields. His first language was Japanese, and he had high proficiency in English, evidenced by almost full scores on the TOEIC and TOEFL tests.

The purpose of the class was to improve EFL students' reading ability. The class met for 90 minutes once a week for 13 weeks in each semester, which means that there were 26 lessons over the course of the academic year. Class was held in an ordinary small classroom with no computers. The lessons were mainly conducted in English. The classroom had portable chairs with flat writing tables, so that students could easily move them to form seating for pairs or groups (see Figure 5).

Figure 5

A Lesson in the CML-Based Class



In addition to in-class teaching practice based on the CML design principles, three roles were given to the LMS used in the study. The “pre-lesson” was the first phase of instruction. Its aim was to activate students’ schema and prepare them for learning. For this purpose, preview materials were posted on the LMS and made available to the students before the lesson. Figure 6 shows an example of the main page for the preview materials.

³ The maximum possible score on the TOEIC Test is 990. The average score of Japanese university students in 2010 was 445 (for more details, see <http://www.toeic.or.jp/toeic/pdf/data/DAA2010.pdf>).

Figure 6
Sample Main Page in the LMS

Unit 15 Andy Warhol's Early Years

COLUMN • Read 01 • Read 02 • Unit 15 復習 • 形音詞一覧

Getting Ready to Read COLUMN

Back ground of the story

本文の背景: アンディ・ウォーホル(1928-1987)は本名をアンドルー・ウォーホル(Andrew Warhola)といい、1928年ペンシルバニア州で生まれたといわれています。アンディ・ウォーホルは1960年代を代表するポップ・アーティストと呼ばれています。彼の作品には、スーパースターや青森県秋田市のピンコといった日本の生活感あふれるものから、エルビス・プレスリーやマリリン・モンローの著名人をモチーフとした抜粋のひらめきの世界までが描かれています。(引用: 竹内、池田、西川(編著)、『Tapestry Reading』松田社)

彼の作品のオザリナリティーはどこにあるのでしょうか? また彼の作品に表現された当時のアメリカとはどのような国だったのでしょうか? 教科書を参考にしながら関連リンクなどをたどって彼の世界観に思いがけず理解を深めていきましょう。

STRATEGY

■Unit 15の読解方略

このUnitでは以下の読解方略について学びました。

■【読解方略その二】

■第一法則 N1 + N2 + V1を見つけたら、N1とN2の間に関係代名詞を挿入しよう

■第二法則 N1 + N2 + V1 のVは関係詞のV、必ず主語のV2を探しに行こう。」

このUnitでは、N + N + Vを見つけたら、Nの間に関係代名詞を挿入する読解方略について学びました。

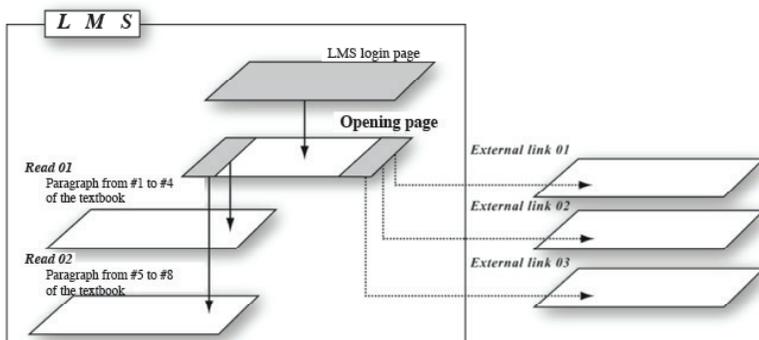
例えば、The company I am affiliated with shows a great profit.を読み解くには?

MEMO
In the future, everyone will be famous for fifteen minutes. -ANDY WARHOL.

関連リンク
WARHOL
Art Photo site
Warholore
Warhol.com
Desk Tacy

The main page showed background information and reading strategies to help students understand the contents of the textbook. In addition, this page was divided into two columns. The left column contained links to a digitalized version of the textbook. There were two links labeled “Read 01” and “Read 02” respectively. The division of “Read 01” and “Read 02” was decided in accordance with the quantity of texts. By clicking the icons on the main page, students could see the text and listen to its narration in English. Then, the right column of the main page contained images and several external links to English language websites related to the textbook contents. These were provided with the goal of helping the students expand their knowledge beyond the contents of the textbook and gain exposure to authentic English. Figure 7 shows the layout of the learning materials on the LMS.

Figure 7
Layout of the Learning Materials in the LMS



The second phase of instruction was the lesson: The instructor taught a lesson in an ordinary small classroom (see Figure 5 above) rather than a CALL classroom. The main focus of this phase was to elicit student participation and utterances in the target language. Collaborative activities such as group work, pair work, and group competition were extensively used to facilitate both instructor-student and student-student interactions.

The last phase is the post-lesson focused on giving students both review and additional study materials through the LMS and also guiding them to the next lesson. All materials were developed and posted on the LMS through consultations with the course instructor. One of the authors also participated in every lesson and worked as a teaching assistant. Soon after the lesson, using the notes and recorded videotapes from class, he created materials that reflected the lesson contents and posted them on the LMS as resources for review and additional study. These materials included the important review points of the lesson and some additional information concerning the reading materials. At the beginning of each class, a quiz was given to assess students' understanding of the previous lesson. This encouraged the students to review the materials posted on the LMS because they often summarized main points that might appear as questions on the quiz.

3.4 Data Collection and Analysis

To examine the influence of the CML-based teaching practice on (a) the improvement of students' English ability and (b) the instructor's teaching methods, data were collected in a variety of ways based on the concept of triangulation. Triangulation is a research methodology that enables us to examine the complex structure of practices from multiple sources (Dörnyei, 2007).

To investigate the influence of the CML-based teaching practice on the improvement of students' English ability, a reading section of the First Certificate in English (FCE), which is a standardized ESL test developed by University of Cambridge ESOL Examinations, was administered. Scores on this test are considered to be a reliable indicator of general reading ability (Chalhoud-Deville & Turner, 2000).

The test was administered four times a year, at the beginning and end of each semester. The same test was used all four times, but the order of multiple-choice items in each section of the test was changed each time. In addition, the question and answer sheets were collected each time, and there was a relatively long interval between each test administration. Additionally, no advance notice was given that the same test would be used again. The test scores were analyzed using nonparametric statistical analysis because the number of students was small and the normality of the data could not be guaranteed (Siegel & Castellan Jr., 1988).

The relationship between students' number of access log entries and total quiz score was examined to determine whether there was a correlation between them. The quizzes were conducted at the beginning of each lesson to evaluate students' understanding of the previous lesson, and the quiz score was considered to be a

measurement of their achievement. Access log entries were automatically counted when the students logged into the LMS system to access the materials. The frequency of the access log entries was considered as indicator of how often the students used the materials for self-learning.

To investigate the influence of the CML-based teaching practice on the instructor's teaching methods, qualitative data from video recordings, field notes from the lessons, and interviews with the instructor were collected. Video data were categorized to explore how the instructor conducted the lesson. Twenty-six lessons were taught over the year, equivalent to a total of 39 hours of study. However, data from the lessons used for the class orientation, tests, and a guest speaker session were omitted. Therefore, 24 hours of data were included in the final categorization. An interrater reliability of 20% of the data analysis was calculated between the authors and a postgraduate student of foreign language education. The interrater agreement was 85.0%, which the authors judged to be an acceptable level (Potter, 1996). Disagreements between the raters were discussed and resolved. The questionnaire included 77 items that asked about (a) the lessons (26 items), (b) self-evaluation (7 items), (c) the instructor (6 items), (d) friends (7 items), (e) the teaching assistant (6 items), and (f) the LMS (25 items). The questionnaire items were designed through consultation with the course instructor. For each item, participants were asked to rate their agreement with the given statement on a 5-point Likert scale (5 *Absolutely agree*, 4 *Agree*, 3 *Somewhat agree*, 2 *Disagree*, and 1 *Absolutely disagree*). Cronbach's alpha was .82, which suggests strong consistency. All data related to the CML-based teaching practice were collected with the permission of the course instructor and the student participants.

3.4 Phase 4: Documentation and Reflection to Produce Design Principles

In Phase 4, the final phase, the data analyzed in Phase 3 were documented and interpreted to propose a new set of design principles and guidelines that can be referred to and followed by other similar practices within their specific educational context (Marden, Herrington, & Herrington, 2009).

3.4.1 Students' English ability

Table 1 shows the results of the reading section of the FCE test. The maximum possible score on the FCE test is 35. Data for only 17 students were analyzed, as two students were absent on one of the test days. The Friedman test was conducted to identify the overall differences among student scores on the four tests, and a significant difference was found ($\chi^2 = 15.93, p < .01, r = .38$), thereby confirming an improvement in the students' English proficiency level following the CML-based teaching practice (see Table 1).

Table 1
Results of the FCE Tests

FCE	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>	<i>Median</i>
First	17	17.41	3.86	10	24	17
Second	17	20.82	2.24	13	24	22
Third	17	22.35	3.92	13	27	23
Fourth	17	22.94	3.80	14	28	24

For an in-depth analysis, the students were divided into two groups based on their first FCE score. The cut-off point was 17 ($M = 17.41$, $SD = 3.86$), and the Mann-Whitney U test was applied to evaluate whether there was a significant difference in proficiency between the two groups. A significant difference was found ($U = 0$, $p < .01$, $r = -.85$). Accordingly, the two groups were designated as Group H (high score group [$n = 8$]) and Group L (low score group [$n = 9$]) (see Table 2).

Table 2
Student Grouping Based on the First FCE Score ($N = 17$)

Group	Student ID	First FCE Score	Rank
High	M02	24	1
High	F16	23	2
High	F03	21	3
High	M04	21	3
High	F04	20	5
High	F05	20	5
High	F07	20	5
High	F10	18	8
Low	F11	17	9
Low	F02	16	10
Low	F12	15	11
Low	F14	15	11
Low	F15	15	11
Low	F01	14	14
Low	M03	14	14
Low	M01	13	16
Low	F09	10	17

The Wilcoxon signed-rank test was used to analyze the difference of results between the first and fourth FCE for each group. A significant difference was found in Group L ($T = 1, p < .01, r = -.61$) but not in Group H ($T = 3, p > .05, r = -.47$) (see Tables 3 & 4).

In addition, the Mann-Whitney U test was applied to evaluate whether there was a significant difference between the two groups in terms of the fourth FCE results. No significant difference was found ($U = 22, p > .05, r = -.33$). This finding suggests that the Group L students notably improved their English ability and increased their test scores. As a consequence, the average scores of the two groups were fairly close on the fourth FCE test.

Table 3
Group L Scores on the First and the Fourth FCE Tests ($n = 9$)

Group	Student ID	First FCE Score	Fourth FCE Score
Low	F11	17	23
Low	F02	16	28
Low	F12	15	24
Low	F14	15	17
Low	F15	15	14
Low	F01	14	26
Low	M03	14	21
Low	M01	13	26
Low	F09	10	22
	<i>Mean</i>	14.33	21.78
	<i>SD</i>	1.89	4.05

Table 4
Group H Scores on the First and the Fourth FCE Tests ($n = 8$)

Group	Student ID	First FCE Score	Fourth FCE Score
High	M02	24	24
High	F16	23	22
High	F03	21	27
High	M04	21	24
High	F04	20	24
High	F05	20	26
High	F07	20	19
High	F10	18	28
	<i>Mean</i>	20.88	24.25
	<i>SD</i>	1.76	2.68

Table 5 shows the sum total of quiz scores and the number of access log entries of each student. To identify the correlation between the two sets of variables, the Spearman rank-correlation was used, and the results indicated that there was a relatively strong relationship between them ($r_s = .61, r^2 = .37$). It is thus possible to maintain that the number of times the students visited the LMS may have influenced their achievement.

Table 5
Students' Quiz Scores and Total Number of Times Students Accessed the LMS
($N = 17$)

Student ID	Quiz score	Number of access times
F01	109.50	41
F02	128.00	71
F03	125.50	58
F04	92.50	26
F05	105.00	18
F07	106.10	42
F09	127.10	56
F10	128.40	24
F11	105.00	29
F12	115.50	26
F14	87.10	33
F15	70.60	25
F16	120.60	53
M01	52.50	20
M02	98.50	14
M03	78.24	14
M04	96.00	10

Table 6 summarizes the number of access log entries and FCE gain scores of each student. The FCE gain score was calculated by subtracting the first FCE score from the fourth FCE score. The Spearman rank-correlation was again used, and there was only a weak correlation between the two sets of data ($r_s = .14, r^2 = .02$). However, when the data set of Group H was omitted and then the Group L data were analyzed in the same way, a relatively strong correlation between the access log entries and the raw gain scores was found ($r_s = .59, r^2 = .35$). This result suggests that the number of times the students used the LMS may have influenced their FCE gain scores in Group L.

Table 6

Total Number of Times LMS was Accessed and the FCE Gain Scores ($N = 17$)

Group	Student ID	Number of times LMS accessed	FCE gain
High	M02	24	0
High	F16	53	-1
High	F03	58	6
High	M04	10	3
High	F04	26	4
High	F05	18	6
High	F07	42	-1
High	F10	24	10
Low	F11	29	6
Low	F02	71	12
Low	F12	26	9
Low	F14	33	2
Low	F15	25	-1
Low	F01	41	12
Low	M03	14	7
Low	M01	20	8
Low	F09	56	12

3.4.2 Changes in the instructor's teaching methods

A part of the Grounded Theory Approach procedure (Corbin & Strauss, 2008, Chapters 8 and 9) was used to classify the video data of the lessons. As a result, the following four categories were generated:

1. Quiz
2. One-way Instruction
3. Interactive Instruction
4. Activity

The "Quiz" category includes time in which quizzes were conducted at the beginning of each lesson. "One-way Instruction" refers to the period of time in which the instructor elaborated on the reading materials or related issues in one-way instruction in English. "Interactive Instruction" includes time in which the course instructor and students interacted directly, that is, the instructor asked questions and the students answered, or vice versa. Lastly, "Activity" refers to time in which students engaged in activities related to the lessons such as sharing information about the reading materials or helping each other understand the materials. Table 7 presents the results of categorization of the video data.

