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DESIGN GUIDELINES FOR A MOBILE-ENABLED LANGUAGE LEARNING SYSTEM SUPPORTING THE DEVELOPMENT OF ESP LISTENING SKILLS

BY

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Approval of Thesis

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Dedication

This dissertation is dedicated to my family and friends without whom pursuing my goals would not be possible. It is also dedicated to all learners without whom my goals would not be worth pursuing.

Ubuntu: "I am what I am because of who we all are."

(Archbishop Desmond Tutu)

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Abstract

This dissertation presents, describes and discusses an interdisciplinary study which investigated the design and development of a language learning instructional solution to address the problem of inadequate aural skills acquisition for college ESP (English for Special Purposes) students. Specifically, it focused on the use of mobile technology to expand learning beyond the classroom.

The eighteen-month process of data collection and analysis resulted in a conceptual model and design principles for a Mobile-Enabled Language Learning (MELL) solution. Mobile-Enabled Language Learning Eco-System was thus designed, developed and trialled in the real-life learning context. Through the iterative process of the design, development and evaluation of the MELL system and its components, design principles were also generated. These design recommendations were refined and reformulated in a cyclical fashion with the help of more than 100 students and ten experts. The resulting MELLES design framework encompasses guidelines addressing the essential characteristics of the desired MELL intervention as well as procedures recommended to operationalize those features.

The study also resulted in a better understanding of the broader context of ESP learning using mobile devices and the role of elements of environment, ultimately contributing to real-life praxis of the Ecological Constructivist framework and the complementary approach of Design-Based Research (DBR) methodology.

Preface

The purpose of this preface is to reflect on my role and engagement as a researcher in my doctoral study. In order to conform to the APA and Athabasca University guidelines, I have deliberately removed myself as a researcher in the dissertation. However, I recognize the important role of researcher's reflection which helps identify researcher's biases and contributes toward more informed reading.

I was fortunate to embark on my first participatory action research study at George Brown College in 2005. At that time I was employed at the college as a curriculum designer and English for Special Purposes (ESP) instructor. Owing to my familiarity with IT programming and expertise in educational technologies, I was engaged in special projects examining Computer-Assisted Language Learning approaches. My first action research project aimed to identify language requirements for internationally-trained professionals studying at the college and investigate ESP educational interventions needed to enhance their language skills. I continued working as an action researcher in a follow-up study (2007-2009) which explored Mobile-Assisted Language Learning solutions as part of an ESP intervention for GBC learners whose first language was not English. These four years of in-situ co-researching and co-practice involving the college students and faculty prepared me well for the challenges of my doctoral Design-Based Research study which I subsequently conducted in the same naturalistic educational context with cohorts of similar student participants and essentially the same faculty.

As an action researcher, I drew on my two-decade long experience as a second language teacher and instructional designer, my knowledge of educational technology, as well as my insider perspective. Working as an integral part of the college day-to-day operations and its community offered me a deep understanding of the institution's culture and practices, including its educational needs and potential interventions. In my role of an action researcher, I carried out the work of identifying educational problems, potential solutions, and subsequently designing and evaluating those interventions in order to improve my own practice as well as that of other practitioners. I was directly engaged in both didactic and research activities as well as in observing and studying their results. For students, I was concurrently their teacher and a researcher, which might have led to reactivity amongst participants. While collecting feedback from my own students allowed me to establish rapport with the participants, facilitating personal and candid dialogue and consequently more informed research (Fontana & Frey, 1994), that rapport might have also limited their objectivity and value-free opinions. For me, it repeatedly produced an internal conflict between the two roles, for instance between intervening when a student needed language support and remaining neutral in order to elicit his/her feedback without "tainting" the context. The high degree of participation in teaching activities thus threatened my objectivity and ability to maintain an appropriate distance from those being observed and evaluated. Moreover, the task of implementing all the design and MALL teaching responsibilities by myself might have diminished the breadth of expertise and insights regarding the studied intervention.

DBR, in contrast, offered the expertise and energy of a team of practitioners representing the relevant disciplines including language learning, software design and development, wireless technologies, and pedagogy. Most importantly, I was able to concentrate on my researcher responsibilities and actively co-research the identified educational problem and solutions with student and faculty participants whom the research aimed to help. In fact, by distancing myself from the teaching responsibilities, I was able to assume the position of an external facilitator who, through a rigorous and objective research process, enabled the design and evaluation of the required educational intervention. Being knowledgeable of the complexities of the specific culture, politics, stakeholders, and technology allowed me to create and evaluate an intervention appropriate for the unique social, political, and educational context of this college. At the same time, by focusing on my primary role of researcher and research process coordinator, I was able to control the researcher bias and remain reflexive during the data collection, analysis, reflection and evaluation of the MELL design (discussed in more detail in Chapter 3). Drawing on my experience as an action researcher, I ensured that the DBR study was not contaminated by the influence of the researcher, that I remained cognizant of any such influences and compensated for them in the interpretation of the data (Wang & Hannafin, 2005), "in selecting evidence, in reporting observations, and in developing trustworthy claims" (Barab & Squire, 2004, p. 3). "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).

Although I had no more teaching responsibilities, my role of a DBR researcher remained multifaceted. I was actively engaged in the exploration, design, testing and evaluation of the intervention and its prototypes as well as the conceptualization of the resultant theory. While I was able to rely on a team of practitioners and experts, I had to employ strong project management skills to ensure the success of numerous concurrent dynamic processes and to coordinate the activities of over a hundred participants. This required ongoing leadership, communication with participants, attention to their needs and questions, as well as the inclusion of team-building strategies, for example the establishment of elaborated communication processes.

Yet another challenge resulted from my joint role of designer and researcher which, in the end, led to having to evaluate my own intervention design putting my objectivity and reflexivity to test, and potentially resulting in threats to validity (treated in more detail in Chapter 3). It was through recursive re-conceptualization of the design and theory based on all participants' feedback combined with my reflections documented in my researcher journal, that I was able to minimize the researcher bias. It was particularly helpful to be able to fall back on other participants to perform tests and some evaluation activities. It was their needs and feedback that influenced all research decisions. Nevertheless, I must admit that at times I might have been less receptive to critique and extra effort was required on my part to achieve neutrality and value-free results. Lastly, as observed by the

Design-Based Research Collective (2003), I often found myself in the conflicting roles of advocate and critic of the MELL design. All in all, I had to assume the roles of an investigator, research processes coordinator, instructional designer and theorist, MELL designer, evaluator and implementer, mobile learning Subject Matter Expert, negotiator and collaborator. Having experienced first-hand the opportunities and conundrums presented by DBR, I would like to conclude with the following reflection: The multiple roles of a DBR researcher can be beneficial in acquiring more accurate and deeper insights into the design and the context in which it is studied; however, DBR researchers have to cautiously walk the boundary between their many roles and be cognizant of how they may influence the people, interventions, results and context of the research. They have to be adaptable, tolerant of changing functions and circumstances, yet systematic and rigorous. In fact, DBR research requires a collaborative effort of a team of practitioners, students, and researcher(s) equipped with diverse competencies. DBR is a research design more conducive to implementation by a collaborative team of researchers than by a single researcher, even when well-supported by her colleagues and participants.

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Chapter 1. Introduction and Project Overview

Introduction

This dissertation presents, describes and discusses an interdisciplinary study which investigated the design and development of a language learning instructional solution to address the problem of inadequate aural skills acquisition for college ESP[1] (English for Special Purposes) students. Specifically, it focused on the use of mobile technology to expand learning beyond the classroom.

The eighteen-month process of data collection and analysis resulted in a conceptual model and design principles for a mobile-enabled language learning solution. The study also generated an understanding of the broader context of ESP learning using mobile devices and the role of elements of environment, ultimately contributing to real-life praxis of the Ecological Constructivist framework and the complementary approach of Design-Based Research (DBR) methodology.

The nine chapters of this dissertation provide a systematic and detailed account of this study and its research, methodology, findings and results. Chapter 2: (Literature Review) focuses on research that informed the design of the solution

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[1] ESP stands for *English for Special Purposes* (also English for Specific Purposes), for example Business English, Technical English, English for Medical Professionals. Students, predominantly adult learners, who learn English for Special Purposes study English in context of a certain field, profession, or topic. ESP is a sub-group of the broader ESL (English as a Second Language) category which is sometimes referred to as general English. Gatehouse (2001) offers a more elaborate discussion of the specific characteristics and approaches of ESP courses. She also discusses key issues in ESP curriculum design which include (1) abilities required for successful communication in occupational settings, (2) content language acquisition versus general language acquisition, (3) heterogeneous versus homogenous learner groups, and (4) relevant materials development. Thus, the key difference between ESP and ESL lies in the learner characteristics and the fact that in ESP, the primary focus is on communication in a professional setting.

which covered language learning, aural skills acquisition, mobile learning, mobile learning objects and learning theory. Chapter 3: (Methodology) reviews the key research question, the DBR methodology, and the three-phase research design and its procedures.

Chapter 4: (Phase 1) Informed Exploration – Findings, Discussion and Evolution, describes how preliminary design principles were derived in Phase 1 and how the study, the theoretical framework and the MELL (mobile-enabled language learning) solution subsequently evolved. Chapter 5: (Phase 2) Enactment, explains the progression of the conceptual framework and the solution prototype. Furthermore, qualitative findings on design development and refined design guidelines are presented. Chapter 6: (Phase 3) Evaluation – Findings, reports on the pilots and assessment of the educational intervention, participant feedback, and further refinement of design principles.

Chapter 7: Evaluation of Local Impact – Discussion and Refinement of Design Principles, presents qualitative and quantitative results which corroborated new insights, and also provides a detailed account of participant feedback. In addition, and in keeping with the DBR process, this chapter highlights reformulated design principles distilled from the findings. Chapter 8: Synthesized MELLES Design Principles, features details of a revised system and its network of interconnections along with final design principles for the MELLES (Mobile-Enabled Language Learning Ecological System) solution. Finally, Chapter 9: Summary, Significant, Limitations and Recommendations, summarizes the study process, outcomes, and conclusions, and provides recommendations and suggestions for future research.

MALL versus MELL

As further discussed in Chapter 2: (Literature Review), the term Mobile Assisted Language Learning (MALL) has been used in the literature of the field to denote an approach to language learning that incorporates the use of handheld mobile devices. A modified term emerged from the findings of this study, namely Mobile-Enabled Language Learning (MELL), which emphasizes the role of mobile technology as an enabler of the learning process. This was demonstrated by the critical impact mobile technology strategies had on enabling the pedagogical features of the MELLES system (Chapter 8). Therefore, MALL will continue being used in the document with reference to any research outside the DBR study reported here. At the same time, the term MELL will replace the broadly-used term MALL in accounts and discussions pertaining to this study and its findings.

Mobile Learning Defined

As discussed in more detail in Chapter 2, for the purpose of this study, mobile learning (m-learning) is defined as knowledge construction, skill development and performance support, in which actors engage across various locations, times, situations and contexts through the mediation of mobile devices. It encompasses learning processes which are either formal or informal, incidental or purposeful, and spontaneous or planned. Mobile learning is enabled and mediated by highly portable devices which are always on and which afford communication as well as networked connection. It is also vital, particularly in a language learning setting, as exemplified in this study, that mobile learning devices are capable of being used for playing podcasts and the production of learning artefacts, capturing and conveying meaning through both images and audio. Accordingly, examples of MELL devices include smartphones[2], web-connectable "dumb" phones[3], any iPod Touch, and tablets. In the context of this definition, MELL devices therefore do not include devices such as laptops, netbooks and notebooks, nor do they include MP3 players.

Overview and Background

Listening is recognized as a critical skill in language learning and communication (Rubin, 1994), and occupies over 50 percent of the time a language learner spends functioning in a foreign language (Nunan, 1998). Although the significance of aural skills has been acknowledged, listening remains the least explored skill in language learning literature (Nation & Newton, 2009). It is also a language skill which, next to speaking, was identified as the area requiring the most remediation amongst second language speakers at George Brown College (GBC) (Palalas, 2009a, Palalas, 2009b).

[2] Smartphone operating systems include Android, Windows Mobile, Apple iOS, Blackberry OS, Palm OS, Symbian OS.

[3] A phone that has lower specs than a smartphone in terms of screen size, wireless connectivity, storage space, etc. The critical differentiator is that there is no development environment that allows any third party applications (apps) to be installed. The most recent dumbphones tend to offer camera, and mp3 player features. Dumbphones are also referred to as "feature" phones.

The basis of this doctoral study originated from findings of the Occupation-Specific Language Profile (OSLP) project, a language benchmarking research study conducted at GBC between 2007 and 2009. The fundamental goal of OSLP was to facilitate ESP college students' attainment of learning outcomes and subsequent success in securing jobs commensurate with their skills, knowledge and experience. Although a number of GBC programs were benchmarked with parallel results, this study originated from work conducted with the Accounting program. Findings gathered through benchmarking the Accounting students' language proficiency, as well as the language requirements of the Accounting program and the corresponding workplace, revealed a critical need for language support. A significant gap was identified between the students' actual language proficiency and the skills required of them by both the college and the workplace (Palalas, 2009a). Speaking and listening were isolated as the most critical skills for students' improved performance. Inadequate socio-cultural competencies were also recognized as factors distancing students from academic and professional success. Similarly, research at other community colleges cited inadequate language proficiency, in particular, listening and speaking skills, as a primary barrier for English as a Second Language (ESL) college learners seeking employment, and employers hiring and retaining immigrants as employees (CIITE, 2004). Acquiring solid oral and aural skills was generally identified as critical for successful integration of newcomers into the Canadian workforce (CIITE, 2004; Palalas, 2009a; Palalas, 2009b). Based on these findings, a need for English for Special Purposes (ESP) intervention was determined.

In order to design effective language support solutions for the second language speakers in the Accounting program, an in-depth needs analysis was conducted. Workplace and program language requirements, as well as students' language competency, were measured using the Canadian Language Benchmarks (CLB) framework. The CLB is "a set of descriptive statements about successive levels of achievements on the continuum of ESL performance" (Pawlikowska-Smith, 2000, p.viii)[4]. CLB numeric values, from CLB 1 to CLB 12, were used to compare the benchmarking results. The average gap between the students' English language proficiency and the workplace requirement was 1.9 CLB for speaking and 1.6 CLB for listening. However, a number of students needed to improve their oral and aural skills by up to 4 CLB levels to meet the minimum workplace requirement of CLB 8. Considering that it takes approximately 380 hours for an individual with graduate level education to progress from CLB 6 to CLB 7 (Alberta Learning, 2004), the recommended ESP intervention had to provide English language instruction going beyond the standard 52-hour course. This requirement, coupled with the desired focus on speaking and listening skills, guided the design of the ESP intervention.

A hybrid English for Accounting course was designed to provide innovative oral as well as aural learning through a blend of in-class, online and mobile-assisted ESP instruction and practice. This ESP course addressed the language and socio-cultural competencies required by the Canadian workplace (see

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[4] The CLB scale, comprising twelve benchmarks (CLB 1 to CLB 12 with Benchmark 12 indicating fluent advanced proficiency), is descriptive and task-based. Each benchmark comprises a number of descriptors, performance conditions, performance indicators, tasks and competencies that serve as an indicator of a learner's language proficiency in each of the four skill areas – speaking, listening, reading, and writing.

examples of listening competencies in Appendix A). Traditional ESP content was delivered in class and online, whereas aural practice was offered via mobile devices. Audio and video content was created in-house and provided to students for on-the-go retrieval and practice. The one-semester course was piloted between January and May 2009 with a group of twelve adult learners. Students were loaned iPod Touch devices for the fifteen weeks of the pilot.

The level of students' satisfaction with the mobile technology and their actual learning were measured using semi-structured interviews, surveys, focus groups and language learning assessments. All participants considered iPod Touch devices to be an effective technology for ESP language learning with a flexible, portable and convenient delivery format that matched their needs and demanding schedules. Consistent with MALL literature, the learners seemed to appreciate the portability and convenience of mobile technologies, as well as the personalization and learning "across contexts and life transitions" (Sharples, 2009). Participants also indicated that they preferred the inherent audio capabilities of mobile devices over text-based options. The OSLP project found that, of the four language skills[5], listening was best served via the iPod Touch and other mobile devices. Both the students and the researchers observed, however, that the audio podcasts developed for the pilot were not sufficiently engaging or interactive. The impact of the audio and video content was not exhaustively investigated, nor was the actual learning adequately evaluated. In fact, most mobile learning studies to date have provided attitude evaluations, yet evidence of

[5] The four language skills are speaking, listening, reading, and writing.

the nature and permanence of learning has been lacking (Sharples, 2009). Unfortunately, due to restricted funding, the OSLP project was not able to further investigate the reasons for students' satisfaction with the mobile technology nor strategies to optimize learning via mobile devices. A number of questions emerged from the pilot, which thus formed a foundation from which to investigate the design of MALL listening content. Some of these questions are listed below.

1. How can pedagogically useful structure be integrated across various mobile platforms?
2. What content is most conducive to acquiring aural skills via mobile devices?
3. What platform-independent record keeping and communication channels are suitable to students' limited data plans and inconsistent network connectivity?
4. Are contextualized language tasks more desirable than activities designed for dead-time or downtime?
5. How vital are social presence and communication to learning listening skills?
6. Is synchronous peer-to-peer communication essential to developing listening skills? Would asynchronous communication provide comparable learning experience?
7. Can peer-to-peer communication be replaced by interaction with content afforded by mobile devices?
8. What type of feedback is most desirable: instant, delayed, peer, instructor, content? How can such feedback be provided "just-in-time"?

9. What is the most appropriate time frame for a MALL listening activity?
10. Can authentic MALL listening tasks be embedded in real-life context to promote interaction with the environment?
11. Is context-independent listening practice equally desired?
12. How much guidance and support from facilitators is required for students to engage and learn?

Most of these issues are reflected in the principal and supplementary research questions which emerged in this study. It was essential to examine how the inherent audio capability and portability of mobile devices could take aural skills learning out of the classroom while still ensuring effective instruction. The acquisition of listening skills, which was considered critical to the pilot students, is the language competency addressed in this study. The equally important speaking skill is an aspect of language competency that, for reasons of time and scope, will have to be explored in future research.

Mobile learning literature provided some direction on this journey, however, listening had not been sufficiently addressed in MALL studies (Rosell-Aguilar, 2005). Recently, several researchers have demonstrated that mobile technologies are perceived as helpful and appropriate for language teaching and learning (Demouy & Kukulska-Hulme, 2010; Kukulska-Hulme & Shield, 2008a). The time seemed appropriate to substantiate assertions of pedagogical appropriateness by investigating actual learning and the conditions under which it occurred. In response to particular needs of students in the unique context of a Canadian college, questions pertaining to MALL content design and delivery were explored to help understand the interplay of technical and pedagogical aspects of this educational intervention.

It was necessary to investigate what types of MALL ESP listening tasks and activities would promote aural skills acquisition and determine the technical and pedagogical requirements of such learning content. This problem is restated in the next section to highlight the key challenges that guided the Design-Based Research (DBR) study.

Statement of Problem

Based on the needs of a specific group of ESP students at GBC and investigation into the nature of the MALL approach for teaching listening, an innovative education intervention was proposed. Mobile devices were used to provide ESP support to Accounting students at GBC. The OSLP project, which sought to evaluate the effectiveness of this intervention in developing aural proficiency, found that students perceived MALL as a useful approach to language learning. However, a more in-depth investigation into the students' learning behaviours and actual progress highlighted a need for further inquiry into the effective design and delivery of mobile ESP content. It became apparent that the original design of listening activities was ineffective and that a systematic process was needed to design and develop appropriate MALL instruction. As illustrated in the literature review chapter, no guidelines or standards were available for creating this type of mobile-technology-based educational intervention. Hence, the three-phase DBR research study aimed at the outcomes described in the following section.

Purpose

This design-based study addressed the problem of inadequate aural skills instruction for college ESP students by augmenting in-class learning through effective utilization of students' own mobile devices. Replicable design principles were formulated through the iterative process of design, development and evaluation of the MELL system, and supported by subsequent analysis of participant feedback and the design process as well as the educational intervention itself. The two primary outcomes, the MELL system and its design principles, contributed to the broader purpose of optimizing the college's ESP instruction through improved effectiveness and appeal.

The research was guided by current second language learning pedagogy and a sound constructivist theoretical framework, which were reconceptualized in the study to reflect an evolving understanding of the appropriate MELL intervention. Accordingly, a close examination of the theoretical framework underpinning the study resulted in Ecological Constructivism, a theory of learning which melds Social Constructivism, Socio-cultural Theory and Ecological Linguistics (further discussed in Chapter 4 discussion: Evolution and Preliminary Design Guidelines). The project, thereby, "enable[d] us to create learning conditions that learning theory suggests are productive, but that are not commonly practiced or are not well understood" (Design-Based Learning Research Collective, 2003, p. 1). Hence, on a macro scale, the study has contributed to the understanding of technology-assisted second language learning and the conditions for the acquisition of listening skills amongst adult learners in the out-of-class real-world context. By "integrat[ing] the development of solutions to practical problems in learning environments with the identification of reusable design principles" (Herrington, McKenney, Reeves, & Oliver, 2007, p.1), the study offers guidance to other ESP practitioners planning to adapt mobile learning to students' needs in specific contexts.

In a real-life college setting, the MELL design principles were tested through iterative pilots of intervention prototypes which yielded reliable and practical feedback from participants. Consequently, input from language teachers, instructional designers and mobile software designers was validated by the learners' experiences. This DBR study attained the goal of producing a set of principles to guide the design of MELL listening instruction for English language learners in their unique context.

Research Question

The main purpose of the study was to formulate valid MALL educational intervention design principles in the specific context of teaching listening skills to community college ESP students. The research question driving the DBR was derived from an investigation of the research problem and related literature. The first phase of the study sought to answer the following question:

What are the characteristics of an effective, pedagogically-sound *learning object* for students' mobile devices, through which adult ESP students in a community college enhance listening skills, while expanding their learning outside the classroom?

However, consistent with the evolving nature of the DBR process, the notion of a more complex learning system emerged from the data and replaced the learning object construct. A detailed explanation of this transition is presented in the discussion of Phase 1 findings (Chapter 4). Accordingly, the overarching research question was reformulated to accommodate the resulting *Mobile-Enabled Language Learning Eco-System* (MELLES) solution:

What are the characteristics of an effective, pedagogically-sound MELLES for students' mobile devices, through which adult ESP students in a community college enhance listening skills, while expanding their learning outside of the classroom?

A comprehensive breakdown of how the components of this complex question were addressed is provided in Chapter 3. The significant aspects of the research question concern the constituent elements of an effective, pedagogically-sound educational intervention and their relationships. For the purposes of this study, "pedagogically-sound" refers to design which aims at student learning and is informed by educational theory. Although elements of all major contemporary schools of thought, namely constructivism, cognitivism and behaviourism, have a place in the final design, the constructivist pedagogies provided the main theoretical framework for this design. The effectiveness of the MELL intervention was measured by participants' perceived learning as well as their satisfaction with the solution design and learning experience. The other important aspects of the research question relate to the role mobile devices play in augmenting classroom learning by embedding language practice in the real-life context. The extent to which learning listening could be enhanced using mobile devices was measured by student and practitioner feedback on their situated Mobile-Enabled Language Learning experience.

The revised research question therefore focused on determining the essential characteristics of an effective MELL (eventually MELLES) solution. This innovative mobile-enabled intervention was studied in the context of a community college where ESP learners use their own mobile devices to augment classroom learning. The overarching question encompassed the investigation of design and development processes, the interplay of numerous variables, and the impact on learning and learning outcomes in a specific educational context. By exploring these factors and their relationships, the study focused on a primary objective of improving aural skills learning with mobile technology support. Development of the potential solutions and design principles required a longitudinal multi-phase research approach. As a result, supplementary research questions congruent with the study phases emerged in the process and further guided the inquiry. These were subsequently reflected in the data collection instruments. These questions are further discussed in the chapters on findings (Chapters 4-7). As recommended by Bannan (2009), the phase-specific evaluation questions were used to ensure more rigorous testing of the intervention.

Chapter 1 Summary

Through a descriptive explanation of the research problem and its context, as well as the purpose of the investigation and its primary research question, this chapter has set the stage for a detailed discussion of the study in the following chapters. The DBR process and findings reported in this document resulted in the design of the Mobile-Enabled Language Learning Eco-System (MELLES) solution which was perceived by the study participants as an effective approach to enhancing classroom language instruction and aural skills acquisition. Corresponding design principles were tested and formulated as guidelines for the future design of similar educational interventions. The primary research question and the purpose of the investigation have been presented as well. The following Literature Review chapter provides a more comprehensive picture of the theoretical underpinnings of this research study.

Chapter 2. Literature Review

The instructional solution addressed in this investigation drew on research on aural skills, language learning, mobile learning, and mobile learning objects. These domains and how they interlink are discussed in this chapter. The design of the MELL solution was informed by the learning methods presented here, as well as the characteristics of learning materials highlighted by the various theories. A Constructivist pedagogy, which is addressed in the last section of this chapter, provided an overarching framework to govern the proposed interdisciplinary study. The evolution of this Constructivist metaphor is further described in the discussion of the first phase of the study (Chapter 4).

Listening and Language Learning

Many researchers agree that listening is a prerequisite to learning a language and that, apart from being a vital performance skill, it is a primary channel for acquiring a second language (Lynch, 2009; Nation & Newton, 2009; Rost, 2002; Rost, 2005). Rost (2005) also stresses that listening leads to comprehension of spoken language. This involves a complex cognitive process which encompasses receptive, constructive, and interpretive aspects of cognition. Adult second language learners, whose cognitive processes and language learning habits have already been established, require more intervention in the development of aural competencies. The activity of listening involves concurrent “bottom-up” (data-driven) and “top-down” (conceptually-driven) processes involving different cognitive skills. Listening comprises decoding, comprehension, and interpretation phases which involve further processes all leading to the main goal of locating in the input the information that is relevant to the listener and prepares him/her to respond. Recent research views listening as active and interpretive: the listener interprets and constructs meaning based on context and through interaction with interlocutors (Lynch & Mendelsohn, 2002). All language comprehension relies on personal memory in conjunction with the real-world context and it occurs according to the norms shared by the “interpretive community” based on their common experiences (Rost, 2005).

Listening is a complex process and teaching the aural skill has to be approached in a systematic way. Rost (2005) recommends a number of learning strategies, most specifically those supporting the development of the ability to deal with real-time input, such as shadowing (direct or paraphrased repetition), non-reciprocal authentic listening tasks, or note-taking. The need for explicit teaching of the metacognitive strategies of planning, monitoring and evaluation is also recognized (Lynch, 2009; O'Malley, Chamot & Küpper, 1989; Rost, 2002; Rost, 2005). Furthermore, while Nation and Newton (2009) recommend one-way and two-way listening activities, such as meaning-focused listening and task-focused interaction, Wilson (2003) ascertains that both “bottom-up” and “top-down” processes are crucial in teaching listening and should be incorporated in second language learning. A variety of approaches have been identified as being effective in teaching aural skills. All in all, for listening to be learned successfully, the following components should be integrated within a relevant context: learners' interaction with oral input, interlocutor, task, listener, and process (Hoven, 1999a; Rubin, 1994).

When reviewing more specific features of listening materials design, some questions remain around the inclusion of paralinguistic cues, especially visual signals, which are crucial in oral language processing (Hoven, 1999a; Rost; 2005), but not always supported in the provision of listening instruction. Consideration should be also given to the issue of listener control of the speech rate as well as the aspect of affective involvement linked to learner's anxiety and self-confidence levels. For effective comprehension to ensue, the learner must not feel anxious or threatened by the situation (Krashen, 1981). In addition, Newmark (1981) posits that comprehension material requires a combination of four co-occurring factors: "(1) sufficient (2) language instances (3) whose meaning can be inferred by students (4) who are paying attention" (p. 39).

For the most part, current approaches to teaching listening skills advocate active context-based practice, wherein a social component is combined with active interaction to enable interpretation and meaning-negotiation, ultimately leading to output (Hoven, 1999a; Lynch & Mendelsohn, 2002; Lynch, 2009; Rost, 2005; Rubin, 1994). These premises, encompassing strategies for cognitive and metacognitive processes, governed the design of the MELL listening materials to accommodate the changing needs, motivation, and cognitive skills of the adult language learners.

Listening, one of the four language skills, cannot be viewed in isolation from general second language learning theory. A brief overview of Second Language

Acquisition (SLA) is thus presented in the next section and followed by Computer-Assisted Language Learning (CALL) and Mobile-Assisted Language Learning literature review to highlight the main tenets of the theory guiding this study.

Second Language Acquisition

According to Krashen (1985), to promote language acquisition learners should be offered meaningful comprehensible input, that is, language that is slightly beyond their current competence level. This linguistic information has to be embedded in a communicative context. Long (1996) subsequently observed that to ensure acquisition, learners must actively obtain the raw linguistic data by engaging in social interaction through conversational repairs such as comprehension checks, clarification, confirmation and definition requests, as well as verifications of meaning. Long's interaction hypothesis emphasizes the acquisition of the target language through interaction and, particularly, the negotiation of meaning. To produce new language that is both semantically correct and accurate, comprehensible input has to be followed by what Swain (1985) called comprehensible output: to generate novel language, learners have to move beyond semantic to syntactic analysis of the second language input. They have to make meaning and then communicate new meaning. Meaning making is not just linguistic, it is also semiotic—supported by visual and auditory sources of meaning available in the context (van Lier, 2000). Hence, the process of language learning can be enhanced by real-world speech situations that require active engagement in meaning-making with others (van Lier, 2000) and “language emerges as learners use the semiotic systems at their disposition to co-construct meanings with different interlocutors" (Lafford, 2009, p. 675).

Computer-Assisted and Mobile-Assisted Language Learning

Mobile-Assisted Language Learning draws on the theory and practice of Computer-Assisted Language Learning. It falls back on decades of CALL experimentation and research which is briefly summarized in the following section.

Computer-Assisted Language Learning.

CALL stands for more than an approach to teaching and learning language with the help of computers; it also is a "catch-all term referring to the use and study of computer applications in language learning and teaching" (Chaka, 2009, p. 539). CALL dates back to the 1960s (Warschauer, 1996) and gained currency in the 1980s when it was also referred to as TELL (Technology-Enhanced Language Learning)" (Chaka, 2009). CALL integrates the precepts of SLA and technology-assisted learning models, often blending in aspects of distance education theory. Today, the term CALL denotes "a variety of technology uses for language learning including CD-ROMs containing interactive multimedia and other language exercises, electronic reference materials such as online dictionaries and grammar checkers, and electronic communication in the target language through email, blogs, and wikis" (Chapelle, 2010, p. 66) as well as more diverse Web 2.0 tools.

In his brief history of CALL, Chaka (2009) observes that these programs, applications and platforms determine how language learning is mediated. Therefore, he adds, the first generation CALL technologies, mainly the mainframe computer, were driven by the behaviourist approach to language learning and teaching. The emergence of new technologies and the ongoing reassessment of language teaching theory and practice resulted in a paradigm shift from behaviourist to second-generation PC-based CALL, informed primarily by what Chaka (2009) calls "cognitivist/constructivist" (p. 540) theories. Warschauer (1996) observes that it was a gradual transition from behaviourist to communicative and, subsequently, integrative CALL. The integrative approach, a more socio-cognitive perspective, entered language classrooms in the late 1980s and early 1990s stressing the integration of the various language skills with the use of technology in real-world social contexts (Warschauer & Healey, 1998). Finally, the third-generation CALL technologies, which rely on multimedia networked computers and the Internet, draw upon "a socio-cognitive view that emphasizes meaningful interactions as embedded in authentic discourse communities" (Chaka, 2009, p. 541), with networked computers mediating those interactions.

Language learning is indeed a social activity (Warschauer, 1999) taking place in an authentic context where learners engage in experiential language tasks (Felix, 2002). Such tasks promote language acquisition through problem-solving activities built around learners' interests, everyday life experiences (Willis, 1996) and their learning goals. Constructivist CALL approaches continue to emphasize the use of computer technologies and computer-based resources in an interactive student-centred way. Accordingly, language learning is mediated by technology through a variety of individualized and collaborative tasks, including:

- communicative and contextual activities,
- simulations and role playing,
- language games,
- language exploration,
- interactive pair and group work,
- synchronous and asynchronous communication,
- multimedia-based tasks, and
- critical thinking and problem-solving activities (Chaka, 2009; Warschauer, 1996; Warschauer & Healey, 1998).

Learners involved in such language activities construct and co-construct their knowledge using the CALL technologies as a tool. Following the Constructivist philosophy and the emphasis on collaborative discourse, the socio-cultural approach to language learning seeks to integrate language learning and technology with learner-centred, task-based, and authentic-content approaches (Ariza & Hancock, 2003; Biesenbach-Lucas, 2004; Felix, 2003; Hampel & Hauck, 2004; Hoven, 1997; Kern, Ware & Warschauer, 2004).

The socio-cultural paradigm, underpinning the original theoretical framework of this study, stemmed from Vygotsky's theory of social constructivism. As such, it integrated the elements of mediation, goal-oriented learning, the Zone of Proximal Development (ZPD) and community of practice (Hoven, 1999a). Vygotsky's claim that "human behavior results from the integration of socially and culturally constructed forms of mediation into human activity" (Lantolf, 2000, p. 8) highlighted the importance of a learning community for effective language learning. According to Lantolf (2000), Socio-cultural Theory (SCT) sees speaking (social interaction) and the internal cognitive process of thinking as strongly interconnected in "a dialectic unity in which publicly derived speech completes privately initiated thought" (p. 6). Similar to aural skill-oriented literature, interactivity was identified by SCT as *sine qua non*: for learning to occur, repeated interaction with the context and other people is needed. For the learner to achieve independent performance, interactivity should be combined with the scaffolding support of a facilitator or peer (Vygotsky, 1978). The computer or other digital technology can become the tool for mediation of meaning "in the form of software incorporating information, feedback, and appropriate help systems" (Hoven, 1999a, p. 96). The technology, just as language, is viewed as a culturally constructed artefact enabling a mediated relationship with others and the world. As learners develop, they gain increasing control over "the meditational means made available by their culture, including language, for interpersonal (social interaction) and intrapersonal (thinking) purposes" (Lantolf, 2000, p. 6). The shift in the tools learners use to interact affects the way they communicate and also has to be factored in the design of instruction. Since SCT addresses the cognitive process and usage of language as enablers of communication, the role of technology in that interaction, and the interdependencies amongst these factors, it was initially selected as the framework for the proposed study and provided foundation for the reformulated Ecological Constructivism described in Chapter 4. It will be revisited in the discussion of constructivism at the end of this chapter.

Rapid advances in the capabilities of multimedia and Web 2.0 technologies resulted in inquiry into their audio and video capabilities for teaching listening. Common themes appearing in the CALL and CELL, Computer-Enhanced Language Learning (Hoven, 1999a), literature on teaching listening are the following:

- meaning-oriented methods;
- learners' communication and interaction;
- an increasing socio-cultural context;
- learner-centeredness;
- a more active learner role;
- engaging goal-oriented activities;
- teacher scaffolding via facilitation according to the student needs;
- choice and flexibility around the task: "potential for the learner to make decisions about the content, mode, order, pace, level, and degree of self-direction" (Hoven, 1999a, p. 92);
- support through multimedia;
- task-specific formative feedback; and

- consistent references to Constructivist philosophy (Gruba, 2004; Hoven, 1999a, Hoven, 1999b; Hoven, 2006; Jones & Plass, 2002).