Table 7

Categorization of Video Data in Hours, Minutes, and Seconds (h:m:s)

	Quiz	One-way Instruction	Interactive Instruction	Activity
First semester	2:30:16 (18.55%)	4:33:47 (33.80%)	2:44:14 (20.28%)	3:41:43 (27.37%)
Second semester	2:09:46 (20.60%)	3:44:12 (35.59%)	3:06:18 (29.57%)	1:29:44 (14.24%)
Total	4:40:02 (19.45%)	8:17:59 (34.58%)	5:50:32 (24.34%)	5:11:27 (21.63%)

As Table 7 shows, the instructor's methods of conducting the lesson seemed to be fully interactive and cooperative. The period of time that the instructor spent on "Interactive Instruction" accounted for 24.34% of the total lesson time. During the "Interactive Instruction," students spontaneously gave their opinions in response to the instructor's questions, and he helped them complete their utterances in English in a variety of ways by offering scaffolding. In addition, "Activity" time, in which students were allowed to learn individually or cooperatively, amounted to 21.63% of the total lesson time. "Interactive Instruction" and "Activity" together accounted for 45.97% of the total lesson time.⁴

Below is a scene from a lesson that was categorized as "Interactive Instruction." At the beginning of the lesson, the instructor asked a student a question related to the topic of the reading materials in the textbook.

- Instructor: What questions do you want to be asked?
 Student: About travel.
 Instructor: About traveling, OK. Do you like traveling very much?
 Student: Yes.
 Instructor: Why do you want to be asked about traveling?
 Student: I have many places to visit...
 Instructor: Ah-ha, you have many places that you want to go.
 Student: So, I want to be asked about it.
 Instructor: Where do you want to go?
 Student: New Zealand.
 Instructor: Why do you want to go to New Zealand?

⁴ The amount of time spent on "Interactive Instruction" and "Activity" together accounted for only 35.0% in other courses examined to obtain the baseline data for comparison. Although this figure was informal, we can note that there was a great difference between the course described in this study and other courses.

- Student: Because I heard the country is safe. I know some people from New Zealand. They are great people.
- Instructor: OK, the country is said to be safe. I don't know exactly, but the country is safe and people from there are nice to you.

In this interaction, the instructor elicited the student's utterances and offered scaffolding to facilitate the interaction. First, the instructor posed an open question to the student, who responded with a simple answer. Second, after hearing the student's answer, the instructor swiftly asked a follow-up question correcting her utterance and gave her another opportunity to answer his question: *Why do you want to be asked about traveling?* Third, he offered scaffolding to help her complete her sentences in English: *Ah-ha, you have many places that you want to go.* With the help of the course instructor, the student could complete her utterance. Lastly, the course instructor gave the student and class feedback on the student's comment, which helped her understand exactly how she could say what she wanted in English: *OK, the country is said to be safe. I don't know exactly, but the country is safe and people from there are nice to you.* These "interaction frames" (Fogel, 1993), which started from a simple "Question and Answer" phase and finished at a "Feedback" phase through a "Scaffolding" phase, were observed many times during the lesson and established the teaching flow of the lessons.

This sample interaction reflects that the CML-based teaching practice ameliorated factors that hinder smooth interaction in LL/CALL classrooms and allowed the instructor the flexibility necessary to conduct student-centered activities while offering scaffolding to the students. As a result, the instructor successfully facilitated the student's use of the target language and elicited her participation in classroom activities.

In the interview, when the course instructor was asked why he was able to spend sufficient time on interactions and student-centered activities during the lesson, he commented as follows:

Since I started using the LMS in connection with the lesson, I was able to divide the contents into what I should teach during (in-class) lessons and what I can let the students study on the website. As a result, I was able to offer many student-centered activities within the lesson and give the students many opportunities to speak in English.

In another part of the interview, he also commented as follows:

I think the amount of time available for activities within a lesson drastically increased with the aid of the LMS, and the students seemed to enjoy learning and speaking up in English in activities. I also think that these positive experiences that the students had in the activities helped them maintain their focus throughout the course while studying English. These positive experiences also might have become the students' motivation for visiting the LMS after each lesson.

These comments, along with many similar comments obtained in the interview data, indicate that the instructor changed his teaching methods after he adopted the CML-based teaching practice.

The students also gave positive feedback on the CML-based teaching practice. In response to the questionnaire item, *Do you think it was good to do activities in the lesson?* 94.7% of them ($n = 18$) indicated “Absolutely agree” or “Agree.” In addition, to the question *Do you think there were sufficient opportunities to give your opinions in the lesson?* 89.5% of the students ($n = 17$) responded “Absolutely agree” or “Agree.”

3.4.3 Reflection

The results described above suggest that the CML-based teaching practice, which was designed, tested, and analyzed following the DBR framework by Amiel and Reeves (2008), helped improve students’ English ability as well as the course instructor’s teaching methods. Also, the CML-based practice expanded time and space for the class; the instructor could use the resources on the LMS as an “extended learning environment” (van Deusen-Scholl et al., p. 657), dividing the syllabus between what he should teach in class and what the students could study on the website. As a result, he could spend more time on student-centered activities in the lessons and offer the students numerous opportunities to speak English without having to worry about using technology in the classroom. The time and opportunities for student-centered activities in class may have contributed to eliciting the students’ participation in the lesson and to effectively guiding them to the learning materials in the LMS. This learning cycle seemed to help increase the number of students’ learning hours outside the lesson, which is indispensable for EFL learning, especially in the Japanese EFL context (Takeuchi, 2002). In addition, the course instructor’s teaching methods may have contributed to creating positive relationships among the students. Especially in Group L, this relationship helped them voluntarily participate in classroom activities.

In this study, however, the improvement of the Group H students was not statistically significant. A few students in Group H even scored lower in the raw gain result of the FCE tests, although their performances in relation to the number of access log entries and quiz scores was similar to that of the students in Group L. This may be because the ceiling effect influenced the Group H students’ performance on the FCE test scores.

3.4.4 Design principles

Based on the results of the implementation of the CML-based teaching practice through the four phases of the DBR framework, additional design principles for foreign language education in EFL context are identified as listed below.

1. Consider persons, classroom context, and tools as one interacting system for foreign language education.
2. Integrate in-class teaching practices with students’ out-of-class self-learning with the aid of technology.

3. Expand time and space for foreign language teaching and learning, especially in the EFL context.
4. Divide foreign language education into what instructors should teach in class and what they can allow students to do as out-of-class self-learning.
5. Facilitate interaction in class, offering students pedagogical scaffolding.
6. Guide students to out-of-class self-learning.

4. Conclusion

Before the conclusion of this paper, some limitations should be addressed. First, the ecological perspective was discussed here only from the teaching perspective. To discuss the ecological perspective in its full sense, the viewpoints of learners, school administrators, and software/hardware developers should be included as well. Second, the CML-based teaching practices were tested only with an LMS. To investigate a wider range of applicability, similar teaching practices should be designed and implemented with other types of technology, such as smartphones. Therefore, additional tests should be conducted in a different type of practice representing the Japanese EFL context. Finally, the method for investigating the influence of the CML-based teaching practice on the progress of students' English ability should be improved. In this study, a reading section of the FCE was administered four times. Although numerous efforts were made to minimize the expected negative impact of the repeated administration, using the same reading passage four times may still weaken the validity of the test results. For further improvement, a computer adaptive test or other standard tests that have consistent measurement across different versions should be considered.

Despite these limitations, the CML based on the DBR framework for foreign language education was successfully proposed. It was shown to have a positive influence on the improvement of students' English ability and the course instructor's teaching methods. In addition, six design principles were proposed. These principles will allow similar teaching practices to develop their own models and establish new design principles through successive iterative cycles of DBR.

Authors' Note

This chapter is dedicated to the memory of Dr. Leo van Lier.

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Chapter 11

Design Principles for Language Learning Activities in Synthetic Environments.

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Abstract

The present study examines 79 Spanish language learners' experiences and perceptions in a synthetic environment used in two hybrid Spanish courses. This study adopts a design-based research (DBR) approach to investigate design principles for language learning activities in synthetic environments. Sociocultural theory (SCT) and Second Language Acquisition (SLA) were used to analyze interactions with native language speakers. Data from chat exchanges and a role-play task show how these learners were able to learn vocabulary and participate in expert and novice dialogues in the construction of meaning. The designed language tasks in the present study were created and improved by following iterative research cycles in 2009 and 2010. Through this, we hope to shed light on the opportunities created for language development in relationship to the affordances of virtual worlds.

Keywords

Design-Based Research, Sociocultural Theory, Design Principles, Second Life®, Hybrid Courses

1. Introduction

Today's second language learners are comfortable using social networks such as Facebook, MySpace, Twitter, and others without much effort (McBride, 2009). Educators have also used these types of social network programs to provide input to students and to prompt learners to produce meaningful output in a collaborative and interactive way (Mitchell, 2012). These tools have captivated the attention of teachers and researchers alike with their promise to enrich learning as an active and social process in the classroom and beyond.

The increasing availability and accessibility to synthetic environments have motivated teachers and researchers to use the diverse tools in these environment

(e.g., Quest Atlantis, Second Life®, etc.) to create virtual contexts for language learning and teaching (Deutschmann, Panichi, & Molka-Danielsen, 2009; Zheng, 2012; Zheng & Newgarden, 2012). Synthetic environments such as virtual worlds provide opportunities for experiential learning, collaboration, and social construction of knowledge (Bixler, 2007; Warburton, 2009). Specifically, virtual worlds have been explored to (a) better understand their affordances for educational purposes (Kemp & Haycock, 2008; Mayrath, Traphangan, Heikes, & Trivedi, 2011; Mazar & Nolan, 2008), (b) investigate their capabilities and limitations (Cooke-Plagwitz, 2008; Young, 2010; Sykes, Oskoz, & Thorne, 2008), (c) explore how and what multiplayer players in online games learn in specialized areas such as education (Steinkuehler, 2007; de Freitas, 2006), and more recently (d) better understand how these synthetic environments might support second language acquisition (SLA) (Thorne, 2008; Sykes, 2009; Kuriscak & Luke, 2009). Although these contributions have undoubtedly enriched our understanding of how these environments can potentially enhance teaching and learning, there is still very limited data-driven research regarding perceptions toward language learning and teaching in Second Life® (Kuriscak & Luke, 2009; Wang, Lefaiver, Wang, & Hunt, 2011).

This chapter reports findings from two studies that investigated one of the most popular multiuser virtual world platforms: Second Life® (SL). The purpose of this report is to extract a set of design principles to guide the implementation of language learning tasks in SL by exploring students' experiences and perceptions in this environment. Different language activities such as a role-play task (e.g., an original version of the Little Red Riding Hood tale) and the interaction with a Spanish native speaker (NS) were implemented in SL. Sociocultural theory was used to explain how the SL chat, defined as text-based synchronous communication between a NS and a nonnative speaker (NNS) or among more users, resulted in the understanding of Spanish language and culture.

The complexity of learners' perceptions and experiences, the ease with which the SL learning environment could be modified, and the almost certainty that the design of the tasks would need to be revised prompted us to select Design-Based Research (DBR) as the most suitable approach. DBR has been described as an iterative cycle composed of multiple steps such as exploration of the design, enactment of interventions, evaluation and analysis of the outcomes, and redesign (Design-Based Research Collective, 2003). DBR allows us to investigate changes over time according to the outcomes observed in each cycle and therefore refine as well as synthesize new design principles (see Reeves & McKenney in this volume). The main research questions addressed in this study were the following:

1. How do different task designs affect the learning of the language on students?
2. How do learners perceive the synthetic world as a tool to assist them in their language learning?
3. What specific affordances of the synthetic world create opportunities for SLA?

In the next section, we review the pertinent literature and present the theoretical framework and the context of the studies. Then we describe the DBR methodology and the implementation process. The results of the study are presented in the order of the research questions. We conclude with implications and recommendations in the form of design principles.

2. Literature Review

2.1 *The Virtual World of Second Life*®

SL is a popular and sophisticated online 3D virtual world platform created by Linden Labs which allows users to design and build virtual spaces and artifacts. SL has been also described as a multiuser virtual environment (MUVE) (Cooke-Plagwitz, 2008) or, simply, as an online game in which people meet to socialize and interact with other users around the world (Bixler, 2007). Although there are other online multiuser environments such as There (<http://www.there.com>), Active Worlds (<http://www.activeworlds.com>), Everquest, Start Wars Galaxies (Brown & Bell, 2004), Quest Atlantis, and River City Project (Evans, Mulvihill, & Brooks, 2008), SL appears to be the virtual tool that has gained greater attention from world language educators and instructors worldwide (Cooke-Plagwitz, 2008; Kuriscak & Luke, 2009; Sykes, 2009; Wang, Lefaiver, Wang, & Hunt, 2011). Quite possibly, a factor that has contributed to the popularity of SL is the fact that not all MUVES possess participant-created communities (Zheng, 2012). Other synthetic worlds, such as Quest Atlantis and River City Project, focus solely on educational purposes (Evans, Mulvihill, & Brooks, 2008).