Focusing on the specific needs of learners, Rost (2007) also highlights the capability of CALL technologies to "isolate, slow down, and manipulate listening processes in order to provide specific interventions" (Rost, 2007, p. 106), thereby raising learner-listeners' motivation and curiosity. By integrating the understanding of individual cognitive processes and the context in which these can be optimized, appropriate teaching strategies can be selected.

While a strong theoretical framework exists to support the design of listening tasks, further research into the actualization of the theory is necessary (Rosell-Aguilar, 2005). CALL models promised to enable and encourage interaction as well as practice of the four language skills. However, in practice, computer technology has not adequately supported the development of listening or speaking competencies, nor has it afforded the flexibility required by adult learners' preferences and their lifestyles. Given that most mobile technologies inherently support oral and aural interaction on-the-go, they can take language learning outside of time and place restrictions into the real-world context of meaningful communication. The main characteristics of mobile technologies salient to language learning are outlined in the section below.

Mobile-Assisted Language Learning.

MALL draws on the attributes of enhanced mobility and flexibility of CALL applications and, building on characteristics of mobile technologies, offers learning that is potentially independent of location, time and space. Mobile learning ‘‘can be spontaneous, personal, informal, contextual, portable, ubiquitous (available everywhere) and pervasive (so integrated with daily activities that it is hardly noticed)” (Kukulska-Hulme, 2005, p. 2). It potentially promotes continuity of learning by seamlessly connecting formal and informal learning, which is particularly beneficial for language learners who find themselves in the natural English-speaking environment. MALL, thus, adds a new dimension to language practice, namely exposure to the language in times and locations accommodating students’ preferences. It affords exposure to authentic language samples and challenges in location-specific communicative situations and provides supports required for such situated learning. For instance, scaffolding can be offered in the form of location-specific resources and interaction, such as on-demand access to vocabulary relating to the context-embedded tasks (Demouy & Kukulska-Hulme, 2010).

Many early definitions of mobile learning emphasized the role of wireless technologies as the key factor differentiating it from other forms of learning (Kukulska-Hulme et al., 2011). These technologies included handheld devices and occasionally other portable devices, such as mini-computers and laptops. Naismith, Lonsdale, Vavoula, and Sharples (2004), for instance, stressed the importance of portable technologies as the enabler of learning across locations. Similarly, Keegan (2005) defined mobile learning as “the provision of education and training on PDAs/palmtops/handhelds, smartphones and mobile phones” (p. 199). O’Malley et al. (2003) proposed to widen the definition by including the aspect of mobility of the learner as well as the act of learning: "Any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies" (p. 6). The definition then expanded to include other elements and perspectives. Sharples, Taylor, and Vavoula (2007) accentuated other vital attributes of mobile learning (m-learning), namely its contextualized character and a need for human interaction. According to them, mobile learning is "the processes of coming to know through conversations across multiple contexts amongst people and personal interactive technologies" (p. 225). Laurillard (2007) revisited her own definition and broadened the perspective even further by discussing the vital role of a teacher who constructs pedagogically sound environments to promote learning. Laurillard (2007) thus suggested that mobile learning is "the digital support of adaptive, investigative, communicative, collaborative, and productive learning activities in remote locations which offer a variety of contexts for the teacher to operate in" (p.173). Definitions in the most recent mobile literature frequently refer to mobile learning as being knowledge construction taking place across changing contexts and life situations enabled by the learner's mobility and the technology. The notions of informal and contextual learning have also been interwoven into the latest discussions of m-learning (Brown et al., 2010; Kukulska-Hulme et al., 2011; Laurillard, 2009; Pachler, 2009). As a result of more than a decade of m-learning experimentation and discourse, the understanding of mobility has expanded to include: (1) mobility in physical space, (2) mobility of technology, (3) mobility in conceptual space, (4) mobility in social space, and (5) learning dispersed over time; with context being the "overarching term to cover interrelated aspects of mobility" (Kukulska-Hulme et al., 2011, p. 159).

With any life situation being a potential learning space (Pachler et al., 2010), the mobility and transparency of the technology, which aids in decoding the context-embedded knowledge, is crucial. Hence, the reference to mini-computers or laptops has been infrequent in m-learning literature; it is the handheld devices that have sustained researchers' interest, chiefly due to their high portability, availability and unobtrusiveness (Sharples, 2000). What all these definitions have in common is the coexistence of mobile technologies and learners in a networked environment by means of which interaction with content, peers, teachers and others takes place. Such interactivity occurs across various contexts and the locations learners and their peers visit. Thus, the mobility of the learner and the affordances of the technology have to co-occur. The term "affordances" refers here to the inherent properties of mobile devices and their potential uses.

For the purpose of this research, mobile learning (m-learning) refers to knowledge construction, skill development and performance support, both formal and informal, incidental and purposeful, and spontaneous or planned, with learners engaging across various locations, times, situations and contexts; m-learning is mediated by highly portable devices which are always on and afford networked connection as well as communication. Mobile learning occurs when learners (1) use their mobile devices to access learning content, resources and tools, (2) create their own learning artefacts, and (3) interact with others, with content, with technology, and the world around them. Mobile learning is potentially available wherever and whenever by offering direct or indirect (delayed or mediated through auxiliary applications) connection to resources, the Internet and the network of learners and experts. Mobile digital technologies enable mobile learning.

According to Pachler (2009), mobile digital tools enable enhanced connectivity with information and other users, thereby positively impacting the socio-cultural dimension of learning. Mwanza-Simwami (2009) concurs, adding that “the fusion of portability of devices and mobility of learners” (p. 99) enables interactive experiences and co-construction of knowledge. Indeed, in networked environments, learners can engage in interaction not only with others, but also with each other and with their environment (Sharples et al., 2007). Such interaction is mediated by “cultural tools such as language and technology” (Pachler, 2009, p. 5) which can co-enable human communication. Mobile tools afford a change in locus of control resulting in a sense of ownership leading, through personalization of these tools, to individualized learning and learner agency (Pachler et al., 2010). They also facilitate cognitive processes by making information available and presented in a way that avoids learner memory overload (Pachler, 2009).

It is essential to investigate how the affordances of mobile technology promote language learning based on sound pedagogic principles and what particular capabilities should be utilized in designing ESP instruction. Language is contextually contingent; therefore, the mobility of the learner across diverse authentic contexts potentially enables situated language practice. MALL offers learners on-demand flexibility "congruent with learners' increasingly mobile, always-connected lifestyles" (Kukulska-Hulme & Shield, 2008b, p. 249). It also enables "continuity or spontaneity of access and interaction across different contexts of use" (Kukulska-Hulme & Shield, 2008a, p. 273). While fewer time and space constraints (Nah et al., 2008), combined with ownership and control of what, when and where to learn (Laurillard, 2007) add to the flexibility of mobile learning, immediate access to people and information enhances interactivity and collaboration. Flexible interaction with teachers, experts and peers offered in a more self-paced collaborative environment can further promote learning. Additionally, Kukulska-Hulme and Pettit (2009) mention convenience and portability, productive utilization of dead time (for instance, when commuting), ability to connect and interact, affordability, accessibility of up-to-date material, and multimedia options. Mobile technologies also allow for organizing learning into ''manageable chunks'' (Chinnery, 2006), and reinforcing oral and aural skills (Abdous, Camarena, & Facer, 2009). Rosell-Aguilar (2007) revisited several MALL studies and completed the list with the advantages of attractiveness, motivation, and access to resources that integrate in-class and out-of-class learning. The next section provides more insight into how mobile devices can be employed in teaching aural skills.

MALL research on listening.

In their overview of MALL, Kukulska-Hulme and Shield, (2008a) observe that only occasional studies go beyond text-based environments and utilize the audio capabilities of mobile devices: "Although mobile phones were developed to allow oral interaction, MALL rarely seems to make use of this affordance, at least in published research" (p. 275). They also provide examples of a handful of studies which do explore oral interaction. Southampton City College (JISC, 2005), for instance, encouraged the exchange of oral and visual information via mobile phones equipped with cameras and voice recording facilities. Likewise, Stanford University investigated the use of audio in language teaching by using synchronous conversation and voice-controlled grammar and vocabulary quizzes (Tomorrow's Professor Listserv, 2002). Both studies were abandoned due to scheduling difficulties and voice recognition software problems. In their study of Irish as a Second Language, Cooney and Keogh (2007) reported that their learners used mobile phones to listen and record their answers in a formal learner assessment. Osaka Jogakuin College students used their iPods to listen to downloaded English language news podcasts in order to carry out homework assignments (McCarty, 2005). One of the more wide-ranging listening and speaking MALL activities was tested at Duke University (Belanger, 2005), where Spanish language students listened to audio information including glossaries, songs, narratives recorded by native speakers, and tutor feedback. They recorded responses during oral quizzes, oral assessment, and reviewed their vocabulary pronunciation. Students involved in this project evaluated positively the feasibility and effectiveness of iPods for comprehension and pronunciation exercises.

A study in Korea (Nah, White, & Sussex, 2008) investigated the attitudes of intermediate English language learners toward using a mobile phone and a related Wireless Application Protocol (WAP) website to engage in pre-, during- and post-listening tasks. The learners expressed positive feedback toward the technology, believing it to be more effective for learning listening skills than traditional classroom or CALL. The key factors which positively contributed to students experience were “frequent comprehensible input, negotiation of meaning and comprehensible output,” (p. 341) as well as student-centred collaborative approach to learning.

Further MALL studies demonstrate the use of audio podcasts in the delivery of learning materials and authentic language samples (Demouy & Kukulska-Hulme, 2010; O’Byran & Hegelheimer, 2007; Stanley, 2006). In a more recent investigation by Demouy & Kukulska-Hulme (2010) into listening and speaking MALL practice, most participants (French language students) recognized the benefits of using their device to maximize time- and space-independent exposure to the target language; however, some students needed to see the demonstrated value of such practice before they were ready to adopt this method of increasing contact with authentic language. There are also many examples of listening comprehension MALL activities involving the audio guides in museums, science centres, and galleries (Chen & Chang, 2011). Mobile language learners in such context connect the audio material with the physical environment and the information it offers. Using mobile devices, they integrate the information on the device with the real-life artefacts and thus enhance their listening comprehension. “While there seems to be very little published MALL research in the areas of speaking and listening, what has been reported so far does suggest that collaborative speaking and listening activities could be successfully supported by mobile devices" (Kukulska-Hulme & Shield, 2008a, p. 281); this would be further supported when linguistic and socio-cultural practice is embedded in the authentic speech situation. However, no technology-assisted instruction can be considered without examining its limitations.

In terms of mobile technology's limitations, sound quality was cited as being inadequate for listening activities (Thornton & Houser, 2005, as cited by Nah et al., 2008); however, this limitation is gradually being addressed as the technology is upgraded. Thornton & Houser (2005) also reported slow downloading speeds, small mobile phone screen sizes, and the limited control functions of mobile phones. The caveat list also includes the excessive mobile phone and network expenses (Dias, 2002; Kiernan & Aizawa, 2004, as cited by Nah et al., 2008; Palalas, 2011), difficulties typing English and completing assignments on the small devices, and difficulties of listening effectively in noisy public places. In addition, Kukulska-Hulme and Pettit (2009) mention technical and ergonomic limitations such as an inadequate quality of some microphones and speakers, awkward controls on cheaper devices, short battery life, and a lack of wi-fi access in many locations. Mobile devices do enable interaction; however, the resulting communication may be less meaningful due to the limited depth of thinking and learning, distraction, and everything having to be "short and small." One of the main concerns identified by end users is the cost of mobile technologies which limits flexibility and "can be a barrier to successful uptake when using mobile devices" (Kukulska-Hulme & Shield, 2008a, p. 282). In the design of MALL listening materials, those constraints should be juxtaposed with the MALL affordances and considered in light of second language learning theory and, more specifically, principles of listening learning theory. Considering the various domains interwoven into the instruction design decisions, proven guidelines for MALL content and delivery are a fundamental starting point.

Unfortunately, to date there has been rather limited discussion pertaining to the design of instruction offered via mobile devices. Recent studies, however, do provide some direction in the choice of language tasks. For instance, Kukulska-Hulme and Pettit (2009), in their discussion of various usages of mp3 players and other mobile devices with audio capabilities, list the following as relevant to listening instruction and practice: (1) distribution and playback of music, interviews, radio programs, language drills, dialogues, samples of authentic language and sound drills, (2) recording student practice or spoken reflections on learning, (3) recording and playback for conversation analysis, (4) listening to recorded lectures and conferences, audio books, audio courses and other podcast language listening materials downloaded from the web, (5) communication by voice, (6) creating digital sound files, (7) using digital sound files to record progress and achievement, (8) gap fill and listening exercises, and (9) logging thoughts electronically. In fact, listening to audio files was mentioned as one of the most frequent activities on mobile devices followed by text messaging, reading e-news, and browsing websites (Kukulska-Hulme & Pettit, 2009; Palalas & Fahlman, 2010).

Having reviewed literature pertaining to strategies and materials developed to enable learning via handheld devices, the focus shifts to the examination of the design principles guiding Mobile-Assisted Language Learning.

MALL design principles.

The mobile learning literature offers some guidance regarding design of MALL instruction that would enable aural skills development. Following SLA, CALL and MALL principles, tasks must be contextualized, interactive, collaborative, goal-oriented and learner-centred. These recommendations aim to encourage student participation, offer supports and, at the same time, challenge language competency. Design principles, therefore, have to lessen the isolation of the mobile language learner and compensate for the lack of paralinguistic cues as well as the increased probability of ambiguity (Erben, 1999; Hampel, 2003). Effective aural tasks should offer comprehensible input, generate opportunities to make meaning, and produce modified output. In addition, Rosell-Aguilar (2005) suggested that effective mobile tasks have the following main features:

- They are appropriate to the medium;
- They are relevant to students' professional, personal, and recreational purposes;
- Vibrant, real and meaningful communicative practice is promoted;
- Expressive dynamics are offered;
- Corrective feedback and scaffolding instructor mediation are built in;

- There are opportunities for questions and feedback;
- Tasks are organized around a communicative goal, achieved through construction and interpretation of linguistic meanings;
- Lexico-grammar is presented as emergent from use and contextually contingent;
- Auxiliary information is available;
- Either integrated skills or an individual language skill is practiced;
- Authentic materials are used.

Jones (2006) expands the above list by stressing the importance of pre-, during-, and post-listening activities. Furthermore, the need to accommodate different pace and sequence preferences and learner control is also reiterated (Wakabayashi, 1998).

More recently, Clark Quinn (2011), in his book discussing strategies for optimizing mobile learning experience, referred back to a set of principles for aligning an engaging learning experience with effective practice as it applies to educational games. Although these principles were formulated for simulation-governed interaction, they are applicable to any problem-based learning contextualized in the real-world setting. They aim to engage the learner in active application of skills or knowledge. The framework proposed by Quinn (2011) integrates the following elements:

- *Clear (or emergent) goal*: the ultimate desired outcome of the activity should be (come) apparent.

- *Appropriate challenge:* the task should be hard enough to avoid boredom but not so challenging as to be frustrating.
- *An integrating story*: the action should be set in a thematically coherent world.
- *Meaningful link between action and story*: what the learner does impacts the storyline.
- *Meaningful link between learner and story*: the learner has to care about the problem embodied in the world.
- *Active exploration*: the learner must make choices and discover the consequences, not just see the question and then the answer.
- *Direct manipulation*: the learner must act on the represented world of the problem in a method as close to the real mechanism as possible.
- *Appropriate feedback*: the consequences of choices should be conveyed in ways that reflect how the world would react (and ultimately should communicate via the concept of why the choice was right or wrong).
- *Novelty*: ideally, there is unpredictability in the outcome, or at least some unexpected components rather than linear and deterministic outcomes. (p. 37; italics in original)

Drawing from this research, the main components of the environment in which the learning of listening skills should occur are mapped to show their relationship. The following concept map (Figure 1) represents the MALL solution elements and their relationships as originally perceived by the researcher in the initial stages of the study. The visual illustrates the characteristics and requirements of the m-learning context, content, actors, technology, pedagogic procedures and processes identified in the literature as essential for effective language learning. That was the starting point for the hands-on DBR study from which a more informed understanding of the intervention design emerged.

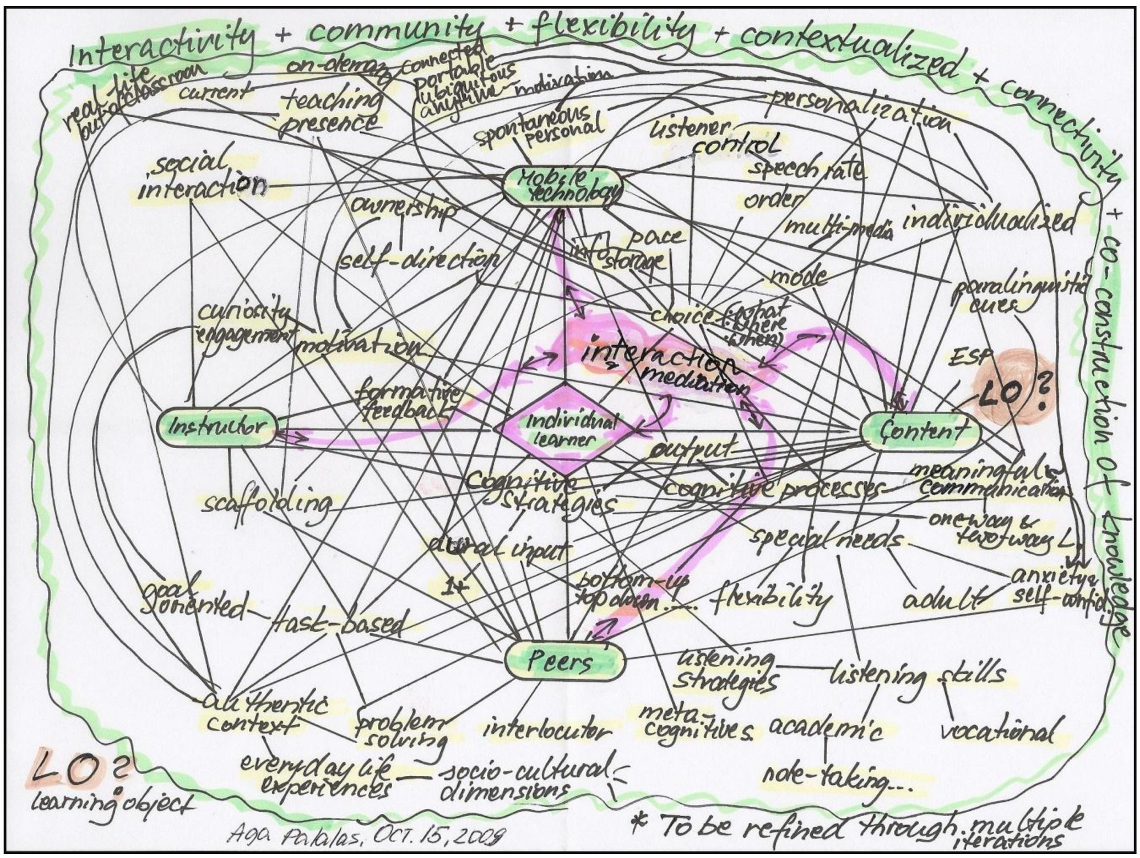

Figure 1. Concept map: ESP listening instruction for mobile devices

The instruction depicted in this concept map has to be packaged into chunks deliverable via mobile devices. The *learning object* (LO)[6] construct was originally proposed to refer to the MELL solution under investigation; however, on the basis

[6] Learning object: "any digital resource that can be reused to support learning" (Wiley, 2000, p.7).

of feedback collected in the first phase of the DBR study, a shift to a more systemic thinking resulted in the investigation of a MELL system as opposed to a MALL learning object (see Chapter 4 for more detail). Nevertheless, some of the design principles pertaining to the creation of mobile learning objects are applicable in this study since they address the tendency of mobile learning to be fragmented and consist of multiple shorter learning events rather than one focused learning episode. These principles are summarized below.

In their research on design of multimedia learning objects for mobile phones, Bradley and colleagues (2009) discern a number of design principles. They advocate the development of short, bite-sized self-contained LOs which could be worked through in a few minutes, preferably utilizing dead time. They reiterate the need for scaffolding options, learner-controlled pacing, and interactivity, principles which are advocated by many MALL and CALL practitioners. At the same time, they warn that, when designing for mobile phones, limitations of the technology such as screen size and limited input devices should be kept in mind. They also recommend navigation as well as interface solutions, which have proven to be effective.

Patokorpi et al. (2007) succinctly sum up the essential qualities of mobile learning objects required in learning guided by Constructivist underpinnings.

General (or intrinsic) mobile learning object qualities:

- small (enabling it to be quickly accessed and processed by the mobile device and the learner)

- intelligible (simple and easy to understand even on its own)
- object-like (can be used as a building block)
- interoperable (can be made to function interactively with other learning objects)

Specific (or extrinsic) mobile learning object qualities:

- expedient (suited to problem solving and everyday learning situations)
- situated (supports learning in a real-life or real-life-like situation or context)
- immediate (can be used at once)
- persistent (enhances learning through the learner's lifetime)
- reusable (can be used repeatedly)
- personalized or personalizable (adapts to the user's skills, experience and learning strategy)
- manipulable (can be moulded by the user). (p. 199)

Similarly, Ally (2004a, 2004b) indicates that the use of mobile devices for learning has direct implications for instructional design. He proposes a set of design principles ensuring the usability and functionality of mobile learning objects. According to Ally (2004a), intelligent systems should be used to enable adaptation to an individual learner's profile and needs. Materials should be presented with the limited size of the screen in mind and chunked into small pieces (five to nine meaningful units) to accommodate processing capabilities of mobile devices and the screen size. Rather than in text, information should be presented visually by mapping out main ideas and their relationships; similarly, multimedia information-rich methods should replace text where possible. Pre-instructional strategies, such as expository advance organizers, should be used to activate prior knowledge and help learners assimilate all components of the module by providing a general framework for the lesson. The interface has to be carefully designed to compensate for the screen size yet allow for the learner-content interaction, preferably adapting to the habits of users to make the learning experience effective and engaging. Information overload could be avoided by presenting fewer concepts per screen and using concept maps followed by details. Navigational systems, preferably adaptive, should be designed in such a way as to enable optimal usability. Learning materials should be available for just-in-time access. These should accommodate different learning styles and learner characteristics, and be developed in a manner that enables “instant assembly of learning materials by learners, intelligent agents and instructors, which facilitates just-in-time learning and training” (p. 94). Consequently, a sequence of independent learning objects would form an instructional event.

These principles add to the already complex network of recommendations and prerequisites drawn from the discussion on listening, second language learning and mobile technologies. To distil the most pertinent requirements and features of the investigated design shared by the aforementioned theories, a sound theoretical framework was needed. This strong base was essential to underpin the formulation and refinement of design guidelines which encompass all the interconnected components integral to an “ideal” MELL model. In view of the notions of cognitive process, interactivity, social interaction, learner-centeredness, and scaffolding, which have been intertwined in this literature review, a Constructivist paradigm seemed to be the best fit as the pedagogical framework on which to base the DBR research study. The following section provides an examination of the components of Constructivism and how the various principles of language learning theory and mobile instructional design can be located within its framework.

The Constructivist Framework

As early as 1990, von Glasersfeld (1990) observed that, although several authors could be considered the “source” of constructivism, Jean Piaget was "the great pioneer of the constructivist theory of knowing today" (p. 22). Von Glasersfeld (1990) also posited that Constructivism[7] “proposes a hypothetical model that may turn out to be a useful one” (p. 27). The accounts of the process of cognition, its enablers, context and circumstances, which are captured across Constructivist theories, can indeed serve as a road map for educators and instructional designers. Although not prescriptive theories of teaching, and originally not educational in nature, Constructivist theories set the ground for enhanced understanding of learning (Davis & Sumara, 2002; Davis & Sumara, 2003; Proulx, 2006). Constructivism, thus, offers descriptive theories of learning and “brings a proscriptive discourse on teaching, one that sets boundaries in which to work, but does not prescribe teaching actions” (Proulx, 2006, p. 65).

[7] Von Glasersfeld was referring to radical constructivism; however, the same can be said for other branches of constructivism.

As Davis and Sumara (2002; 2003) observe, the term "Constructivism" encompasses a number of discourses related to cognition. The subject-centred discourses, rooted in the work of Piaget, and manifest as cognitive and radical constructivism, differ in focus from the social accounts. The latter, including situated, social, cultural, socio-cultural, and critical constructivism, are more aligned with the work of Vygotsky. Although, they differ in their orientation and emphases, Constructivist discourses share three points of agreement: (1) learning being conceived as complex, dynamic, and continuous active processes of ongoing adaptation; (2) "these dynamics [being] regarded as the means by which the cognizing agent …maintains its coherence (Davis & Sumara, 2003, p. 125); and (3) a rejection of representationist theories such as behaviorist and mentalist accounts of cognition (Davis & Sumara, 2003). Many educators and theorists influenced Constructivism indirectly (for instance, Dewey, Kant, Marx, von Glasersfeld, Lave and Wenger, or Bruner) with Piaget's cognitive developmental theory forming the basis of the subject-oriented Constructivist accounts. Piaget's epistemological work offered insight into human learning. Its central idea is that human learning is constructed or construed[8] upon the foundation of previous knowledge, through "progressive equilibrium of assimilation and accommodation" (Piaget, 1971, p. 108). Such learning is an active process through which the learner updates his/her knowledge based on the relevant elements in the new information and their consistency with prior and emerging knowledge. According

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[8] According to Davis and Sumara (2003; 2002) and Proulx (2006), there are differences in the English translation of the original French verb "construire." It can be translated either "to construe" or "to construct," with the former emphasizing a more "biological" contingent, tacit, unfolding, ever-evolving process of the emergence of a structure or organism, whereas the latter – more "architectural" pre-determined, deliberate, and explicit construction.

to Piaget's theory of individual learning the knower is "engaged in the unrelenting project of assembling a coherent interpretive system, constantly updating and revising explanations and expectations to account for new experiences" (Davis & Sumara, 2003, p. 413). In fact, individuals create subjective knowledge on the basis of their own experiences. They learn while trying to make sense of the world. Von Glasersfeld (1990), the father of radical constructivism, posits that the knower is responsible for what he/she constructs and the context or circumstances of individual cognition are not the focus of subject-centred constructivism.

By contrast, Vygotsky (1978) proposed a paradigm of learning which emphasizes the collective phenomena and the relationship between subjectivity and objectivity. Social Constructivism stemmed from his view that meaning is socially and culturally mediated. Vygotsky (1978) asserted that knowledge is first constructed in a social context and is subsequently appropriated by individuals. Each learner is viewed as a complex multidimensional individual with unique needs and backgrounds. That uniqueness becomes an integral part of the learning process (Wertsch, 1991). Thought and language are entirely interlinked in human mental functioning and in human life (Vygotsky, 1986). In fact, individuals are constituted by the language of the culture in which they live and which they share with others. Language is inherited by the learner as a member of a particular culture and it is learned throughout the learner's life. In this learning process, individuals contribute their unique background, culture, as well as their worldviews. Language, which is used as a means of communication and mediation, is embedded in the socio-cultural context embracing its cultural, historical and institutional dimensions (Wertsch, 1985; Wertsch, 1991). Language is also an integral element of the process of socialization which, for instance, “involves mastering the rules for using particular speech genres in a particular sociocultural setting” (Wertsch, 1991, p. 130). Hence, meaning is generated and transformed in socio-cultural contexts in which individuals become “collaborative meaning-makers among a group defined by common practices such as language, use of tools, values and beliefs” (Spikol, 2009, p.125).

A Social Constructivist would say that knowledge is not merely constructed but it is co-constructed. Only with support of others, or in collaboration with them, can cognitive structures be developed. Accordingly, the notion of a “zone of proximal development” (ZPD) plays a vital role in the learning process. Vygotsky defines the ZPD as the distance between a learner’s “actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers” (Vygotsky, 1978, p. 86). Consequently, by use of scaffolding techniques, instructors can provide temporary support which enables learners to construct knowledge structures that are meaningful to them. Effective scaffolding is provided by a more knowledgeable person, most often, however not necessarily, an instructor, and is optimized by social interaction. That is why it is essential that students learn cooperatively in groups.

In Social Constructivism “human beings are viewed as coming into contact with, and creating, their surroundings as well as themselves through the actions in which they engage” (Wertsch, 1991 p. 8). Thus, active learning around real-life problems promotes the cognitive process. Such learning cannot occur without a mediator (Vygotsky, 1978; Wertsch, 1991), yet active construction of personal meaning thrives when performed at the individual's own pace. A notion of motivation is also apparent in this paradigm. Motivation is viewed both as intrinsic and extrinsic. To engage individuals in cognitive processes, instruction and interaction should be closer to the level of potential development while tasks should be purposeful and challenging. Consequently, to tap into the learners' intrinsic motivation, they must be challenged with tasks that draw from skills and knowledge just beyond their current level of mastery (Williams & Burden, 1997). Extrinsic motivation is sustained through social interaction.

Similar to subject-centred Constructivism, Social Constructivist discourses are not theories of teaching. However, they can inform teaching practice indirectly by shedding light on the complexities of individual and collective learning. Vygotsky's notions of ZPD, scaffolding, language, and culture as tools mediating communication and cognition, can be a source of practical guidance for teachers about learning phenomena (Davis & Sumara, 2002) and the design of instruction.

As noted, these Constructivist concepts were adopted by linguists as Socio-cultural Theory. The Socio-cultural Theory and its integral elements of mediation, goal-oriented action, social interaction and ZPD, melded with the constructs derived from the Ecological Constructivism metaphor (which emerged later in the study as discussed in (Chapter 4), guided design decisions in the study. This theoretical paradigm ensured pedagogically sound choices as well as usable, effective, satisfying technological solutions, and also established the innovative, engaging, and appealing design of MELL. In keeping with the contention of Kukulska-Hulme (2009) that “[t]he human dimension should always remain at the centre of research in learning” (p. 360), the students’ needs and the theories of human cognition and communication presented above provided direction through all the phases of this research study.

Chapter 2 Summary

This chapter started by introducing the key principles and approaches to teaching and learning listening and placing them within the context of broader second language learning theory. Subsequently, an overview of literature pertaining to Computer- and Mobile-Assisted Language Learning was presented to highlight the correlations and overlaps between the two interrelated paradigms, which then informed the theoretical framework governing the design of the ESP intervention. Examples of the support for the aural skill practice with mobile technologies was discussed in the section on MALL Research on Listening. This also demonstrated the need for more research concentrating on the design of MALL instruction targeting listening competencies. Having established the need for MALL tasks to be contextualized, interactive, collaborative, goal-oriented and learner-centred, MALL design principles were then examined in the context of the existing mobile learning literature. Finally, an overview of Constructivism was provided as it forms the basis for the Ecological Constructivist paradigm which melds together the various principles of second language learning and mobile learning, and provides the theoretical framework for the study. The methodology employed in the study is presented in the next chapter.

Chapter 3. Methodology

This chapter is divided into three main sections: Research Question and Outcomes, Methodology Description, and Research Design. The first section restates the research question that initiated this study and its associated methodology, and discusses the three key research outcomes. This is followed by a description of the DBR methodology, the adopted research framework, and a brief introduction of the educational intervention under study. Finally, the last section presents details of the research design, the three phases comprising the study, and its procedures.

Research Question and Outcomes

The principal question guiding this study, reformulated after the findings of Phase 1 (see Chapters 1 and 4) was:

What are the characteristics of an effective, pedagogically-sound MELLES for students' mobile devices, through which adult ESP students in a community college enhance listening skills, while expanding their learning outside of the classroom?

This question led to the inquiry about the characteristics of the MELL (Mobile-Enabled Language Learning) system designed to improve second language proficiency among adult learners, and more specifically their listening skills. The outcome of this intervention encompassed students' positive evaluation of the learning process as well as the actual acquisition of ESP listening skills as perceived by participants. The context captured in the research question has two key components: (1) the intervention was designed for college ESP students using their own mobile devices and (2) it aimed to take learning out of the classroom into the real world. Moreover, the investigation of the design of the m-learning solution was informed by current language learning pedagogy “which [is] predominantly social constructivist in nature” (Hoven, 2007, p. 1) and which engendered the Ecological Constructivist framework evolving alongside the results of the study. The MELLES solution was designed, developed and piloted following the blend of Constructivist, Ecological Linguistic and Ecological theories (as discussed in Chapter 4). The multi-cycle DBR process provided data for evaluation and refinement of the MELL design leading to an improved understanding of what constitutes a satisfactory learning experience, promotes advancement in listening competencies, and is attainable within the technical constraints of the unique context. Details of how the data were collected and analyzed are provided in the Research Design section. Given that the development of prototype solutions and design guidelines required a multiphase method, supplementary research questions informed by, and congruent with, the various phases of the study were determined during the process and were reflected in the surveys, focus groups and interview questions.

The DBR research, guided by the overarching question, produced two key outputs, which Plomp (2009) refers to as interventions and design principles (intervention theory). In his discussion of design research, Plomp (2009) also identifies a third outcome, namely the professional development of the research participants. The three outputs are briefly characterized below.

Interventions.

No ready-made pedagogically sound m-learning solutions were available to address the need at hand with its specific purpose and target audience. Therefore, this study aimed to develop practical, innovative, mobile learning intervention to teach listening skills to adult ESP students. MELL content used in the OSLP study, described in the Introduction, required modification based on empirical and theoretical investigation. Starting with podcasts and resources derived from the OSLP and DBR pilot study, participants produced several consecutive versions of stand-alone mobile phone applications followed by individual mobile-enabled listening tasks before a more systemic framework resulted in integrating these tasks into a complete solution. Consequently, a prototype MELLES system (Figures 29–33) was created as an instantiation of the intervention theory (see Chapter 5). The system interface, namely the mobi-english.mobi website, served as a conceptual model for the tests and summative evaluation of the design guidelines. The many cycles of the solution redesign and tests, as well as the evolution of thinking resulted in a MELLES design framework. With numerous design concepts, test and evaluation results being completed concurrently, sifting through them was managed through close consultation and collaboration with participants coupled with rigorous data collection and analysis procedures. While the first attempts at designing MELL models drew primarily from the design principles identified by current literature (presented in the Literature Review chapter) and the DBR pilot, the conceptualization and development of the successive prototypes (see Figures 23–33 in Chapter 5) were driven by the DBR feedback and design guidelines emerging progressively from each cycle of the study. Ultimately, through iterative refinement, these principles evolved into what the MELLES pilots demonstrated to be pedagogically useful guidelines. These guidelines are introduced in the next section.

Design principles.

A set of interconnected design principles was extracted from the research findings and analysis. The refined version of guidelines is presented in the summary discussion (Chapter 8). These principles create a framework which can inform future design of MELL listening instructions, as well as provide an improved understanding of the praxis of mobile learning. The proposed design principles encapsulate all the essential pedagogical elements of an effective MELLES intervention, including content, procedures, context, and actors. They also incorporate the technical dimension of the system pertaining to the functionality, tools, and technological context required. The final MELLES design principles are formulated as heuristic statements by following the format developed by Van den Akker (1999):

> "If you want to design intervention X for the purpose/function Y in context Z, then you are best advised to give that intervention the characteristics A, B, and C [substantive emphasis], and to do that via

> procedures K, L, and M [procedural emphasis], because of arguments P, Q, and R." (Van den Akker, 1999)

In this recommendation, van den Akker refers to substantive and procedural knowledge, thereby encompassing essential characteristics of an intervention as extracted from the solution itself and the design activities observed in the process of design and development. The MELLES design principles aimed to capture the knowledge about whether, when, how and why the intervention and its unique elements work in the specific context. The study aimed to enrich the intervention theory by providing a framework to guide and constrain the design of similar educational interventions. In addition, the discussion of the MELLES guidelines situates them in the context that was demonstrated to produce effective learning outcomes (Chapter 5, 6, and 7).

Starting with the aforementioned preliminary principles derived from literature and analysis of learning objects developed during the pilot phase, a set of design guidelines was generated based on the findings of Informed Exploration. They were then revisited as a result of the adoption of the ecological paradigm. Subsequently, through experimentation, collaboration and consultation with participants, the preliminary design principles were incorporated into the design of a new collection of solutions. Several conceptual models (see Figures 23–33 in Chapter 5) were created by GBC Digital Design and Computer Programmer Analyst students during the Enactment phase. The analysis and repetitive discussions of these ideas resulted in the redefinition of the design and construction of the mobi-english.mobi website, which was piloted with five groups of students. Consequently, the design principles were further modified based on the findings of the intervention tests with ESP students as well as practitioners' feedback. As recommended by Plomp (2009), the final version of the MELLES design guidelines resulted from systematic reflection and documentation combined with rigorous data collection and analysis. The resultant design principles were formulated to guide ESP practitioners and they are not "intended as recipes for success, but to help others select and apply the most appropriate substantive and procedural knowledge for specific design and development tasks in their own settings" (McKenney, Nieveen, & van den Akker, 2006, p.119).

Professional development.

As previously indicated, creation of the intervention and corresponding design principles was facilitated by collaboration and dialogue with a group of college faculty. It was observed during the study that, while contributing their expertise, practitioners were able to enrich their understanding of the novel educational technology, its application in the context of language learning and, most importantly, the interplay of pedagogy and technology in practice. This almost two-year long study also benefitted from the progressive informal learning of all stakeholders; over time, this produced better-informed input and research results. In addition, understanding and awareness of the practical applications of mobile learning increased across the college effecting a number of strategic and professional development initiatives. The next section demonstrates how the three outcomes (1) interventions, (2) design principles, and (3) professional development, were attained by means of Design-Based Research.

Methodology Description

This section explains the selected methodological approach in more detail by first defining DBR and then presenting its theoretical underpinnings as they applied to the study. The rationale for selecting the DBR approach will be conveyed through juxtaposition with other research methods. The final section of the Methodology chapter will introduce the four phases of the Integrative Learning Design Framework (IDLF), which served as a guiding model for the study.

Design-Based Research (DBR).

The combination of two parallel goals, namely, the design of MELL educational intervention and the development of a corresponding instructional design framework, made DBR a suitable approach for this real-world practice study. The interdependence of these two research goals has been cited as one of the primary features of DBR (Brown, 1992; Collins, 1992; Plomp, 2009). This approach also allowed describing educational practice holistically, notwithstanding its complexity and local idiosyncrasy (Kelly, 2006). Consistent with the ecological lens applied to the study, the DBR approach provided a broader and more comprehensive overview of the design process and the various elements essential for the successful MELL system. It also accommodated the evolution of design constructs and conceptual thinking, which advanced with the subsequent pilots and exchange of participant feedback. Moreover, this approach allowed for experts in the field of mobile learning, software design, wireless technologies and language learning to collaborate and contribute their input. Both students and practitioners worked together to generate a solution to an educational problem they had been observing or experiencing at the college. Hence, they were able to engage in the study with enhanced understanding of the context and the intervention needed.

Being interventionist in nature, design research seeks to progressively improve learning and teaching by redesigning artefacts and revising theory in response to feedback and evidence gathered from actors involved in the specific context. The following definition of DBR, proposed by Wang and Hannafin (2005), captures the salient characteristics of this method as demonstrated through the study:

> 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. (p. 7)

Van den Akker and his colleagues (2006) further defined DBR by describing it as practical, interventionist, iterative, both process- and theory-oriented as well as informed by practitioners. In fact, this definition encapsulates well the characteristics of the DBR method as experienced during the MELLES project. This approach proved to be congruent with the questions, goals and context of the proposed research, as detailed below.

In this study, new design work resulted in a verified framework for the development of MELL solutions focusing on aural skills acquisition outside the classroom. Bearing in mind the complexity of the observed real-world educational problem the study targeted, there was a need for an innovative intervention to be developed in-situ and to be guided by second language pedagogy combined with the expertise of practitioners. The primary question asked by this research and the multiple ensuing questions could not have been adequately addressed outside the actual college setting. Regular feedback from L2 students allowed re-evaluation of designs and design guidelines which, in turn, facilitated the development of practical solutions. Prototype development was enabled by the expertise of practitioners who were able to pilot them in situ. Collaboration of all participants facilitated the interrelated macro and micro-cycles of feedback collection and analysis, as well as resultant design modifications. Moreover, since many DBR activities were incorporated into the participants' curriculum, the investigation was perceived as highly relevant resulting in regular recurrent feedback. The dynamic character of the contextualized feedback coming from simultaneous processes of design, evaluation and development allowed for the immediate reflection of the findings in the succeeding version of the prototype model. Thus, the contextual and integrative character of DBR research made it the most appropriate approach for the pragmatic study of MELL instruction provision. By using the interventionist method in the GBC context, the study was able to address actual need within that educational environment, namely the need for learning listening skills outside of the classroom to support student success and learning outcomes.

The intervention design process was embedded in, and informed by, that complex context; therefore, a wide-ranging inquiry into the multiple factors that contribute to the effectiveness of the solution was possible.

Another aspect of the DBR approach that made it suitable for the MELLES investigation was the interactivity and collaboration amongst researcher, practitioners, and students. Considering the complexity of the research problem and the multiplicity of variables coming into play, a solid solution required the expertise and perspective of many key actors. In return, by developing theory in practice, the study contributed to their understanding of mobile learning, hence "inform[ing] practice and practitioners in meaningful ways (Roth, 1998, p. xvii)." The design work and consequent pilots of the prototypes also engaged and, thus, empowered ESL students and practitioners.

The length of the study and its cyclical nature were also important. Indeed, only by means of an iterative design and research method which allowed findings to be fed back into the next cycle of the design experiment, could an effective technology-based solution be created. Moreover, such an in-depth process required repetitive steps to be carried out over a period of time (June 2010–September 2011). The "usable knowledge" generated through the DBR iterative processes of co-designing pedagogy, technology, and hypothesis was also informed by the concurrent exploration of literature. This was imperative considering how fast mobile technologies and m-learning have been advancing. As observed by van den Akker (2009), such dynamic interrelation between theory and practice produces more effective solutions and leads to "new theories, artifacts, and practices that account for and potentially impact learning and teaching in naturalistic setting" (Barab & Squire, 2004, p. 2). Staying in touch with the latest developments and literature also helped to better situate the MELLES solution in the current m-learning context.

Design-Based Research vis-à-vis other methods.

Before proceeding to the structure of the study, a brief comparison of DBR and other approaches to educational technology research is presented here to highlight the appropriateness of Design-Based Research.

Being grounded in a naturalistic setting, DBR addresses issues of everyday practice from which, as the Design-Based Research Collective (2003) argued, other educational research tends to be divorced. Furthermore, Reeves (2006) called into question the effectiveness of educational technology research which tends to focus on the gains of technology-assisted learning vis-à-vis traditional methods of teaching with rather little inquiry into the "how and why" of educational interventions. He considered such predictive research studies to be "largely pseudoscientific" and "socially irresponsible" (Reeves, 2006, p. 1) and recommended DBR as an alternative model for inquiry into educational technology. As mentioned earlier and demonstrated through this study, only through a longitudinal collaborative process can solutions to practical problems and reusable design principles be developed. Reeves further argued that technology-assisted teaching and learning can be successfully improved only through iterative cycles of testing, reflection, and refinement of problems, solutions, methods, and design principles. In contrast to DBR, traditional experimental studies do not engage in a "thorough, systematic process integrat[ing] multiple design and research processes to progressively improve understanding about learners, learning, context, or culture as well as iteratively improve an intervention" (Bannan, 2009, p. 56). Figure 2 (Herrington, McKenney, Reeves, & Oliver, 2007, p. 2) illustrates the different DBR cycles through which design is evaluated in an uncontrolled context, thus generating knowledge about design, learning, and culture of use, as opposed to the controlled experiments which are designed to test hypotheses.

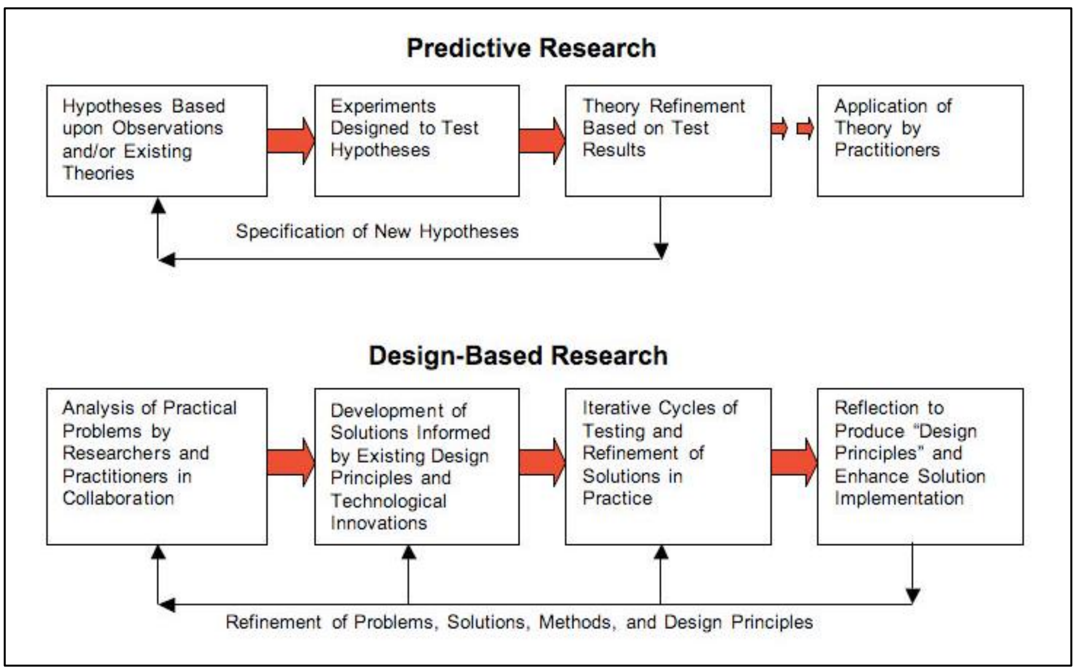

Figure 2. Evaluation cycles (Herrington, McKenney, Reeves, & Oliver, 2007, p. 2)

Likewise, Bannan (2009) explores another alternative research approach. In her comparison of traditional formative evaluation in instructional design and DBR, Bannan (2009) observes that formative evaluation, despite being rigorous and comprehensive, "provides a limited focus on a particular technology system of instruction and judges its effectiveness, appeal and efficiency" without addressing the complexity inherent in educational setting. Alternatively, DBR offers a more comprehensive understanding of instruction in situ than formative evaluation. The formative evaluation process, however, is integrated in "meta-methodological" (Bannan, 2009, p. 53) DBR as one of many constituent methods. Bannan (2009) also adds that DBR may combine other research methods as it "attempts to progressively and dynamically generate (exploratory research), improve (constructive research) and learn about (empirical research) a particular phenomenon from interconnected research and design cycles" (p. 56). What sets Design-Based Research apart, however, is the interdependent macro and micro-cycles of feedback collection, data analysis, reflection and results-driven design refinement that is illustrated in the framework in Figure 3 below.

Design-Based Research indeed incorporates many approaches, including action research, which preceded DBR and resembles it in its processes and the goal of improvement of professional practice. The two approaches target authentic problems identified by educational practitioners and aim to intervene through subsequent actions. Practitioners are highly involved in both action research and DBR; however, unlike action research, DBR entails cooperation between researchers and practitioners, with researchers taking the initiative in the study as both researchers and designers (Wang & Hannafin, 2005). Moreover, one of the key goals of DBR is generating theory to solve real-life educational problems on the basis of the iterative design of educational interventions and their evaluation. DBR therefore results in practical solutions which are supported by design theory.

All in all, Kelly's (2009) list of conditions for selecting DBR for a study succinctly summarizes its features. He observes that when at least one of the following criteria is met, the problem becomes "more wicked and open than simple and closed" (p. 76), thus rendering it appropriate for Design-Based Research:

> 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. (Kelly, 2009, p. 76)

It was demonstrated in this study that DBR was the appropriate approach to address the "wicked and open" issues presented by the particular educational situation under study. The complex, however data-rich, DBR processes and activities produced the MELLES prototype and corresponding design guidelines for an m-learning intervention targeting aural skills acquisition. Nevertheless, several limitations of the DBR approach became apparent during the study. These are discussed in the Limitations section of this chapter.

In order to ensure a systematic approach to the various processes of the study and minimize the inherent limitations of DBR, an established model was employed. This is presented below.

Integrative Learning Design Framework (ILDF) model.

The study, while mindful of the limitations of the approach, built on its strengths by following a well-organized process adopting the comprehensive four-stage model proposed by Bannan, (2009), namely the Integrative Learning Design Framework (ILDF). The ILDF model integrates processes from the fields of "instructional design, object oriented software development, product development and diffusion of innovations and educational research" to offer a systematic framework guiding researchers toward "more rigorous, research-based cycles within a technology-based instructional design effort" (p. 53). Bannan (2009) adds that the ILDF model "challenges researchers to provide improved articulation of Design-Based Research processes by phase and to consider the entire scope of research from initial conceptualization to diffusion and adoption" (p. 53). It also captures the cyclical nature of "analysis, design, evaluation and revision activities [which] are iterated until a satisfying balance between ideals ('the intended') and realization has been achieved" (Plomp, 2009, p. 13). Designed to be dynamic and flexible, the framework presents a logical structure encompassing the multitude of research and design decisions, and cycles involved in the study. In addition, the

ILDF model suggests applicable questions and research methods for its four phases of (1) Informed Exploration, (2) Enactment (3) Evaluation: Local Impact, and (4) Evaluation: Broader Impact (Figure 3).

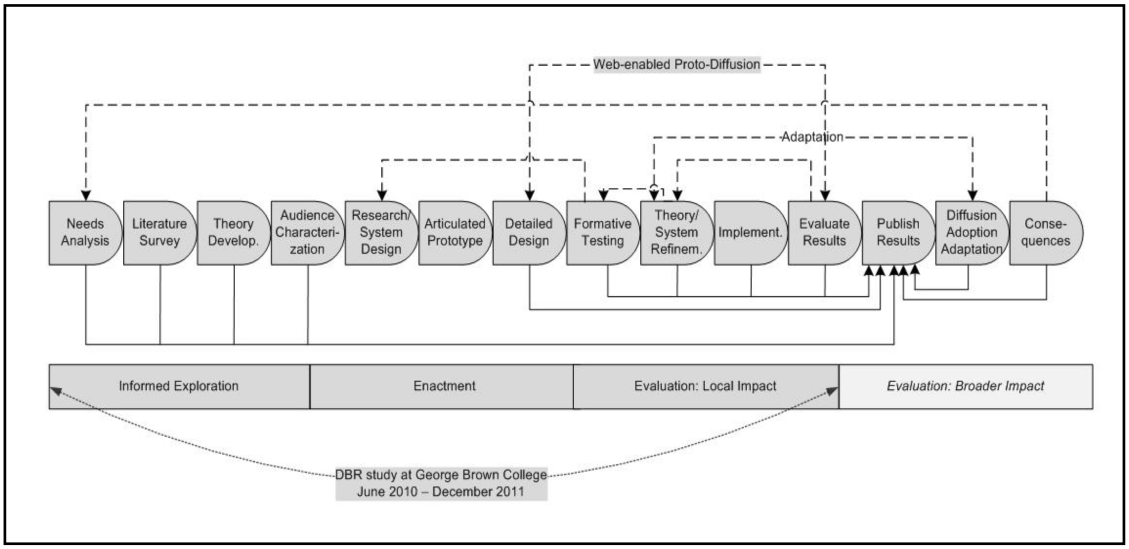

Figure 3. The ILDF model. Modified with permission (Bannan, 2009, p. 54)

As the study demonstrated and the framework reiterates, such a multipart study encompassing various concurrent “macro and micro-cycles” (Bannan, 2009) requires methodical planning and sound project management skills. A portfolio of research methods and activities had to be integrated and a number of participants invited. A brief description of all four stages is presented below with a more in-depth description of the three stages covered by the study following in the Research Design section.

Accordingly, the research commenced with Informed Exploration including comprehensive literature review, closer audience characterization, investigation of comparable design solutions in equivalent MELL contexts and qualitative data collection via interviews with experts and language teachers as well as semi-structured student focus groups. The purpose of the first phase was to produce a theoretical construct which would guide the design experiment. This process was facilitated by the fact that a substantial portion of needs analysis and audience characterization had already been completed during the pilot study. Moreover, the processes of literature review and theoretical conceptualization had been ongoing since the previous project.

In the Enactment phase, prototype MELL conceptual models were designed by participants who were studying mobile design and, subsequently, the mobi-english.mobi prototype was designed and developed by the researcher in collaboration with college students and practitioners. All design and development decisions, processes, time and funds requirements, as well as challenges, were scrupulously documented. The subsequent versions of the design principles were mapped out and refined on the basis of the feedback gathered from practitioners and students through interviews, focus groups, correspondence and communication via the Wiggio[9] project site. The researcher's observations and reflections were also incorporated in the data analysis.

The Evaluation within a local context phase encompassed implementation, formative testing, evaluation, and the refinement of the design framework as well as the MELLES solution. It involved testing of the constituent tasks of MELLES by L2 students in a real-life setting in Toronto. Feedback was collected from 109 respondents through successive surveys, interviews and focus groups as well as communication via the Wiggio site.

[9] Online collaborative tool supporting group work and communication; http://wiggio.com.

The final Evaluation: Broader Impact phase is outside of the scope of the proposed project. Nevertheless, it is intended that the project be continued so that the resulting MELL listening system can be studied in a setting outside GBC. This final phase of the research will enable further improvement of the listening content and corresponding design principles. Dissemination and a broader discussion of the future findings will also be part of the upcoming phase of the study.

The three phases of the research produced contextually-grounded knowledge in a circular fashion with the three stages overlapping and undergoing multiple iterations. The core activities of the DBR process were completed within 16 months and followed a work plan designed around the schedule of the participating institution (GBC). An additional three months were required to revisit the data, re-evaluate the findings and generate a report of the results.

The overarching intent of this research was to support change in one particular context, and subsequently enable advancement of MELL instruction design in other contexts. Brown (1992) convincingly captured the goal of well-designed Design-Based Research by saying: "An effective intervention should be able to migrate from our experimental classroom to average classrooms operated by and for average students and teachers, supported by realistic technological and personal support" (p.143). The following section presents the details of the research procedure which aimed to produce such results.

Research Design

As noted earlier, this study focused on generating a MELL listening intervention along with design principles for such an m-learning solution. All processes involved in the education intervention design, development and implementation were also documented. The DBR study was conducted at George Brown College in Toronto and supported by the college practitioners and students.

The next four sections specify the research procedures for the phases of (1) Informed Exploration, (2) Enactment, and (3) Evaluation: Local Impact. First, an overview of the three phases and the DBR pilot is presented, including the specific data collection tools and activities employed in each phase. Additional details pertaining to the participant selection, data collection and recording as well as data analysis methods common for all phases are then discussed. Information regarding the timelines, role of the researcher, study limitations and ethical considerations is offered in the last five sections.

Because of the length of this Design-Based Research study, the Evaluation: Broader Impact phase will be conducted at a later time outside of this project. The order in which the remaining three phases are discussed does not necessarily reflect the progression of the constituent processes. The various cycles were, in fact, iterative and they overlapped, as illustrated in Figure 4 below.

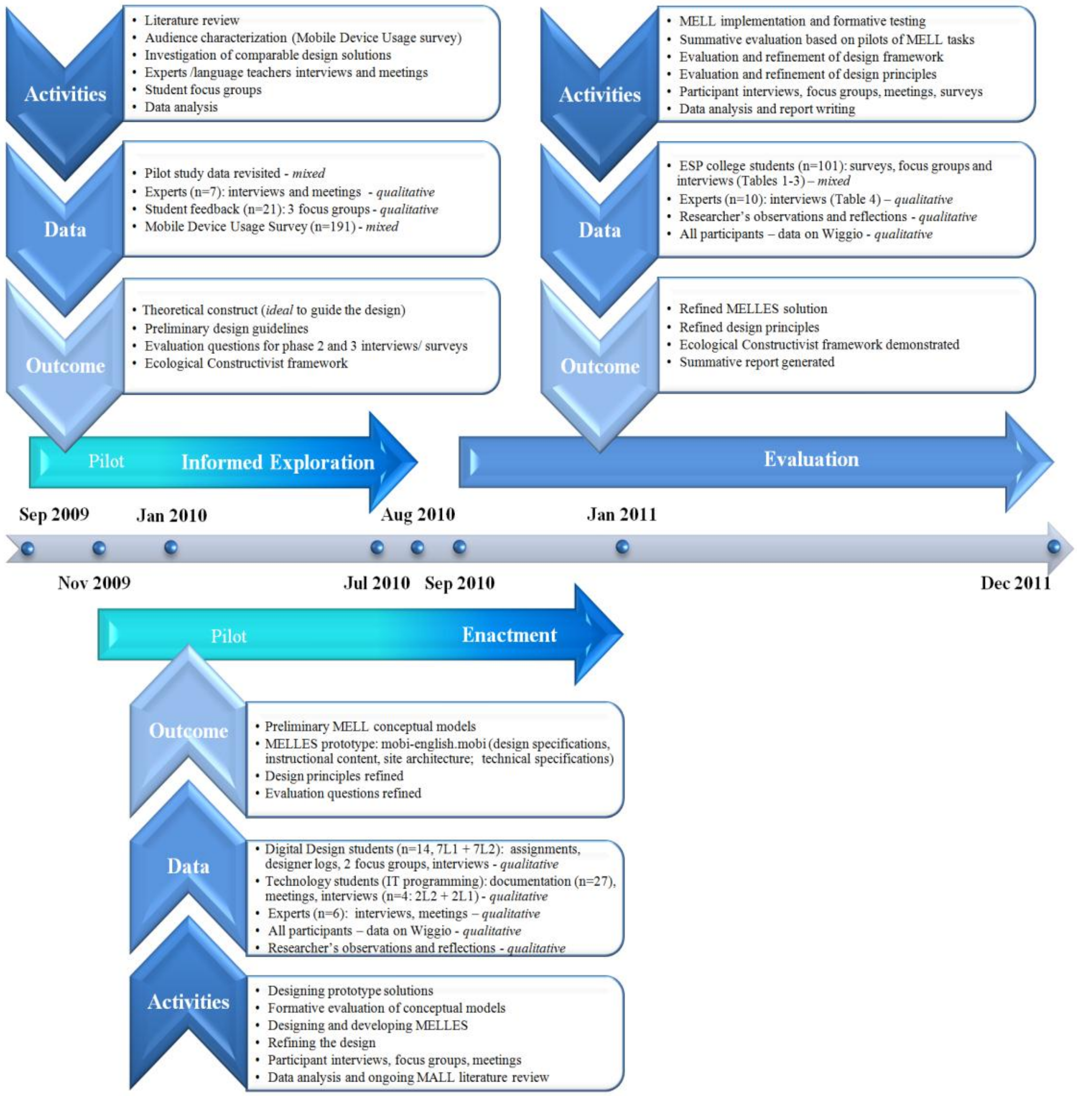

Figure 4. DBR phases: Timeline, main activities, data and outcomes

The study was launched in June 2010 and concluded in December 2011, stretching over five college semesters. Before the three-phase study commenced, a pilot was conducted (September 2009–January 2010) to ascertain the appropriateness of the DBR method. Essential details of each phase are elaborated below.

Procedure.

Pilot study.

As noted earlier, a pilot study had been carried out at George Brown College to test the research approach and some of its constituent elements. Over the period of September 2009–January 2010, the pilot progressed through one iteration of the Informed Exploration and Enactment phases. Fourteen GBC School of Design (Digital Design) students were involved in the design of the same number of MELL conceptual models following an overview of mobile learning and second language acquisition offered by the researcher. Students engaged in creation of a conceptual map for a mobile learning object (Figure 5) and proposals for design of such software (Appendix E). The initial conceptual framework was then mapped out based on the investigation of literature and refined through dialogue with Digital Design students and professors.

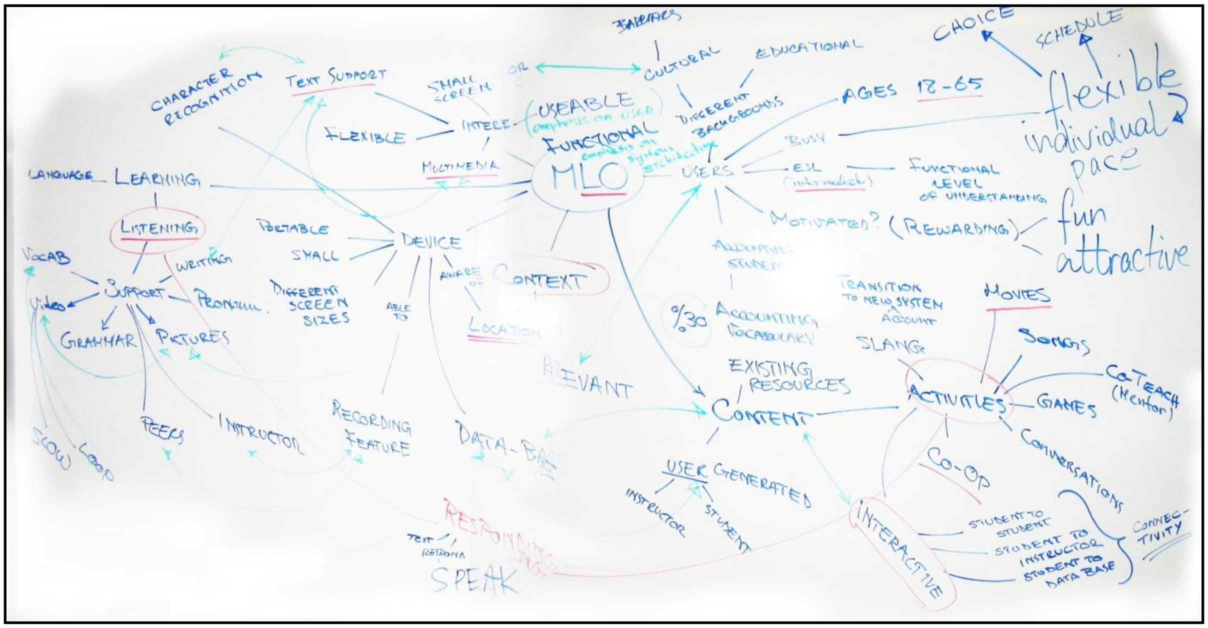

Figure 5. MELL concept map created by Digital Design students during in-class discussion (September 2009**)**

The pilot provided the opportunity to observe the DBR process and participants in practice and to devise the research questions and strategies for the study. It prepared the stage for the next phase of Informed Exploration.

Informed Exploration phase.

This stage of research began with in-depth exploration of the target audience and practitioner perceptions to further the understanding of the ESP student needs. The particular college ESL learner population had been studied by means of earlier exploratory research at GBC; however, more focused understanding of their needs in terms of learning listening with mobile devices was needed. Consequently, results of previously conducted language benchmarking of students' language proficiency, the programs in which students were enrolled, and the target workplaces were revisited. In addition, data collected during the m-learning exploratory study and the DBR pilot were incorporated. To re-articulate learning targets, these findings were combined with the feedback from students and practitioners from the original Accounting pilot-course, the School of Design[10], and the School of Technology[11] as well as Communications/ESL[12] professors. The data was collected via three student focus groups, practitioner interviews and meetings, and then analyzed for common themes. The additional analysis of the context highlighted the systemic social, cultural, and organizational influences as well as constraints on the intervention design. Accordingly, a comprehensive survey of GBC students' use of mobile devices was conducted college-wide. Its aim was to understand participants' mobile device usage patterns and m-learning experience in order to gauge their readiness for m-learning as well as the specific needs of the student population. One hundred and ninety one (191) L2 students answered questions regarding the mobile devices they own and how they use those devices. Through student and practitioner feedback coupled with comprehensive review of relevant literature on second language acquisition, m-learning and instructional design, the MELL listening solution was conceptualized. The educational technology studied was explored via steady dialogue with the professors and students from Programming, Wireless Networking as well as

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[10] Two School of Design programs were involved, namely (1) Digital Design - Advanced Digital Design Program (Postgraduate, 2 semesters) and (2) Digital Design - Game Design Program (Postgraduate, 3 semesters).

[11] Participants represented two School of Technology programs, namely (1) Computer Programmer Analyst (6 semesters) and Wireless Networking (Postgraduate, 3 semesters).

[12] These English for Special Purposes courses included ESL courses for Business and Communications (ESP) courses for Business Administration, Business Accounting as well as Hospitality and Culinary Arts.

Digital Design. The existing data gathered through the pilot study helped to distil the preliminary design principles and thereby provide a sound theoretical base for the progressive development of the design framework.

A number of evaluation questions also evolved from the exploratory phase to guide the consecutive study and to form a base for the MELL surveys. On the whole, Informed Exploration resulted in an ideal which provided “a vision and a guide as well as a significant component of the measuring stick by which the ideal, as instantiated in actions within a real context, is measured” (Anderson, 2007, slide 48).

Enactment phase.

In this highly visible production phase (Anderson, 2007), a number of prototype MELL listening solutions were proposed and designed in cooperation with the School of Design and School of Technology students and practitioners. Multiple attempts at designing stand-alone learning objects and more elaborate learning tasks met with relatively limited success. These rather unsuccessful design attempts gradually led to a more holistic solution. The constant evaluation of the many design ideas and models combined with the new ecological paradigm resulted in construction of the MELLES prototype (Figure 29-33); the mobile web-based system encompassed the properties and functions of the constituent language tasks, their interactions, the dynamic real-life context of the tasks, the technological context of all the components, and their relationship to the whole.

The ensuing prototype design guidelines were further articulated along with the learning targets for the innovation. Central to the process was the design of the evolving versions of the MELL intervention which were concurrently evaluated via Phase 3 tests and pilots. The DBR design, development, and evaluation cycles were systematic and efficient as a result of their tie to the programs and academic schedules involved. The DBR activities were coordinated with the Digital Design, Computer Programmer Analyst[13], Business, and Intensive English Program (IEP) courses being integrated in the study as part of curriculum. For instance, the project-based School of Design postgraduate course[14] had been revised to include the design of a real-life MELL prototype as its course outcome. Consequently, all students in these courses participated in the design and evaluation activities as part of their program. Many volunteered to share their feedback on their own projects gained through that experience (data collection was on a voluntary basis). In addition, four School of Technology students and one School of Design student invested many volunteer hours outside of the program to work on the MELL design.

During Enactment, and to a lesser degree other phases of the study, the researcher was frequently invited as a Subject Matter Expert guest speaker to share her knowledge of second language learning and mobile learning with the students and practitioners. Such an ongoing exchange of expertise between the researcher

[13] In this document also referred to as “Programming”.

[14] Interface Design, part of Digital Design - Advanced Digital Design Program (Postgraduate). In this project-based course students, in three successive graded projects, created proposal of prototypes for MELL solutions for various mobile platforms. They discussed, created and presented in class MELL concept maps, MELL proposals, system requirements chart and visual presentations of the user interface design.

and the participants formed the basis for the validity and applicability of the theoretical framework needed for the conceptualization of the mobile learning construct. On the basis of that framework, participants produced individual MELL listening prototypes using a systematic approach to design which is reflected in Figure 7. While the students documented the process through their assignments and designer logs, their ideas were also circulated and critiqued by their professor, the researcher and the other practitioners involved. The ensuing design documentation encompassed the following (examples provided in Figures 23-28 and Appendix E):

- detailed MELL prototype design specifications;
- detailed description of the MELL design content with graphic design and interface design sketches;
- wireframes and prototypes demonstrating site architecture;
- technical specifications: system requirements charts.

This documentation, upon students' consent, was subsequently transferred to the researcher for analysis and refinement. Upon consultation with participating practitioners, the resultant prototype designs served as a starting point for the development of corresponding digital constructs. Consequently, the School of Technology Programming students and their professors generated a number of prototypes and partial solutions based on the detailed design documentation from the School of Design course. In common with the Digital Design course, the

Programming course[15] included a mobile learning software development project as its core assignment. Two iterations of the design-development cycles were completed, with the second one following the formative evaluation of the first set of prototypes. Feedback and observations from these projects were analyzed thoroughly and resulted in the development of the more complex MELLES solution (Figure 29 –33), which was constructed in response to the preliminary findings of the study.

Concurrent with the product design and construction, subsequent versions of design principles were sketched and fed back into the system. Task analyses of ESP learning objectives resulted in the inclusion of eight m-learning listening tasks in the MELLES intervention. The mobile technology system design constituted another part of this phase and led to the adoption of the WordPress[16] mobile web framework in order to optimize cross-platform access to MELLES and its components.

All research decisions, processes, constraints and other usable knowledge were recorded; this is noted in more detail in the Data Collection and Data Analysis sections. Before these particulars are discussed, however, the steps in the Evaluation: Local Context phase are presented below.

[15] Mobile Application Development is a last-semester course of the three-year Computer Programmer Analyst program. Through hands-on projects, students gain experience in developing and deploying wireless applications on mobile platforms. Students learn how to create cross device GUIs, handle events, access remote services and store and retrieve data on the device.

[16] WordPress Mobile Pack. A toolkit which helps mobilize any WordPress site (available via Internet from any mobile platform) and its components; it includes a mobile switcher which toggles between the desktop and mobile view, a selection of mobile themes, widgets, device adaptation and a mobile administration panel to allow users to edit the site.

Evaluation: Local Impact phase.

ESP college students were the key actors of this phase of formative testing. Data essential for evaluating the product and process of the innovation design were gathered during individual prototype tests and pilots of MELLES listening tasks. L2 students used their own devices to complete the out-of-class listening tasks and evaluate their effectiveness, with the exception of two students who chose to borrow iPod Touches from the project. Practitioner input, based on their contribution in the design work and observations of the students during their MELLES tasks, offered an invaluable perspective and expertise. Two external experts in the area of mobile and IT programming contributed their expertise via individual interviews. The combined participant feedback addressed questions about: the intervention usability, validity, relevance in the context of the learning process, and the specific needs of the student population. The ensuing findings helped to identify the essential characteristics and components of a MELL system. Moreover, participants commented on the overall effectiveness of the MELLES approach and their perceived attainment of the learning outcomes targeted by the intervention.

Tables 1–4 outline the data collection activities completed between October 2010 and August 2011.

Table 1.

ESP Learners: Surveys

Evaluated Tasks	Date Administered	Respondents (n)	ESP Cohort	Teacher
Task 1 & 2	Dec-15-2010	20	Group 1 + Group 3	P1 + P3
Task 3 & 4	Nov-29-2010	15	Group 1 + Group 2	P1 + P2
Task 5 & 8	Dec-13-2010	24	Group 1 + Group 5	P1 + P5
Task 6	Dec-13-2010	32	Group 1	P1
Task 7	Dec-15-2010	47	Group 1	P1
Final survey: tasks 1-8	Feb-23-2011	20	Group 1 + Group 4	P1 + P3

Table 2.