SL contains an array of computer-mediated communication (CMC) tools that can be used by the residents in synchronous or asynchronous manner. Users can communicate with all users within a range or with selected users (private) via text and voice chat. SL also offers users the ability to create identities or personas. In the context of language learning, SL affords learners opportunities to practice the language in authentic and relatively low-risk environments (Sykes, Oskoz, & Thorne, 2008) and also offers instructors the possibility to enact constructivist pedagogical practice (Evans, Mulvihill, & Brooks, 2008). The environment additionally enables social learning through observation and interaction (Smith & Berge, 2009) and can support second language learning (Sykes, Oskoz, & Thorne, 2008). SL also is an ideal collaborative tool for bringing together learners from diverse cultures (Wang, Song, Stone, and Yan, 2009), as well as for teaching hybrid and distance courses due to its flexibility in time and space (Kemp & Haycock, 2008) and for the possibility to lower student anxiety and increase their motivation to learn a foreign language (Wehner, Gump, & , 2011).

However, the latest technology is not worth the investment without “a paradigm shift by educators and learners who must adapt to a new environment of teaching and learning” (Smith & Berge, 2009, p. 439). As Zheng and Newgarden (2012) have pointed out, educators need to rethink SLA to teach languages in the virtual environment of SL. As Zheng (2012) has stated, Second Life® “not only allows designers to provide learners with social, historical, and cultural materials to aug-

ment 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).

2.2 DBR in CALL

DBR is an emerging approach in CALL that was first introduced in educational research and was later used in disciplines that focus on the study of technology and learning, such as educational technology, the learning sciences, and, more recently, CALL (For a more detailed discussion of DBR in CALL, see Pardo-Ballester & Rodríguez, 2009). This section briefly introduces DBR and then provides a review of the specific literature in DBR and CALL.

According to the Design-Based Research Collective (2003), DBR is characterized by (a) dual goals manifested in the design of learning environments and the contribution to existing theories or the development of new theories of learning (b) the presence of iteration in the research and design process, (c) the requirement to account for authentic settings, and (d) the use of methods suitable to document and relate "processes of enactment" to "outcomes of interest" (Design-based Research Collective, 2003, p. 5). Researchers who actively participate in this novel approach will most probably agree on a fundamental principle: the development of learning environments and theories is inextricably intertwined. Wang and Hannafin (2005) define DBR as

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 setting, and leading to contextually-sensitive design principles and theories. (pp. 6–7)

In CALL, Yutdhana's (2005) overview of DBR and its potential for research in language learning constitutes one of the first contributions that addresses DBR. In her chapter, she describes two studies that illustrate the potential of DBR, namely Barab, Baek, Schatz, Scheckler, More, & Job-Sluder's (2002) study, which analyzes the implementation of a technology tool in a mathematics and science teacher development context, and Bannan-Ritland's (2003) study, which uses DBR to create an educational design research framework. Inferring from these two sources, Yutdhana reflects on the potential of DBR in CALL and some of its limitations.

DBR implementation seems to be particularly useful to explore complex contexts, such as technology in world language teacher development. Rodríguez (2006) used DBR to operationalize a construct in world language teacher development that might help improve how technology is integrated in world language teacher education contexts. The technological pedagogical content knowledge (TPACK) construct is presented in the introduction to this volume.

DBR has also been used in language learning contexts. Pardo-Ballester and Rodríguez (2009, 2010) described the implementation of DBR on the development of instructional CALL materials by explaining the processes of iterative cycles in the design, development, and evaluation of reading materials and interfaces for

elementary and intermediate Spanish. The development of the online readings with embedded multimedia glosses integrated SLA hypotheses from Chapelle (1998) and work on elaborated input by Long (2007). Students' perceptions using the reading materials over time were used to improve both the readings and the interface.

Wang, Song, Stone, and Yan (2009) conducted a collaborative DBR research project with teachers in China and the United States using SL with a focus on Chinese EFL learners. The research in this project draws on social constructivist principles applied to EFL learning. The purpose of the research was to improve the EFL program in SL and to explore the oral proficiency and students' perceptions in a multiuser virtual environment. Although they did not report results from oral tests and other multiple means (e.g., surveys, interviews, blog posting, and video clips of students' language performance), they reported recommendations for designing and implementing similar DBR projects.

Hung (2011) used DBR to explore the experiences of 89 Taiwanese EFL learners to improve not only the speech course design, but also to enhance students' oral presentation skills by means of reflecting on their presentations after reviewing the recordings of their learners' presentations. She guided her study by adopting Chapelle's (2005) theoretical SLA framework for designing multimedia environment and Moreno's (2006) multimedia design principles. She was able to extract six major design principles based on the data of her study and the theoretical framework adopted. Hung concludes that more empirical studies are needed in different contexts and with different groups to study the effectiveness of other tasks or tests with the purpose of validating the design principles synthesized in her study.

Hoven and Palalas (2011) conducted a DBR project to use mobile CALL with learners of English as a second language. For two years they collected data and were able to redesign a hybrid English for Special Purposes course. They used Ecological Constructivism as a theory of learning to improve the course and to study students' listening and speaking skills with the aid of mobile devices. Students' perceptions revealed renewed engagement by using mobile devices (for a reflection on their DBR project for investigating mobile CALL, see Palalas and Hoven in this volume).

Zheng and Newgarden (2012) used DBR to explore the affordances of SL for second language learning, applying constructs from ecological psychology and sociocultural theories. The researchers stated that there is need for designing tasks that go beyond autonomy, task-based learning, and construction of a second language identity by participating and evaluating the effect of language actions.

2.3 Sociocultural Theory and Second Language Acquisition

SL as a social network offers opportunities for interacting with people located in different cultural and geographical communities throughout the globe. Sociocultural theory (SCT) provides the foundation to explore and analyze this context and was therefore chosen as the framework for the study. The linguistic interaction

between NSs and NNSs or a peer-peer interaction can help to construct meaning which is relevant to learning. Numerous studies have explored these types of interactions in the language learning context from a perspective of SCT (Borer, 2007; Chung, Graves, Wesche & Barfurth, 2005; Lee, 2008). These studies have proposed a Vygotskian SCT for SLA, that is, social interaction is viewed as an opportunity for knowledge construction.

SCT has been extensively used in CALL. For example, Chung et al. (2005) used SCT to explore how online Korean-Canadian tandem partnerships constructed knowledge through online collaboration, allowing students to build relationships with one another and actively develop their understanding of their peers' language and culture. The authors of this longitudinal case study emphasized the central role of social interaction made possible by tandem interactions which draw from the principle of reciprocity to support learners' emerging identity as Korean-Canadian bilinguals and language development. They uphold the socio-cultural tenet that language learning does not occur exclusively in the individual's mind but rather is a socially constructed activity mediated by different tools such as the language, tasks, and computers. The findings suggested that students were able to (a) develop a variety of language practices, including awareness of chat jargon and Korean honorific language; (b) develop increasing awareness of their sense-of-self in relation to their partners, reflecting on their identity and ethnicity in the Canadian context; and (c) participate in expert and novice discursive practices, simultaneously constructing meaning with their peers. The authors conclude that the learners provided the scaffolding and conditions necessary to support complex language and cultural learning and teaching between peers from different backgrounds and with different areas of knowledge, demonstrating that the ideas and language from one individual can transform into the ideas and language of another.

SCT has also been used to investigate NS/NNS perceptions of networked collaborative interaction. Lee's (2008) study reports how expert-to-novice interaction using multiple types of synchronous CMC tasks resulted in the corrective feedback of less experienced language learners. SCT was used as the theoretical framework for this study and examined the Vygotskian concepts of scaffolding and the zone of proximal development (ZPD) to explain how corrective feedback was achieved. Scaffolding in this study is defined as the process by which more proficient learners are able to assist in the L2 development of their less capable peers, thereby enabling them to produce target language forms that they would be unable to produce on their own. Scaffolding also helps L2 learners access their ZPD, which is defined as the distance between what learners can achieve on their own and what they can only achieve with assistance. Finally, corrective feedback plays a role in assisting learners to reach an optimal level within their ZPD by providing the collaboration necessary to solve various linguistic problems. In conclusion, the author reports that the results of the study may have several significant pedagogical implications, such as the importance of different levels of scaffolding, starting with more controlled and moving toward less controlled, to draw learners' attention to their linguistic errors. Overall, synchronous CMC tasks

were found to (a) support focus-on-form through expert-novice partnerships and (b) allow for the feedback negotiation necessary for L2 learners to advance within their ZPD, exhibiting more self-regulated error correction strategies as time went on.

SCT has been successfully used to explore CMC teaching and learning experiences. Since SL is intrinsically a social virtual environment, it provides fertile grounds for participants to interact and learn from others through observation, imitation, and interaction, all of which are necessary for L2 learners to advance their ZPD and to facilitate L2 internalization.

3. Overview of the DBR Project

This DBR project was conducted at Iowa State University, and it lasted for two semesters. The Spanish courses presented in the two studies that make up this project were delivered in a hybrid format. Each of the 4-credit courses had two 50-minute face-to-face meetings in the classroom and one 25-minute synchronous on-line meeting with a group of classmates and instructor. Students were divided into groups of 4-6 in the online mode. Students interacted in SL through voice-based chat in the small groups. Although students spent shorter time in the online meetings, they had more opportunities for interaction in the online mode due to the lower number of participants in the online meetings.

The two courses in this project include the second semester Spanish courses of the first- and second-year (Spanish 102 and 202, respectively). At the time we began the DBR project, these two courses were offered for the first time in a hybrid format. The syllabi for the hybrid courses clarified that all students were required to attend all the online meetings and work with a group to perform a role-play task in SL at the end of the semester. All hybrid courses were also required to interact with a NS of Spanish using the chat tool of SL.

The task with the NS was intended to have students exposed to Spanish language and culture and discuss in class their experience (see homework 4 and 5 in Appendix A). The role-play task, which was also their final project, was intended to evaluate students based on fluency, content, vocabulary, grammar, and pronunciation. The online meetings provided students with the same material covered in a regular class. Students' participation was graded according to their preparation and performance. In order to facilitate interaction, students were given a list of questions related to a topic (e.g., focusing on linguistic forms, vocabulary, culture) before the in-world meetings, so they could work on these questions beforehand and be better prepared to participate.

Online meetings took place in two virtual environments. Adobe Connect®, a synchronous communication tool, was used at the beginning of the course because it was the platform available at our university and therefore had local support for students and instructors. Its two-dimensional nature also makes its use less complex for both learners and instructors, so, in a sense, Adobe Connect was used to scaffold SL use. SL was introduced toward the middle of the semester.

As novice users of a virtual environment, our first idea was to replicate familiar

concepts and spaces in the virtual world. The initial thought was to use the virtual campus of our university island in SL, which, not surprisingly, bore some resemblance to actual physical spaces. For example, it contained buildings with conference rooms, art exhibits, lecture halls equipped with stadium seating, podiums and presentation screens, and so on. One reason that motivated the original choice of setting was the idea that interruptions by SL users would be less likely in a virtual space with limited access. However, we soon realized that we were missing opportunities to expose students to environments that are not typical instructional settings. SL beaches and coffee shops became our regular classroom.

SL offers the possibility to implement activities that are difficult to do in real-world instructional contexts, such as rehearse or perform a play in a realistic setting similar to what learners might experience in a theater or 3D movie. The realism and ambiance of SL can be uncanny, partly due to the immersive experience enhanced by directional sound. For example, when near a beach, river, or creek, SL users hear running water; in a mall or bar, they might hear the rush of shoppers or patrons as well as background conversations; in nature, users can hear birds and other animals as well as the wind moving through the trees. Voices of other users fade as their avatars move away. The potential for engaging language learning activities in SL is even greater if we consider the possibility of recording in-world events. For example, learners can easily find many interesting locations to shoot movies, such as in-world replicas of present and ancient cities (e.g., Barcelona, Buenos Aires, ancient Rome, etc.).

3.1 A Fairy Tale Task in SL

In this section we describe a synthetic world language learning activity that promotes collaboration and interaction in the target language. Although this activity was designed with Spanish language in mind, it can be adapted to any language supported in SL.

The main instructional objectives for this activity were to (a) motivate learners to use the target language in an informal setting and (b) help learners avoid frustration when performing the SL activities by getting them acquainted with the synthetic environment and its operation. The goal of the activity was for students to create a product, a new version of the fairy tale *Little Red Riding Hood* *Caperucita Roja* in Spanish, and perform it in the virtual world in front of an audience.

Taking advantage of the technical affordances of the synthetic world, character costumes were designed and made available to learners (see Figure 1), thus scaffolding for learners the otherwise time consuming and complex technical requirement to build objects in the synthetic world. A folder containing the necessary costumes, including hairstyles and character props, was shared with the students ahead of time. The basic setting for the tale, which included a cabin and trees to simulate a small forest, was also constructed for the students to perform. Figure 1 shows the outfits created for *Little Red Riding Hood* during our activity.

Figure 1
Costumes and Prompts Provided to Learners



3.2 Two Studies and Two Iterations

Two iterations of the activity were conducted in-world with participants in different locations (e.g., the Language Studies Resources Center at Iowa State University, a computer classroom at the same institution, a computer lab in the main library, personal computers in dormitories and the participants’ residences). The participants were 3 Spanish instructors (2 females and 1 male) and 79 elementary and intermediate Spanish students (51 females and 28 males) enrolled in beginning and intermediate Spanish hybrid courses. All participants signed a waiver stating that they were aware of the realities of the virtual world and that they knew and accepted what they may encounter in SL (see Appendix B). Participants were also contacted in class and asked to participate on a voluntary basis to share their opinions about their experiences using SL. Table 1 presents the overview of the different variables in the studies. Below is a detailed description of the two iterations.