ESP Learners: Focus Groups

Evaluated Tasks	Date Administered	Respondents (n)	ESP Cohort	Teacher
Task 1 & 2	Nov-16-2010	14	Group 3	P3
Task 3 & 4	Nov-29-2010	14	Group 2	P2
Task 3 & 4	Jan-20-2011	12	Group 4	P3
Task 1, 2, 5 & 8	Dec-20-2010	6	Group 3	P3
Task 5, 6, 7 & 8	Dec-16-2010	24	Group 1	P1
Task 7	Mar-4-2011	11	Group 4	P3
Final: tasks 1-8	Feb-23-2011	12	Group 1 + Group 4	P1 + P3

Table 3.

ESP Learners: Interviews

Evaluated Tasks	Date Administered	Respondents (n)	ESP Cohort	Teacher	Ss	Gender	Age
All tasks	Nov-29-2010	1	Group 1	P1	S1	F	28
All tasks	Jan-27-2011	1	Group 1	P1	S2	F	23
All tasks	Jan-25-2011	1	Group 2	P2	S3	F	35
Tasks 1-5	Jan-28-2011	1	Group 3	P3	S4	M	32
All tasks	Dec-15-2010	1	Group 1	P1	S5	F	22
All tasks	Nov-2-2010	1	Mobile Designer/ Developer	P9	S6	M	23
All tasks	Apr-14-2011	1	Mobile Developer	P7	S7	F	21
All tasks	Aug-15-2011	1	Mobile Developer	P7	S8	M	20

Table 4.

Practitioners: Interviews

Evaluated Tasks	Date Administered	Respondents (n)	Course Taught	Teacher	Gender
All tasks	Nov-23-2010	1	ESP Group 2	P2	F
All tasks	Jan-26-2011 Feb-9-2011 Jun-7-2011	1	ESP Group 1	P1	F
All tasks	Nov-20-2010 Jan-28-2011 Mar-8-2011	1	ESP Group 3, 4	P3	F
All tasks	Dec-15-2010 Mar-31-2011	1	ESP Group 5	P5	F
All tasks	Feb-1-2011	1	Wireless Technologies	P6	M
All tasks	Jun-10-2010	1	Mobile Programming	E4	M
All tasks	Jan-8-2011 Aug-15-2011	1	Mobile Programming	P7	M
All tasks	Aug-15-2011	1	IT Programmer	E10	M

As illustrated above, the prototype pilots were conducted with five groups of L2 students representing eight different college programmes. Their feedback was collected through six surveys, seven focus groups, and five interviews (Table 1–4). In addition, one Digital Design and two Programming students, as well as two external software programming experts, tested the prototype MELLES tasks and shared their observations through individual interviews. In total, eight student and thirteen practitioner interviews were completed during the Evaluation phase. Data obtained in practitioner interviews encapsulated the feedback from the ten experts involved in the study (Table 5).

After the analysis of the data from the first round of pilots concluded in December 2010, the MELL system and the corresponding design guidelines were modified. Subsequently, the updated MELLES tasks were offered for evaluation to Group 1 and 4 along with two other ESP volunteers from the School of Technology. They piloted all eight listening tasks in January–February 2010. Their input was invited through the final summative survey of MELLES and its constituent tasks. With surveys on individual tasks and interviews being staggered over the period of three months (October–December 2010), sufficient time was allocated for the content redesign. Feedback generated from these DBR cycles was rigorously analyzed and systematically worked into the design of the mobi-english.mobi system. Certain modifications that were not feasible to integrate either due to time restrictions or the researcher's programming skills are noted in Chapters 7 and 8 as well as reflected in the summative discussion (Chapter 9). These encompassed, for example, the inclusion of locally-residing MELLES apps which would communicate with the MELLES server.

As the study progressed from formative to summative evaluation, results of the study were regularly evaluated. As in the other stages, formative findings were examined and conclusions drawn, based on data analysis, consultation with expert practitioners, researcher observations and reflections, and a review of the relevant literature. Such formative evaluation was interwoven into the study across all stages. The DBR process illustrated in Figures 6 and 7 summarizes the various phases, actors and outcomes of the study, and emphasizes its iterative character. The actual MELLES process diagram (Figure 7) is presented side by side with the preliminary DBR study plan (Figure 6) in order to reinforce the progressive character of the study: as the conceptualization of MELLES evolved from LO, the visualization of the DBR process also evolved in keeping with the changed and elaborated conceptualization.

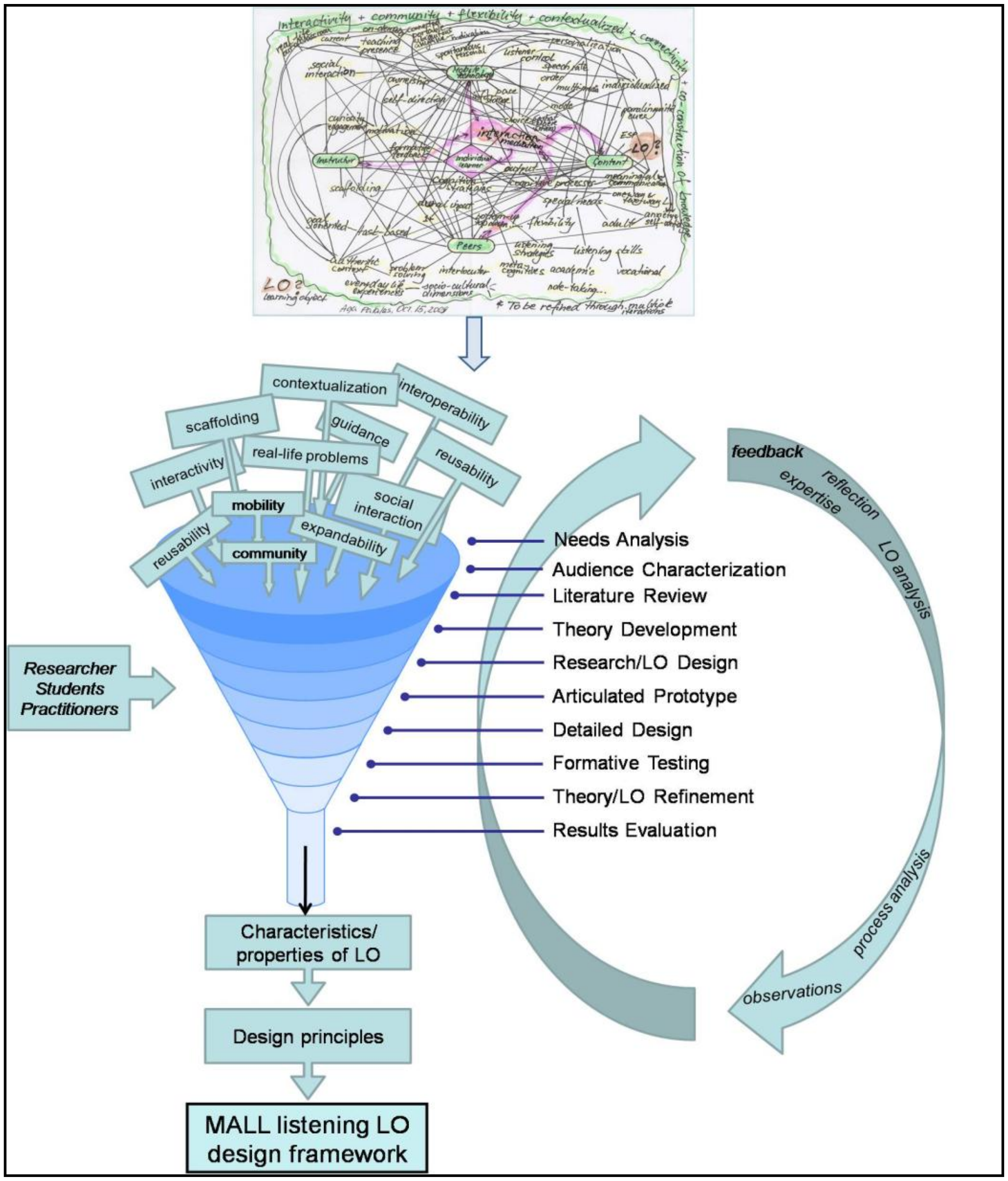

Figure 6. Processes and outcomes of the study (preliminary DBR study plan)

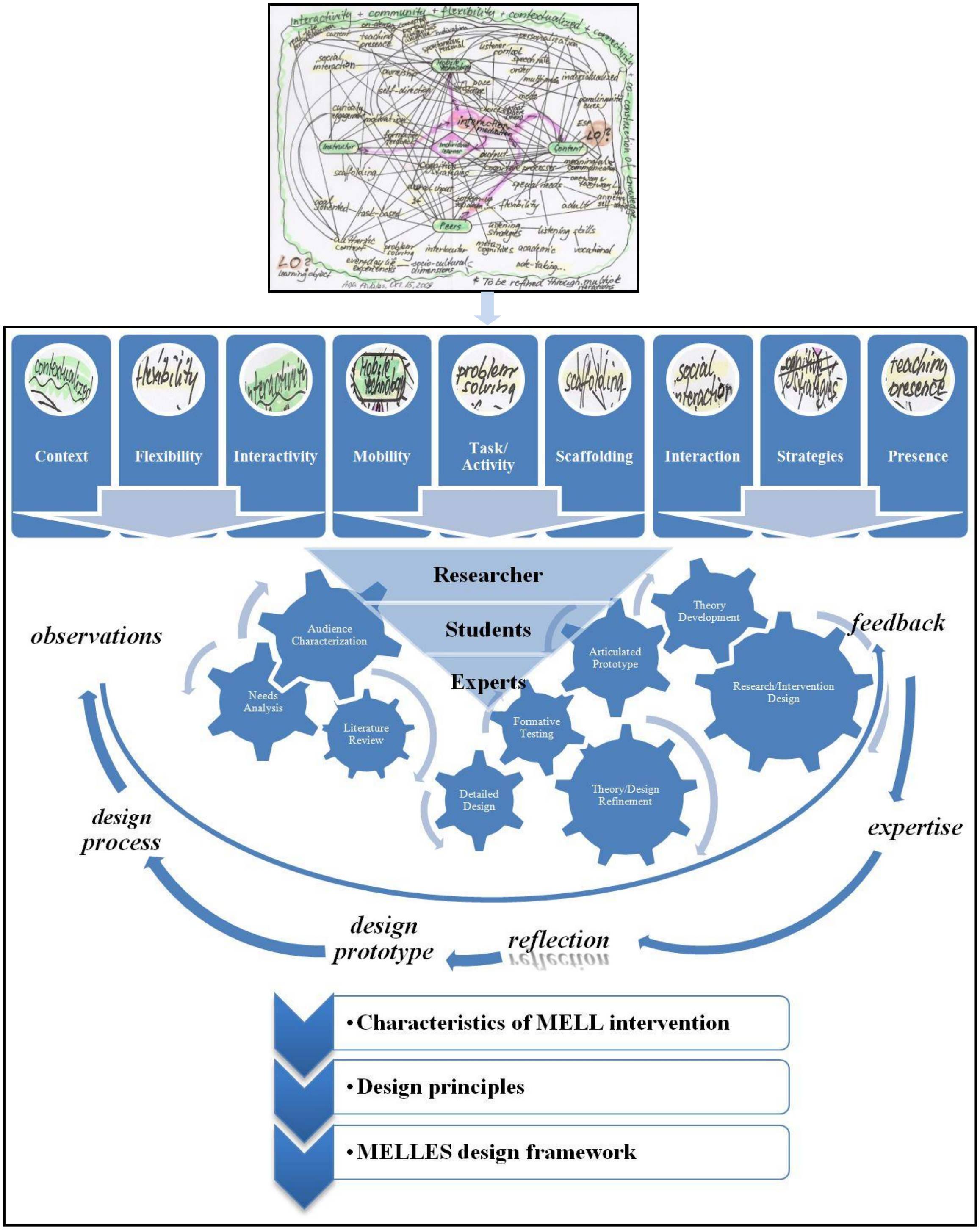

Figure 7. Processes and outcomes of MELLES design principles study

The next section provides a description of the research participants.

Participants.

As Herrington et al. (2007) have commented, "(b)ecause of the highly situated nature of Design-Based Research, participants in a Design-Based Research study in education are central to the investigation" (p.6). This interdisciplinary study included contributions and feedback from more than 100 students (excluding the 191 students from the Mobile Device survey), eight professors from a variety of GBC programs (Table 5)—School of Design (2), School of Computer Technology (3), School of Business (1), Centre for Hospitality and Culinary Arts (1) and the IEP program (1)—as well as two IT and mobile programming experts from outside the college. The Digital Design professors contributed their expertise in the design of content for mobile devices as well as in interactive game design. One IEP professor and three Communications (COMM) faculty from Business, Computer Technology and Hospitality and Culinary Arts who taught Communications courses in their respective programs, offered their knowledge of ESP and language learning. Two School of Computer Technology professors contributed their extensive applied knowledge of wireless technologies and programming for mobile devices. It is worth noting that five of the experts are L2 speakers themselves. The profiles of all the participants are presented in Table 5 and 6 below.

Table 5.

Participant Profile: GBC Practitioners and External Experts

GBC Practitioner or External Expert	Gender	Main Area of Expertise
P1	F	COMM/ESP
P2	F	COMM/ESP
P3	F	ESL/ESP
E4	M	Mobile Programming
P5	F	COMM/ESP
P6	M	Wireless Technologies
P7	M	Mobile Programming
P8	M	Mobile Interface Design
P9	M	Mobile Design and Development
E10	M	IT Programming

Discrete groups of students from the above-mentioned departments were involved in two different roles: two cohorts of Digital Design and Computer Programmer Analyst students as designers and developers and five groups of IEP and COMM students, representing eight different college programs, participated in the pilots and evaluation of these designs. It is worth noting that the ESP and COMM classes involved in the study were taught by four different professors to diverse groups of students. A rather broad spectrum of didactic approaches was therefore exemplified across these groups. While all professors offered high levels of face-to-face interactivity as well as individual and group language activities, a heavy reliance on expert feedback, scaffolding, and guidance was observed. Furthermore, there was a wide variation in the use of technologies among the professors and depending on particular language tasks.

Table 6 provides details on student participation in the various phases of the DBR research study as well as the program of study they represented.

Table 6.

Student Participation in DBR Phases and Their Program of Study

Number of Students	Program: *Course*	DBR Phase	Notes
21 (11+6+4)	Accounting pilot course (MALL Design Pilot) - 11 Digital Design - Advanced Digital Design (Postgraduate, 2 semesters): *Interface Design* - 6 Computer Programmer Analyst: *Mobile Application Development* - 4	1	Digital Design and Programming students from the 1st cohort (also included in the next two items – overlap)
13	Digital Design - Advanced Digital Design (Postgraduate, 2 semesters): *Interface Design*	1, 2, 3	2 cohorts designed and evaluated MELL prototypes
1	Digital Design - Game Design Program (Postgraduate, 3 semesters):		Student participated in the project as part of his thesis: *Toronto Walkthrough – ESL Mobile Game*. Student volunteered his time and feedback outside of the course work until Sep 2011
27	Computer Programmer Analyst: *Mobile Application Development*	2, 3	Two cohorts designed, developed, tested and evaluated MELL prototypes; 4 students volunteered their time and feedback outside of their course work, and worked on MELLES design until Sep 2011
191	Representatives from all GBC programs	1	Mobile Device Usage Survey : L2 students only
101	ESP college students: Business (2 programs), Design (1), Computer Technology (2), Hospitality and Culinary Arts (2), Intensive English Program (IEP) (1)	3	5 groups of IEP and COMM students, representing 8 college programs, participated in the pilots and evaluation of MELL designs

The purposive sampling method was employed to recruit student-participants from the GBC ESP population. These students therefore represented both females and males of diverse demographic and cultural backgrounds including the following: Russian, Ukrainian, Philipino, Chinese, Venezuelan, Indian, Polish, and Persian. While the average age of female students in the study was 28, the average for male participants was 23. The students were enrolled in the face-to-face GBC courses noted above. The typical enrolment in these courses was 30 to 35 students per class with the IEP course being smaller at 12 to 15 students per class. The main design, development, and task piloting DBR activities were integrated in the curricula of the programs involved in the study. However, student participation in the feedback exchange and the Phase 1 online survey was entirely voluntary. An invitation to the Mobile Device Usage survey was distributed via the college email system. All GBC students were invited; however, for the purpose of this study only the 191 questionnaires completed by L2 learners were considered. 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. An information letter was presented to potential participants followed by a consent form. Both the consent form and the information letter are included in Appendix B and C. Upon their written consent, students commenced their contribution to the study. Students used their own cell phones with the exception of two students who used mobile devices loaned to them by the project[17]. The majority of students participated in testing of all MELLES tasks as illustrated in Tables 1-3. Twelve students withdrew from the study before its completion. Those who stated a reason for their withdrawal attributed it to busy schedules that prevented their participation in surveys and focus groups held outside the class time.

[17] Fifteen mobile devices were purchased during the previous mobile learning project and were available to the study.

The School of Design and School of Computer Technology students who designed, developed, and tested the prototypes, participated in the study as part of their project-based courses. As noted earlier, one School of Design and four School of Technology students volunteered their time and feedback outside of their course work, thus forming a team which continued working on the MELLES design until September 2011. Data and knowledge generated with the help of all participants was documented by means of data collection and analysis which are described in the following two sections.

Data collection.

The DBR process was “meta-methodological”, to use Bannan’s (2009) descriptive term, and, as such, encompassed multiple data collection methods. Qualitative feedback from practitioners was collected by means of regular project meetings (both face-to-face and online using Elluminate and Skype), interviews, communication via the Wiggio site, and expert reviews, all of which had proven feasible during the pilot study. Their input was recorded through the researcher’s field notes (Evernote), audio files from Elluminate and Skype meetings, and written communication records. The School of Design, School of Computer Technology, School of Business, Centre for Hospitality and Culinary Arts and Intensive English Program (IEP) student feedback was gathered via surveys, semi-structured focus groups, interviews, and in-class dialogue, which were part of the class project as described above. The student input was documented through the researcher’s field notes (including observations from pilots of the MELLES tasks), written correspondence, Wiggio communication records, and class discussion notes. Informal dialogue between the researcher and students was also a rich source of data. Such input was captured in students' iterative redesign of the intervention as well as in the researcher's notes and reflections. Photographs of the whiteboard content taken during the class (for example, Figure 5) and other records of the dynamic design dialogue (for example, sketches of the process of design architecture) also served as a source of new knowledge. In addition, COMM and IEP students participating in the many pilots of the prototypes and the MELLES tasks communicated their opinions and perceptions via six online surveys (Zoomerang[18]) (see Table 1), followed by focus groups and interviews with students who expressed their interest in individual interviews. The findings from the first task-specific surveys were fed back into the evaluation loop by way of the end-of-semester summative survey encompassing the whole MELLES system. These findings were further triangulated in an in-class focus group. The survey instruments were designed to be valid and reliable. To ascertain content validity (Neuman, 2003), all questionnaires were derived from the design principles relevant to specific MELLES tasks being piloted and underpinned by the theoretical framework. The questions were designed to capture the entire meaning and all aspects of students' experience with MELLES. Face validity was established through pilots of the questionnaires, and concurrent validity by comparing results of former established surveys with a new questionnaire and ensuring that the results were consistent. Furthermore, the questions were written

[18] Full-paid version of Zoomerang online survey tool proved] reliable when used in the pilot study.

following the principles of good question writing proposed by Neuman (2003) with consideration for students' limited language proficiency. The subsequent surveys were modified to reflect the updated understanding of the design and participant feedback. The five-level Likert-Type scale, dichotomous, ranking and multiple choice questions were used along with text fields and open-end questions to encourage comments.

During the semi-structured interviews, an open framework of themes was explored, promoting conversational yet focused communication. The interviews started with more general questions allowing new questions to emerge as a result of what the interviewee said. A set of guiding questions and potential follow-up questions were prepared for each interview, however, the process was kept open. Interviews were followed up with member-check e-mails sent to confirm the researcher's interpretation. The member-checking technique was employed to validate the findings by "consult[ing] the participants themselves during analysis" (Saldaña, 2009, p. 28). All interview records were then kept for analysis and archival. Similarly, focus groups offered an open interactive setting where participants were encouraged to share their comments, opinions and perceptions.

Observations and reflections accumulating throughout the research process were documented on a password-protected collaborative Wiggio website and in the researcher's notes and reflective journal using Evernote. After each meeting or discussion, the researcher summarized pertinent points in the journal. All observations related to the characteristics of the MELL system, interconnections between its elements, and the impact of the context, were noted. Successes and fiascos were both recorded. The same Wiggio site housed links to the MELL prototypes, minutes from participants' meetings, records of preliminary findings, and other research documents. Communication among all stakeholders and details of their discussions of the design and MELL prototypes were recorded either in text-based documents or audio files from regular Elluminate and Skype meetings or the Wiggio dialogue. In fact, a combination of feedback collection methods were employed to capture "the intended and the unintended consequences of the intervention" (Anderson, 2005, p. 3).

Lastly, review of relevant literature and existing research findings continued to provide invaluable data throughout the study. The results from the aforementioned exploratory studies at GBC were also available for secondary analysis. The various types of data obtained across the three phases of research were analyzed using valid and reliable tools as demonstrated below.

Data analysis.

The many approaches to data collection were a result of the number of dependent variables which formed a complex net of inter-reliant factors affecting the MELL intervention design. In research design, dependent variables are not controlled but rather characterized (Kelly, 2007); therefore, data were analyzed to distil the variables considered crucial for effective learning and to understand the effects of their complex interdependence, rather than to measure how all the discrete independent variables affected each other.

Qualitative feedback from practitioners and students aggregated across the stages was regularly reflected upon and documented researcher notes. Qualitative data from each focus group and interview, along with mixed data from surveys, were systematically analyzed to enable the constant flow of input into the DBR process. The results were shared for discussion and, consequently, the design of the intervention was updated. However, to ensure completeness and validity of the analysis and its reflection in the MELL solution design, all data were aggregated and analyzed at four milestones to integrate these findings before the next design evaluation. The data analysis milestones were the following:

1. at the completion of the Informed Exploration phase to inform the design production process (August 2010);
2. before finalizing and launching the mobi-english.mobi website for piloting—findings from Informed Exploration and initial stages of Enactment were incorporated (October 2010);
3. prior to the final survey of the MELLES system (January 2011)—updated findings from Enactment were integrated into the design before its summative evaluation;
4. after the data collection process was completed in August 2011.

With qualitative data being collected throughout the study from more than one hundred participants, a tool was needed to organize the data and aid the analysis. To this end, the NVivo analytic software was employed and proved to be indispensable in the analytical work necessitated by the study. All qualitative data were coded and analyzed using the NVivo9 Qualitative Data Analysis System (QSR International) (Figure 8). This Computer Assisted Qualitative Data Analysis System (CAQDAS) enabled the analysis to remain grounded in the data. It also facilitated data management and retrieval, searches within and between cases, systematic and comprehensive coverage of datasets, efficient coding and recoding, as well as transparency when collaborating with others (Spencer, Ritchie, & O'Connor, 2003).

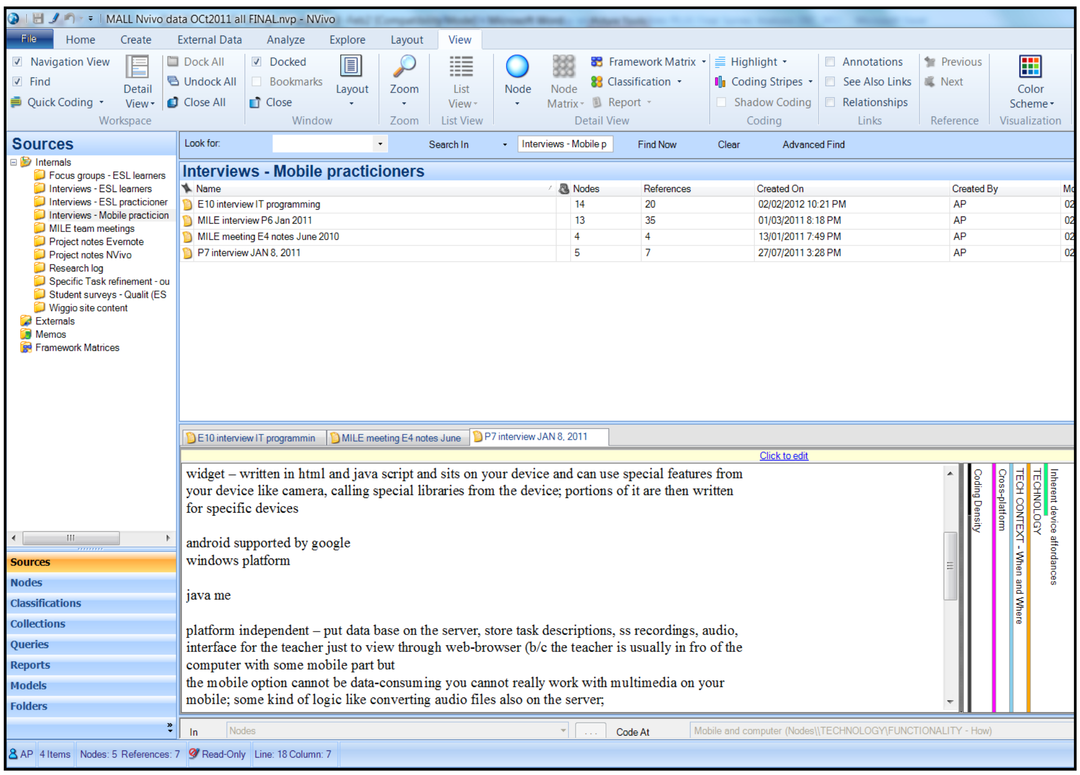

Figure 8. Screenshot of the NVivo9 Qualitative Data Analysis System

To conduct exhaustive and rigorous data analysis, all data sources were integrated into the NVivo system. Text, images and audio files were imported into NVivo, where the audio files were then transcribed. Subsequently, codes (NVivo nodes) were generated and assigned in a cyclical fashion. Codes were assigned to phrases and sentences through repetitive thematic analysis driven by the main research question. Due to the comprehensive character of the study and amount of data accumulated, some pre-coding techniques were first employed including highlighting significant quotes and phrases and coding them in NVivo as “Quotes” (Creswell, 2007). Some of these quotes are actually used in the Findings chapters to illustrate participants’ feedback. The researcher noted preliminary phrases for codes in her Evernote journal or NVivo memos, and then refined those ideas whenever interacting with the study data. Pre-coding was then elaborated by the Descriptive Coding for the initial stages of the analytical work and, subsequently, Focused Coding methods (Saldaña, 2009).

Descriptive coding was utilized for the first cycles of the analysis to summarize in a word or phrase the main topic of a message. The codes were identifications of the topic the respondent would talk about rather than the details of the content. The open-coding technique was combined with in-vivo (Babbie & Mouton, 2004) assignment of NVivo nodes to promote both the discovery of the unexpected and give voice to the participants. Categories of results, with sub-categories, were created by coding words and themes—as units of analysis—and grouping these codes together in logical themes. Some of the questions asked at that stage were: (1) What aspect of mobile learning is she/he talking about?; (2) What element of the theoretical framework does this refer to?; (3) Is he/she talking about learning or technology, what aspect of it?; and (4) Is she/he talking about the process or outcome, a feature or procedure? These questions became narrower as the analysis progressed and more information was entered into the data corpus.

The product of this analytical process, namely a set of categories (NVivo nodes), built a foundation for further qualitative inquiry and interpretation.

Focused Coding was the method selected for the second cycle of coding. This allowed for astute questioning, exploration of meaning, re-conceptualization of concepts which led to reconfiguring and reformulating of categories. The objective of Focused Coding was to “develop categories without distracted attention at this time to their properties and dimensions” (Saldaña, 2009, p. 155) while remembering that those categories are not always exclusive and their constituents do not always share a common set of features. At this stage, some new codes were constructed, others were rearranged or deleted, codes with lower frequencies were removed, and others were collated together or split. After multiple reiterations and analysis of all the available data, the researcher was able to see the results through a systemic lens. The analysis of relationships of the categories, their properties and dimensions as elements of a MELL system and how they interplay, resulted in the final collection of codes addressing the overarching research question. Moreover, the regular rigorous examination of participant comments and repetitive themes, as well as the interdependencies of those themes led to the construction of the theory proposed by this study. To avert any selection bias, the entire dataset was included in the analysis rather than portions of transcripts selected to illustrate theoretical points.

It is worth noting that to assemble the categories as they appear in this dissertation, required time and reflection combined with frequent visits back to the data corpus and reconsideration of its meaning. Most importantly, though, the repetitive cycles of re-coding allowed for the new knowledge emerging from the process of analysis to actually enable a more informed approach to coding and, hence, more valid and reliable findings.

Thus, the final MELLES coding scheme, reflected in the tables presenting the final findings of all three phases of the study (Tables 7, 10, 13, and 39), was generated in order to provide an all-embracing snapshot of the findings and to facilitate future replications of the study or construction of a MELL system. Only the repetitive themes with relatively high frequencies were included in this account of the study findings. As noted earlier, the final codes were combined, juxtaposed, re-labelled and clustered into thematic groups using NVivo. The consequential structure of categories and subcategories (Table 7) is therefore a result of many iterations, and did not emerge in its current format until the final summative analysis.

The evolving systemic perspective highlighted the multiplicity of coexisting components, hence leading to the adoption of a hierarchy of themes as presented in Tables 7, 10, 13, and 39. Two super categories (Pedagogy and Technology) were divided into major themes (PEDAGOGIC PROCEDURE, FUNCTIONALITY) and then further divided into 3 levels of subcodes (Level 1: Grouping, Level 2: group work, Level 3: collaboration and peer support). As a result, the subcategories provided further information pertaining to their “parents” and then would be expanded upon by their own “children” and “sibling” categories (Saldaña, 2009).

Table 7.

The Final MELLES Coding Scheme

Codes (NVivo Nodes) (Examples)	Code Structure
PEDAGOGY	1. Super category
PEDAGOGIC PROCEDURE - How	**1.1. Major theme**
Grouping	**1.1.1. Subcode (Level 1)**
group work	1.1.1.1. **Subcode (Level 2)**
collaboration and peer support	*1.1.1.1.1.* **Subcode (Level 3)**
interaction and communication	*1.1.1.1.2.* **Subcode (Level 3)**
individual practice	1.2. **Subcode (Level 2)**
Motivation	**1.2.1. Subcode (Level 1)**
motivating factors	1.2.1.1. **Subcode (Level 2)**
TECHNOLOGY	2. Super category
FUNCTIONALITY - How	**2.1. Major theme**
Audio player functionality	**2.1.1. Subcode (Level 1)**
Audio files quality	**2.1.2. Subcode (Level 1)**

To ascertain the consistency and validity of the results, a co-coder was invited to independently code a sample of the data and to then discuss his coding decisions with the researcher. In addition, the co-coder contributed his expertise by discussing the thematic categories and codes at multiple consensus meetings. His background in IT technology, along with a solid understanding of the learning process, enhanced the empirical aspect of all coding decisions.

Memo writing was demonstrated to be another data analysis technique vital to the validity of findings. Recording memos was a significant part of the coding process and in fact, became “a critical analytic heuristic” (Saldaña, 2009, p. 46). The researcher used analytic memos to encapsulate observations and tentative ideas resulting from reflection on the data to ensure “reflexivity on the data corpus" (Saldaña, 2009, p.33). Hence, the researcher engaged in "thinking critically about what [she was] doing and why, confronting and often challenging [her] own assumptions, and recognizing the extent to which [her] thoughts, actions and decisions shape[d] how [she] research[ed] and what [she saw]" (Mason, 2002, p.5 as cited by Saldaña, 2009, p.33).

Before discussing the quantitative data analysis, the code frequency concept should be noted. Code frequencies and relative frequencies[19] were used to summarize and compare the perceived significance of a theme. Data related to the same nodes was "quantitized" (Saldaña, 2009, p. 49), by means of a code frequency metric available in NVivo. As suggested by Saldaña (2009), frequencies were determined on the basis of the number of individual participants referring to a particular node rather than the total number of times the node appeared in the feedback. NVivo node frequencies are reported together with the names of codes in the findings chapters (Tables 10, 13, and 39).

The majority of collected data was qualitative, though some quantitative data were gathered through the surveys. The quantitative data were analyzed with Excel and the SPSS statistical predictive analytics software. In addition to the Likert-type scale questions, dichotomous, ranking and multiple choice questions were incorporated in the surveys. The data captured by Likert-type scale questions were analyzed with the assumption that Likert scales fall within the ordinal level of measurements (Jamieson, 2004): "The response categories in Likert scales have a rank order, but the intervals between values cannot be presumed equal (p. 1217).

[19] Relative frequency: the density of the occurrence of an event, specifically, the frequency score divided by the total number of observations.

Therefore, all Likert-type responses were described using frequencies and percentages of response in each category and then collated into pie charts. The cross-tabulation tests were also performed by age range and gender using the Chi-Square test, a non-parametric test deemed appropriate for ordinal data (Cohen, Manion, & Morrison, 2007)[20]. Likewise, the other quantitative data were analyzed for percentages and compared using pie charts and bar charts, with exception for ranking questions (such as Q24 in the final survey) which resulted in interval data. For these, the mean was calculated as the "measure of central tendency" (Cohen et al., 2007) and used to compare categories included in the question. In addition, responses to the same question, but in relation to a different task, were compared to determine the overall trends. These are presented in tables with the relative frequencies for various categories being juxtaposed across the surveys (for example, Tables 16–35 in Individual Tasks Surveys).

Subsequently, findings from quantitative analysis were juxtaposed with the results of the qualitative data analysis to articulate salient MELL design principles. The use of multiple data sources also ensured data triangulation (Cohen et al., 2007).

Furthermore, data resulting from consultation, dialogue, observation and subsequent reflection formed the basis for the descriptive account of the research and the concurrent investigation of the enacted theoretical framework. The design

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20 Due to the extent of detail shared in this dissertation and the fact that no statistically significant results were obtained through the tests, only an example of the Chi-Square test is provided in Appendix H and none of these findings are included in the body of this document. The remaining test results are available on request.

principles were further revised based on the data captured in the developed conceptual models and prototypes themselves. This was achieved by comparing analyses of the design of the most successful interventions along with their design records. The ensuing observations and reflections were recorded in the researcher's journal which, as noted earlier in this chapter, was part of the NVivo analysis.

It was the aim of this study to present sufficient data and description to inform the practice of other educators. Due to the context-bound nature of this Design-Based Research study, however, context-free statistical generalizations from sample to population might not be possible. Consequently, an analytical generalization has been promoted through thick description of the study so that readers can transfer the "research findings to theoretical propositions in relation to their own context" (Van der Akker, 2009, p. 49).

Role of researcher.

It has been demonstrated in this study that the role of a DBR researcher is multi-part. Apart from engaging in exploration, design, evaluation, and experimentation, the researcher had to employ strong project management skills. As an investigator, the researcher led the study through its multiple phases and processes which she had planned and coordinated. She also acted as the link between the theory and practice by providing the theoretical underpinnings in the domain of second language learning, mobile learning and instructional design. As a conceptualizer and designer, the researcher was the driving force of the study and its leader. She was also responsible for scrupulous documenting of findings and observations. Finally, having designed the research approach herself, she ensured its rigorous execution in terms of the mechanics and research methodology. The researcher's expertise in ESP, coupled with her involvement in the earlier studies conducted at GBC, may be perceived as a source of bias. In order to minimize researcher bias, all findings were validated through consultation with other practitioners. This leads to some other possible weaknesses of the study which are discussed below.