Table 1
DBR Schematic Overview

	Study 1	Study 2	
Course	Spanish 102	Spanish 102	Spanish 202
Participants	Instructors A and B 26 students (13 females and 13 males)	Instructors A and C 37 students (25 females and 12 males)	Instructor B 16 students (13 females and 3 males)
Semester	Spring 2009	Spring 2010	
Duration	6 weeks (once a week)	14 weeks (once a week)	

Tasks	Orientation day (English) Fairy tale (Spanish) Chat conversation with NS (Spanish) 3 tasks assigned for homework (video viewing, dancing and shopping in SL) (English)	Orientation day (English) Fairy tale (Spanish) Chat conversation with NS in Spanish	Orientation day (English) Role-play (Spanish) Chat conversation with NS in Spanish
Data	6 in-world meetings using PowerPoint on WebCT that students had available before class Screenshots and classroom observation notes from SL during meetings Synchronous chat transcripts with NS Questionnaire Pre/post oral proficiency exam (Versant Test)	Notecards used in 14 in-world meetings Instructor notes Questionnaire (as in Study 1 but 4 questions were deleted) Video recordings of in-world meetings and final projects	Notecards used in 14 in-world meetings Instructor notes Questionnaire (15 questions on perceptions) Synchronous chat transcripts from the interaction between students and NS Video recordings of in-world meetings and final projects

3.2.1 Iteration 1

Iteration 1 was conducted in the spring 2009 and included 26 students (13 participants were female and 13 were male) enrolled in the second semester of the first year of Spanish. Twelve students were enrolled in Spanish with a female native English instructor (Instructor A) and the rest of the students learned Spanish with a female native Spanish instructor (Instructor B) who also was a researcher-observer in this study. One student was a NS of Russian, and the rest of the students were all native speakers of English. Six students had experience using SL, and 6 other students did not know how to use any collaboration tools to chat online.

Both instructors had experience teaching Spanish using technology. Instructor B had already taught hybrid and distance courses using web conference tools and had been trained to use SL the previous semester through a mentoring experience. Neither instructor had used SL before in the context of teaching.

Participants met online six times using Adobe Connect and six times in SL. Learners were asked to open an account and to watch two videos about how to perform basic skills in SL before the initial orientation. During an initial face-to-face orientation, a person with teaching experience in SL and the instructor of each class demonstrated basic SL technical skills, such as flying (an effective way to explore in-world) and teleporting (similar to hypertext in 2D environments, teleporting is a basic skill needed to transport to specific in-world locations). This orientation was carried out in English. Participants were asked to complete three

additional tasks in SL as homework, such as buy a free t-shirt and take an in-world picture wearing it. After the orientation session, students met with their group and instructor in SL.

All in-world meetings took place on the island of the International Society of Technology in Education (ISTE), in a quiet location around a campfire on a beach. In order to facilitate interaction, students were provided a PowerPoint presentation which was posted in the class learning management system (WebCT at that time), so students could prepare for class.

The task with a NS was carried out in week 10. For this task, students received suggested questions to use in their conversation with the native speakers. This was a two-way information exchange task (Lee, 2004), so it required negotiation of meaning, clarification requests, and comprehension and confirmation checks. Lee (2004) also states that a “[t]wo-way information exchange also promotes the development of ZPD in an electronic environment” (p. 91). Learners were required to take a pre and post proficiency test (Versant) (for a description of the Versant test, see Blake, Wilson, Cetto, & Pardo-Ballester, 2008).

3.2.2 Iteration 2

Iteration 2 was conducted in the spring of 2010 with a total of 37 learners enrolled in Spanish 102 (instructors A and C) and 16 in Spanish 202. Spanish 102 learners had a native male Spanish instructor (instructor C), and Spanish 202 learners had instructor B, who at this time already had a year of experience teaching hybrid courses using SL and also had experience teaching a hybrid Spanish course using SL.

In Spanish 102, one learner was a NS of Chinese and all other learners were NSs of English. Eight of them had experience with SL. In this iteration, 16 students were enrolled in Spanish 202 (3 were male and the rest were female). All learners in Spanish 202 were NSs of English. Three of them had used SL in a previous course, and the instructor for this study was instructor B. A total of 53 students participated in Iteration 2. As in Iteration 1, students from Spanish 102 were also required to take the Versant proficiency test at the beginning and at the end of the semester.

This second time around, participants used only the collaboration tool of SL, and they had two days for orientation in English and 14 in-world meetings in the target language. During those two days they completed the first three assignments in the classroom instead of doing them for homework. During the in-world meetings, instructor C took learners to different places in order for them to describe the different settings and thereby practice vocabulary (e.g., restaurant or stadium), instead of having in-world meetings in the ISTE Island. Instructor A decided to stay in the ISTE Island. Another change in Iteration 2 was that participants were provided with a notecard before the in-world meeting which provided activities, and they were called on one by one to complete the activities. The use of in-world cards replaced the PowerPoint presentations posted in WebCT in the first iteration. During our in-world meetings students interacted with their classmates using

proposed open-ended questions. Students also completed the task with the NS, and they discussed their encounters with a NS in class. However, the teacher prepared the task to be performed with a NS differently because, after exploring SL, we noticed that we needed to provide students with different pedagogical techniques. This change was only made for the group with a higher proficiency level (i.e., Spanish 202). Students were told to use their Spanish as much as they could and to imagine that they were meeting with that person in the real world when they had their interaction with the NS. They were told to initiate the dialogue as they would in real life, without a script of open-ended questions.

In Iteration 1 students were asked to complete a two-way information task (see 3.2.1 Iteration 1). In Iteration 2 we took a different approach because we used the virtual world of SL, and we needed to take into account the learner-environment interaction when engaging students in real time interaction with NSs. Many times, learners interact with more than one person because even though they begin chatting with one person (avatar), there is a chance that more people will join the conversation. A similar opportunity for interaction arises when learners take advantage of the environment by joining a group of avatars who are already chatting, thereby following a conversation and interacting with more than one person. We see this interaction very similar as what we would hope learners would do in the real-life environment, such as in a study abroad experience. When learners visit the L2 country, they need to be ready to interact and make meaning on the fly. In a virtual world, as Zheng and Newgarden (2012) state, it is necessary “to rethink language and learning in a dynamic nonlinear fashion” (p. 14) in pretty much the same way we think of unscripted interactions happening in a study abroad experience.

3.3 Data

For the purpose of this DBR study, mixed data were collected from multiple sources: in-world meetings, questionnaires for instructors and students, screenshots, chat-log scripts, videorecorded tasks and online classes, pre- and posttests to measure language proficiency, as well researcher observations and reflections (see Table 1). The questionnaires were created to elicit learners’ experiences and perceptions of learning Spanish in SL. A 5-point Likert scale ranging from *completely agree* to *completely disagree* was used at the end of the semester. The questionnaires also included open-ended questions to gather additional comments and suggestions on the tasks implemented in SL and the use of SL to learn Spanish. Students’ questionnaires for the first-year courses in both iterations were the same, but the questionnaire for the second-year course in the second iteration was different since it was intended to explore affective factors in relation to learning Spanish in SL. All questionnaires were administered at the end of the semester. This study used SCT as a framework for examining the chat interactions among NSs and NNSs of Spanish. Concepts adopted from SCT, including scaffolding and ZPD, were applied to understand the affordances of SL chat logs to support the learning of language and culture.

4. Results and Discussion

Research questions

1. How do different designs of tasks affect the learning of the language on students?
2. How do learners perceive the synthetic world as a tool to assist them in their language learning?
3. Specifically, what affordances of the synthetic world create opportunities for SLA?

4.1 Orientation Training and Tasks in SL

We asked students if the tasks were useful for their preparation for our online meetings and final project. In Iteration 1, 54% of the learners (13 out of 24) agreed, somewhat agreed, or completely agreed with the statement that the assignments were useful. For various reasons, 46% of the learners (11) thought that the homework assignments did not help them prepare for their final project. Eight students considered these assignments a waste of time. One student thought that the assignments were irrelevant because he had learned the content targeted in the assignments during the initial in-class orientation. Another student mentioned that the activities were irrelevant, frustrating, and annoying with the exception of having the opportunity to speak with NSs in SL. He later appreciated this assignment because he met several friendly people at the Spanish Orientation landmark, and he got a chance to practice Spanish. For one student, a technical problem with SL was the reason for having a negative experience. He mentioned that the real world is so much better and so much more hands-on.

Students who thought that the activities were helpful stated that they knew that the required assignments helped them to know how to move, to find clothes for free, to go shopping, or to be more familiar with SL and learning how to make gestures. Another student mentioned that learning how to teleport, to move around and to wear clothes was helpful, but it was more helpful to have a conversation with a NS. Because of the negative feedback collected in Iteration 1, students in Iteration 2 completed these assignments in class during the orientation days. Surprisingly, only 38.5% (10 out of 26) reported that the assignments helped them prepare for their online meetings and final project, and 61.5% (16 out of 26) reported that the assignments were not useful. These students did not have an opportunity to comment on their answer, but we believe this perception may be influenced by the fact that some of them were already familiar with SL since they had taken a hybrid course in the previous semester.

4.2 Interaction with NS or Classmate and Opportunities for SLA

4.2.1 Iteration 1

Participants were asked to qualify their experience in SL and to share an experience in SL with us. Sixty-nine percent of the respondents (16 out of 22) had a positive experience, and 23% (6) reported a negative experience. In their comments, students mentioned their desire to complete tasks that would prompt them

to practice their Spanish, such as going to a particular SL location and chat with a Spanish NS. Some of the positive comments centered on chatting with NSs from different places such as Argentina, Brazil, and China, learning chat conventions (e.g., *ja ja* 'ha ha'), talking for almost an hour, getting assistance from NSs, and learning about another country. Naturally, not everyone had a positive experience using SL: specific landmarks such as *Barcelona Virtual* or the Spanish Orientation were deemed too crowded and made the software freeze. They also thought it was difficult to find someone with whom to speak in Spanish. When students tried to speak with NSs, they were sometimes ignored. A male student, for example, was ignored when he requested help, possibly because he was wearing the grandmother costume used for the fairy tale activity. In other instances it may have been that NSs simply realized the learner's motive was to fulfill a task rather than engage in authentic conversation.

Learners also reported good experiences, even though they had difficulty finding people because they were wearing their fairy tale costumes. A learner recounted: "It was hard to find someone to talk to but I think I found a good person ... people weren't talking to me when I was wearing my Little Red Riding Hood costume! ha ha." Some portions of her conversation are below. In the conversation, the NS (Carmela) had a conversation with the NNS for almost 20 minutes. The NS was nice and responded to the NNS's questions. However, due to her low language proficiency, the learner could just come up with formulaic questions. But even in this situation, the interaction was still successful because the NS continued the conversation despite the miscommunication (bold text).

[10:05] CARMELA: heidi q te pasa [*What's going on?*]

[10:05] Heidi: tu hablas espanol, Carmela? [*Do you speak Spanish, Carmela?*]

[10:05] CARMELA: si claro [*Of course*]

[10:05] CARMELA: soy española [*I am Spaniard*]

[10:08] Heidi: qué te gusta hacer en verano [*What do you like to do in summer?*]

[10:08] CARMELA: jaja ... a mi?? ir a la playa y ponerme morena [*ha ha ... me? Go to the beach and get a suntan*]

[10:08] CARMELA: y descansar sobre todo [*and relax above all*]

[10:08] CARMELA: jaja [*ha ha*]

[10:08] CARMELA: y a ti? [*what about you?*]

[10:09] Heidi: **yo no vivo en una playa, en central de america** [*I don't live at the beach, in the center of America*]

[10:09] Heidi: **pero me gustaria ir** [*but I would like to go*]

[10:09] CARMELA: jajajja ... ya [*ha ha ... I see*]

[10:09] CARMELA: me imagino [*I can imagine*]

[10:10] CARMELA: entonces que haces en verano tu? [*So, what do you do in the summer?*]

[10:10] Heidi: nada! me gusta ir a la piscina [*nothing!, I like to go to the pool*]

4.2.2 Iteration 2

4.2.2.1 Spanish 102

Students in Spanish 102 were asked if they would like to have an assignment where they could converse with a Spanish NS. This question was added to the questionnaire because Iteration 1 showed it to be a successful task. In Iteration 2, only a 39% (11 out of 28) expressed interest in having this type of task and more than half of the students did not think they would like to converse with a NS (61%).

Eighteen students from this group shared perceptions about their experience in SL: 78% (14 out of 18) had a positive experience and 22% (4 out of 18) reported a negative one. The 3 students who shared their negative experiences complained about (a) getting stuck when teleporting from one place to another, (b) not having enough training in SL, or (c) finding undesirable people. On the other hand, learners who had a positive experience reported (a) learning about culture from different places, (b) talking to NS without stress, and (c) becoming friends with strangers due their willingness to provide help.

In the example below, the NNS (Steve) had difficulty asking the NS (Ashley) what year she is in the university, but he was able to negotiate meaning in the target language after a breakdown. In this example the NNS had to reformulate his question twice for the NS to understand the message.

- [19:58] Steve: tan está usted en la universidad? [*are you at the university?*]
 [19:59] Ashley: si Steve y tu? [*yes, Steve and you?*]
 [19:59] Steve: si, que ano se le? [*yes, what year ("se le" makes no sense in this context)*]
 [20:02] Steve: ????
 [20:02] Ashley: que paso' Steve??? [*What happened Steve?*]
 [20:03] Steve: ques ano se le en la universidad? [*what year ("se le" makes no sense in this context) in the university?*]
 [20:05] Steve: o que grado?? [*or what grade?*]
 [20:05] Ashley: sorry Steve pero no entiendo tu pregunta!!! [*Sorry Steve, but I don't understand your question*]
 [20:09] Steve: um ... como estudiante de primer ano, segundo ano, menor ano, mayor ano?? [*like first year student, second year, lower year or higher year*]
 [20:09] Ashley: 2 año Steve!! [*Second year Steve*]
 [20:09] Steve: ahhh ic [*ahh!*]
 [20:10] Steve: yo 3 ano [*Me, third year*]

4.2.2.2 Spanish 202

Students in Spanish 202 had different assignments when communicating in SL. They interacted in SL with a classmate and with a NS as well as with a group and their teacher. Students were asked about their preference to work in SL with a classmate or a NS. Forty-four percent of the respondents (7 out of 16) preferred

to work with a classmate, 50% (8 out of 16) preferred to work with a NS, and one student chose both. She thought that for conversation, grammar, and vocabulary the NS was her choice, but when dealing with their final project or preparing exams she preferred a classmate.

Two questions targeting perceptions asked (a) whether students learned Spanish better with a classmate or with a NS and (b) with whom they felt they learned more Spanish. Twelve and one half percent (2 out of 16) reported not learning from a NS, while 87.5% (14 out of 16) reported learning Spanish when interacting with a NS. These were not surprising responses in light of the positive comments on Iteration 1. Researchers in SLA agree that expert-to-novice interaction helps students overcome cultural barriers for learning the language (Chung et al., 2005; Zheng et al., 2009) and also fosters SLA by receiving corrective feedback and by focusing the learner's attention on form. However, 94% (15 out of 16) indicated that they also learned Spanish during their interactions with their classmates. Only one student reported not learning from this experience. Finally, 62.5% (10 out of 16) reported learning more Spanish from a NS, and 37.5% (6 out of 16) reported learning more Spanish from a classmate.

The students' perceptions indicate they are learning from both NS's and classmates, although they feel they learn more from NSs. By examining the chat logs that students sent to the instructor via a notecard, it is clear that the interactions with a classmate were easier because these were guided (e.g., completing exercises from the textbook to practice linguistic structures) while the interactions with a NS were natural. In the NS-NNS conversation below, corrective feedback provided by the NS (Marcos) helps the NNS (Helena) focus both on meaning and on form.

[11:20] Helena: uno de mis profesores de espanol es de colombia y uno de sus amigos es en el grupo de juanes [*one of my Spanish professors is from Colombia and one of his friends is in the Juanes's group*]

[11:21] Helena: no recuerdo cual instrumento que ese amigo juegas [*I don't remember which instrument that friend plays*]

[11:21] Marcos: no se dice "es en el grupo de juanes", sino "es del grupo..." [*You should not say "is in the Juanes's group, but "is from the group"*]

[11:21] Helena: gracias [*thanks*]

[11:21] Helena: es mi espanol muy malo? en serio [*is my Spanish very bad? seriously*]

[11:21] Marcos: los instrumentos se tocan, no se "juegan" [*we play instruments, but we don't play with them as a toy*]

[11:22] Marcos: pero se trata de que aprendas, y corregirte los errores [*but it's all about learning and correct your errors*]

[11:22] Helena: si [*yes*]

[11:27] Helena: y Barcelona? [*and Barcelona?*]

[11:27] Marcos: también [*also*]

- [11:27] Marcos: pero está algo más lejos [*but it is a bit far away*]
 [11:28] Helena: si yo se [*Yes, I know*]
 [11:28] Marcos: se dice “sí, lo sé” [*You should say “yes, I know” (the NNS was using “I” as in English and missing the pronoun “lo”)*]
 [11:28] Helena: gracias [*Thanks*]

The chat logs and students' perceptions provide evidence that the students advanced in their L2 development and internalization of language structures by paying attention to the linguistic forms used by the experts. Students stated that they learned Spanish from these natural interactions. For example, a student, while chatting with a NS from Spain, paid attention to the use of informal spelling in Spanish that occurred in the local chat (of which she was not a part). In other words, she paid close attention to these conversations. She reported that NSs were saying “*kien* and *kiero*, using the shorter *k* instead of *qu* spelling. She retained this information and was able to reproduce the forms when she answered the questionnaire, but she was not motivated to use them when interacting with the NS. She stated “I did not want to mess up or not make sense”.

Another student also noticed that NS dropped the subject pronouns (e.g., *yo* ‘I’ or *tú* ‘you’), as is customary in Spanish. The student reported that she tried to use the correct verbs like the NS avoiding using the pronouns. When reviewing the chat log of this interaction, no subject pronouns were used by the learner in the exchange with the NS. This shows that the learner internalized the grammatical rules by interacting with a NS.

Another student who had a conversation with a 40 year-old man observed that the NS did not use the formal *usted* form: “when talking to someone casually even though you don’t know them, you still use the *tú* form.” In her chat log we could observe that by imitation she internalized the use of use of *tú* (informal 2nd person singular pronoun). Several students also observed the differences in laughter markers in both languages: “*ha ha*” (English) versus “*ja ja*” or “*je je*” (Spanish). One student mentioned that it was more difficult to follow the conversation with multiple users, but when this happened, she still used the expression (e.g., ‘*ja ja*’) the other users had employed. On this occasion she imitated the language because she was aware of the positive reinforcement and consequences of imitating the laughing behavior from the NS. Even when she could not follow the conversation, she tried to be part of the NS and stayed in the conversation.

The chat logs from the interaction between NNSs enrolled at Spanish 202 were reviewed, and we found the following: (a) students encouraged each other to complete the assignments, (b) they were very comfortable when talking to each other, (c) they tended to use more English when there was a lack of vocabulary (e.g., shark or security) or when they have problems with technology (i.e., log in/out automatically), (d) they applied the vocabulary that they had learned in class previously, (e) those with lower proficiency levels benefitted from their partner, (f) there was no feedback for correction from one classmate to another, and (g) self-correction happened when misspelling a word and typing it again correctly.

4.3 Fairy Tale/Role-Play Task

Providing character costumes and props for the role-play task was very much appreciated by the learners. This technology scaffold received very positive feedback. In Iteration 1, 95% of the students (24 out of 26) agreed or completely agreed when asked about the usefulness of providing them with costumes and objects. Only 2 students did not agree because they had problems with technology and their avatar would not change appearance. In Iteration 2, 93% (27 out of 29) of learners agreed or completely agreed with the need of having them provide with the costumes. Again only 2 students did not agree with the need of having the costumes provided by their instructor. The positive results (i.e., video recordings, screenshots, and oral proficiency tests) with respect to their oral performance and their creativity in looking for a setting (e.g., forest, port, restaurant, etc.) suggest that the design of costumes is worth implementing in tasks that aim to develop students' creativity and oral proficiency. Retaining their avatars' role-play costume appeared to have a negative effect when trying to find native speakers to interact with, which suggests that learner training in this particular aspect of the technology would probably be advisable.

Warburton (2009) identified affordances of synthetic worlds that could provide opportunities in pedagogy, such as (a) the presence of opportunities for social interaction, (b) the possibility of immersion into authentic language and culture, (c) the potential for role plays and simulations such as the advantage of reproducing a context that in real life could be too expensive or physically impossible to do, and (d) the possibilities for visualization and contextualization. It is encouraging to note that students reported having benefited from many of these affordances in-world. Students felt they learned culture and language from their interaction with NSs. In terms of language gains, they internalized some forms they read while chatting with them, and they produced a significant number of words from the fairy tale when they were asked to write the words they remembered from their performance.

In order to take a closer look at language production, students' oral proficiency and vocabulary use in Iteration 1 and Iteration 2 were compared. Paired sample *t* test was used to compare the pre- and posttests in Iterations 1 and 2. Pretest and posttest for overall proficiency in Iteration 1 $t(25) = 3.02, p = .006$ indicated that there was a significance difference ($p < .05$) between the pretest ($M = 27.23, SD = 5.41$) and the posttest ($M = 32.65, SD = 7.47$). The *t* test showed that students improved their oral proficiency test by speaking in in-world meetings, performing a role-play task, and interacting with a NS. The same positive results were reported for Iteration 2 with a significance difference ($p < .05$) between pretest and posttest for overall proficiency $t(36) = -2.14, p = 0.39$. Means for these variables in Iteration 2 (pretest: $M = 28.89, SD = 5.49$ and posttest: $M = 31.32, SD = 5.06$) were shown to be very similar when compared to Iteration 1.

A questionnaire item specifically asked students in both studies if they could recall words from working with the fairy tale. Although they produced a predominant number of words, the *t* test results showed there were no significant differ-

ences in improving vocabulary. Iteration 1 pretest and posttest for vocabulary indicated no significance difference $t(25) = -2.04, p = .052$ between the pretest ($M = 21.11, SD = 2.95$) and the posttest ($M = 26.50, SD = 12.65$). In Iteration 2, the pretest and posttest for vocabulary indicated again no significance difference $t(36) = -1.33, p = .191$ between the pretest ($M = 23.94, SD = 10.07$) and the posttest ($M = 25.81, SD = 10.79$).

5. Design Principles

This DBR project reported an exploration involving the experiences and perceptions of 79 Spanish learners enrolled in a hybrid course that used SL. Drawing from findings, we propose the following design principles to design activities in virtual worlds:

1. Activities in virtual worlds should create opportunities to maximize in-world engagement and interactivity. An example of the former is to provide learners with activity management information (e.g., activity instructions) within the environment and using the environment's tools (e.g., notecards in SL) rather than outside the environment (e.g., email or a learning management system). An example of the latter is to design activities that provide opportunities to interact with in-world participants in order to take advantage of in-world speakers of the target language. This principle implies that students need to be trained in how to deal with in-world situations that may become uncomfortable or stressful (e.g., meaning negotiation from the NNS when encountering vulgar words). Synthetic world locations provide real-life, yet safer, opportunities to interact with NSs and learn the language through meaningful and authentic collaboration. Models for study abroad student orientations may be a helpful resource to design this type of activity.
2. Learner training in virtual worlds should include both the basic aspects of the technology as well as basic strategies to deal with potentially uncomfortable situations. Data in this DBR study shows that SL provided learners with a flexible environment that allowed them to freely talk about any topic of their choice with speakers of the target language. These environment create exceptional opportunities for immersive experiences and interactions with NSs. However, because of the level of fantasy and anonymity involved in participating in virtual worlds, educators should make their learners aware of the ethical issues involved and provide them with a repertoire of strategies to avoid or end potentially uncomfortable situations. Models for study abroad student orientations may be a helpful source to design this type of orientation.
3. Technology scaffolds should be provided so that the technology does not detract from the primary goal of the activity, that is, help learners develop their communicative competence. Learners should be provided with the needed outfits and props if the activity uses such elements to enhance realism.

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Appendix A

Training orientation in the classroom

What to do first?

- Join the Internet's largest user-created 3D virtual world community. Create an account.
- You will receive an email link, and you must click to activate your account.
- Read and agree with the terms of SL.
- Download the latest version of SECOND LIFE: <http://secondlife.com>.
- Login.
- Don't forget to send your avatar's name to your instructor.

Help Island

- During your first SL visit, your avatar is going to land on the Help Island. This is the place for SL training.
- On the Help Island you will find people to help you. They are working for you, so you can ask them for anything you need. These people normally look nice (great clothes and hair). Look for them if you need them.
- Each of you is going to land on a different Help Island (there are a several), so perhaps you will meet some of your classmates there, but maybe you won't see anyone that you know.
- Once you leave this island, you cannot go back.

Hands on in class

1. Learn to jump using the keys on your keyboard for "PgDn" and "PgUp."
2. Click on the key M for "Mouselook" to see through your avatar's eyes.
3. To move your avatar, use the arrow keys on your keyboard.
4. To fly, use the button on the bottom of the SL viewer.
5. To change your viewpoint, hold the ALT key and click where you want to look using the arrow keys of your keyboard.
6. To chat (local chat), this is in "Communicate."
7. To add friends to your friends list, right click their avatar and select "add friend." Check the two first boxes to offer permission to find you on the map.
8. Teleport.
9. To see items in your inventory, click the "inventory" button at the bottom of the second Life viewer.
10. To change your avatar's appearance, right click your avatar and select "appearance."

Homework #1

1. Visit <http://trainingvideos.hscs.wmin.ac.uk/secondl/index.html> and watch the following videos:
 - Registering
 - Downloading the player
 - Login on

- Appearance
 - Appearance2
2. Visit <http://trainingvideos.hscs.wmin.ac.uk/second1/index.htm> and watch the following videos:
- Giving Notecards
 - Accepting Notecards
 - Zooming in to read
 - Camera controls

Homework #2

- Go to Search in SL (located in the upper right corner of your screen). Type “Barcelona Virtual.”
- Once you find the landmark (place), click on “TELEPORT.”
- Walk around Barcelona Virtual and find the dancing club (next to the pool).
- Point to a little ball which is the name of a dance (salsa, twist, rock...) and right click with the mouse, then select “Dance.”
- When you are dancing, take a photo by clicking on the snapshot button at the bottom of your screen.
- Then send it to your instructor.

Homework #3

Shopping for Free in Second Life

- Go to “Go to Search” in SL (located in the upper right corner of your screen). Type “Freebie Beach.”
- You will get a few landmarks. Click on the first link (Freebie Beach MetaRL gives free Lindens).
- Once that you find the landmark (place), click on “TELEPORT.”
- Walk around Freebie Beach and find new clothes to buy for free (\$0 lindens).
- When you find what you like, point to the object then select “buy.”
- Make sure the clothes you buy are free.
- Go to your inventory (button located on the bottom right of your screen) and find the object you bought. Normally you will find this under your folder “Trash.”

Once that you find the object (pants, a purse, shirt, bikini...) select the object

- and drag the object to your avatar. When dragging the object you will see a small white square on your avatar.
- With your new object take a picture by clicking on the snapshot button at the bottom of your screen.
- Then send it to your instructor via WebCT.