Limitations.

When conducting Design-Based Research one has to be cognizant of the limitations and constraints of this method. As Kelly (2009) points out in his account of quality criteria for DBR, the original concerns which Brown (1992, as cited by Kelly, 2009) identified in her seminal paper, are still reiterated in more current literature. These include:

Inadequate attention to sampling bias;

Inadequate attention to response bias;

Inadequate attention to researcher bias;

Overwhelming amounts of data and unsatisfactory methods of turning data into evidence;

Confounded variables;

> Inadequate attention to scaling up or scaling out studies that test parameters outside the initial sample;
>
> Inadequate attention to dissemination and diffusion studies as tests of the efficacy of the emerging design "products." (p. 171)

Kelly indicates, however, that these issues are not specific to DBR but concern any research methods which "attempt to model a phenomenon as complex as education" (p. 171). Further, a language classroom is indeed "multi-faceted, messy and even chaotic" (Freeman, 2006, p. 239).

Nevertheless, literature does suggest some caveats rooted in the complex nature of Design-Based Research. When discussing DBR methodological challenges, for example, Dede (2004) cautioned against research design being "under-conceptualized and over-methodologized" (p. 3) and lacking standards for determining when to abandon or conclude the study. To address the former issue, a strong conceptual framework was established in the Informed Exploration phase and repeatedly revisited in order to ascertain its currency and appropriateness for the study. This was juxtaposed with the findings emerging from the DBR process and reconceptualized based on those results. In Phase 1, an Ecological Constructivist framework evolved as the underpinning conceptual foundation. With respect to the latter DBR limitation, integrating multi-methodological cycles did indeed require rigour and time. In terms of time constraints, this project faced some difficulties due to its longitudinal character and the time investment required of the researcher across all DBR phases. To minimize the negative effects of those requirements, the study was planned around the college schedule with clear deadlines and deliverables attached to each milestone. Although adhering to those timelines proved problematic at times, the rigour in data collection and analysis activities led to successful completion of the three phases of the research. Moreover, it was the initial intent to exclude the final DBR phase, Evaluation: Broader Impact, from the scope of the study. At the same time, some of the data had been collected during the process of the pilot study, thereby shortening the Informed Exploration and Enactment phases. Since the study was designed to aggregate data over time and over differing participants, there were considerations regarding how to maintain the cooperation and participation levels of students and practitioners over the length of the study. Many students, indeed, perceived their participation in the research as an opportunity for supplementary free ESP practice and found the idea of mobile technologies "attractive." Also, as noted earlier, the researcher has been affiliated with the College for an extended period of time; therefore, based on the joint interest in the final findings, support for the research persisted. In the interest of preserving the integrity of the study, the researcher remained aware of potential researcher bias. Thus, she maintained reflexivity by using journals and logs to minimize possible blurring of the researcher-participant distinction and by monitoring her "interactions with participants, [her] own reaction, roles, biases, and any other matter that might affect the research (Cohen, et al., 2007, p. 172).

Dede (2004) also mentioned problems arising from the need for consensus-reaching and interaction among the many actors involved. Related to this, was the amount of data gathered and the methodological issue of sound data collection, analysis procedures, and quality of information uncovered in the data as identified by Reigeluth and Frick (1999). In order to ensure the soundness of data collection, communication with all stakeholders, and appropriate data analysis, the procedures detailed below were put in place.

- Frequent and timely communication and feedback exchange amongst practitioners and students:
  - regular face-to-face, Skype and Elluminate meetings;
  - communication and collaboration via the project Wiggio site including
    - project updates and meeting minutes
    - any discussion outside the meetings
    - exchange of materials, documents and resources relevant to the project
    - tasks managed through the Wiggio to-do list.
- Participant engagement in attaining their projects goals (agency, ownership) and consequent activities leading to those outcomes:
  - Participants were formally recognized at the college for their efforts.
  - Participants were encouraged to showcase their solutions.
  - They were invited to co-present at conferences.
  - Students' artefacts were marked as part of their course assignments.
- Thoroughness of data collection:

- Data-collection processes were kept flexible and responsive to the participants’ and academic schedules, accommodating any college timeline restrictions, such as collection of the college-wide Key Performance Indicators feedback.
- Participants were informed as to the study aims and aware of the impact their feedback would have on the development of educational theory and practice.
- The researcher accommodated the needs of ESL students for additional language support both during the in-person data collection and before the online surveys were administered (for instance, supplementary explanation of the survey questions by participants’ teachers).
- During interviews and focus groups, the researcher applied an array of elicitation techniques including guided questions, follow-up questions, and questions for ideas emerging from the feedback.
- All data collection instruments were piloted prior to use, particularly with ESL students, and the language of the questions was adjusted accordingly.
- Data were collected in multiple rounds until the point of data saturation when no new feedback appeared to emerge.

  - The researcher kept a research diary (Evernote[21]) to facilitate instant capturing of any observations, reflections as well as qualitative data resulting from ad-hoc feedback exchange; text-based and audio notes were taken with the help of any tool at hand.

- Credibility of data:
  - Data from all sources were fed into NVivo and analyzed meticulously.
  - All themes emerging from participant feedback were compared with the researcher's observations and reflection documented in Evernote.
  - Triangulation, member checks, and co-coder were employed (Neuman, 2003; Saldaña, 2009):
    - The instructional design theory resulted from the integration of expertise of the participants representing various fields (m-learning, adult education, software development, wireless technologies, language acquisition, game design).
    - Data were collected over many cycles of feedback collection with questions revisiting the same aspects of the intervention design; the multiple rounds of data collection resulted in enhanced consistency of results among participants.
    - For member checks, the researcher's written notes from each interview were combined with the key points of the researcher's

[21] Evernote: A multi-platform application designed for note-taking and archiving. A "note" can be a piece of formatted text, webpage, photograph, voice memo, or a handwritten "ink" note. Notes can be taken on a mobile device, laptop or desktop and then synchronized over the web.

interpretation and emailed to participants to check accuracy; any discrepancies were further clarified.

To ensure reliability of coding, a co-coder first worked independently on a portion of data to code responses and group concepts into themes. The interpretations of the main researcher and the co-coder were then compared and combined in a discussion.

Other criticism of this genre of research includes it being new and misinterpreted, lengthy and multilayered, as well as “messy” (Bannan, personal communication, October, 25, 2009). In fact, the length and complexity of the study required strong project management skills to be employed. It necessitated a well-designed and executed strategy that was firm enough to provide direction, yet adequately flexible to accommodate the dynamic character of the DBR research. To streamline the process, a systematic approach following the Integrative Learning Design Framework (Bannan, 2009), described in the next section, was employed. The “messiness” of the method, however, corresponded well with the “messiness” of the educational context where few variables ever remain constant. Such “messiness” mirrors the tendency of the educational context to involve multiple stakeholders with their diverse needs, varying approaches and unpredictable outcomes. It reflects the interdependencies among the many components of the educational environment, therefore contributing the tacit knowledge of that specific context.

Another issue inherent in the design-based methodology was the small sample size with respect to the quantitative data analysis. While the Informed

Exploration Survey resulted in 191 completed questionnaires, the samples in the other surveys varied between 20 and 47 responses with only one survey being $n<20$. Moreover, questions from the individual task surveys were validated through the final survey. Even with a smaller sample size, findings were adequately triangulated by employing more than one method of feedback collection, and by iterative evaluation cycles involving other participants.

Another significant aspect of participant feedback, which Neuman (2003) warned about, is the bias that might be triggered by the Hawthorne effect—the type of reactivity that occurs when subjects modify their behaviour or opinions because they know they are being studied. Likewise, they may romanticize the novelty of m-learning which wears off over time (novelty effect). With mobile technologies being a relatively unexplored area, the likelihood of the novelty effect was minimal. Considering the consistency of findings across the study, the reactivity effects seem to have had minimal impact on the results of the study.

Finally, difficulty in making generalizations across participants and in defining the successful combination of features of the intervention was identified by O'Donnell (2004) as stemming from the ongoing adjustments and complexity of the process. The findings may be limited in generalizability to all mobile learning contexts due to the specifics of those educational settings and situations. Although "[d]esign-based research does not seek for universal solutions but rather for deep understanding of innovations and the factors that affect improvement in local contexts" (Anderson, 2005, p. 3), an effort was made through the MELLES design framework to make the study results applicable to a broader MELL context.

To increase generalizability, it is intended for this study to be replicated in the future in a different milieu as suggested by Reigeluth and Frick (1999). In addition, the remaining Evaluation: Broader Impact phase of this project is intended to be conducted in the future to include other educational institutions in Ontario. Furthermore, the thick description of this study, including detailed findings (for instance, multiple thematic codes), the evolution of the conceptual framework, and the depiction of the context and procedures, will enable interpretation of the results and transfer of the usable knowledge to other settings (Van der Akker, 2009).

In spite of the inherent limitation of the DBR method, this approach proved to be effective for the comprehensive investigation necessitated by the main research question. In summary, there were a number of challenges inherent in the methodology of the study, but by capitalizing on the strengths of the design process and its context, enhanced practical insights into the design of the technology-based solution have resulted.

Ethical considerations.

There was minimal ethical risk involved in this study. To ensure voluntary participation, potential participants were informed by their professors, orally and in writing, about the project purpose, voluntary participation, expectations of participation, freedom to terminate participation with no consequences, and assurance of confidential responses. All participants were asked to sign written consent forms (see Appendix C). The researcher was available via e-mail and by phone to answer all participants' questions.

To preserve participants' confidentiality, privacy, and anonymity, the collected data collected were anonymized. A database was created which included participant pseudonyms and corresponding feedback so that participants' names are not associated with their responses. Reporting does not identify any names or personal information. All research information has been kept in secure cabinets and password-protected electronic files. Information collected using Zoomerang Survey software used the option to remove names from surveys collected, ensuring anonymity.

An additional issue with respect to student participants was the likelihood that, as new immigrants whose first language is not English, some ESL students might have exhibited increased sensitivity to their status and their language proficiency. For that reason, the researcher remained particularly sensitive to the unique needs of the students when interacting with them. This approach was successful in eliminating any issues related to the participants' status or background.

Timelines, main activities, outcomes, and data.

Table 9 below summarizes the key stages of the study along with its milestones, main activities, outcomes and data collected during each phase. To provide the backdrop for the DBR study, another brief chart (Table 8) is provided describing the pre-study research activities completed by the researcher in the same educational setting between 2005 and 2009.

Table 8.

Pre-DBR Activities: Timelines

Main Pre- DBR Activities	Date
Benchmarking Study	2005 - 2007
Mobile Learning Exploratory Study	2007 - 2009
MALL Design Pilot (fifteen-week)	June - August 2009
DBR Pilot Study *Informed Exploration and Enactment*	September 2009 – January 2010 *Exploration: Sep. 2009 – Jan. 2010* *Enactment: Nov. 2009 – Jan. 2010*

Table 9. DBR phases:

Timelines, Main Activities, Outcomes, Data and Participants

DBR Phases	Date	Main DBR Activities	Data & Participants	Outcomes
Informed Exploration *overlap with Ph2*	Jun – Aug 2010 Mobile Device Usage Survey (Jun 2010)	• Literature review • Audience characterization (Mobile Device Usage survey) • Investigation of comparable design solutions • Experts /language teachers interviews and meetings • Student focus groups (3) • Data analysis	• Pilot study data revisited - *mixed* • Experts (n=7): interviews and meetings - *qualitative* • Students (n=21): 3 focus groups - *qualitative* • Mobile Device Usage Survey (n=191) - *mixed*	• Theoretical construct (ideal to guide the design) • Preliminary design guidelines • Evaluation questions for phase 2 and 3 interviews/ surveys • Ecological Constructivist framework
Enactment (Production) *overlap with Ph1 and Ph3*	Jul 2010– Jan 2011	• Designing prototype solutions • Formative evaluation of conceptual models • Designing and developing	• Digital Design student (n=14, 7L1 + 7L2): assignments, designer logs, 2 focus groups, interviews - *qualitative* • Technology students (IT Programming):	• Preliminary MELL conceptual models • MELLES prototype: mobi-english.mobi (design specifications, instructional content, site architecture;

		MELLES • Refining the design • Participant interviews, focus groups, meetings • Data analysis • Ongoing MALL literature review	documentation (n=27), meetings, interviews (n=4: 2L2 + 2L1) - *qualitative* • Experts (n=6): interviews, meetings – *qualitative* • All participants – data on Wiggio - *qualitative* • Researcher's observations and reflections - *qualitative*	technical specifications) • Design principles refined • Evaluation questions refined
Evaluation: Local Context (Formative testing and evaluation) *overlap with Ph2*	Sep 2010-Aug 2011 + Sep – Dec 2011 *(Data collection completed in Aug 2011)* *(Summative data analysis and report writing completed in Dec 2011)*	• MELL implementation • Formative testing • Summative evaluation based on pilots of MELL tasks • Evaluation and refinement of conceptual framework • Evaluation and refinement of design principles • Participant interviews, focus groups, meetings, surveys • Data analysis • Report writing	• ESP college students (n=101): surveys, focus groups and interviews (*Tables 1-3*) – *mixed* • Experts (n=10): interviews (*Table 4*) – *qualitative* • Researcher's observations and reflections - *qualitative* • All participants – data on Wiggio - *qualitative*	• Refined MELLES solution • Refined design principles • Ecological Constructivist framework demonstrated • Summative report generated

Chapter 3 Summary

This chapter reiterated the main research question of the study and introduced the three research outcomes, namely the MELLES system, corresponding design principles as well as the benefit of professional development and heightened mobile learning awareness observed at the college as the result of the study. The DBR approach was discussed and its appropriateness for the study was demonstrated through a comparison with the aims and purposes of alternative research paradigms. The Integrative Learning Design Framework, the model adopted for this DBR study, was also discussed. Details on the procedures of the three DBR phases comprising the study were then presented, as well as details of the participants, data collection and analysis, and explication of the role of the researcher. Limitations, biases and ethical considerations of the study were examined along with the measures taken to address those issues and ensure credibility and trustworthiness of findings. Finally, the three DBR phases were presented including the timelines, main activities, outcomes, data, as well as methods and participants employed to collect the data.

Findings resulting from the phases illustrated in Table 9 above are presented in subsequent chapters. Chapter 4 concentrates on the findings of the Informed Exploration phase and a discussion of these results.

Chapter 4. Informed Exploration (Phase 1): Findings, Discussion and Evolution

Preliminary design principles for a MELL listening application were derived from data gathered through various activities of the Informed Exploration phase enriched by a comprehensive review of relevant literature on second language learning, m-learning and instructional design. This, in turn, provided a sound theoretical base for progressive development of the design framework. The key findings are presented in the first portion of this chapter in sequential order and then discussed to demonstrate the evolution of both the design of the MELL solution and of the research study itself. The theoretical framework, along with the development of preliminary MELL design principles, evolved to reflect the findings of the first stage of the study. The resulting learning theory of Ecological Constructivism (Hoven & Palalas, 2011), which formed the basis for the design of the MELL resources, is presented in the discussion section of this chapter.

Informed Exploration Findings

The sources of data for Informed Exploration included the following:

- MELL Exploratory Research at GBC;
- MELL DBR Pilot;
- Mobile Device Usage Survey;

- feedback from students and practitioners from the original Accounting pilot-course, the School of Design, and the School of Technology, as well as Communications/ESL professors;
- literature review.

While detailed descriptions of the MELL exploratory study and the resulting MELL pilot can be found in earlier publications on the research (Hoven & Palalas, 2011; Palalas, 2011; Palalas, 2010; Palalas, 2009a), the key findings which re-emerged in Informed Exploration are presented below. Having been repeatedly restated by new and returning study participants, these observations formed the basis for the investigation of mobile learning design.

Student focus groups and practitioner feedback.

The initial Informed Exploration feedback collection revisited the pre-DBR study findings and elaborated on them. Qualitative data was collected via three student focus groups and dialogue with practitioners. Student voices were represented by twenty-one adult L2 learners of diverse cultural and demographic backgrounds: eleven from the original Accounting pilot-course, six from the School of Design, and four Programming students from the School of Technology. Practitioner perspective was offered by two Digital Design faculty, two Programming faculty, and three Communications/ESP professors. The two key questions pertaining to the effectiveness of m-learning activities and the affordances of mobile technologies were posed to students and practitioners:

1. Based on the MELL resources you tested, and other m-learning ESP materials, what are the characteristics of effective listening activities/resources for mobile devices?

2. How do you usually use your mobile device for learning, work, and leisure? Which of these uses should be adopted in the design of MELL listening activities/resources?

The qualitative data collected by means of these questions were combined, compared to each other and then clustered into thematic groups using NVivo. Subsequently, codes (NVivo: nodes) were assigned to the thematic groupings in an iterative fashion. A number of themes emerged from the categorization, coding and analytic reflection. They were then organized into subcategories (Saldaña, 2009): two levels of subcodes (Level 1: Mobile technology affordances, Level 2: flexible delivery). Through subsequent analysis all Level 1 categories were organized into major themes (CONTEXT - When and Where), and ultimately the major themes – into two super categories: Pedagogy and Technology (as illustrated in Tables 7 and 10). A more detailed description of the process is provided in the Methodology section. Considering the exploratory character of this phase, as well as the multiplicity of respondents' ideas and the broad scope of their observations, only the themes recurring with a frequency above 50% were considered and are, thus, presented here (Table 10).

Table 10.

Informed Exploration Qualitative Findings: Emerging Themes

Codes (NVivo Nodes)	References/ Frequency	Relative Freq (n=33S + 7P**)
CRITICAL ELEMENTS OF EFFECTIVE DESIGN: PEDAGOGY		
PEDAGOGIC PROCEDURE - How	**138**	
Group work	**60**	**75%**
collaboration and peer support	36	90%
interaction and communication	24	60%
Scaffolding – guidance and help from teacher	29	73%
Focused individual practice	26	65%
Motivation	23	58%
CONTENT - What	**220**	
Impromptu speech practice	30	75%
Rehearsed utterances practice	28	70%
Self-paced non-reciprocal audio	26	65%
Support materials & resource (text-based)	26	65%
Authentic speech	23	58%
Relevance - work & program related	23	58%
Listening skills/comprehension	22	55%
Socio-cultural knowledge	21	53%
Pronunciation	21	53%
CONTEXT - When and Where	**198**	
Mobile technology affordances	**126**	79%
oral and aural skills	36	90%
flexible delivery	34	85%
learning outside the classroom	33	83%
reliance on inherent audio capabilities	23	58%
Own devices	29	73%
Blending classroom and outside (mobile)	22	55%
Real-life practice (dynamic language environment)	21	53%
ACTORS - Who	**21**	
Learning community	21	53%
CRITICAL ELEMENTS OF EFFECTIVE DESIGN: TECHNOLOGY	**42**	
User-friendly mobile user interface	21	53%
Web-based and mobile formats	21	53%

Note. * Percentages colour-coded blue are the average of their sub-categories.
Note. ** 21 students + 12 students (previous study) + 7 practitioners

As demonstrated by the major themes in Table 10, when asked about the essential components of an effective MELL design, respondents concentrated on the pedagogical aspects of the solution, namely the pedagogic procedure, content, and context. The respondents commented mainly on two aspects of the technology dimension. Listed below are some of the most frequent observations expressed by students and practitioners with respect to the language learning activities and scaffolding (Palalas, 2011):

- a need for practicing both impromptu speech and rehearsed utterances, such as recorded audio blogs or reflections;
- some written language support needed to help with the m-learning tasks; for instance, transcripts, vocabulary and terminology sheets, and task handouts;
- an effective mix of self-paced non-reciprocal audio podcasts and interactive activities;
- a balance between focused individual practice offering flexibility of time and place, and collaborative activities offering peer support;
- the significance of more authentic and dynamic language practice—authentic communication problems to form the core of the language practice;
- vocabulary, language functions and themes taught to be aligned with students' interests and the college program in which students are enrolled;

- listening activities requiring some interactive components and listening comprehension;
- more guidance needed in finding and selecting both the required and optional materials as well as other digital learning resources.

Comments vis-à-vis the typical usages and affordances of mobile devices that would enhance learning ESP listening skills included the following:

- mobile devices being an effective technology for ESP language learning especially oral and aural skills;
- the flexible delivery format offered by mobile devices matching students' needs and demanding schedules;
- mobile technology allowing for expanding learning outside the classroom and ESP practice interwoven into daily commute, downtime and other routine activities;
- reliance on the inherent audio capabilities of the mobile devices rather than their text-based options with apparent preference for audio over any text-based resources.

In terms of the learning context, the following four recurrent themes provided further understanding on the conditions preferred by the respondents:

- favouring own devices over those loaned to students by the college;
- mobile activities to be accompanied by classroom learning which helps maintain higher levels of motivation amongst learners (blended learning);

- learning experience being enhanced by belonging to a community, especially in comparison with the previous experience of isolation and exclusion in the college community;
- natural oral communication to be conducted in person in a dynamic language environment.

Lastly, respondents also commented on the importance of a simple, user-friendly mobile user interface, and optimized access to resources with the same content being available both in the web-based and mobile formats.

The following responses are representative of L2 students' and practitioners' opinions pertaining to the main characteristics of effective listening activities/resources for mobile devices (Q1). They illustrate the range of significance of learner-specific needs and provide a snapshot of the coding decisions.

Table 11.

Informed Exploration: Examples of NVivo Nodes Emerging from Participant Quotes – Q1

Participant Quotes	**Codes (NVivo Nodes)**
	CRITICAL ELEMENTS OF EFFECTIVE DESIGN
All that helps you practice how to understand other students and other people not only at school but outside and at work.	CONTENT: Authentic speech; Relevance - work & program related; Listening skills/comprehension
Most important characteristic is that we can listen when we are not busy (like on the subway) and we can practice pronunciation and vocabulary.	CONTEXT: Mobile technology affordances- flexible delivery; CONTENT: Self-paced non-reciprocal audio; Listening skills/comprehension; Pronunciation; Vocabulary
I like the videos from work that show the culture office behaviours. I think that this is important to learn about	CONTENT: Socio-cultural knowledge; Relevance - work & program

what's important at work and also new things to immigrants… and to listen to accounting vocabulary.	related; Vocabulary
I really like the podcasts that I can listen to when I'm on the TTC [Toronto Transit Commission] but sometimes I catch myself that I stop to listen and to concentrate. I also stop when I'm not sure what it means. So it's better if I could ask about the meaning when I listen instead of to wait when I meet my friends… When we meet with the teacher she can help us or other students can help me… maybe we could [get help] over the phone.	CONTEXT: Mobile technology affordances- flexible delivery; learning outside the classroom CONTENT: Self-paced non-reciprocal audio; Listening skills/comprehension; Pronunciation; Vocabulary PEDAGOGIC PROCEDURE: Scaffolding – guidance and help from teacher; Group work- collaboration and peer support
When we work with our mobile phones we are isolated, like I am isolated when I am in the Accounting courses because my English is not so good; but when we meet once a week and do team assignments, we feel part of the group…I don't know if that can be done through the phone, but belonging is very important.	PEDAGOGIC PROCEDURE: Group work- collaboration and peer support; ACTORS: Learning community
Sometimes the mobile learning does not keep me interested because it's like listening to the radio, you can stop if you want to or if you are tired. When we are in the ESL class the teacher forces us to get up and do things. Something like that is needed on the phone.	PEDAGOGIC PROCEDURE: Scaffolding – guidance and help from teacher; Motivation
…more like real case studies not ESL exercises.	CONTENT: Authentic speech CONTEXT: Real-life practice
They need both individual listening comprehension practice and authentic communication when they have to respond to the audio or real people talking. They can focus on listening comprehension on their own [that] can prepare them for the actual real-life conversation […] taking them on field trips would be helpful	CONTENT: Impromptu speech practice; Self-paced non-reciprocal audio; Listening skills/comprehension; Authentic speech CONTEXT: Real-life practice
They will need some kind of handouts or scripts, whether on the phone or printouts, after all paper is portable.	CONTENT: Support materials & resource (text-based)

Participants further elaborated on the salient functionalities of handheld devices in their comments to the second question (Q2): How do you usually use your mobile device for learning, work, and leisure? Which of these uses should be adopted in the design of MELL listening activities/resources? Some examples of responses to the latter question and corresponding NVivo nodes are presented in the Table 12 below.

Table 12.

Informed Exploration: Examples of Nvivo Nodes Emerging from Participant Quotes – Q2

Participant Quotes	Codes (NVivo Nodes)
	CRITICAL ELEMENTS OF EFFECTIVE DESIGN
I use my phone usually for to text and call my friends. I also check my email and Facebook.	PEDAGOGIC PROCEDURE: Group work- interaction and communication
Like everybody, I communicate with my friends and classmates, also [colleagues] at work, both for leisure and work; we communicate for fun and to get things done...we keep in touch.	PEDAGOGIC PROCEDURE: Group work- collaboration and peer support; interaction and communication ACTORS: Learning community
Listening to music is for pleasure, but I listen also to radio, some podcasts [the teacher suggested] and other that my classmates found. My phone is like a phone and a [MP3] player.	CONTENT: Self-paced non-reciprocal audio; Listening skills/comprehension CONTEXT: Mobile technology affordances- oral and aural skills; reliance on inherent audio capabilities
YouTube or The Economist podcasts come to mind; they are a great source of authentic language, especially for Business students. Plus they can work on their listening on their own time, at their convenience…well, they might need some help from their prof […] next time they see her in class.	PEDAGOGIC PROCEDURE: Scaffolding – guidance and help from teacher; CONTEXT: Mobile technology affordances- flexible delivery; reliance on inherent audio capabilities; Blending classroom and outside (mobile) CONTENT: Self-paced non-reciprocal audio; Listening skills/comprehension; Relevance - work & program related; Authentic speech
When we did interviews for our radio, different students used different recorders. It depends on what you can afford. The teacher put us in groups so we had all tools we need for the assignment.	PEDAGOGIC PROCEDURE: Group work- collaboration and peer support; Scaffolding – guidance and help from teacher
You can use what you have on your phone, you can listen or type, you can learn or have fun… it's your choice. It is your phone and what you need.	CONTEXT: Mobile technology affordances; Own devices
You find information from Wikipedia, or answers.com, or use audio Google app.	CONTENT: Support materials & resource (text-based); Authentic speech CONTEXT: Mobile technology affordances - reliance on inherent audio capabilities TECHNOLOGY: Web-based and mobile formats
I have dictionary and apps that you can practice words…flash cards that with audio would be better.	CONTENT: Support materials & resource (text-based); CONTEXT: Mobile technology affordances - reliance on inherent audio capabilities
To help you learn you can ask teacher for lesson podcasts.	PEDAGOGIC PROCEDURE:

	Scaffolding – guidance and help from teacher CONTENT: Self-paced non-reciprocal audio; Listening skills/comprehension
For media, I normally send my favourite pictures and songs, and I listen to songs;… I take photographs and send to show what I like… but maybe we can listen to other people favourite songs and talk about them…not only for learning also to be friends outside of school […]this too helps to push to learn.	PEDAGOGIC PROCEDURE: Group work- collaboration and peer support; interaction and communication; share learner-generated artefacts (*Ph3 node*); Motivation CONTEXT: Mobile technology affordances - reliance on inherent audio capabilities; oral and aural skills; learning outside the classroom ACTORS: Learning community
For help with English, I use my dictionary or there are translators for iPhone.	CONTENT: Support materials & resource (text-based)
But if I can't get on the Internet from my phone, it doesn't work. I have to wait when I get home to go on my computer.	TECHNOLOGY: Web-based and mobile formats
Usually, I make photos with my phone to send to my friends, but you can use pictures when don't know the word and you want to explain something, or for you to ask someone later.	PEDAGOGIC PROCEDURE: Group work- interaction and communication; share learner-generated artefacts (*Ph3 node*)

As mentioned above, several other aspects of preferred mobile learning design were discussed by practitioners; however, only the most frequent themes are reported in this section. Validating the Informed Exploration findings, many of these thematic codes reappeared with a stronger emphasis in the consecutive stages of the study and will be reported in Chapters 5-7. As one of the students stressed: "it works for me but I'm not sure about everybody." Hence, feedback from more participants, derived from their interaction with the MELL prototypes, was needed to approximate the "ideal model." The following section summarizes the results of the mobile device usage survey conducted at GBC in the summer of 2010.

Mobile Device Usage Survey.

More comprehensive exploration of students' use of mobile devices was conducted through the college-wide online survey. Oksman (2006) posits that "the actual use contexts and user experiences of mobile devices among different generations in their daily life can provide important insights on how to improve design and services associated with the technologies" (p.1). Kennedy et al. (2006) assert that research is needed to determine the specific circumstances under which students would like their 'living technologies' to be adapted as 'learning technologies'. Corbeil et al. (2008) argue that to assess students' readiness for m-learning, research should examine the mobile devices currently being used and the activities learners are engaged in while using these devices.

Indeed, in order to improve the instructional design and incorporate a learner-centred approach, it was vital to understand what devices were available specifically to the L2 students and the actual patterns of how they used the technology. The online questionnaire comprised 17 quantitative questions (nine Likert scale, three dichotomous and five multiple choice), including two concerning demographics. This information, collected across all college programs, provided insights into the affordances and limitations of technologies available to students, as well as users' preferences pertaining to interaction with others, the device, and the content. All findings pertinent to the research question are discussed in the following paragraphs. They are organized by themes, therefore questions are not reported in a consecutive order.

As mentioned in the Methodology chapter, 191 L2 students were asked questions pertaining to the type of mobile devices they use and the manner in which they use those devices. While 186 (97.4%) of respondents had their own mobile devices, a small group of 5 students (2.6%) did not possess a handheld device at all (Q1). At the same time, 25.9 percent of respondents owned multiple handheld devices, including one or more smartphones, mp3 players and game consoles. Figure 9 below demonstrates the breakup of device brands used by the respondents. In terms of the mobile platform, which had to be factored into the MELL system design decisions, Blackberry was in the pockets of 11 percent of respondents, and the Apple OS in use by 16 percent (excluding iPod nano and classic which do not support mobile web or custom apps). The Android and Windows platforms were also represented, however, the data collected did not allow to discern between the two (most manufacturers listed in the questionnaire produce both Android and Windows phones). The majority of the students had smartphones offering an array of inherent capabilities such built-in camera, mp3 players, voice recorders, Internet, e-mail, SMS and MMS options, as well as many apps offering additional tools. These features make them constructive multimedia tools for mediating learning and communication in a language-learning context.

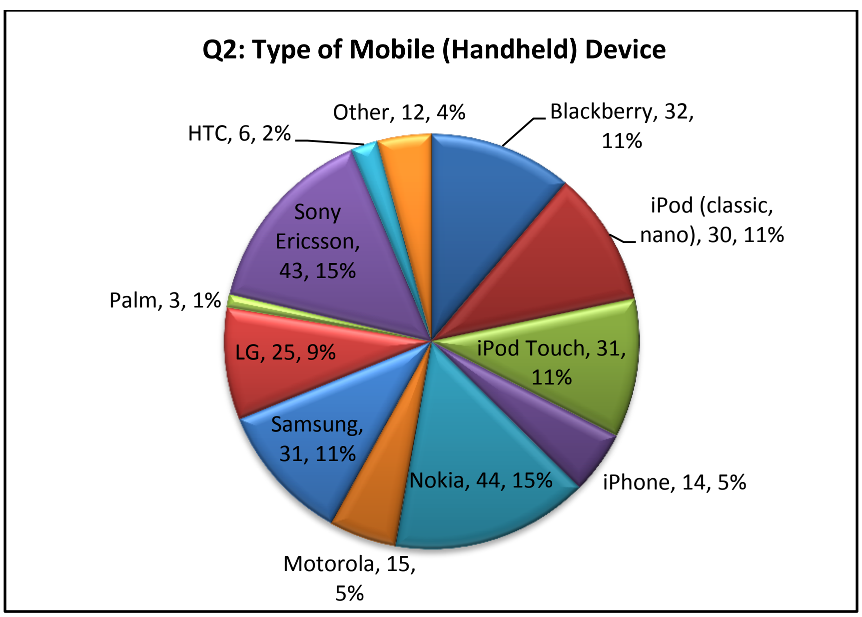

Figure 9. Mobile phone brands—students' responses

Over three quarters of the students had used their mobile devices either for minimum a year (17%) or more than two years (62%), hence being rather familiar with those technologies (Figure 10). With an additional 14 percent having enjoyed the mobile technology for six to twelve months, and the remaining group for less than half a year (3–6 months: 4%; less than 3 months: 3%), one fifth of the respondents could be still considered novice users of the mobile devices.

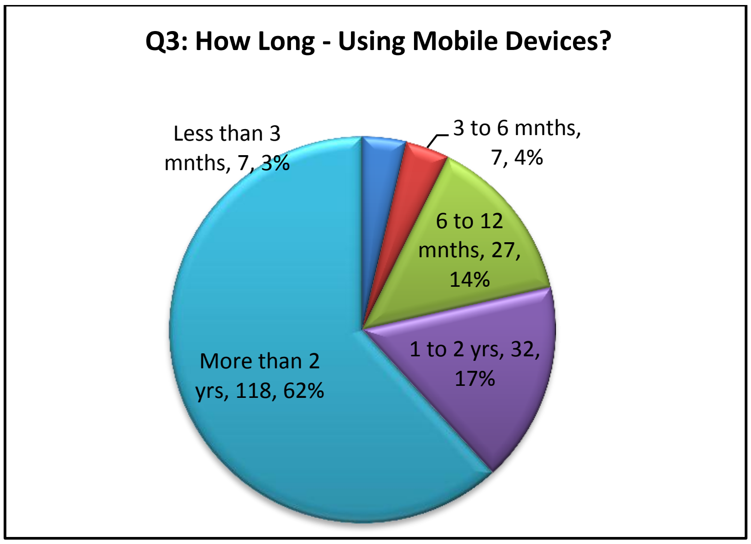

Figure 10. Length of experience with mobile devices

To further understand students' comfort level with mobile technology and the concept of mobile learning, Q4 asked whether the respondents had ever used mobile devices for learning. Half of them reported some m-learning experience (Yes: 48%; No: 52%) either through formal or informal learning activities.

How mobile learning can be realized depends, amongst other factors, on the availability of device features, the user's ability to exploit those capabilities, and also the type of network connection the learner enjoys. Many of the mobile technology affordances might be limited by the lack of access to the network or the Internet. For instance, users may not be able to benefit from on-demand access to Internet-based resources if their phone plan excludes the data option. Therefore, Q5 inquired about the data plans to which students subscribed (see Figure 11 for details). The results highlighted how the cost of a data plan affects the ubiquity of mobile technologies.