Homework #4

Send to your instructor via WebCT a chat conversation in Spanish with a new friend or a classmate in the landmark Spanish orientation. To do so, follow these instructions:

1. Go to: <http://slurl.com/secondlife/Spanish%20Orientation/186/96/26/>
2. Click on “Teleport.”
3. Walk around in a circle and try to read the Spanish boards.
4. Walk toward the exit, “Salida,” and you will see on top a big number “1.”
5. Walk under the tunnel and get into number 2. Here, you can change your appearance if you want to.
6. Get out of number 2 and go to number 3 [just like you did in instructions 4) and 5)].
7. In station number 3, buy the black t-shirt hanging from the ceiling and wear it. Take a snapshot and send it to your instructor via WebCT. If you don’t remember how to buy an object, check instructions on the board (around your avatar) or check the instructions you received in your Third homework in SL.
8. Pass the tunnel to go to station 4 and read the boards.
9. Go to station 5 and find the sign “Salida aquí para salir del Tutorial.” Click on it to get out of the tutorial by pressing the right button of your mouse. Then select “Salir” (note: you can come back to this tutorial again if you want to).
10. Walk a little bit and pass the sign “Volver al tutorial.”
11. Now, look for people to practice your Spanish with. Use the local chat (Go to “Communicate, local chat” and find someone to chat with in Spanish). You don’t need your microphone here, only instant messages. You could use the people who have a title (e.g., “Orientador isla “Ñ” or “Seguridad isla “Ñ”) on top of their avatar. Or you could chat with anybody else in Spanish. *Here some topics for talking: 1) greetings, 2) could I please chat with you for a while? I need to do my homework, 3) where are you from? 4) how long have you been playing or working with SL? 5) what do you think about SL? 6) Could you tell me some nice places to visit in Second Life? or 7) make two more questions of your own.*
12. Take a snapshot of this conversation with your avatar and the other avatar you are talking to. Send the snapshot to your instructor via WebCT.
13. Finally, cut and paste the chat conversation in Spanish into a Word document. Send the file to your instructor. Save the file as: Your name+ Chat conversation in SL in Spanish orientation.

Note: This place is for orientation, so don’t freak out if you see some avatars naked. They are learning too.

Homework # 5

Send to your instructor, via WebCT or SL, a chat conversation in Spanish with Spanish native speaker in one of these landmarks:

Spanish Orientation [SPANISH ORIENTATION] Ayud, Spanish Orientation (60, 137, 35)

Barcelona Virtual BA, Barcelona Virtual (57, 125, 22)

1. Take a snapshot of this conversation with your avatar and the other avatar you are talking to. Send the snapshot to your instructor via WebCT.

2. Be original in your conversation and use your knowledge of Spanish as much as you can. You know more than you think you do. Just imagine that you are meeting with this person for the first time in real life, so what would you say to him/her?
3. Finally, cut the chat conversation (use Ctrl + C keys from your keyboard) in Spanish and paste it in a notecard.

Appendix B

ABOUT SECOND LIFE

Second Life is a Virtual World that was created with a very “hands off” philosophy, with the intent of having the users of that world shape it as they wished. As you’ll discover, almost everything you see in Second Life was created by the users, rather than a group of corporate programmers. This means that you’ll find a huge variety of experiences in SL.

Some locations in Second Life may very much resemble traditional educational setting in the real world, but others may be pure fantasy. Some areas in SL are be very much rated “G,” while others are most definitely aimed at a “Mature” audience. Just as in the real world, if you encounter an uncomfortable situation in SL, feel free to leave that location at any time. Above all, don’t forget that SL is not real life--keep a sense of humor and an open mind, and explore!

Please sign this waiver to state that you are aware of the realities of this virtual world and that you know and accept what you may encounter in Second Life.

Name: _____ Signature: _____

Chapter 12

DBR and Task-Based Learning: The Ongoing Experience of Designing a Task-Based Telecollaboration

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Loyola University Maryland

Abstract

This chapter describes how a design-based-research (DBR) approach is currently being used to create and constantly improve the development of a telecollaborative language exchange in first- and second-year Spanish courses at Loyola University Maryland. Since DBR employs a systematic yet flexible methodology (Wang & Hannafin, 2005), which integrates research, design, and learning so that instructional innovations can take place (Pardo-Ballester & Rodríguez, 2009), it is the starting place from which this telecollaborative language exchange project began. The project described connects DBR with the CALL practice of telecollaboration (i.e., an internet-based intercultural exchange between individuals from different cultural backgrounds within an institutional context with the objective of developing language skills as well as intercultural communicative competence). In the Virtual Language Exchange program proposed in which American students studying Spanish connect with Mexican students studying English through a synchronous multimodal video-conferencing software, structured tasks have been developed over time to ensure that students use authentic language to fulfill meaningful tasks in the target language. A task-based approach to language teaching/learning (Candlin, 1987; Ellis, 2003; Nunan, 1989, 2004; Prabhu, 1987; Skehan, 2001; Willis, 1996) allows learners to successfully acquire and use language at any stage of acquisition. The tasks presented in this chapter morph over time under a DBR methodology to better reflect the goals of task-based language learning and to help students expand their intercultural communicative competence.

Keywords:

Design-based Research, CALL, Telecollaboration, Task-based Language Teaching/Learning, Intercultural Communicative Competence

1. Introduction

Design-based research is a relatively new approach to researching pedagogical innovations through the design and development of a context-sensitive methodology (Design-Based Research Collective, 2003). It is a research methodology that

seeks to simultaneously integrate theory with practice while extending innovative knowledge concerning learning environments. Interest in design experiments, which centered on the concepts of dependent input (e.g., teacher training, curriculum, assessment, etc.), output (e.g., expected outcomes based on learning design and accountability), and contribution to a theory of learning along with its dissemination, first began in the 1990s (Brown, 1992). The term *design experiment* was later replaced with the term *design-based research* in order to “avoid invoking mistaken identification with experimental design, with studies of designers, or with trial teaching methods” (Design-Based Research Collective, 2003, p.5). More recently, as this CALICO Monograph Series volume suggests, design-based research is now being used as an approach to study computer-assisted language learning (CALL) and various other learning environments such as the second language classroom.

According to The Design-Based Research Collective (2003), design-based research must demonstrate the following: (a) a linkage between the design of learning environments with theories of learning, (b) an iterative research cycle in terms of development and design, (c) a contribution of theory to existing research, (d) involvement of authentic settings, and (e) a connection between educational enactment and specific educational outcomes. Many researchers support the need for such a research perspective (Bell, 2004; Hoven & Palalas, 2011; Pardo-Ballester & Rodríguez, 2009, 2010; Reeves, McKenney & Herrington, 2011; Sandoval, 2004; Sandoval & Bell, 2004; Sharma & McShane, 2008; Wang & Hannafin, 2005) because its underlying assumptions “make it an effective alternative for educational research” (Yutdhana, 2005, p.171). Design-based research speaks directly to fields like education because of its ever evolving environment design.

CALL in particular is an educational environment in which rapid involvement can be easily observed. Yutdhana (2005) reports the potential for design-based research to benefit CALL by commenting on two fundamental studies, Barab, Baek, Schatz, Scheckler, Moore, and Job-Sluder (2002) and Bannan-Ritland (2003). The Barab et al. study focused on the process of creating a virtual web-based community where teachers could share, inquire about, and reflect on pedagogy. The Bannan-Ritland (2003) study used an educational model of design research called “integrative learning design” composed of four stages (informed exploration, enactment, evaluation of local impact, and evaluation of broader impact) in order to help a particular educational community (i.e., teachers, parents and tutors) facilitate literacy through collaborative reading processes for children. Yutdhana (2005) highlighted the importance of these two studies because they each provide an initial pedagogical CALL model to build upon.

Pardo-Ballester and Rodríguez (2009, 2010) used design-based research in their studies to guide the development of online instructional materials for language learning. The online instructional materials for Spanish language courses were designed and redesigned after various evaluations of the materials at different intervals in order to improve the language learning materials from multiple perspectives (i.e., instructor and student). The design-based research framework

ultimately allowed the researchers to manipulate and enhance the content and context of language instruction and instructional materials.

Hoven and Palalas (2011) described the first stage of a pilot study in which mobile-assisted language learning took place within a design-based research framework. Students used mobile-assisted language learning outside of class time to help them learn English as a second language. Through multiple means (e.g., surveys, interviews, focus groups, and a language proficiency test) Hoven and Palalas assessed various aspects of the use of mobile-assisted language-learning devices. Overall, they found that the mobile-assisted language-learning devices resulted in high levels of student satisfaction due to their appealing, engaging, and effective nature. However, students also reported lower levels of motivation when using the devices because of the lack of person-to-person interactivity. The researchers plan to further investigate the role of synchronous peer-to-peer communication in second language acquisition and to determine whether asynchronous communication could possibly provide a comparable learning experience.

Following in the footsteps of these previous studies, I will describe in this chapter how a design-based research approach is currently being used to create and constantly improve the development of a telecollaborative language exchange in first- and second-year Spanish courses at a U.S. university. Since design-based research characteristically employs a systematic yet flexible methodology (Wang & Hannafin, 2005) that integrates research, design, and learning so that instructional innovations can take place (Pardo-Ballester & Rodríguez, 2009), it is the starting place from which this telecollaborative language exchange project began.

2. Theoretical Framework

2.1 Telecollaboration

Telecollaboration is defined here as an internet-based intercultural exchange between individuals from different cultural/national backgrounds within an institutional context with the objective of developing language skills as well as intercultural communicative competence. Some researchers have also identified telecollaboration as internet-mediated intercultural foreign language education (ICFLE) (Belz & Thorne, 2006) as well as online intercultural exchange (O'Dowd, 2007b).

The main intention of telecollaboration is quite complex because it is not solely geared towards practicing language skills as one might think. Telecollaboration is meant to unite learning language and culture (i.e., both intercultural awareness as well as intracultural awareness) (Belz, 2006). Through the simple act of interaction and information exchange (Belz & Thorne, 2006), foreign language learners have the opportunity to learn about and reflect upon their own culture as well as that of another culture and thereby increase their intercultural communicative competence (Byram, 1997). Presently, telecollaboration is widely used in the field of language education. It comes in the form of learning management systems, email, social-networking sites, wikis, blogs, video-conferencing software, media-sharing websites, Second Life, and so on. It can be used both in and out

of the classroom in a synchronous or an asynchronous manner. Many researchers support the use of telecollaboration in foreign language learning because of its potential to promote intercultural communicative competence (Chun, 2011; Levy, 2007; Müller-Hartmann, 2006; O'Dowd, 2003, 2007a; Schenker, 2012), but some have also pointed out several of its shortcomings (Belz, 2002; O'Dowd & Ritter, 2006; Schenker, 2012; Ware, 2005; Ware & Kramsch, 2005).

O'Dowd (2003) and Schenker (2012) investigated an asynchronous example of the use of email in American Spanish and German foreign language classrooms. O'Dowd (2003) found that students studying Spanish demonstrated intercultural communicative competence when allowed to express their own cultural identity. This mere act of cultural reflection and expression led learners to dialogue and inquire about the new culture with their partner. Unfortunately, when there appeared to be a failure of intercultural exchange, negative attitudes and stereotypes surfaced. Schenker (2012) also found that the email served as a constructive tool for students studying German to learn about another culture. In this study, the email exchanges gave them the opportunity to demonstrate their intercultural communicative competence, however, not without challenges.

In contrast, Chun (2011) explored the relationship between telecollaboration and second language pragmatic competence development using a synchronous methodology. American students in an upper division German sociolinguistics courses were paired with German students studying in an upper division English course who first completed a word association task in an online asynchronous discussion and later had a synchronous online chat pertaining to the information gathered from asynchronous discussion. This study found that despite the difficulties that the learners faced in terms of developing pragmatic competence, both asynchronous and synchronous telecollaboration had positive effects for learners. Students who felt satisfied with the asynchronous interaction demonstrated more intercultural communicative competence than students who felt dissatisfied with the interaction. However, overall, the synchronous chats demonstrated more engagement and intercultural communicative competence when compared to the asynchronous environment.

Some of the limitations that have been pointed out in previous research, such as lack of student motivation and participation (Belz, 2002; Ware, 2005), miscommunication (O'Dowd & Ritter, 2006, Schenker, 2012; Ware & Kramsch, 2005) and varied expectations and norms between teachers and students (Schenker, 2012; Ware, 2005), are legitimate concerns for the second language educator. They can lead to less than desirable results when implementing a telecollaborative component in language classes. Despite these potential complications, I will show that a design-based research approach in the area of telecollaboration for second language acquisition might help language educators improve telecollaborative implementation over time. Specifically, I will describe how a design-based research methodology is currently being used to create and constantly improve the development of a telecollaborative language exchange in first- and second-year Spanish courses at a U.S. university using synchronous multimodal video-conferencing software.

2.2 Task-Based Learning in Second Language Acquisition

The current telecollaborative language exchange project requires students to complete a level appropriate task after having engaged in a telecollaborative language exchange via Skype. The structured tasks ensure that students use authentic language to fulfill meaningful tasks in the target language.

The task-based approach to language learning originally began to take shape with The Bangalore/Madras Communicational Teaching Project (Prabhu, 1987). The project materialized under the primary assumption that “the development of competence in a second language requires not systematization of language inputs or maximization of planned practice, but rather the creation of conditions in which learners engage in an effort to cope with communication” (Prabhu, p. 1). Prabhu felt strongly that teaching should revolve around generating conditions for managing meaning, as opposed to intentionally focusing on grammatical competence or language behavior. At the same time, Candlin (1987) made a connection between communicative language teaching and task-based language learning. Tasks were considered to be communicative if they created conditions for learner exploration, challenge, negotiation, interaction, production, engagement of comprehensible input, universal design, problematizing language learning, and language management.

Willis (1996) pointed out that task-based language teaching is an especially successful approach to second language acquisition because it creates essential and desirable conditions for language learning. The essential conditions include exposure to real language, use of the language to accomplish a specific task, and motivation to use the four skills to process and use the target language. The desirable condition includes opportunities for focusing on form.

As research of task-based language learning evolved, Skehan (2001) developed a simpler working definition of a task, which he defined as an activity where meaning is crucial, a problem must be solved, the outcome can be evaluated, and the problem relates to a real-life situation. Ellis (2003) expanded this definition so that a task specifically involves the following features: (a) a work plan, (b) a primary focus on meaning, (c) real-world processes of language use, (d) use of any of the four language skills (i.e., reading, writing, listening and speaking), (e) engagement in cognitive processes, and (f) a clearly defined communicative outcome.

Because of the wide-ranging definitions that have been proposed for task-based language learning as well as the extensive characteristic features of what a task should look like, tasks can come in many forms. They can be focused in which the use of a specific predetermined feature is sought in communicative language use or unfocused in which there is no focus on a specific predetermined feature (Ellis, 2003). Examples of tasks include information/reasoning/opinion gap activities, questions and answers, dialogues and role plays, matching activities, communication strategies, pictures and picture stories, puzzles and problems, discussions and decisions, and so on (Nunan, 2004).

Tasks are useful in the second language classroom because they provide the means through which a communicative approach can be implemented. The com-

municative approach emphasizes interaction as its central tenet, and interaction enables learners to acquire and use language at any stage of acquisition. The tasks described in this chapter morph over time under a design-based research methodology to better reflect the abovementioned goals of task-based language learning.

3. The Telecollaborative Language Exchange

3.1 The Virtual Language Exchange: First Time Around

In the 2011 fall semester, a telecollaborative language exchange involving a synchronous Skype chat exchange was developed between students from Loyola University Maryland studying Spanish at the beginning and intermediate levels and native speakers of Spanish studying English as a second language at the Instituto Tecnológico y de Estudios Superiores del Occidente (ITESO), a university in Mexico. The initial motivation for this project was a desire in both locations to have students gain more intercultural communicative competence by reaching out to a target language community in another country. The Association of Jesuit Colleges and Universities was first contacted by a Loyola University Maryland faculty member who was interested in making a connection with another university in a Spanish-speaking country in order to begin the processes of facilitating a match with an institution that had similar interests. Once the connection was made, the Virtual Language Exchange program was born. The description of the Virtual Language Exchange below and the findings from the project pertain solely to the experiences on the American side of the exchange.

The Virtual Language Exchange program began as an optional cultural event in which students at the beginning and intermediate levels of Spanish could participate. The curriculum stipulated that Spanish students at all levels were required to attend at least one cultural event during the semester for which they had submit a reaction report to their instructor after having attended the event. These cultural events were intended to have students exposed to Spanish language or culture and have them reflect on the experience of attending an event in the target language. The two Virtual Language Exchange sessions that were scheduled for that semester were only one option of many cultural events that students had the choice of attending.

Prior to attending one of the Virtual Language Exchanges, both the American and Mexican representatives collected the names and personal Skype contact information of the students who had previously signed up to participate in the exchange. The facilitators then paired the American students with the Mexican students before starting the exchange in order to avoid complications on the day of the exchange session. It was left up to the students to initiate the Skype contact once the session began. Approximately 10 students attended each of the two Virtual Language Exchange sessions in the fall semester.

A week before the Virtual Language Exchange was scheduled to take place, the two facilitators (one from the Loyola University Maryland and one from ITESO) individually decided on the proposed topics of conversation for the sessions. Since the sessions were scheduled for 1 hour, students were expected to divide

their time, speaking at least 20 minutes in English and at least 20 minutes Spanish.¹ The facilitators prompted students when it was time to switch languages. In the first Virtual Language Exchange session, the students learning Spanish were expected to ask questions in order to get to know their partner (i.e., name, hometown/country, current living situation, etc.). The pretask instruction for the first session included creating questions and preparing students to talk about similar personal topics. In the second Virtual Language Exchange session, the students learning Spanish were expected to ask the Mexican students about the holiday *Día de los muertos* ‘Day of the Dead’ and what is typically done to celebrate such a holiday. The pretask instruction for the second session involved having students watch a brief video segment about the holiday and subsequently writing down any questions they had about it. This second session also had a posttask activity of relaying the information obtained during the Virtual Language Exchange to other American student participants. However, since this was not controlled, students rarely made an immediate effort to relay the new information to their peers.

At the end of the semester, an informal survey was conducted to investigate student reactions to the Virtual Language Exchange experience. Based on the feedback received (see below) and an initiative to create a more level-appropriate meaningful language exchange that would ultimately enhance their language learning experience, a specific task-based approach to the exchange was implemented in the curriculum at all levels.

3.2 The Virtual Language Exchange: Second Time Around

In the following spring semester, the program was considerably expanded. The motivation for expanding the program on the Loyola University Maryland side was the belief that this type of exchange program should be accessible to all students studying Spanish and that it would probably be of great interest to many students because they would be able to make connections with real people of the same approximate age in the target language country. As the new version of the Virtual Language Exchange began to take shape, more and more instructors in both university settings (Loyola University Maryland and ITESO) showed interest in participating.

While the Virtual Language Exchange program began as an optional cultural event for students studying first- and second-year Spanish, the program coordinator decided that it should be required for students in Beginning Spanish I, Beginning Spanish II, and Intermediate Spanish I. For students in Intermediate Spanish II, the program remained an optional cultural event. Due to the large amount of ITESO instructor interest for participating in the program during the spring semester, 23 sessions had to be scheduled.

¹ The facilitators took 10 minutes before beginning the Virtual Language Exchange to state the rules and regulations of the Language Learning Center and prepare the students with necessary information regarding participation in the session. In addition, 10 minutes were left at the end of the session for wrapping up, sharing comments and impressions on the experience, and completing a survey.

In contrast to the fall program, the Loyola University Maryland representative created generic Skype names so that the students did not have to share their personal information.² The generic name policy had the additional advantage of allowing the American facilitator to log students on to the computers before the start of the program and thereby save time and avoid complications prior to students' arrival at the Language Learning Center laboratory. Throughout the semester the American representative passed out signup sheets for each session in all sections of first- and second-year Spanish to confirm available space in the Language Learning Center laboratory. Prior to the beginning of each exchange session, the Language Learning Center staff prepared the computers for the Skype exchange and sent contact requests in advance to the students who were signed up on the Mexican side of the exchange. When the American students arrived at the Language Learning Center, the staff directed each one to a computer that had already initiated a contact request from a randomly selected Mexican student willing to participate in the exchange. Between 15 to 20 students attended each of the 23 sessions.

Since the Virtual Language Exchange program morphed into a required cultural event for most lower level Spanish courses at Loyola University Maryland, we developed an initiative to create a more level-appropriate meaningful language exchange that would ultimately enhance students' language learning and cultural experience. For this reason, a more involved task-based approach to the exchange was implemented in the curriculum throughout the various levels. The exchange sessions were again scheduled for 1 hour, and students were expected to divide their time, speaking both English and Spanish for a minimum of 20 minutes each.³ The level-specific task for students in Beginning Spanish I and II courses encouraged the students to gather personal information about their partner (i.e., name, age, where they are from, major, information about their family, favorite pastimes, etc.) during the sessions. A handout posted on Loyola University Maryland's course management system served as a template for what information students were to seek during the sessions (see Appendix A). Once each of the sessions was over, the first-year students had 1 week to complete a posttask activity that involved writing a minibiography of their partner which they then submitted to their instructor for grading. During the sessions, the level-specific task for students in Intermediate Spanish I involved gathering much of the same information but, in addition, other information pertaining to holidays celebrated in their partner's hometown, special Mexican foods/dishes, and interesting places in Mexico. Yet again, a handout was posted on Loyola University Maryland's

² Creating generic Skype names also avoided the problem of students who did not already have a Skype account, students who could not remember their Skype contact information, and for students who provided the facilitator with incorrect Skype names.

³ Again, the facilitators took 10 minutes before beginning the Virtual Language Exchange to state the rules and regulations of the Language Learning Center and prepare the students with information regarding their participation in the exchange. However, in contrast to the 2011 fall semester, 10 minutes was left for the end of each session for wrapping up. The survey was not distributed to the participants until the end of the semester.

course management system to serve as a template for what information students were to seek during the sessions (see Appendix B). Once each of the sessions was over, the second-year students had 1 week to complete a posttask activity that involved creating a tourist brochure which demonstrated a particular cultural aspect that they had learned about during their session. Students were also expected to elaborate upon their chosen topic by conducting an internet research as well. Each student's instructor graded the brochures.

At the end of the semester, a more elaborate online survey was developed using Survey Monkey in order to investigate student reactions to the newest Virtual Language Exchange experience. Again, based on the feedback received (see below), adjustments and appropriate modifications to the telecollaborative experience at Loyola University Maryland will be made for the 2012 fall semester.

4. Student Reactions

4.1 The Virtual Language Exchange: First Time Around

After completing the Virtual Language Exchange in fall 2011, students were asked to complete a survey pertaining to their experience in the telecollaborative exchange. Thirteen students completed the survey. The survey included the following open-ended questions:

1. What are your overall impressions of the Virtual Language Exchange experience?
2. What did you learn about your partner?
3. What did you learn about their school or culture?
4. Was this a good way to practice communicating in Spanish?
5. Which part did you enjoy more – English or Spanish?
6. Would you do this again?
7. Do you plan to keep in touch with your partner?
8. Do you have any suggestions to improve the Virtual Language Exchange?

The students' overall impressions of the exchange project reflected a very positive experience. Students said that they really enjoyed speaking with someone from a different country and that they found the experience fun and interesting. Some students even mentioned that it was one of the best opportunities that they had been given to actually practice Spanish for real-world purposes with friendly people of approximately the same age. Most students recommended this type of exchange as a way to improve second language listening and speaking skills in a more informal environment than the one found in a classroom. One student even commented that the experience made him see how good his Spanish was.

When asked what they learned about their partner, most students reported learning something about what their partner studies, what their family is like and what each family member does for a living, what they do in their spare time, if they have studied abroad, if they have any trips planned for the near future, and what they aspire to do one day.

When asked what they learned about the partner's university and Mexican cul-

ture, the students mainly commented on the similarities and differences between Americans and Mexicans. They pointed out that Mexicans are very proud of their language and culture, but also value learning other languages and cultures. In addition, students mentioned that Mexican students, unlike American students, live off-campus, usually with their families while they attend university and that Mexican students are required to enroll in more classes per semester than the American students. Many students reported that they had similar interests such as spending time with their friends and traveling.

All of the students agreed that the Virtual Language Exchange was a good way to practice communicating in Spanish. Some students admitted that they were nervous at first, but that their partner helped them along when they had trouble expressing themselves. Other students even mentioned the particular skills with which they were having difficulty (i.e., listening or speaking). However, when asked which language they preferred using, most students made a comparison of their Spanish skills to the Mexican partner's English skills, which were for the most part more advanced. By and large, the American students reported that they felt more comfortable using English, but that they enjoyed practicing their Spanish.

All the students said they would take part in the Virtual Language Exchange again and most students said that they hope to keep in touch with their Mexican partners in the future. Some students even revealed that they had become friends on Facebook. Overall, students appeared very pleased with the Virtual Language Experience.

When asked if they had any suggestions for the program's improvement, the students made various comments. Some comments pertained to problems with the quality of the Skype call, which was not as clear as they would have liked it to have been. This led some students to use text-chat without audio while viewing the video. Others had trouble with the video and were able to use the text-chat features only. Some were able to use the video chat, even though they commented that it was difficult to hear their partners due to audio problems. Comments not dealing strictly with technology issues reflected a desire to have a previously determined set of printed questions or topics to talk about so that the conversations would not be so spontaneous. One student even mentioned that she would have liked a lesson in colloquial Spanish terms in order to better understand authentic young adult Mexican speech.

4.2 The Virtual Language Exchange: Second Time Around

At the end of the 2012 spring semester, 84 students at Loyola University Maryland completed an online survey about their experience participating in the Virtual Language Exchange program. The survey included demographic data questions, questions about the specific exchange session the students attended, questions regarding technological aspects of the exchange, and overall impressions of the program.

The demographic questions revealed that students registered in all levels of Spanish courses attended the exchange sessions, not only students whose cur-

riculum dictated that they do so. Most of the responders were in their freshman or sophomore year, and most were female. A small percentage of students declared Spanish as their secondary academic major, while a larger percentage of students declared Spanish as their minor.

The questions pertaining to the program demonstrated that most students participated in a session in the month of February or April; the January sessions had the fewest number of participants. This also appeared to be the first exchange experience for the majority of participants. Students reported for the most part being paired up individually to one partner in the target language country, however, having two or three partners did occur on rare occasions. Most students also confirmed never having been to Mexico.

The technological questions uncovered that most of the sessions included audio and video as the primary means of communication. However, in some instances students had access to video with audio or text-chat only. Rarely did students have access to text-chat only. The internet connection was reported as either good or fair; a few students lost the internet connection, but only once or twice. A few students reported faulty headsets, but the majority had no problems with the headset that was provided to them. For the most part, students confirmed using a generic Skype name as opposed to a personal Skype name, but a few students opted to use their own Skype names for personal reasons.

The students' overall impression of the program revealed again that they found the experience very positive. Students primarily commented on how enjoyable the experience was and how they found it a nice way to practice their language skills. A few students pointed out that the sessions were disorganized and that the internet connection was less than desirable. One or two students found the session pointless and a waste of their time.