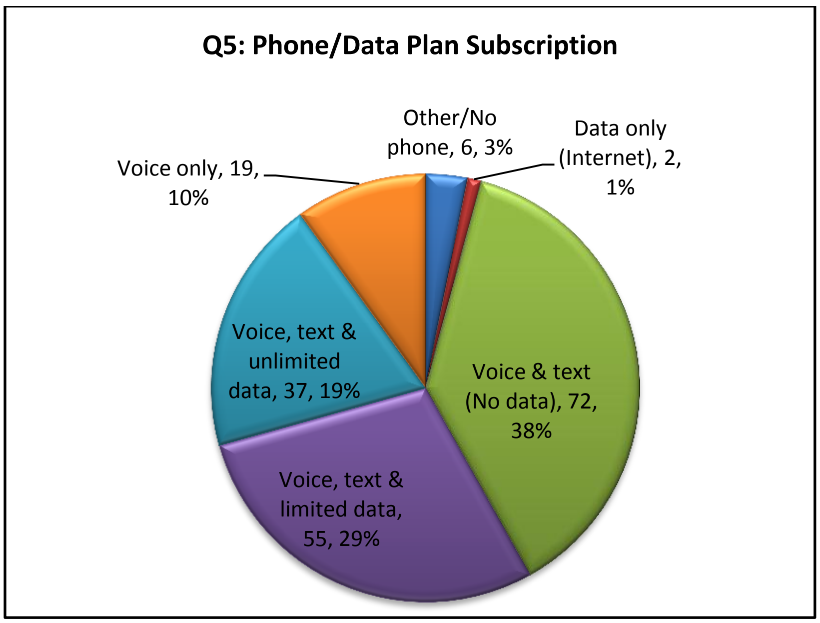

Figure 11. Data plans students subscribe to

Nearly half of the students (Voice & text: 38%; Voice only: 10%) subscribed to a phone plan that did not include access to the Internet, and an additional 29% of respondents enjoyed a limited data option. Nineteen percent benefited from the voice, text and unlimited data plan. It is worth noting that, since the survey data was collected, all Canadian telephone providers introduced student plans offering more affordable pricing for mobile phone packages. With the cost of data access decreasing, more learners might be able to enjoy just-in-time interaction with information available on the Internet and any other web-based resources. In addition, the perceived effectiveness and accessibility of mobile learning might be impacted in a positive fashion. Notwithstanding the reduction in the cost of data subscriptions, limited access to the Internet and, consequently, to features and applications relying on that connection, still should be factored into the design of all m-learning activities. Moreover, regardless of the data plan restrictions, access to the Internet and to the telephone network is also limited for all students commuting to the college via the subway. More than a quarter of respondents (26%) spend over two hours a day commuting to the college (Figure 12); another 52 percent commute between one and two hours (1–1.5 hr: 27%; 1.5–2 hrs: 25%), whereas 18 percent spend up to an hour commuting (30–60 mins: 15%; Under 30 mins: 3%). The many students who spend a substantial portion, of their day on public transport could benefit from dead-time m-learning activities (residing on their mobile devices and not requiring any instantaneous interaction with peers, other devices or a database); such learning, though, might be devoid of interaction opportunities essential for effective language learning.

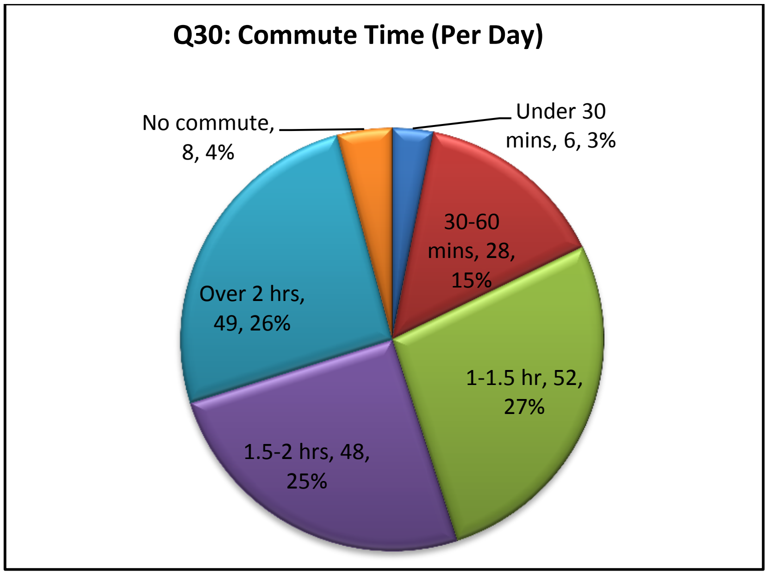

Figure 12. Commute time (per day) for students

The respondents identified commute time as the most opportune time for m-learning (Q9 and Q25). In fact, in Q9 (When do you use your mobile device?) they stated that travelling/commuting (82% of respondents) and walking to a destination (76%) was when they primarily used their mobile devices. In addition, they tended to make use of their mobile device around the house (64%), during leisure time (62%), shopping (46%) and when working out (29%) (Figure13). Likewise, when asked when they would engage with prospective m-learning materials and applications downloaded onto their devices (Q25, multiple selections), respondents consistently singled out travelling/commuting (67% of respondents), the time around the house (58%), leisure time (45%), and walking (28%) as the most suitable (Figure 14).

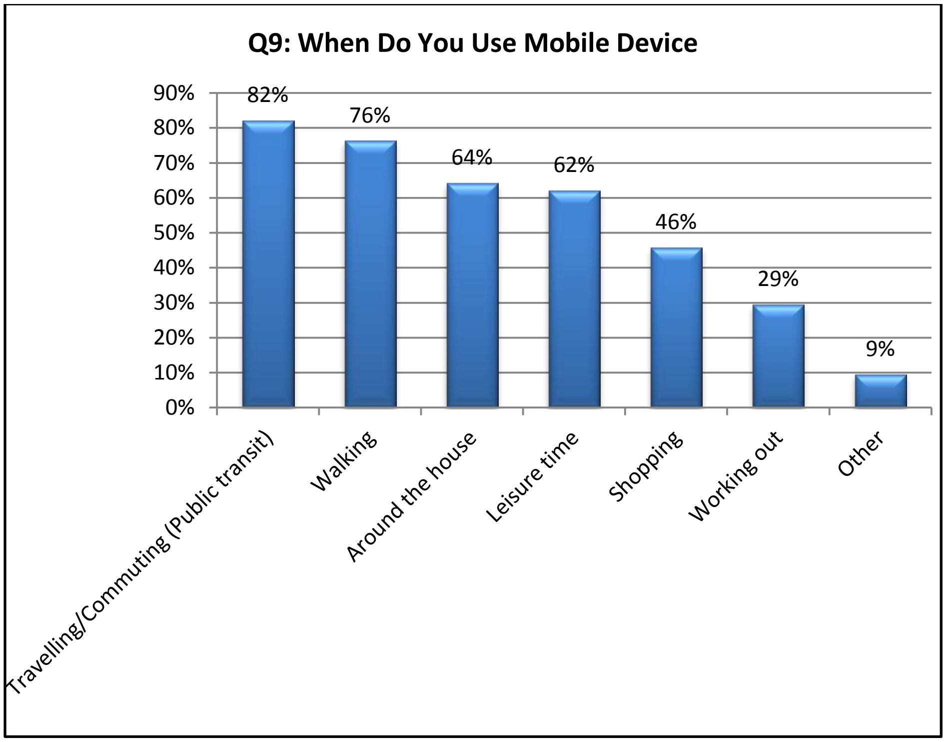

Figure 13. Time of mobile device use

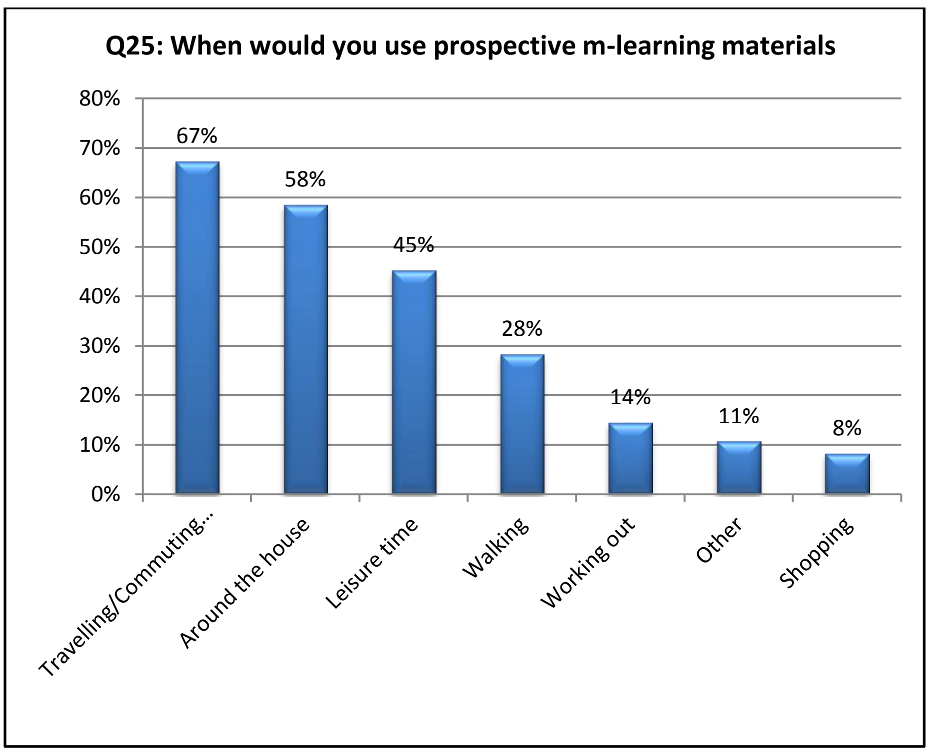

Figure 14. Time when m-learning materials would be used

The following question of the survey (Q8: In total, how much time per day do you spend on your mobile devices?) looked deeper into students' mobile device behaviours. Twenty one percent of respondents reported spending more than three hours a day on their devices. Eighteen per cent devoted between two and three hours to mobile tools, 22 percent, one to two hours, and a quarter of students, 30 to 60 minutes. Those that spent under 30 minutes using their devices formed the smallest group (14%). Overall, mobile devices tend to permeate students' daily activities (Figure 15).

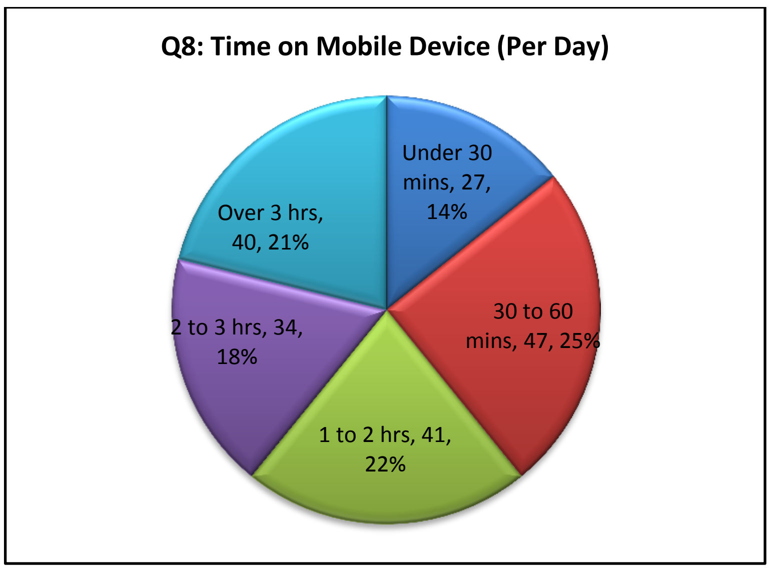

Figure 15. Time spent on mobile devices per day

The insight into when, how long, and during what daily activities students tend to use their devices enables the design of learner-centred mobile learning. Understanding what mobile device features users are most accustomed to also sheds light on the tools they might favour and be more inclined to use. Our survey (Q6) determined that talking on the phone (86% of respondents), texting (85%)

and taking photos or videos (65%) were the most popular activities amongst the students (Figure 16). These were followed by listening to audio/music (57%), using apps such as clock or calendar (57%), playing games (52%), accessing Internet (43%) or email (37%). All respondents identified multiple activities for which they use their mobile technology, with voice-based communication slightly exceeding the text-based medium. See Figure 16 for the full list of commonly used mobile features.

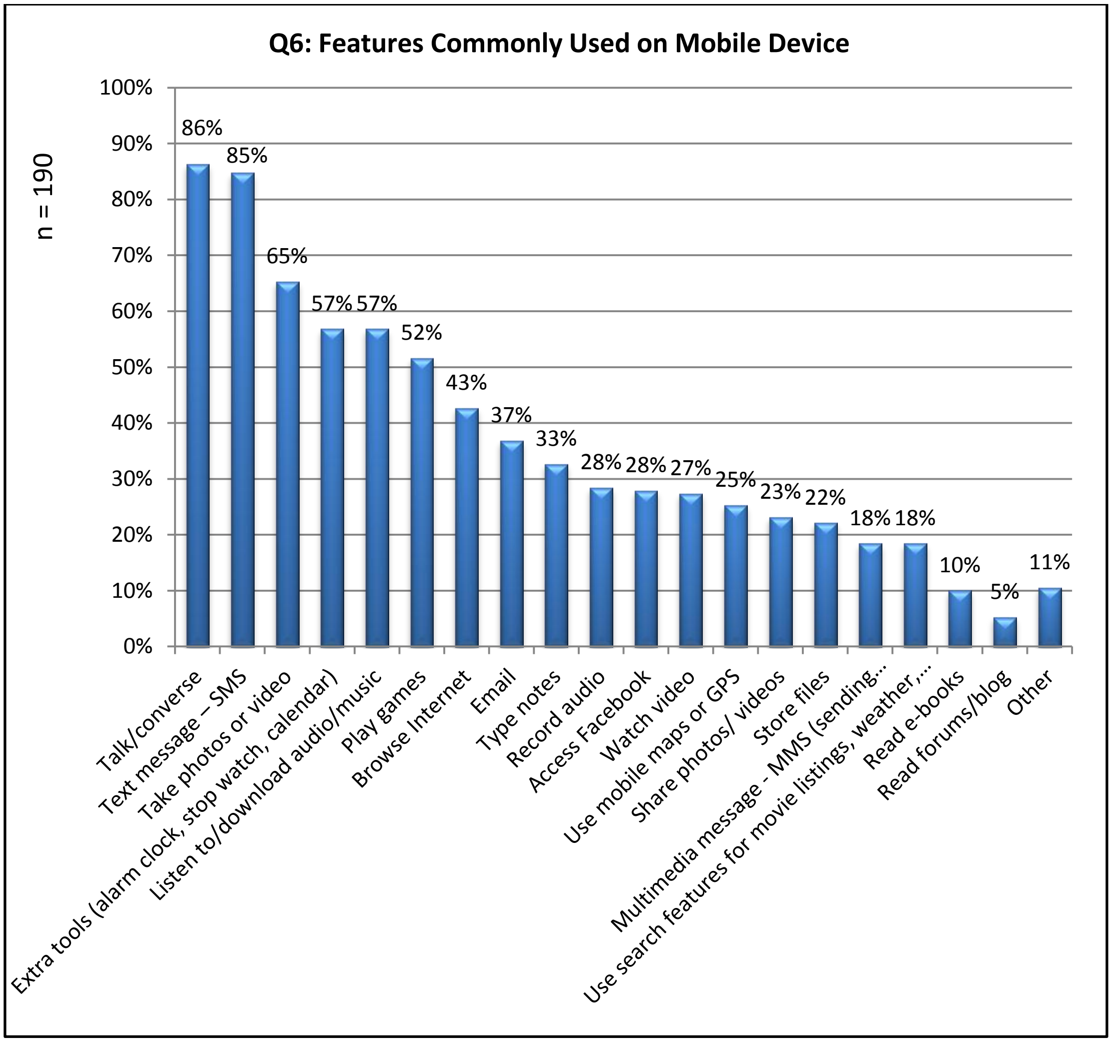

Figure 16. Average time per day spent using mobile device features (in minutes)

Q7 (List three things that you use your device/phone for and how many minutes per day you spend on them) inquired into the time spent on these activities. The answers revealed differences between the time dedicated to talking (58 mins/day), listening (40 mins/day), texting (37 mins/day), Internet surfing (12 mins/day) and other features (see Figure 17). On average, respondents spent 167 minutes a day using their mobile devices.

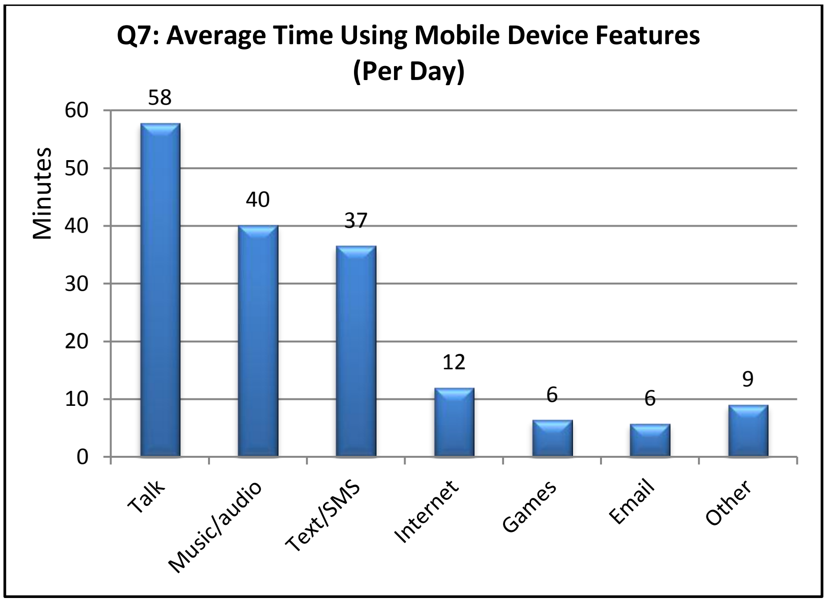

Figure 17. Average time using mobile device features (per day)

As demonstrated by the juxtaposition of Q6 and Q7, while more learners tend to send SMS messages than listen to the audio or music, on the whole they spend less time using the texting feature. Accordingly, fewer respondents listen to the audio but for longer periods of time. Likewise, more people play games than browse mobile Internet; however, they devote twice as much time to the Internet than games. These observations regarding learners' existing patterns of mobile use provided an enhanced understanding of their needs and preferences allowing for a more user-friendly and engaging MELL solution. To optimize learning, the mobile instructional design should not only capitalize on the technology features to which students are currently accustomed but also encourage students to explore other device affordances which are conducive to learning. Therefore, the survey posed some additional questions to gauge learners' preparedness for mobile learning.

Asked whether they would want to learn using their own mobile devices (Q18, Figure 18), 57 percent of students expressed their readiness to do so (SA: 18%; A: 39%); however, 29 percent were undecided and 14 percent were not willing to engage in mobile learning (D: 8%; SD: 6%).

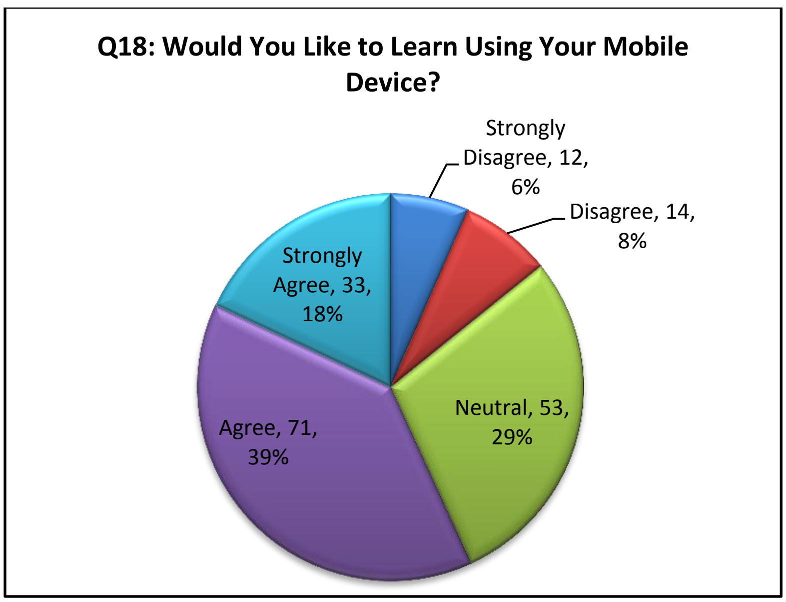

Figure 18. Willingness to learn using mobile devices

In terms of privacy issues, over three quarters of respondents (SA: 28%; A: 52%) did not seem to hesitate in sharing their cell phone numbers with their peers for the purpose of learning (Q19). A small percentage remained cautious (D: 3%;

SD: 3%), whereas 14 percent did not have an opinion (Figure 19). Consequently, voice-based communication could be considered as an integral element of the design of the MELL system.

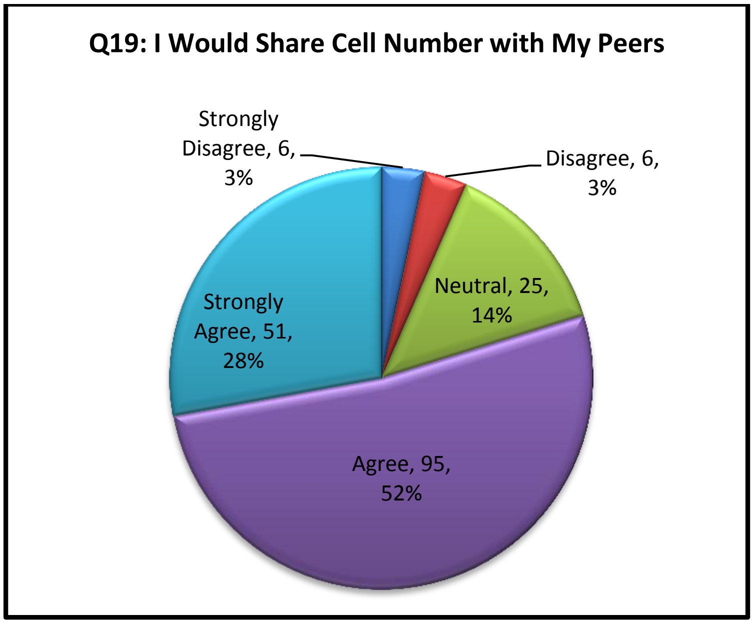

Figure 19. Willingness to share cell phone number with peers

To optimize the accessibility of a mobile learning system, learners might be required to download materials and apps onto their devices. Hence, it was imperative to determine whether respondents would be willing to do so. Q23 (I would download class materials such as audio, notes, review questions, summaries, study guides onto my mobile device/ phone for the purpose of learning) examined that aspect of m-learning. Consistent with their willingness to engage in MELL, 65 percent of respondents were prepared to download m-learning materials (SA: 20%; A: 45%), 19 percent were undecided, and 16 percent did not feel ready to do so (SD: 5%; D: 11%) (Figure 20).

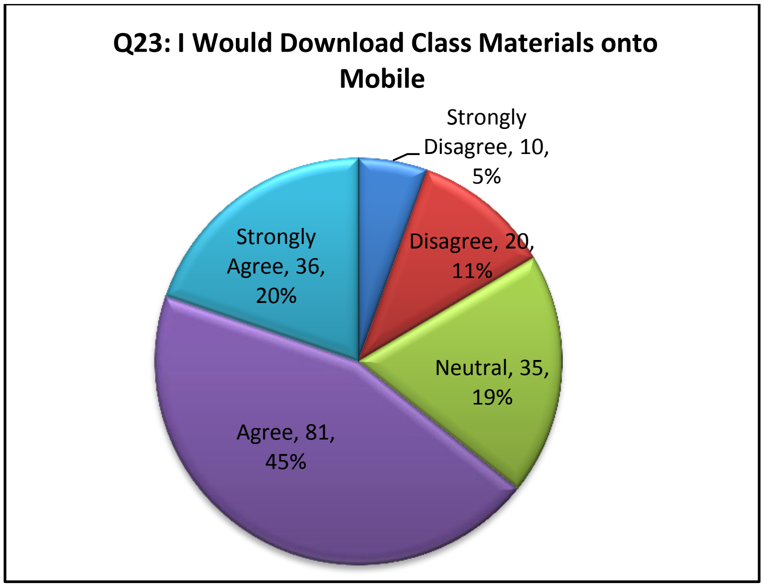

Figure 20. Willingness to download materials onto the mobile device

Finally, to gain more insight into how essential it was to the students to have learning materials at their fingertips anytime they needed them, Q26 measured their agreement with the following statement: I think having learning materials available on my mobile device anytime I need them, would benefit my learning. The level of agreement was rather high—33 percent strongly agreed and 37 percent agreed that it would be beneficial to have materials accessible just-in-time. While 20 percent of students did not have an opinion, 10 percent (SD: 6%; D: 4%) did not recognize any benefit to instruction being readily available on their mobile devices (Figure 21).

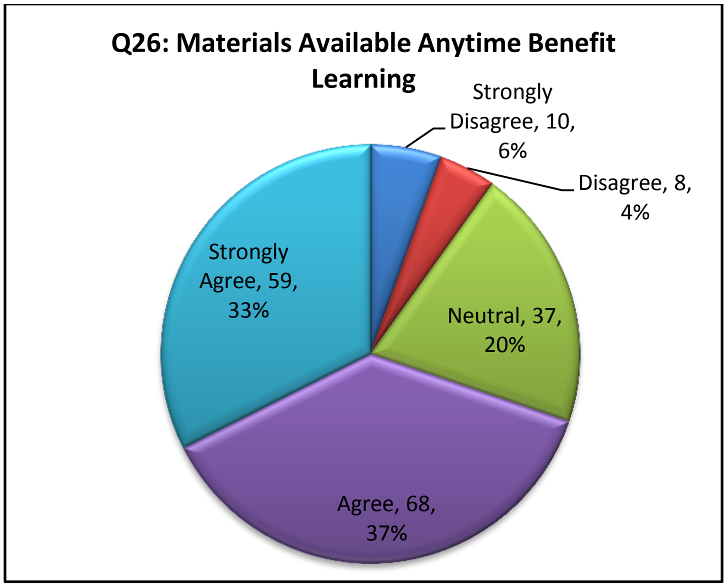

Figure 21. Learning materials available anytime - benefit

Considering that audio podcasts form a substantial portion of the learning materials used by ESP students, Q21 (I would accept and send audio as part of a learning activity) inquired into respondents' willingness to exchange audio files. Sixty percent of participants were open to sending and receiving audio files (SA: 15%; A: 45%), 27 percent had no opinion, and the remaining students were not willing to exchange audio files (D: 8%; SD: 5%) (Figure 22).

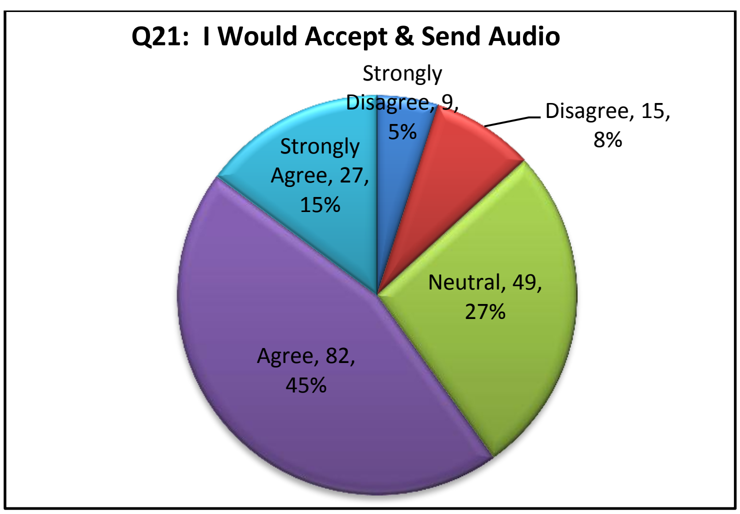

Figure 22. Sending and accepting audio podcasts

All in all, it is essential that the MELL application draws on the mobile habits and preferences identified in the survey. However, in its design learners are not precluded from seeking out other opportunities to adopt a new mobile device or different type of use with a familiar device (Pettit & Kukulska-Hulme, 2007). Learners were encouraged to devise new ways of language learning, learning which would be enabled by the mobile technology and the affordances of the context in which the learning took place. Their experiences and observations through the subsequent iterations of the study continued to provide direction to the design of the MELL system. The next section demonstrates how the Informed Exploration findings impact the conceptual and design framework.

Informed Exploration Discussion

In this section, three aspects of Informed Exploration findings are discussed to provide a foundation for the subsequent iterations of the study. These are: (1) the learner preparedness for MELL, (2) the theoretical construct distilled from the data analysis resulting in a refined theoretical framework, and (3) a shift from the focus on designing a learning object (micro) to an ecological (macro) perspective on the educational intervention in question. A list of the preliminary design principles, which encapsulate the key Phase 1 findings, concludes this chapter.

Starting with the brief synopsis of the mobile device usage and ownership patterns, this discussion aims to demonstrate that the GBC L2 students are prepared and eager to engage in MELL learning using their own devices. They are ready to assimilate out-of-class mobile learning into their daily activities as an integral part of their second language learning experience, seamlessly connecting the formal and informal ESP learning efforts.

Overall, the survey findings substantiated the observation that mobile technologies permeate the way the students work, learn, communicate, interact with each other, and access information. They tend to spend, on average, nearly three hours per day utilizing their mobile tools to communicate via text and voice, listen to audio and music, access information and email, play games and exploit other mobile options. Contingent on the data plan the user subscribes to, the majority of respondents use smartphones to access not only the content residing on the device, but also the plentiful data on the Internet or a web server. With almost half of the students experiencing merely limited access to the web-based data and the access to any network being limited during their rather long (often exceeding two hours) commute on the subway, a portion of MELL content should be available locally on the device. Thus, learners can complete certain activities off-line before they can connect to the database again and synchronize the updated information. The findings also confirmed that almost all students would be willing to download necessary materials, multimedia files, and applications onto their devices in order to have them readily available for learning. In terms of the preferred timing and place for m-learning, apart from the commute periods, other daily activities were identified as an opportune time for learning English using mobile devices. Students indicated that they would be eager to integrate MELL activities into their daily lives both at home, and even more so, outside the house, where they could engage in authentic communicative situations.

With respect to design of the “ideal” MELL instruction, respondents emphasized that mobile-enabled activities should be guided by experts who would provide just enough structure not to take away from the flexibility of m-learning and who would manage the logistics of the learning experience, including the learning path itinerary and work plan (preferably obtainable on-demand). Experts’ scaffolding and coordination was also recognized as a backbone of interaction and communication with peers. When working on individual fluency and accuracy tasks, ESL learners most value the facilitator’s feedback as a measuring stick of their overall progress. Learners also rely on the facilitator to stimulate their motivation and point them to pre-selected linguistic as well as technology resources.

Respondents observed, however, that a substantial portion of the motivation and scaffolding responsibility should be automated through the MELL solution design by providing on-demand resources, notifications, reminders, engaging tasks and assessments. Moreover, learners’ engagement could be optimized by including relevant content related to their program of study and facilitating their acculturation in Canada (socio-cultural skills). To further aid the development of their listening skills, respondents would appreciate a strong pronunciation component in their MELL instruction as well as opportunities to hear authentic speech and to work with native speakers of English. Students indicated, though, that apart from the audio-based help and instructions, they would require written language support such as transcripts, vocabulary and terminology sheets. While participants found mobile audio podcasts and listening tasks more advantageous than using text-based resources, and particularly convenient for on-the-go learning of listening skills, they maintained that some written mobile content or even hard copies of handouts would be helpful.

Another source of scaffolding and motivation deemed by most respondents as essential to successful acquisition of aural skills was the ability to work with peers both face-to-face and online. Being able to interact in the classroom reinforced both the cognitive and the social dimensions of students' listening practice. While working with others face-to-face, students had an opportunity to receive instantaneous feedback, and also to demonstrate their linguistic skill and have their proficiency assessed in a less threatening environment. In a group setting, they experienced higher levels of motivation; they felt that the in-person interaction made their learning community stronger and that the connection strengthened their individual practice. Respondents recommended that such face-to-face group contact be blended with individual work to facilitate both the comprehension-focused language exercises and collaborative situated learning. The social and teaching presence could be, hence, expanded beyond the in-person meetings into the web of the learning network by means of the mobile technologies. In terms of the type of listening activities preferred by respondents, impromptu speech practice (such as responding to ad-hoc questions) alongside rehearsed utterances exercises (for example, recorded audio reflections) and self-paced non-reciprocal audio tasks (such as language podcasts) were identified as the most effective. It was the combination of oral and aural tasks, offering the ability to carry out linguistic functions both in simulated language situations and in real-life contexts, that respondents considered a winning solution. Real-world linguistic tasks offering authentic and dynamic communication challenges should be the heart of the MELL design. The inherent audio capabilities and portability of mobile devices can take aural skills learning out of the classroom into the streets of Toronto, while at the same time ensuring effective instruction. The external environment, indeed, offers authentic samples of language in natural speech situations and places. While it may force learners to communicate and make meaning, such communication can be supported through instantaneous feedback as well as visual and auditory cues. The environment also supports cognitive processes by social presence of peers, experts and other language users. Respondents repeatedly emphasized the value of the semiotic interaction with the environment and the language support offered by the context. The environment is full of language; it is "full of demands and requirements, opportunities and limitations, rejections and invitations, enablements and constraints – in short, affordances" (Shotter & Newson, 1982, p. 34). As will be discussed in Chapter 5-7 (Phase 2 and 3 findings and discussion), it was demonstrated through the study that learners can benefit from these affordances through interaction with their environment aided by mobile technologies.

Using their own mobile devices, students were open to experimentation with various functionalities of the tools. They perceived their personal mobile devices as flexible and convenient enablers of ubiquitous communication and learning. In addition, some indicated their preparedness to participate actively in the selection and creation of their own learning resources. These observations prompted the inquiry as to what extent student-generated content could be part of the design and how conducive to learning it would be to capture the information embedded in the context with the help of built-in cameras and recorders. Considering the variety of functions and multimedia-based tasks most students regularly performed using their devices, the design of MELL instruction does not have to be limited to any particular format or mode unless technical restrictions come into play (for instance, the size of larger multimedia files). With a preference for voice-based rather than text-based communication and the focus on the acquisition of aural skills, audio content should constitute the core of MELL instruction. Retrieving, recording and interaction with such audio linguistic resources is advantageously supported by the inherent audio capabilities of any handheld mobile devices. Nonetheless, respondents stressed that the design of the MELL solution should further enhance the effectiveness of the technology through a simple user-friendly interface and optimized access to resources via dual channels—the web and the mobile platform. All in all, students displayed familiarity with their devices, suggesting that the technology itself did not constitute a barrier to learning. On the contrary, even novice users of mobile technologies demonstrated willingness to adopt the tools in order to join others in mobile interaction and communication and they did so either with the help of formal training or the support of their peers. Moreover, students were accustomed to using an array of apps and tools offered by their devices; the vast majority displayed aptitude to utilize those applications (in some cases only after an expert demonstration) for mediating learning and communication in a language-learning context. The survey findings verified that

GBC learners were ready to interact with others, and with technology, content, and context, using their own mobile devices.

Overall, respondents perceived MELL as an effective and promising approach to augmenting classroom learning and their personal language practice. A number of critical characteristics of the MELL solution have been presented above, the essence of which formed the theoretical construct guiding the consecutive stages of the design. The resulting design guidelines are summarized at the end of this chapter after the discussion of the evolution of this DBR theoretical framework.

Evolution and Preliminary Design Guidelines

One of the most significant findings of Phase 1 was the realization that in their discussion of an effective MELL solution, respondents would usually refer concurrently to several elements and their functional relationships as opposed to a specific *characteristic of an effective pedagogically sound learning object* that they were asked to identify. For instance, they would emphasize the need to combine both *impromptu speech* practice embedded in a *real-life* context necessitating support by means of *collaboration* with *individual rehearsed utterances* practice at the *flexible time and place* accommodating their preferences and schedules. Likewise, the need for *motivation* was related to the *relevance* of learning task content alongside the general desire for a strong *learning community* and *support from a teacher*. The core of the feedback focused on what content should be delivered using what specific procedures and in what particular time and technological context. Although a list of specific design essentials was distilled through the feedback analysis, it would be a misrepresentation to consider these items in isolation. The various elements do support each other, therefore they need to co-exist and be viewed as parts of a whole. In fact, participants emphasized that for the resultant learning to be effective, the design of constituent parts should not be the sole focus, but, most importantly, the focus should be on how these parts interplay to create an engaging dynamic learning experience. Once the critical elements of the system are identified, a question of how they are organized into a whole MELL solution should be addressed before investigating the detailed requirements of every fundamental component of the system.

Moreover, the actual context in which MELL learning takes place should be considered as a part of the system since, according to the respondents, it enables genuine dynamic language practice. The dynamic and fluid connections with the context, made possible through the technologies, engender authentic language practice which students deemed most crucial for acquisition of aural skills. The recognition that the Toronto setting offered a unique English speaking environment which enabled situated language learning, and that mobile devices were the tools to mediate the interaction with that context, led to the re-conceptualization of the research theoretical framework—a shift to a more ecological perspective. Having emerged from Informed Exploration, this ecological framework joined together the main feedback themes pertaining to the pedagogic procedures, content, context, actors, and technology desired for the effective MELL design.

Ecological Constructivism.

As mentioned in the Literature Review, a socio-cultural paradigm, namely SCT was initially selected as the DBR framework for its potential to address the cognitive process in tandem with mediation and learning through interaction in a community, the usage of language as an enabler of communication, the role of technology in that process, and the interplay amongst all these elements. However, a more holistic and contextual theoretical model was required to fit some aspects of the MELL design advocated by the Informed Exploration findings. It was vital to address both the need for active learning embedded in a real-life context with potential supports and affordances, and the role of mobile devices in such context-embedded communicative practice. At the same time, more emphasis was required on the integrational[22] character of the MELL solution linking together mobile technology, learning activities and resources, context, learners, peers, facilitators and other speakers of the language. The interconnectedness of all aspects of the MELL learning system mirrored the relational web of components identified by the respondents as being essential for the desired intervention design. As a network of elements and their relationships began to emerge from the findings, a more ecological view resonated with the need to create a MELL design suitable for the “nomadic” ESL learners and their preferences. Hence, a new learning theory, which Hoven and Palalas (2011) referred to as Ecological Constructivism, was devised, encompassing the manifold

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[22] The term “integrational” has been borrowed from the field of Integrational Linguistics (Harris, 1998), which views language-making as an emergent, context-bound human activity; accordingly, utterances have to be integrated with linguistic and non-linguistic activities in a particular context and particular moment. For the purpose of this study the term “integrational” emphasizes joining together the actors, language, tools, resources and the context in which they interact.

dimensions of Ecological Linguistics and Social Constructivism. While a more in-depth treatment of Ecological Constructivism is offered by Hoven and Palalas (2011), the aspects of this learning theory as they pertain to the "ideal" MELL design are recapitulated below.

"Ecological Constructivism provides a lens through which to view holistically the systems of language (Halliday, 1993; Wells, 1994), the processes of language learning, the systems of interaction among different participants or interactors, and a research approach to exploring the mutual exchanges within these emergent systems" (Hoven & Palalas, 2011, p. 5). Drawing from Ecological Linguistics and works of, amongst others, Halliday (1993), van Lier (2000, 2004), Lam & Kramsch (2003), and Lafford (2009), language is viewed as a system of relations between thoughts, action, power and situations; language mediates interactions between people and the world and it emerges "as learners use the semiotic systems at their disposition to co-construct meanings with different interlocutors" (Lafford, 2009, p. 675). Challenged by communication requests surfacing in the real-world context, learners would attempt to make meaning and respond verbally or non-verbally through actions, gestures or artefacts. As a result, they produce authentic language, both purposefully and incidentally, drawing from their language repertoire, from their perceptions of the circumstances, from the information the surroundings avail, as well as from interactions with their interlocutors and other elements of the environment. Language is, thus, emergent and dynamic. It is more "biological" than "architectural" to use the terms contrasted by Davis and Sumara (2002; 2003) and

Proulx (2006) in their discussion of the original French verb “construire” being translated as either “to construct” or “to construe”, and explained earlier in the Constructivist Framework section in Chapter 2. Accordingly, knowledge building is more like a “biological” contingent, tacit, unfolding, ever-evolving process of the emergence of a structure or organism. This contextualized process of language learning is contingent on the communicative needs of the individual in a particular speech situation. Motivated by the communication objective, learners engage in negotiation of meaning which promotes “improved comprehensibility of input, enhanced attention, and the need to produce output”; “in negotiation meaning a piece of language that was not comprehensible before, now becomes comprehensible as a result of negotiation work and thus [can] be incorporated into the learner’s target-language repertoire” (van Lier, 2000, p. 247).

In a formal and informal learning event, that interaction can be aided by portable devices leveraging their built-in capabilities of accessing information, capturing audio and images, or on-demand communication; thus, the learner’s attempts at meaning-making and communication can be guided, coordinated and scaffolded with the help of their mobile devices. These tools can also facilitate provision of feedback, which, coupled with the feedback afforded by the environment, further promotes language acquisition. Receiving the evaluation of their linguistic abilities alongside examples of language usage in situ enhances students’ learning outcomes. Offering “contingent, flexible, dynamic, adaptive, localized feedback to learners are hallmarks of an ecological approach to language learning” (Lafford, 2009, p. 685). Peers are another invaluable source of feedback, be it in the form of teaching or social presence, whether in person or virtually over the network.

Learning integrates the individual cognitive processes with social processes which stimulate, mediate and situate the individual efforts in a broader web of language learning. According to van Lier, (2000), individual learning and cognition derives from "the perceptual and social activity of the learner, and particularly the verbal and nonverbal interaction in which the learner engages" (p. 246). Learning and language are both "representational (schematic, historical, cultural, and so on) and ecological (perceptual, emergent, action-based)" in nature; they are also "inherently dialogical" (van Lier, 2000, p. 247). Language learning emerges out of linguistic and semiotic activity resulting from interaction and communication with others. This organic interdependence is essential for the evolving process of MELL. It allows for "individuals [to come] to new understandings both through their own perceptions and purposeful actions as well as in collaborative co-creation with others" (Hoven & Palalas, 2011, p. 14), and with the use of mobile technologies to facilitate that dynamic connection. The "co-construing" of knowledge occurs when learners share reciprocally with other individuals, groups and networks (whether purposefully or incidentally), thereby contributing to the common repository of knowledge. Hence, the ecological perspective adds a new dimension to the SCT emphasis on the interaction and co-creation of knowledge amongst groups and networks of human learners: the significance of the dynamic real-life context offering potential supports and affordances.

It is this dynamic interconnectedness between (1) processes internal to individuals, (2) the dealings and supports from other human beings, (3) the tools used to mediate the relationships, and (4) the environment in which the parts of this system interact, that forms one of the principles of Ecological Constructivism. This systemic perspective supports *contextual* thinking, where context means *the conditions and circumstances that are relevant to an event, a setting in which the event occurs* and *interweaving* or *joining together* (The American Heritage Dictionary, 2000; Collins English Dictionary, 2003)[23]. Thinking in terms of connectedness, relationships, processes and context encapsulates the notion of whole language learning, namely, practicing it as a whole system (as opposed to studying the parts of speech or only one language skill in isolation), learning it in a whole context of students' life, as part of the whole learning community, and in the whole environment of the particular language situation students encounter. The role of the context, in this case the English speaking real-world setting, and its affordances is the central characteristic of the ecological metaphor resulting from the Phase 1 findings.

Affordances.

Language learners realize meaning-making through "kinesic, prosodic, and other visual and auditory sources of meaning" (van Lier, 2000, p. 258) as well as other verbal and non-verbal information available in the context. All these elements form a fluid system of relationships which may be mediated by other

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[23] [From Latin *contextus* a putting together, from *contexere* to interweave, from *com-* together + *texere* to weave, braid]; [, from Latin *contextus*, from past participle of *contexere, to join together* : *com-, com-* + *texere, to weave*];

learners, more proficient users of the language, signs and nuances in the environment, technology-based resources and the technological tools themselves. These relationships between the active learner and the elements of the environment that are potentially useful to the learner's cognition are defined as affordances.

The notion of an affordance, as it relates to the use of technology in education, has been used to denote different meanings (Bower, 2008; Hartson, 2003). The term was first coined by Gibson (1977, 1979) to refer to the opportunities for action offered by environment:

The *affordances* of the environment are what it *offers* the animal, what it *provides* or *furnishes*, either for good or ill. The verb *to afford* is found in the dictionary, but the noun *affordance* is not. I have made it up. I mean by it something that refers to both the environment and the animal in a way that no existing term does. It implies the complementarity of the animal and the environment. (p. 127, italics in original)

Gibson's ecological approach to affordances *latent* in the environment is highly pertinent to MELL practice situated in the real-world context. According to Gibson, affordances are present in the environment notwithstanding the individual's ability to recognize them but dependent on his/her capabilities to utilize them, for example a written definition under an object would not afford meaning-making to an individual who doesn't know the Latin alphabet. This perspective on affordances was further interpreted by Norman (1988) who proposed a more relational definition of affordances - action possibilities readily *perceivable* by an individual. Norman also posits that affordances “are properties of the world” and that they “reflect the possible relationships among actors and objects” (p. 10). While several other definitions and classifications of affordances have been proposed (Bower, 2008; Hartson, 2003; Kirschner, Strijbos, Kreijns, & Beers, 2004; Scarantino, 2003), the use of the concept of affordances has been also criticized (Ling, 2004; Wright and Parchoma, 2011), for instance for being essentially circular and tautological where “the functions are defined in terms of their functions” (Ling, 2004, p. 26). Nevertheless, the feedback gathered during the DBR study points to the usefulness of the notion of affordances in describing the process of learning encompassing the interactivity of learners with the environment, mobile tools, resources, objects and others.

For the purpose of this study van Lier’s definition of affordances was thus used to summarize the aspects of the affordance germane to the MELL context. Van Lier (2000) defines an affordance as “a particular property of the environment that is relevant—for good or for ill—to an active, perceiving organism in that environment” (p. 252). Moreover, Shotter and Newson (1982) further postulate what constitutes such affordances: "demands and requirements, opportunities and limitations, rejections and invitations, enablements and constraints” (p. 34). Accordingly, a picture, a gesture, an action, a sound or a building can become an affordance. Likewise, a mobile device can serve as an affordance, as can the resources available through the device such as web-based dictionaries, a language app or a voice recorder. Van Lier (2000) observes that affordances are contingent on learners’ activity, goals and needs and that for learners to utilize the affordances necessitates perception and action: "if the learner is active and engaged, she will perceive linguistic affordances and use them for linguistic action" (p. 252). However, not all learning opportunities can be planned; some learning emerges and evolves as students discover various resources and affordances on their own. The learner, thus, ought to interact actively with and within the environment to progressively decode the meaning it offers. The language learning environment is a complex adaptive system characterized by constant change and fluctuation. Therefore, some degree of expert scaffolding and mediation should be integrated into the learning process to enable provide novice language speakers benefit of contextual affordances. In the case of the MELL solution, potential affordances of the real-world environment can become learning opportunities when:

1. affordances are actually present in the environment: the location, time and organization of the learning activity are rich enough in affordances available to be picked up and acted upon;

2. affordances are required to complete a purposeful task: the learner actively seeks linguistic material to attain a relevant communicative goal through an activity involving locating and utilizing those affordances;

3. affordances are perceived as salient: the usefulness of an affordance is acknowledged by an individual learner or as a result of collaboration with others;

4. affordances offer added value: they enhance the learning process in an explicit way; they noticeably facilitate communicative tasks , preferably followed by a feedback highlighting their contribution;

5. affordances are noticed: appropriate scaffolding is provided pointing to potential affordances and guiding learners in discovering and picking them up (either by an expert, peer, strangers, or technology);

6. affordances are understood: learners' language proficiency and socio-cultural competency are sufficient to benefit from the information, signs, gestures, actions, and other affordances, or appropriate scaffolding is offered with help of others or mobile-enabled language resources to aid comprehension;

7. affordances "(e.g., visuals to support audio discourse) [are] linguistically rich enough for selection by diverse learners" (Hoven & Palalas, 2011, p. 16);

8. affordances are shared over the learning network: affordances or examples of such are perceived differently by different learners; therefore they are shared fluidly between the individuals to optimize their impact and to guide others to the affordances; new affordances derived from the process of collaboration are introduced into the system, enabling "individuals to perceive novel affordances that could not be perceived by an individual learning in isolation" (Hoven & Palalas, 2011, p. 15).

The notion of language affordances adds a heuristic dimension to the current research framework. The Ecological Constructivist paradigm integrates: the SCT elements of socially and culturally mediated knowledge co-creation, the relation between individual cognition and collaborative learning, active learning promoted by real-life goal-oriented tasks, tools enabling mediation, ZPD and scaffolding with the ecological focus on the dynamic context and its affordances, the active process of knowledge emergence, and the wholeness of the system and the interplay of all its elements.

Preliminary guidelines.

These theoretical constructs, interwoven with the characteristics deemed essential for the "ideal" MELL system design, provided a foundation for the redesign of the original m-learning solution. The resulting preliminary design principles guided the subsequent iterations of the DBR study and the modification of the intervention. The design guidelines were derived from the participant feedback distilled into thematic codes illustrated in Table 10, coupled with the findings of the Mobile Device Usage survey, and guided by the Ecological Constructivist framework. They were further refined in the Enactment and Evaluation phases to include both substantive and procedural design principles. This refinement of MELL design principles will be revisited in more detail in Chapters 5-8 when the results and discussion of these phases are presented. The following guidelines represent the essential features and interdependencies for an effective MELL solution supporting the acquisition of aural skills while expanding learning outside the classroom. Guidelines 1–9 relate to characteristics of learners, guidelines 10–22 relate to learning activities, and guidelines 12–26 relate to mobile technologies.

1. Learners are active and engaged in the English language speaking environment.

2. Learners actively attempt communication through interaction and discourse with interlocutors.

3. Learners became more autonomous and, at the same time, more contributive in the process of learning including both formally organized linguistic events and the informal learning experience context.

4. Learners participate in the negotiation of meaning—they make meaning and share meaning with others who may be more, equally, or less competent.

5. Learners together perform language activities drawing on the affordances of the context.

6. Learners experience a blend of social, cognitive, and teaching presence (Anderson, Rourke, Garrison, & Archer, 2001) distributed face-to-face or through digital channels.

7. Learners apply creative effort to a communication situation (for instance, create learning materials or other artefacts).

8. Learners actively interact with others, content, technology, environment and the affordances of the context.

9. Learners contribute to their own learning and that of others as they co-construe meaning for themselves and others through both individual and collaborative practice.

10. Learning activities promote practice of the whole language: all four skills of listening, speaking, reading and writing should be integrated (with

focus on listening following the desired learning outcome), rehearsed and ad-hoc communication, as well as socio-cultural skills which are an integral part of the language context.

11. Learning activities are situated in the dynamic and fluid real-life environment which challenges them linguistically yet provides affordances.

12. Learning activities reflect or include real-world tasks that learners will encounter outside the classroom.

13. Learning activities integrate both individual and collaborative efforts and promote communication between the learning community members in-person and through technological channels.

14. Learning activities incorporate scaffolding and guidance to point to affordances.

15. Learning activities include either immediate or delayed feedback from the context, others, content, or experts either directly or using mobile tools.

16. Learning activities empower and motivate resulting in individual or group agency and authorship.

17. Learning activities showcase learners' linguistic skills (such as text-, audio-, graphic-, and video-based artefacts) and demonstrate their ability to carry out linguistic functions in real-life situations (authentic assessment).

18. Learning activities incorporate authentic speech samples and practice including pronunciation materials.

19. Learning activities are organized around meaningful communicative goals.
20. Learning activities are relevant to students' whole life context, including their personal, educational, or professional interests.
21. Learning activities accommodate students' life schedules and preferences by being accessible outside of time and place barriers.
22. Learning activities are interrelated and form a complete learning system with its parts feeding into each other; a system that offers continuity of learning and flexibility derived from choice of timing and sequence.
23. Mobile technologies enable access to multimedia linguistic resources, learning tasks instructions and materials, dictionaries and other information on the device or on the web (mainly audio with some text support).
24. Mobile technologies support interaction and communication with others.
25. Mobile technologies offer tools to capture affordances present in the environment (for instance, students take pictures using their cell phone camera or record audio with the voice memos app in order to illustrate a meaning of a phrase).
26. Mobile technologies assist with the perception of, and interaction with, the affordances (for example, audio directions instruct students to collect evidence of various features of a Victorian style home).

Based on the findings of the Informed Exploration phase that are embedded within the Ecological Constructivist paradigm as discussed, a more systemic perspective on the educational solution under investigation evolved. As the focus of the investigation shifted to a complete MELL system rather than characteristics of any individual component of such a system, a renaming of the system seemed necessary. Therefore, the term Mobile-Enabled Language Learning Eco-System (MELLES) will be used henceforth in this work to refer to the intervention under study. This perspective better encapsulates the ecosystem element that enables the integration of the 26 guidelines listed above as contributed by GBC students and practitioners in the Phase 1 data.

Consistent, therefore, with the evolving character of DBR, it became necessary to reformulate the overarching research question replacing the learning object construct with the notion of MELLES. The principle research question was then rephrased as:

What are the characteristics of an effective, pedagogically-sound Mobile-Enabled Language Learning Eco-System (MELLES) for students' mobile devices, through which adult ESP students in a community college enhance their listening skills, while expanding their learning outside of the classroom?

Guided by this principal question, the DBR inquiry continued to explore the critical elements of MELLES through the design, development and testing of prototype m-learning solutions in Phase 2 and Phase 3 (discussed in Chapters 5-7). The preliminary design guidelines served as a backbone for the model and its successive versions generated from the data iteratively fed back into the DBR process loop. The pilots of the prototype facilitated reformulating and refining of the design parameters and design principles on the basis of the feedback collected from students, practitioners and the MELLES solution itself. In addition, it was possible to tackle some auxiliary research questions which emerged during Informed Exploration. Firstly, these questions aimed to verify the general approach taken by MELLES and its effectiveness as a complete educational solution. Secondly, the various constituent parts of the system were examined for their essential characteristics and their relationships. The supporting questions were refined and reformulated at various stages to accommodate the focus of each particular research event, the updated understanding of the target solution, and the language proficiency of the participants. These questions concentrated around the key themes of the feedback, which were later mapped out and classified into the two main super categories of Pedagogy and Technology. The following thematic subcategories of inquiry thus emerged: Pedagogic Procedure, Content, and Context as well as Technological Functionality, Solution and Context. These are further examined in the Enactment and Evaluation phases presented in detail in the next three chapters.

Chapter 4 Summary

In this chapter the key findings of the Informed Exploration phase were reviewed and discussed, including the overview of student and practitioner qualitative feedback resulting in a compilation of the major themes. Participant feedback from the Mobile Device Usage Survey was presented to demonstrate how the design of the MELL intervention was formulated on the basis of students' mobile habits and preferences. Learner preparedness for MELL was then examined together with the refined theoretical framework and a shift to an ecological perspective on the design of the MELL intervention - a discourse that emphasized the wholeness of the evolving system, the network of relationships formed from its integral parts, and the dynamic and contextual character of the system. The notion of contextual affordances was also introduced as it evolved from the discussion of the re-conceptualized theoretical framework. The preliminary MELL design guidelines were then listed. These guidelines encapsulate the main findings of Phase 1 and address the essential features and interdependencies of a MELL intervention supporting the acquisition of aural skills while expanding learning outside the classroom. The chapter concluded with a reformulation of the key research question in keeping with DBR principles. The following chapter presents the new findings of Phase 2: Enactment and discusses the practice and theory of the MELL design refinement emerging from these findings.

Chapter 5. Enactment (Phase 2): Findings, Discussion and Refinement

This chapter is divided into four sections which illustrate the progression of the MELL conceptual framework development. Firstly, the conceptual models leading to the creation of the “ideal” prototype, namely the mobi-english.mobi website, are introduced. Secondly, the qualitative findings distilled from the design and development work are shared. Thirdly, details on the theory behind the MELL practical solution are provided. Lastly, this theory is recapped in the form of design guidelines recommended in the Guidelines Refinement portion of the chapter.

Prototype MELL System

Sixteen students and six practitioners were involved to various degrees in the design, development and testing of the prototype MELL system solution. Over a period of seven months, their qualitative feedback was collected systematically and the essence of their observations is presented in this section.

The final product of Phase 2 (Enactment), namely the mobi-english.mobi website, resulted from multiple attempts to design stand-alone mobile learning objects which were to be ultimately integrated into one larger system. The search for a common platform and universal conceptual framework for these constituent learning objects led to the adoption of the WordPress Mobile Pack solution. All the final design and development decisions drew from the design principles and the theoretical model generated in Phase 1 (Informed Exploration). The final design guidelines were derived from refinements based on the Phase 2 (Enactment) findings.

Throughout the multiple cycles of the Enactment phase, the overarching question posed to the research participants was:

What are the characteristics of an effective, pedagogically-sound MELLES for students' mobile devices, through which adult ESP students in a community college enhance listening skills, while expanding their learning outside of the classroom?

This key research question aimed to elicit feedback principally in terms of the pedagogical dimensions of the solution. However, owing to the participants' expertise in mobile technologies, the investigation could also delve into some technical aspects of the MELL system. Several functionality issues were examined as they were directly related to the successful delivery of instructional content. In addition, respondents commented on various tools and system constituents required for the technology to work as an effective educational intervention. Feedback concerning the limitations of the physical environment in which the learning took place was also invited.

As mentioned in the Methodology chapter, data was obtained from students who designed prototypes of what they deemed effective ESP mobile solutions. In addition to an ongoing dialogue, student feedback was expressed through class assignments as well as design and development documentation, for instance, design presentations (see Figure 23 for an example), diagrams of their solutions (Figures 24-26), use cases (Figure 27), or system requirements charts (Figure 28).

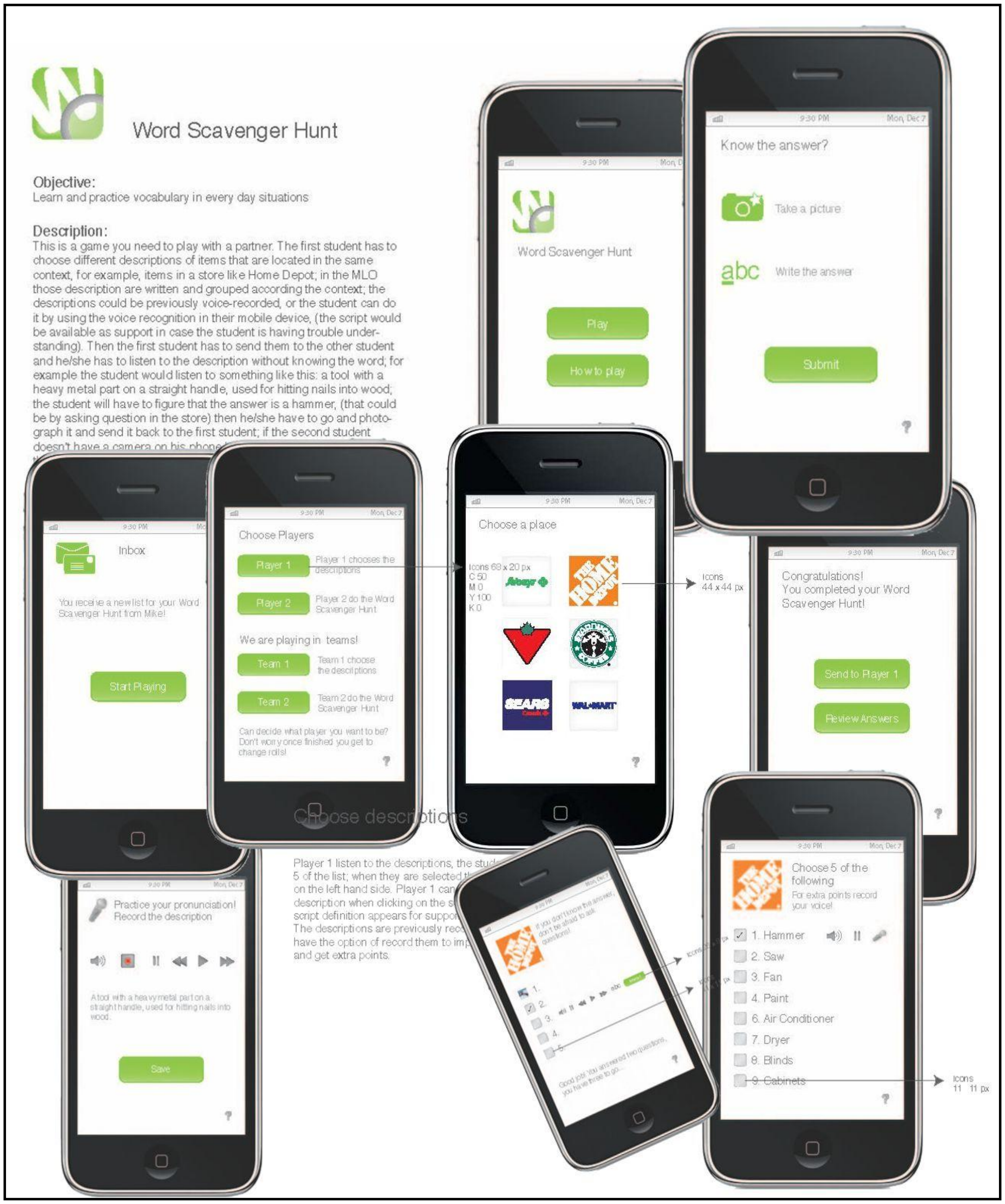

Figure 23. Prototype design presentation (example contributed by students)

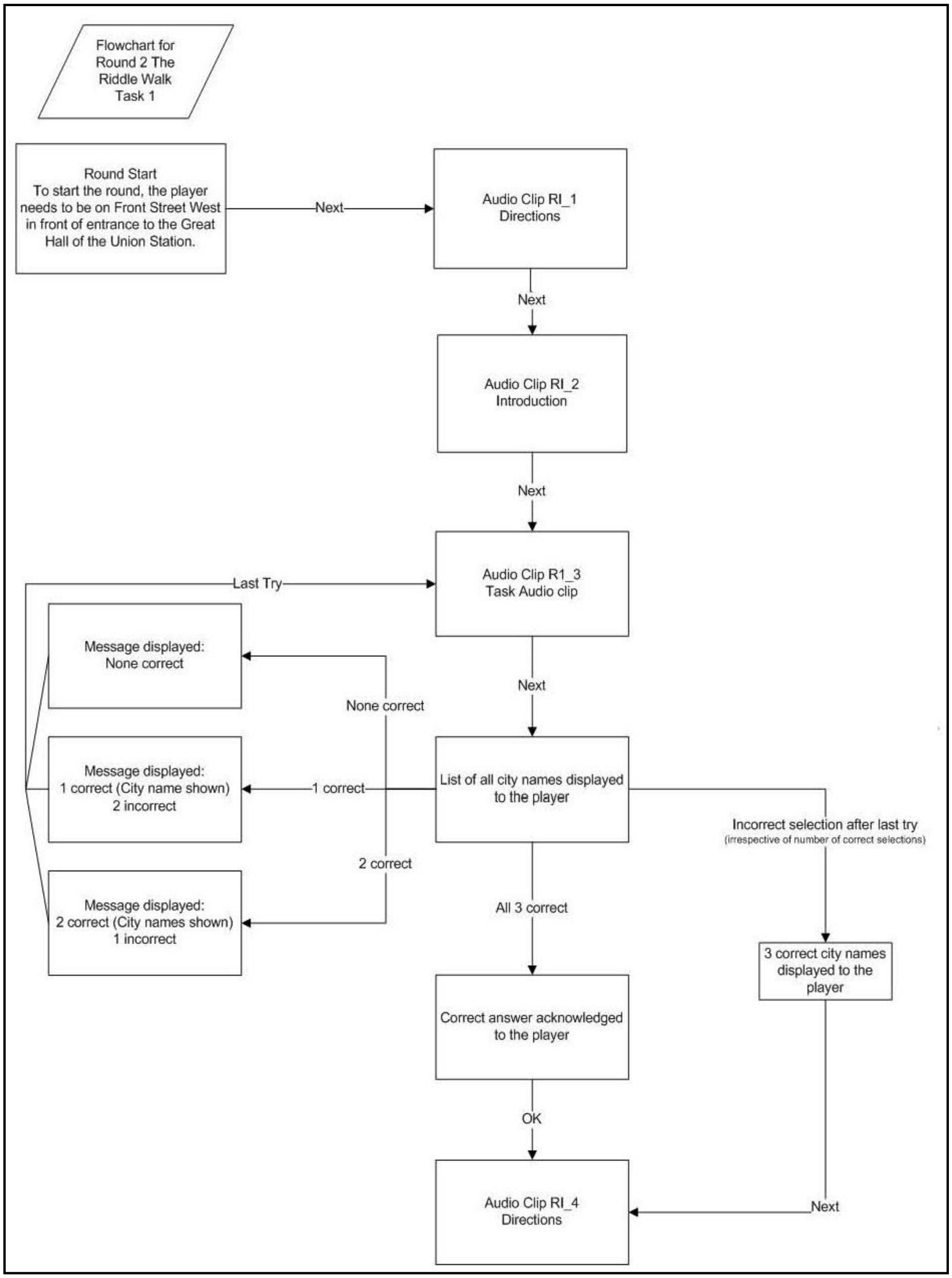

Figure 24. Scavenger hunt prototype diagram (example 1 contributed by students)

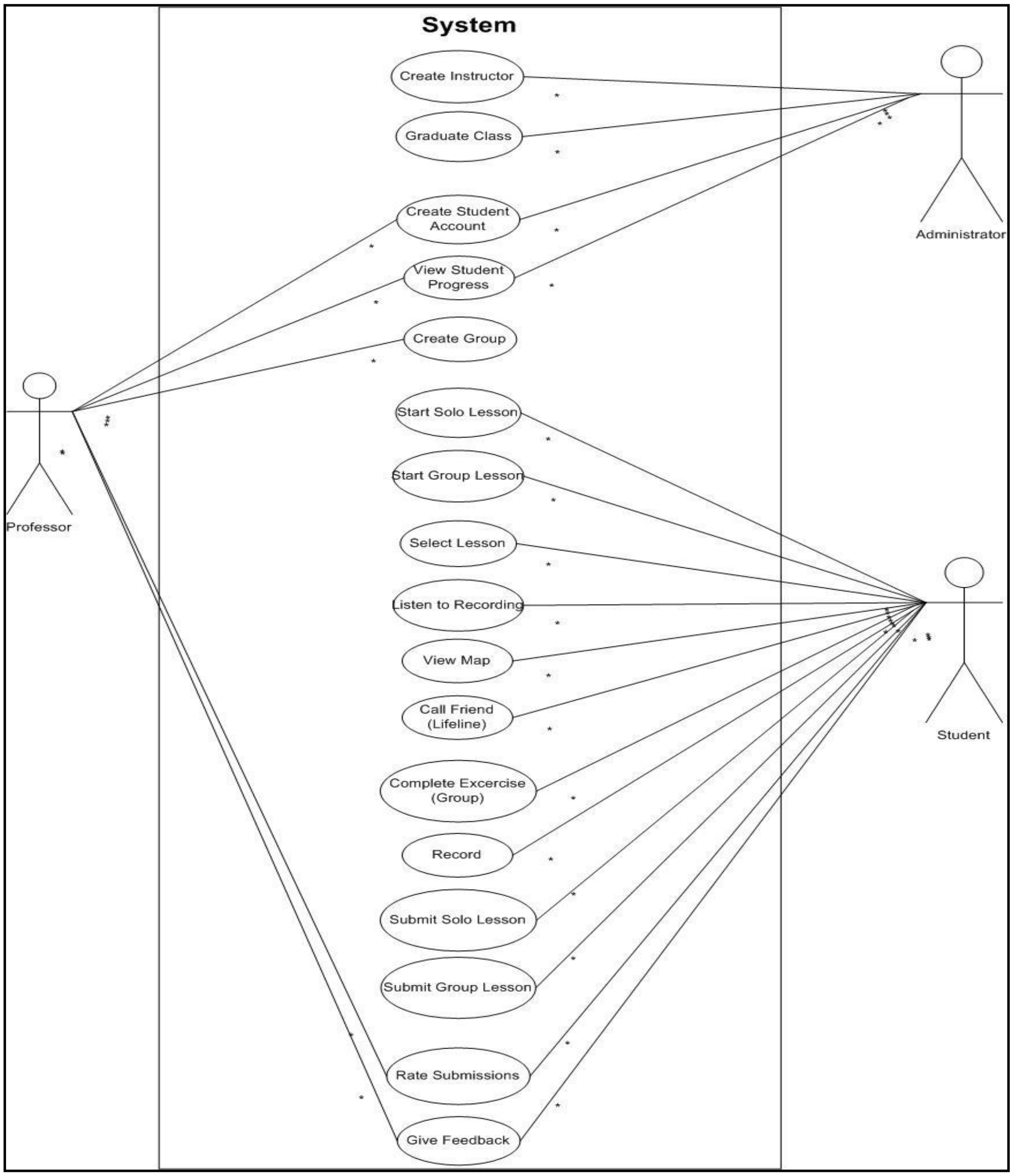

Figure 25. Scavenger hunt prototype diagram (example 2 contributed by students)

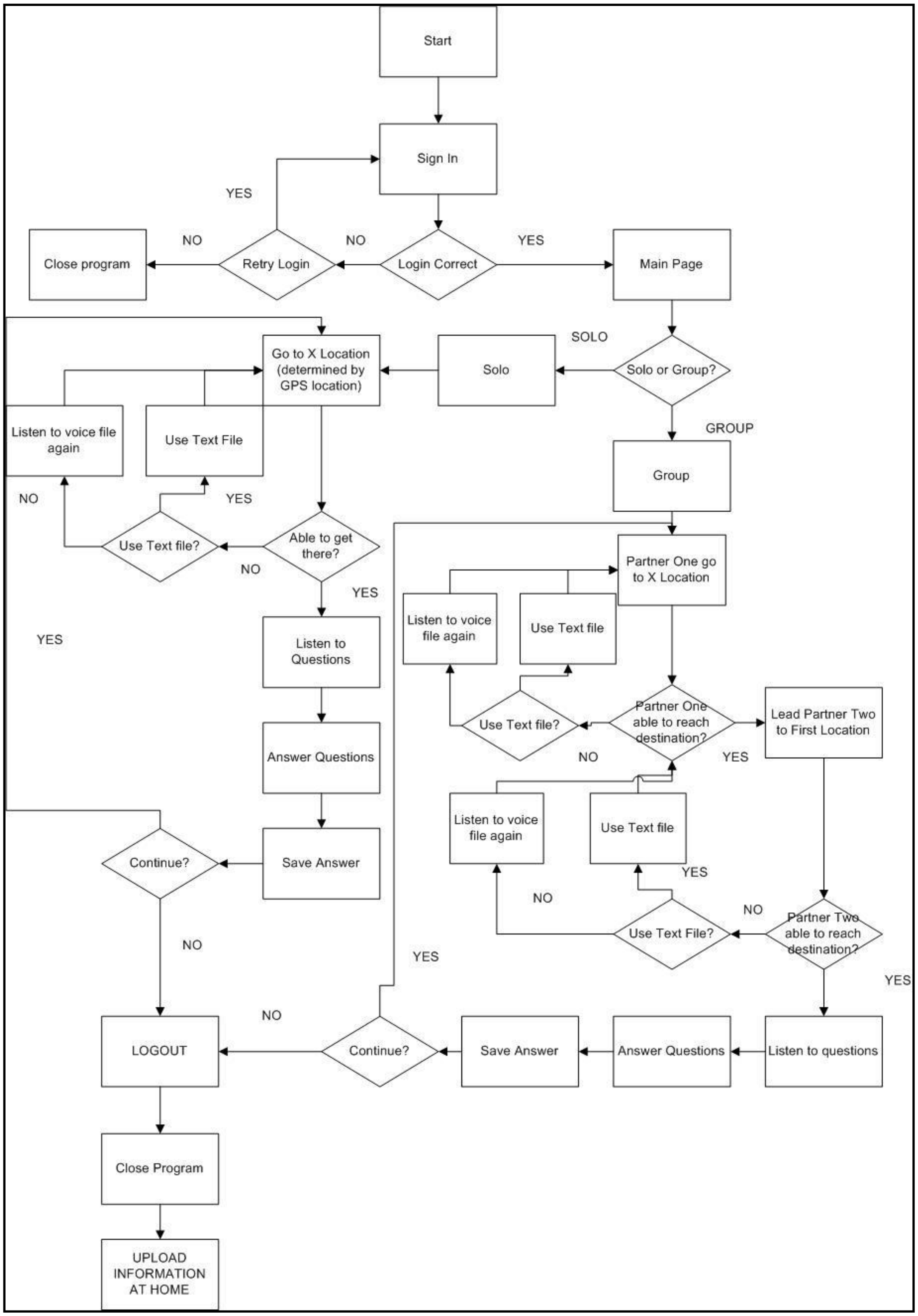

Figure 26. Scavenger hunt prototype diagram (example 3 contributed by a student)

USE CASE
TASK: Collaborative Interactive Map of Toronto L

Each student/pair of students is responsible for one landm photos/video, answer questions and based on these ansv the landmark. These digital resources form the base for t The map becomes both the interface of the activity and i placeholders for the landmark photos and recording. The generated content.