When asked about what students learned about their partner, most students again reported learning something about their partner's hobbies, studies, where they are from, likes and dislikes, family, and so on. When asked what students learned about their partner's university and culture, students also mainly commented on the similarities and differences between the two cultures. Some students received a virtual tour of their partner's campus, which led them to talk about the similarities and differences between campuses, classes, and course expectations. Some students discussed food and how the kind of food Americans consider to be Mexican food does not necessarily originate in Mexico. Students also mentioned that Mexican students tend to live at home with their families while attending a local university, a concept that is relatively foreign to Loyola University Maryland students.

For the most part students agreed that the Virtual Language Exchange was a good way to practice communicating in Spanish. However, some students did not like the fact that their partner's English abilities were superior to their Spanish abilities. This led students to feel self-conscious when speaking in Spanish. Some students reported liking the fact that they were engaged in real-life conversations with native speakers, and some students even reported learning new colloquial

phrases during the experience. For those students who found the experience negative, it appears that the internet connection may have had something to do with this sentiment. When asked which language experience the students preferred, English or Spanish, the results appear to be divided evenly for all of the reasons mentioned above.

Most students said they would take part in the exchange program again, but most students said that they were not going to keep in touch with their partner in the future. For the students who stated that they would not take part in the Virtual Language Exchange again, this seemed to be because they would not be required to do so (i.e., they would not enroll in any more Spanish classes). For the few students who stated that they would remain in contact with their partners, they said they would do so through Facebook.

When asked if students had any suggestions for the program's improvement, many students said no. Students who offered suggestions mentioned that they would like to see a better internet connection. One student mentioned that she would have preferred a one-to-one conversation, while another student mentioned that she would have preferred a group conversation.

5. Overall Findings and Implications for the Program

In most language classrooms, some form of technology is being used to help students acquire a second language. Technology is generally used as a tool to help language learners interact with the language in new and interesting ways. Technology even has the potential to enhance a second language learner's encounter with the target language when used wisely (Blake, 2008). The telecollaborative Virtual Language Exchange program described here is founded on these basic principles. Not only is it a program that provides learners with the opportunity to interact in the language in a new and interesting way, it also offers second language learners an environment in which they are required to conduct meaningful face-to-face exchanges in which negotiation of meaning must take place in order to complete a particular task.

The more detailed task-based approach that developed as the Virtual Language Exchange program progressed from one semester to the next is the result of a design-based research approach that set out to improve the language learning experience over time, keeping in mind all of the people who are affected by the implementation of this program (i.e., the students, the instructors, the coordinator, and the facilitators).

The Virtual Language Exchange program is linked to specific theories of second language acquisition. Second language acquisition research has clearly demonstrated over the years the importance of negotiating meaning with other learners and/or native speakers in face-to-face exchanges (Pica, 1994; Long, 1996; Gass, 1997; Gass & Varonis 1994). Essentially, learners who negotiate meaning notice gaps in their linguistic knowledge and must find a resolution for this gap before continuing (see Example 1).

Example 1

- NNS: Ok um, ¿Qué es tu papá y mamá?
 ‘Ok, um, what is your father and mother?’
- NS: Eh, ¿a qué se dedican?
 ‘Eh, what do my parents do?’
- NNS: Yeah.
- NS: Their occupation?
- NNS: Yeah, Yeah.
- NS: Eh, eh, mi papá trabaja en una compañía de ventas.
 ‘Eh, eh, my father works at a company.’
- NNS: Ok.
- NS: Y mi mamá es ama de casa.
 ‘And my mother is a housewife.’

Despite the fact that the native speaker of Spanish in this example resorted to double checking whether or not the partner had really asked about her parents’ professions in English, a comprehension gap occurred created before the language switch, and both speakers had to deal appropriately with the noticing of this gap.

In the next example, the Spanish student noticed a gap when the native speaker reiterated her year in university using a more natural Spanish phrasing. The student confirmed the native speaker’s recast, acknowledging that that was indeed what she meant to say before continuing on with their conversation.

Example 2

- NNS: Ok um, ¿qué estudias?
 ‘Ok um, what do you study?’
- NS: Nutrición. Y tú ¿qué estudias?
 ‘Nutrition. And you, what do you study?’
- NNS: Eh f... Yo estudio um finanzas.
 ‘Eh f... I study finance.’
- NS: Finanzas. ¿En qué año vas?
 ‘Finance. What year are you in?’
- NNS: Um uno.
 ‘Um one.’
- NS: El primer año, ok.
 ‘The first year, ok.’
- NNS: Yeah y ¿tú?
 ‘Yeah and you?’
- NS: No, yo voy en quinto semestre.
 ‘No, I am in my fifth semester.’
- NNS: Ok.

In both semesters, the Virtual Language Exchange provided students with an opportunity to engage in face-to-face conversations with a Mexican partner through synchronous multimodal video conferencing software. Although the tasks during each semester were different, students reported having to negotiate meaning successfully in order to complete the task (see Examples 3-5).

Example 3

NNS: ¿Tú visitas Estados Unidos?

‘You visit the United States?’

NS: Sí, sí he ido hace ...

‘Yes, yes it’s been ... since I have gone.’

NNS: Where?

NS: Los Ángeles, San Diego.

NNS: ¿Te gustas o no?

‘Do you like yourself or not? (Student meant to ask: “¿Te gusta o no?”)’

NS: ¿Me gusta Estados Unidos? Sí, sí me gusta pero solo para pasear, no para vivir.

‘Do I like the United States? Yes, yes I like it but only for visiting, not for living.’

NNS: ¿Qué?

‘What?’

NS: Solo para ir como turista.

‘Only to go as a tourist.’

NNS: Oh sí.

‘Oh, yes.’

NS: Para vivir no.

‘Not to live.’

Example 4:

NNS: Mmm... ¿Visitar Americana?

‘Mmm... You visit American?’

NS: ¿Qué? ¿Si he visitado a América?

‘What? Have I visited America?’

NNS: Mhm.

NS: ¿Cómo?

‘What?’

NNS: ¿Y ha visitar Estados Unidos?

‘And have to visit the United States?’

NS: Sí

‘Yes.’

NNS: ¿Dónde?

‘Where?’

NS: Sí ... este ... Texas, fui a XX,⁴ Dallas, San Antonio, uhm Laredo, Austin, y lo que más me gustó fue San Antonio. Los museos de Ripley, El Alamo, San Marcos también. El XX, eh que más ...

‘Yes ... let’s see ... Texas, I went to XX, Dallas, San Antonio, uhm Laredo, Austin, and what I like the most was San Antonio. The Ripley’s museums, the Alamo, San Marcos as well. The XX, eh what else ...’

⁴ XX is used to signify that the participant said something that the researcher did not understand.

Example 5

NNS: ¿Qué edad tienes?
'What's your age?'

NS: ¿Qué?
'What?'

NNS: ¿Cuántos años tienes?
'How old are you?'

NS: Diecisiete.
'Seventeen.'

In examples 3, 4 and 5 it is clear that without the act of negotiating meaning, the student would not have been able to complete the assigned task. Ultimately, the transformation of the Virtual Language Exchange program from one semester to the next provided a supplemental tool to students for target language interaction outside of class time where students would be in complete control over their own language learning experience. They instinctively noticed the gaps and negotiated meaning because of the way in which the telecollaborative exchange was set up and carried out.

Since the initial conceptualization of the Virtual Language Exchange program in the fall of 2011, it has undergone an iterative research cycle in terms of development and design. The program began as an optional cultural event but later became required as part of the curriculum. During its implementation in the first semester, students were given the simple task of getting to know their partner as well as the cultural tradition of the Day of the Dead. In the second semester, students were required to complete a more elaborate task that also included the posttask activity of relaying the information that they had acquired back to their instructor in written form. In addition, small modifications in the program's implementation took place based on informal feedback from the students, instructors, facilitators, and coordinator.

The results of the surveys contribute to the growing body of research regarding CALL, telecollaboration and task-based learning in various ways. A program such as the one described here offers the field of CALL a new approach to facilitating telecollaborative encounters. From an organizational standpoint, this type of activity can be integrated into a curriculum, but completed outside of class time yet still using departmental resources. This prevents it from cutting into precious class time, and it saves overburdened instructors from having to coordinate the logistics and technology needs individually. In addition, from a pedagogical standpoint, it is not sufficient simply to provide language learners with the opportunity for telecollaborative communication; it is much more pedagogically sound to incorporate a task-based approach to the telecollaboration event so that students become accountable for their own language learning throughout the exchange experience.

The Virtual Language Exchange is the quintessential example of involvement of authentic settings; it has students personally use technology, in this case Skype,

to communicate with another student in different country.⁵ It is not the instructor who manipulates the technology for the students' benefit; it is the student who is in complete control of the language exchange. In addition, students communicate with a native speaker living in the target language country. This is potentially the most authentic setting that American students will experience besides studying abroad.⁶

The level-appropriate posttask used in the second semester of the exchange also speaks directly to making a connection between having students participate in the Virtual Language Exchange and expecting them to be able to relay the information learned during the exchange to an outside observer. Students are asked to take responsibility for their learning during the exchange and then held accountable for communicating what they have learned in the target language to another audience. The biographies and brochures that students produced in spring 2012 were eventually posted in the Language Learning Center for all to see.

Taking this one step further, when analyzing oral exam outcomes from a sample of students who did not participate in the Virtual Language Exchange in fall 2011 in comparison to a sample of students who did in spring 2012, there is a small, yet evident, improvement in terms of their oral proficiency outcomes (see Table 1).⁷

Table 1
Oral Proficiency Exam Grades in Spanish

	Fall 2011	Spring 2012
First year	91.2%	92.3%
Second year	86.9%	88.2%

The Virtual Language Exchange program began with a basic goal of facilitating a language/culture exchange between American and Mexican university students studying Spanish and English, respectively. Yet under a design-based research

⁵ Skype is one of the most commonly used real-world platforms with which people communicate at a distance. It is not designed to serve as a pedagogical tool in language learning. Many students already use Skype for their own personal communication; therefore it inherently provided an authentic, yet familiar, context for the Virtual Language Exchange sessions. Additionally, it was already in use at the sister institution and considered the standard interface among all the institutions participating in another, similar program. For these reasons, there was no need to adjust this aspect of the Virtual Language Exchange model over the two semesters.

⁶ Based on some comments made in the surveys, the use of Skype in this context led students to use other Web 2.0 technologies (i.e. screen capture, social-networking sites, blogs, etc.) in order to stay in contact with their Mexican partners after the initial Virtual Language Exchange.

⁷ Given that only 20 students participated in the Virtual Language Exchange in fall 2011 and those 20 students could have been from any level of Spanish (i.e., first, second, or third year), it is assumed that the outcome percentages shown here for first- and second-year Spanish students is truly reflective of their oral proficiency capabilities before being required to participate in the Virtual Language Exchange in spring 2012. Hence the comparison of outcomes between these two semesters.

framework, the program eventually allowed for the manipulation and enhancement of the program's content of language instruction and instructional materials developed for the learner's benefit through the use of a synchronous multimodal technology accessible to all and familiar to many.

6. Suggestions for Expansion

The Virtual Language Exchange program will continue to undergo various adjustments as the program evolves. First, the representative at Loyola University Maryland has requested that the Association of Jesuit Colleges and Universities expand this program to include more than just an exchange with ITESO students in Mexico, preferably a connection with various Jesuit universities in Spanish-speaking countries. The Virtual Language Exchange program fundamentally furthers the department's and the university's mission of having students become proficient in a language other than their own and learn about other cultures.

Second, a more in-depth pretask activity will be implemented in the curriculum to guide students to a more positive Virtual Language Exchange experience. All instructors will be asked to discuss the Virtual Language Exchange program in their classes prior to having their students sign up to participate. Not only will students be provided with the same handout as in spring 2012 with the topics that are to be discussed during the exchange, but, also as a class, students will create appropriate questions with the help of their instructor that will elicit appropriate responses from their partner. Consequently, students will be better prepared for the actual task of obtaining specific information during the exchange sessions.

Third, the online survey intended for gathering information about the student experience during the Virtual Language Exchange will be given immediately following each exchange session before students leave the Language Learning Center laboratory. Given that more than five hundred Spanish language students will participate in the next Virtual Language Exchange program, it benefits the research to receive as much feedback as possible to get a better idea of how well the program is working overall.

The promoters of the Virtual Language Exchange program at Loyola University Maryland hope that the success of this program in Spanish will not only encourage the department's other language sections to offer a similar experience to their students, but also provide a model for the implementation of comparable telecollaborative programs at other institutions. By harnessing the power of technology and second language acquisition theory under a design-based research approach, we can ensure that students will continue to make connections with students from other countries and cultures while improving their intercultural communicative competence.

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Appendix A
Intercambio Virtual
(Virtual Language Exchange)

Descubre la información siguiente sobre tu nuevo amigo de México.

Nombre y apellido:

Edad:

Ciudad de origen:

Especialidad académica:

Familia:

Pasatiempos favoritos:

Otras cosas interesantes:

TAREA: Escribe una biografía sobre tu nuevo amigo incluyendo la información de arriba. También, incluye una foto de tu nuevo amigo.

(100 words, typed and single spaced – will be posted to the Loyola University community)

Appendix B
Intercambio Virtual
(Virtual Language Exchange)

Descubre la información siguiente sobre tu nuevo amigo de México.

Nombre y apellido:

Edad:

Ciudad de origen:

Especialidad académica:

Familia:

Pasatiempos favoritos:

Día festivo:

Comida especial:

Lugar interesante en México

Otras cosas interesantes:

TAREA: Crea un folleto turístico que presente un aspecto cultural de lo que aprendiste durante tu conversación. Investiga el tema que escogiste por Internet para elaborar tu folleto turístico.

Enlaces útiles:

<http://www.culturamexicana.webs.com/>

<http://www.explorandomexico.com/mx/about-mexico/5/>

<http://www.turismoenmexico.com.mx/>

(Will be posted to the Loyola University community)