How to play:
On their own time, students are directed by audio instr them. Once they arrive at the landmark, mini-podcasts followed audio questions about the landmark are sent these questions orally (recording) based on the inforn (they can even record their answers) and on their ow digital artefacts which can be contributed to the colla

UC_Map_1_AudioRanking
Use case 1: The peer audio recording reviewing process Landmarks.

Primary Actor

- Reviewer (each student has to review three re provides feedback for the author).

Preconditions

- Reviewer has a valid username and passwo
- *Audio recording files* have been received by reviewers.

Postconditions

- The recordings are assigned points (from receive 6 or more points and ready to be landmarks of Toronto will display links to "approved" folder. Those recordings whi rerecording" folder along with feedback have to be rerecorded and resubmitted.

Basic Flow

1. Reviewer visits the Toronto Landmarks Audio Map web application using their browse..
2. System displays the welcome page.
3. Reviewer clicks on the "Student" link.
4. System goes to the login screen.
5. Reviewer enters their username and password.
6. System authenticates the user.

Reviewing:

(working with three folders: approved, needs rerecording, unapproved=those submitted or resubmitted recordings that haven't been reviewed)

7. System displays a list of recordings (by landmark name) which need to be reviewed.
8. Reviewer selects a recording.
9. System displays a preview of the feedback form and reminder that the recording will have to be peer-evaluated using the form.
10. Reviewer agrees to review.
11. System displays a link to the selected recording.
12. Reviewer listens to the recording.
13. Reviewer completes the feedback form by selecting a number of points for each evaluation category.
14. Reviewer clicks on "send".
15. System calculated the points and moves the recording along with the evaluation form to either "approved" or "needs rerecording" folder.
16. System displays the next unapproved recording.
17. Reviewer repeats steps 12-16 until no more new recordings are available.
18. System reports that there are no new recordings left in the unapproved category.

Alternate Flows

- 6a. System fails to authenticate the user.
  1. The system redirects the browser back to the login page.
- 7a. There are no unapproved recordings.
  1. The system reports that there are no unapproved recordings, to come back later.
- 10a. The reviewer selects deny.
  1. The system removes the recording from the temporary list of unapproved pictures.
  2. The system displays the next unapproved recordings.

Special Requirements

- ???

Frequency of Occurrence

- Very often.

Open Issues

- ???

Figure 27. Interactive map of Toronto—Use Case (example - collaboration of practitioners and students)

WORD SCAVENGER HUNT

DESCRIPTION	RATIONALE	TYPE	PRIORITY	CONTENT	FUNCTION
Explain the nature of the requirement	Why is this requirement needed and how it relates to research findings?	Data, user, environmental or usability	Rate according to MoSCoW rules	What content will be needed in the system to address this requirement?	Describe a mechanism or feature needed to meet this requirement
Database with text and audio descriptions grouped according to the context	The student need to choose a list from the descriptions and then send it to the other student	Data, User	Must	The mobile device must have access to a database containing the information in text and audio form	The mobile device should have connectivity to the data base. The student should have the option of play, slow, pause, fast forward, go back and stop.
User Profiles	System should have user profiles to save the progress	System	Should	User should be able to continue where they left off	Programming aid should keep track of the progress
The mobile device must have enough memory	The student needs to be able to save photos, and have enough space to have all the data required in the MLO activity	Data, System	Must	To build up content in order to be shared	Student needs to have a phone with enough internal memory or expand it purchasing an external memory for the mobile device
Camera: Student need to be able to take pictures	A visual reference would help them remember and improve their vocabulary	Usability	Should	Device must have an application that allow the students to access their pictures	Mobile should have a camera feature
Voice recorder: Students are encouraged to save the descriptions of the activity using their own voice	Students need to practice their listening and pronunciation skills	User, Data	Should	The phone should have and application that allow the students to voice record the activity or listen to it.	Voice recorder allow the student to read the information in the screen and recording it at the same time
Voice recognition option	To translate what the students say into words	System	Would	The phone is helping building the data base	The program would listen to the audio and turn in into words
Data Plan: The students need to be able to send and receive mail with attachments included	The activity needs to be play with two students and they need to be able to interact with each other using their mobile devices	Data, User,Usability	Must	The phone needs to have a mail or similar application	The system need to take advantage of the data plan
Screen: The screen need to have enough space	The students need to improve their vocabulary by reading the activity and looking at the pictures. A small screen would be hard for the student to read a large amount of text	Usability	Should		The mobile needs a bigger screen
Keyboard: students need to be able to write their answers in case they are not taking pictures	Students could practice their writing skills	Data, User,Usability	Should	Words	All mobile devices have a keyboard included, an extra feature could be an spelling assistant.
Speaker phone or hands free: Student can listen the description while reading the text	Students need to practice their listening skills but if they are having trouble they could read the text for support	Data, User,Usability	Must	The mobile device needs to be able to access to the audio and text at the same time	Most of the cell phones have an speaker feature but the student could buy a hands free device so they can use it in the streets without anyone listening.
Student need to navigate through different activities	Students need to navigate through the description, pictures and audio	Usability	Must	Script, picture, audio	Touch screen, scroll ball, key board
Rewards/ Points	When the students get the right answers they get points and that encourage them to keep playing and have fun	System	Should		MLO should be able to keep track of their progress
Instructions	Student need instructions of how to play the game	Data, Usability	Must	Instructions in text or audio form	The mobile device should have connectivity to the data base. The student should have the option of play, slow, pause, fast forward, go back and stop.

Figure 28. System requirements chart (example contributed by a student)

Enactment Qualitative Findings

Student ideas captured in design proposals and final prototype submissions (Figures 23–28) were combined with feedback from two focus groups, face-to-face project meetings and email correspondence. They were then complemented by the practitioners' feedback and analyzed with the help of NVivo. Respondents shared a wealth of ideas, however only the comments addressing the research question were included in the final analysis. These are summarized in a table of the most frequently repeated themes (Table 13). As the data were analyzed, a number of thematic categories and subcategories emerged (subcode Level 1: grouping, Level 2: group work, Level 3: collaboration and peer support), on the basis of recurring frequency. Both pedagogy- and technology- related requirements were identified as vital for an effective MELL solution and consequently were organized into two super categories: Pedagogy and Technology. To estimate the relative importance of the themes, the number of individual respondents who referred to a particular theme was calculated. Although these counts provided a rather rough estimate of relative importance, they helped reveal general patterns in the data (Taylor-Powell & Renner, 2003). With 22 participants involved in the Enactment phase, only the themes which appeared in responses of five (20%) or more respondents were included in the analysis. The higher level of granularity than in the previous phase aimed to investigate the data in more depth. Adopting Saldaña's (2009) suggestion to determine frequencies based on the number of participants who mention a particular theme, not the total number of occurrences of the code, repetitive instances of the same theme for an individual respondent were treated as one reference.

A number of themes identified through analysis of Enactment phase data overlapped with those from the Informed Exploration coding. These recurring ideas are indicated in both findings tables (Tables 10 and 13) using the same NVivo nodes. Some categories partially overlapped, for instance, the Phase 1 node "Rehearsed utterances practice" was fused into the Phase 2 "Recording own voice" node. When juxtaposed with both Phase 1 and Phase 3 codes, several Phase 2 themes seem to be specific to the Enactment phase only (these are highlighted in yellow in Table 13 below). In fact, a strong focus on technical concepts is manifested through a higher number of Technology nodes. This amplified attention to the technology aspects of the MELL design was most probably brought about by two factors: (1) the target of the phase being the production of a workable m-learning system including practical software and hardware solutions, and (2) the majority of respondents involved in this phase having a background in mobile design and development.

The various qualitative categories, their interconnections and relationships were mapped and captured in the design principles. These, along with a more in-depth treatment of the evolution of themes which emerged from the feedback collected across all three phases of the DBR study is provided in Chapters 6-8. The findings specific to Phase 2 (Enactment) are presented in Table 13 below.

Table 13.

Enactment Qualitative Findings – Main Themes

Codes (NVivo Nodes)	References/ Frequency	Relative Freq (n =16 S+ 6 P)
PEDAGOGY	**199**	
PEDAGOGIC PROCEDURE - How	**111**	
Motivation (*Ph1*)	**46**	**41.8%**
engagement	12	54.5%
rewards (ranking, point system)	11	50.0%
fun-enjoyment	9	40.9%
educational game	8	36.4%
showcase success	6	27.3%
Grouping (*Ph1*)	**30**	**34.1%**
group work **(*Ph1*)**	14	**31.8%**
collaboration and peer support **(*Ph1*)**	*8*	*36.4%*
share learner-generated artefacts	*6*	*27.3%*
individual practice **(*Ph1*)**	11	50.0%
pair work	5	22.7%
Feedback	**12**	**27.3%**
teacher feedback	7	31.8%
classmate feedback	5	22.7%
Scaffolding - help from teacher (*Ph1*)	**11**	50.0%
Recording own voice	**7**	31.8%
Integrated skills	**5**	22.7%
CONTENT - What	**74**	
Directions & explanations	**15**	68.2%
Vocabulary	**12**	54.5%
Listening skills/comprehension (*Ph1*)	**11**	50.0%
Socio-cultural knowledge (*Ph1*)	**9**	40.9%
Support materials & resource (*Ph1*)	**8**	36.4%
Communication skills	**8**	36.4%
Variety of topics	**6**	27.3%
Pronunciation (*Ph1*)	**5**	22.7%
CONTEXT - When and Where	**14**	
Real-life practice (*Ph1*)	**9**	40.9%
Context affordances	**5**	22.7%
TECHNOLOGY	**163**	
FUNCTIONALITY - How	**95**	
Visual support	**20**	90.9%

Audio player/recorder functionality	**14**	63.6%
Text support	**13**	59.1%
Upload and publish students' artefacts	**8**	36.4%
User-friendly (*Ph1*)	**7**	31.8%
Audio files quality	**6**	27.3%
Modify or update content on-the-go (facilitator)	**6**	27.3%
Device memory management	**6**	27.3%
Search function	**5**	22.7%
View other students' artefacts	**5**	22.7%
Mobile and computer (web-based) access (*Ph1*)	**5**	22.7%
TECH SOLUTION - What	**46**	
Audio podcasts	**12**	54.5%
Instructions how to use system	**9**	40.9%
User profile and progress report	**7**	31.8%
Tools for creation of multi-media artefacts	**7**	31.8%
Communication tools	**6**	27.3%
User evaluation of the system	**5**	22.7%
TECH CONTEXT - When and Where	**22**	
Cross-platform	**12**	54.5%
Flexible on-the-move access	**10**	45.5%

Note. * Percentages colour-coded blue are the average of their sub-categories.

The various pedagogic themes repeatedly raised by participants were once again classified into three groups (major themes): (1) Pedagogic Procedure (How: strategies and tactics used to optimize learning), (2) Content (What: themes, functions, skills, and resources selected to support learning), and (3) Context (When and Where: time, location and environment which enable an effective learning experience). The concept of motivation attracted more attention of respondents than any other theme. Twelve participants stressed that for students to benefit, the MELL design has to meaningfully engage students in learning activities through interaction with others, worthwhile tasks, and attractive design of the interface. While speaking of cognitive engagement they mentioned the importance of enjoying the activity and being highly motivated by the element of fun (41% of respondents): “The system must be enjoyable and provide positive emotional experience […]”; “The activity has to be engaging enough for students to have fun with it: attractive interface, engaging questions and activities, relevant topics, and some pictures”; “This design must be engaging for the ESL student to use on their own. It needs a fun atmosphere to engage ESL students.” They also suggested incorporating a reward system (such as ranking, peer evaluation, point system) to increase their motivation and thus ensure superior learning outcomes. Students commented: “When the students get the right answers they get points and that encourages them to keep learning and have fun”; “It can show rankings to promote positive competition among students’; “Create a points system: [a]nother feature to motivate users to compete against each other and progress further.” As demonstrated by their comments, respondents viewed competition as a positive extrinsic motivating factor. Accordingly, they believed that integrating elements of educational games would enhance the effectiveness of MELLES (36%), as well as the display of learners’ successful task results or their own creations (27%): “A feature to showcase success [is needed] to encourage people.”

The theme of individual versus team work was raised during many discussions. While eight respondents (36%) commented on the significance of collaboration and pair work (23%), even more (50%) believed that the design must also enable individual practice. “When you learn how to listen, you have to listen to another human being […] you need to learn together with others”. At the same time “[w]hen you travel on the subway, you cannot be with your group; then you need individual practice” and “the logistics of learning in a team limit the flexibility which is inherent in mobile learning". One of the main strengths of group work and collaboration was, according to the respondents, the ability to learn from each other, which is enhanced by sharing documents and student-created artefacts (27%): "You should be able to send sounds and pictures to your classmates" because "[they] can learn from things I create and I can learn from their ideas too" and "students recordings could be combined and showcased on a class website".

Respondents were not able to envisage effective learning without feedback both from peers (23%) and the teacher (32%). A feedback mechanism would have to be incorporated into the MELL design to optimize the learning process: "The student must be able to send the recorded answers to the teacher; the teacher will correct it, and then record her feedback, and send it back to the student. The students will be asked to keep a[n] audio log of their activities so that they can go back to that feedback and learn from it." As demonstrated by the quote, respondents emphasized the importance of feedback being captured in a more permanent fashion for review and reference. In fact, some respondents remarked on the value of such comments being shared with the class so that all participants could benefit from the learning episode. They also stated their belief that that their classmates' critiques of each other's recordings would be helpful and would boost the collaboration between the students.

Likewise, recording language samples, answers to questions, dialogues, descriptions or narratives were identified as useful in learning ESP listening skills (32%). "Students should be encouraged to record their own voice; they could listen to real language spoken on the street and then record what they understood." "When students listen to their classmates recordings they still practice listening […]; it is like on the streets of Toronto, everybody speaks with an accent." One of the themes that emerged from the discussion of practicing listening by recording learner's speech, was the recommendation to integrate all four language skills when learning ESP (23%). Respondents observed that listening is part of communication which inherently encompasses speaking, and often it is supported through reading and writing. Listening cannot be learned in isolation. Therefore, MELL activities must go beyond listening to podcasts or authentic speech. They should provide opportunities to "[p]ractice listening, listening to dialog in context, understand real world conversation, practice speaking, and expand vocabulary."

In terms of Content, the second major Pedagogy theme, the importance of well-designed clear directions and explanations for any learning activities was emphasized by 68 percent of respondents. The following comments provide a good synthesis of respondents' observations: "Students, especially non-native speakers, need clear directions on what to do"; "Give detailed audio instructions", which include "[t]exts and images that help understanding audio instructions ([for instance,] Hint button)" and ensure that "instructions must be extremely easy to understand." Having support materials and resources needed to best facilitate learning was also a frequent theme. Over 38 percent of respondents considered resources such as handouts, dictionaries, glossaries, and other text and multimedia-based materials as essential to effective mobile learning. Some would like to include pronunciation practice (23%) and ensure a variety of topics (27%) in their m-learning experience. In terms of language skills that should be addressed through the effective MELL design, listening and comprehension (50%) as well as general communication skills (36%) were cited along with vocabulary (55%) and socio-cultural competencies (41%). Respondents elaborated on the significance of cultural knowledge: "Content should assist user in everyday situations and social life in Canada". They also highlighted the benefits of experiencing the everyday Canadian language in situ: "When visiting locations in Toronto, you learn the language but also the culture […]" and "the [s]imple day to day slang used frequently in North American culture," which "ESL learners need to understand." This view was further supported by observations about embedding learning in the cultural context of the language studied. In responses coded as "real-life practice", under Context, some commented (41%) that "[t]he system [should] encourage learning by offering content pertinent to the user's day-to-day life in the Canadian culture." Authentic language usage including "real world conversation", "real-life language usage" in "real world locations" was cited as the most favourable usage of the MELL technologies. At the same time, the Toronto streets and sites were deemed a rich source of authentic language as they offer samples of language usage, hints and artefacts to support comprehension, and opportunities to practice communication. These comments were captured under Context affordances (23%) and were best summarized by the following recommendation from a respondent: "Encourage interaction with the surrounding environment."

To enable such interaction with the context, the mobile application necessitates a functional and user-friendly design. Owing to the technological expertise of the Digital Design students and practitioners, many of these requirements surfaced in their comments. These were grouped into three major themes: (1) Functionality (How: device functions, capabilities, and qualities associated with optimized performance, (2) Tech Solution (What: tools, applications, functions, and resources to be included in the system), and (3) Tech Context (When and Where: software platform and performance environment which enable an effective learning experience).

The essence of the Technology feedback is condensed below using one of the tools adopted by the Digital Design students, namely a system requirements chart. Categories (subcodes) unique to this phase are highlighted in yellow.

Table 14.

Enactment Findings—Technology (System Requirements Chart)

DESCRIPTION	RATIONALE	TYPE	PRIORITY	CONTENT	FUNCTION
Explain the nature of the requirement	Why is this requirement needed and how it relates to research findings?	Data, user, environmental or usability	Rate according to MoSCoW[24] rules	What content will be needed in the system to address this requirement?	Describe a mechanism or feature needed to meet this requirement
1. Visual support (90% of respondents)	Provides scaffolding for language learners; visual representation of the audio content offers helpful message	Data/ Usability	Must	Pictures, photos, graphics, diagrams, other images,	Provide the functionality to upload media files to the a storage server and keep

[24] MoSCoW: MoSCoW is a prioritization technique used in business analysis and software development to reach a common understanding with stakeholders on the importance they place on the delivery of each requirement. According to A Guide to the Business Analysis Body of Knowledge, version 2.0, section 6.1.5.2, the MoSCoW categories are as follows:

- **M** - MUST: Describes a requirement that must be satisfied in the final solution for the solution to be considered a success.
- **S** - SHOULD: Represents a high-priority item that should be included in the solution if it is possible. This is often a critical requirement but one which can be satisfied in other ways if strictly necessary.
- **C** - COULD: Describes a requirement which is considered desirable but not necessary. This will be included if time and resources permit.
- **W** - WON'T: Represents a requirement that stakeholders have agreed will not be implemented in a given release, but may be considered for the future. (Wikipedia: http://en.wikipedia.org/wiki/MoSCoW_Method)

	redundancy "*Visual aid should be there to help the student (ex. graphics, images)*."			video	track of the file ownership and access rights for other users
2. Audio player/ recorder functionality: ability to control audio recordings (64%)	Allows learner to review audio at the speed appropriate to their comprehension level Allows to rehearse and record corrected audio clips Provides convenience needed to review and record audio Minimizes affection barriers resulting from lack of control *"Student should have the option of play, slow, pause, fast forward, go back and stop" and "be able to repeat the sound and adjust the audio speed."*	Usability	Should	Audio player/ recorder controls	Build in the following controls for audio retrieval, recording and editing: play, record, adjust audio speed, pause, fast forward, rewind, replay, delete
3. Text support (59%)	Provides scaffolding for language learners; text representation of the audio content provides helpful message redundancy and supports comprehension *"Textual aid should be there to help the user."* *"The system must feature text files to accompany sound files, i.e. subtitles."* *"Text transcripts, so the user can look at the spelling."* *"Students need to be able to write their answers in case they are not taking pictures."*	Data/ Usability	Must	Audio transcripts Summaries of audio lessons Video captions Text representation of new vocabulary Text-based instructions	Must be able to store, text input from students either as typed text or text files. Also the system is supposed to keep track of input ownership and other user's access
4. Tools to upload and publish students' artefacts (36%)	Enables collaborative learning through artefact exchange, affords peer feedback and peer support Encourages higher levels of participation through the opportunity to showcase own creations *"Students have to be able to send their audio and post it on the class mobi-website."*	Usability	Must	Mechanism to exchange audio, images, photos, videos, text	Provide a common interface for managing author's artefacts under certain limitations.
5. User-friendly system and interface (32%)	Clear, coherent, and consistent design of the system allows for learning experience without creating additional barriers to language learning	Usability	Should	User-friendly interface	Should be easy to understand and use; performing any task should be simple and intuitive (without need for elaborate

	"As the user doesn't have a full grasp of English, the system must be very straightforward."				explanation); a context-sensitive help function should be implemented
6. Adequate quality of audio files (27%)	High quality audio not to hinder comprehension or discourage practice *"The system must feature high quality audio as bad sound files are not good for comprehension."*	Data/ Usability	Should		The audio recording and editing tool should produce files which meet certain quality standards and comply with rules
7. Ability to modify or update content on-the-go (facilitator) (27%)	Allows users to modify content on the go thus keeping the system current *"Instructor can add contents whenever necessary."*	Data/ Usability	Could	Authoring interface for facilitators	Incorporate a mobile authoring interface allowing facilitators to create/update learning content on-the-go
8. Device memory management (27%)	Works around device memory limitations to provide uninterrupted performance and hence improved functionality of the system; especially when working with multimedia files *"Some phones might not have enough memory to handle lots of audio and video" thus "rules are needed to limit the size of files."*	Usability	Should	System awareness of device memory; notification options; restrictions on multimedia file size	The system should notify when the minimum requirements are not met and the available memory drops under a certain value; some media files restrictions should be implemented
9. Search function (23%)	Allows to search for items of interest hence optimizing the mobile learning experience *"Search function is important for finding information faster."*	Data/ Usability	Should	Database containing the information	Integrate a full-featured search engine capable of retrieving data from database based on numerous parameters
10. Ability to view other students' artefacts (23%)	As an extension of the content sharing and collaboration feature, learners should be able to view and rate peers` creations *"You have to access pictures and audio of other students too."*	Usability	Should	Display of other user's artefacts based on various levels of access permissions	Each user should have a certain type of access to other user's artefacts under a set of rules dictated by the system general rules or by artefact owner's discretionary decision
11. System access from	Enhances accessibility of the system and flexibility of	Usability	Should	Mobile and desktop	Provide various ways of access

mobile and computer (23%)	learning by providing choice of platform and milieu *"[...] support for different mobile browsers, devices, and desktop computer too."*			platform interface; mobile switcher between the desktop and mobile interface	and usage, include mobile clients for different platforms and a common web interface for higher productivity; build in switcher detecting mobile vs. desktop visitors
12. Audio podcasts (55%)	Audio files are the core element of the system as they support listening practice *"Audio files are the fastest way to communicate." "Teaching listening requires working with audio files."* *"User has to have an option to listen to prerecorded content."*	Data	Must	Audio files (various audio formats converted to one common format – MP3)	Incorporate tools to create, store, exchange, upload, download and listen to audio podcasts
13. Instructions how to use system (41%)	Unfamiliarity with the system/technology generates barriers to learning *"As it is for ESL students instructions how to use the system must be extremely easy to understand."*	Data/ Usability	Must	Audio and text-based instructions	In addition to the traditional text-based help, the system must implement audio help support (context sensitive)
14. User profile and progress report (32%)	Student profile and progress information enables seamless continuity of practice; it also enables feedback exchange and scaffolding; by providing personalized information, it motivates learners to engage *"The system should inform instructor the progress of the student."* *"It should save the profile and progress of the user."*	User/ Data	Must	Database, ability to update profiles either by students themselves or admin	All user related information like profile data, activity and progress must be stored in a centralized database and the system must be able to provide reports; all in compliance with personal information security policies
15. Tools for creation of multimedia artefacts (32%)	As part of the content sharing and collaboration feature, learners should be able to create their multimedia artefacts on-the-go (multimedia files) *"You can use your phone to take pictures or record your voice."*	Usability/ Data	Should	Voice recorder, camera (inherent features of smart phones)	Make use of device built-in camera and voice recorder or construct tools for creation of multimedia artefacts
16. Communication tools	Support collaboration, interactivity and	User/ Environm	Should	Message board system	Incorporate existing or build

(27%)	communication on the move *"We already have dedicated inter-communication tools, real time text chat or Message Board or voice chat."*	ental		with a database of users, topics, discussions Chat/text messaging	dedicated communication/ collaboration channels, integrated with the learning content for fast and accurate reference
17. User evaluation of the system (23%)	User evaluation of all the constituent parts of the system and comments on how the system affects learning, provide feedback for continuous improvements of the solution, and engage the user in its refinement.	User/ Usability	Could	An online evaluation form/ blog/mail-box where users can leave their feedback	A self-improvement mechanism provided -user's evaluation can be incorporated in subsequent corrections and developments
18. Cross-platform design (55%)	For system to be inclusive, it has to be accessible from various mobile platforms owned by learners *"The system must be accessible from [...]" and "compatible with any mobile devices"* *"The system must work on mobile platforms (iPhone, Blackberry) as a stand-alone application" or "support different mobile devices students have."*	Usability/ Environm ental	Must	Separate stand-alone platform-specific applications or various platform-specific clients connecting to the same web-service	Mobile clients must meet specific standards across all different platforms
19. Flexible on-the-move access including offline option (46%)	Users need access from wherever whenever they are to optimize learning on-the-go which includes interacting with the system both online and offline. *"Students have to be able to use their commute and travel time, and also wait time. But that translates into inconsistent connection; one minute they are connected and the next minute, for example, they enter the subway, and they find themselves offline."*	Usability/ Environm ental	Should	Offline and online access to content options; offline storage options; notifications when offline	The system should be aware of the connection availability; notify the user when offline; it should switch to off-line mode when the connection is not available; it should also allow the user to work offline at will

The Enactment findings were derived from the real-life application of the preliminary MELL design guidelines and hands-on tests of conceptual models. The "technological" lens offered by the Schools of Design and Technology students and practitioners further enriched the feedback offering their practical perspective and workable solutions. Thus, the identified essential characteristics of the intervention, as extracted from the prototypes and the process of design and development, formed the base for the substantive knowledge. The ensuing guidelines were then supported by the understanding of how these pedagogical features can be afforded by the tools and mechanisms offered by mobile technology procedural knowledge. The discussion of how these results impacted the development of the MELLES prototype is offered in the next section. This is followed by a summary of the updated design guidelines in the Guidelines Refinement part of this chapter.

Enactment Discussion

Drawing on the findings presented above and on the Ecological Constructivism framework, a MELLES prototype was built. This proof-of-concept solution is presented in the next section followed by a description of its constituent listening tasks.

MELLES prototype and mobi-english.mobi.

A proof-of-concept website was created in order to test the key concepts and further refine the design of the MELL system. Using a reliable cross-platform tool, namely the WordPress Mobile Pack, a mobile website was constructed which aimed to encapsulate the essence of the feedback gathered across the multiple iterations of Phase 1 and 2. The resulting mobi-english.mobi website incorporated most of the design requirements identified thus far, with a few being limited by the capabilities of the mobile devices and the interim character of the proof-of-concept solution. The constraints included the lack of (1) visual support of audio content through video, (2) automated feedback, (3) multimedia artefact upload and (4) artefact rating tools (replaced with email communication and exchange of feedback), (5) audio player/recorder functionality limited to the specific device functionality, and (6) the offline option which had to be addressed by downloading the required podcasts directly onto the devices prior to the task.

Before introducing the proof-of-concept website, the key points of Phase 1 Discussion and the ecological framework should be briefly summarized to provide a backdrop for the next set of findings. As mentioned earlier, one of the main goals of the proposed educational intervention was to contextualize learning in the real-life setting and to provide a complete solution which can evolve with the developments of technology and increased familiarity with the mobile tools. At the same time, it was essential to accommodate the diversity of the college L2 population, their needs, learning preferences and the level of language proficiency. Considering the multiplicity of elements recognized as critical for the effective mobile design, and how these elements interrelate and support each other (Chapters 6-8), the MELL prototype had to provide a learning environment in which the parts of the system could interact in various configurations promoting the flexibility and the evolution of the whole system (Figure 29).

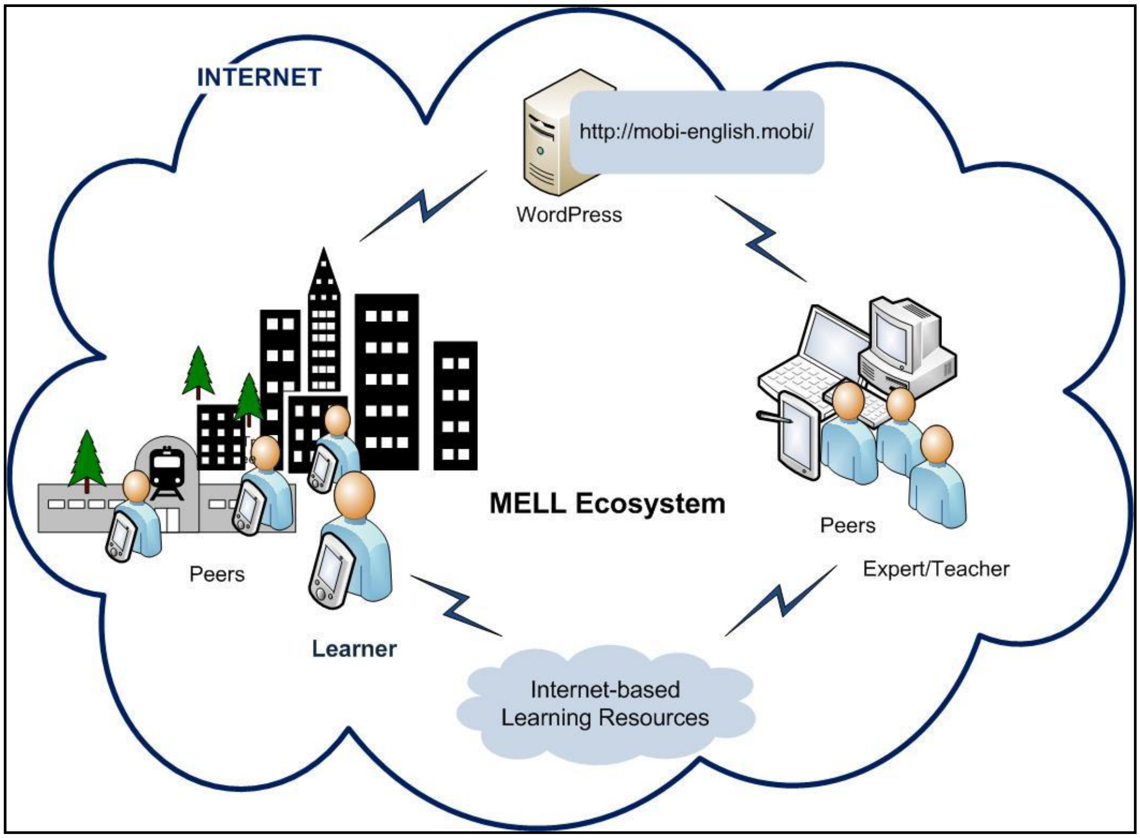

Figure 29. MELLES—Key interacting components of the system

Hence, the prototype website offered a set of eight tasks which did not have to be completed in a linear fashion. Instead any one of them could serve as an entry point into the mobi-english.mobi network. In addition, all tasks were related and fed into each other. Following the key principles of ecological thinking—relationships, connectedness, dynamic process and fluid context in which all elements interact to form a web—the prototype solution was designed to encourage collaboration and interaction, thus interlinking the members of the learning community. Consequently, students were asked to complete some of the tasks in groups or pairs, and they were also encouraged to co-create multimedia artefacts and evaluate each other's work by leaving comments and rating their audio recordings. Communication was enabled through more traditional channels, such as email and telephone, as well as by blogging, phlogging (blogging by phone), and by exchanging audio recordings. To reinforce the spirit of collaboration, some activities required students to visit Toronto landmarks and sites together and support each other in completing real-life communication challenges.

Despite the heavy reliance on peer support, expert facilitators were available whenever needed to ensure constant inflow of information and exchange of ideas. ESP experts moderated the interaction and feedback sharing as well as participated in person in the Scavenger Hunt task (Task 4). They also pointed to appropriate language and technology resources, and facilitated the artefact construction. By directing students to some of the affordances available in the context, ESP professors facilitated affordance noticing and thereby meaning-making. Thus, expert support complemented the MELL tasks instructions aiming at enhancing the perception of, and interaction with, the linguistic affordances availed by the dynamic real-life context. To encourage active engagement in the English language speaking environment, spontaneity of creation and communication had to be supported. Consequently, the learning process had to be flexible and include activities that allowed for individual cognition and collaborative knowledge "co-construing" both group and individual activities, both same-time-same-place and time- and place-independent tasks. Blending learner autonomy with peer and expert support was a significant aspect of how the MELL system functioned. In addition, to provide support in the form of scaffolding, resources and motivation, the system had to be resource-rich and consistently stable. It was the role of the moderators to step in when the instability was apparent. They had to recognize when the time was right for some form of feedback or intervention to be introduced. It was the expert's role, indeed, to support the development of new mobile activities and behaviours if she considered them conducive to learning. Students were also encouraged to contact the expert when they required her linguistic or technological support. By maintaining the steady flow of information and interaction, the facilitator helped glue the learning community together. Connected by the mobile network enabling social, cognitive and teaching presence (Garrison and Anderson, 2003), the students were able to interact with others, technology, content and the real-world context supporting authentic language learning.

However, as respondents repeatedly indicated in their feedback, some structure and clear directions were critical for the learners to benefit from the mobile learning experience. The mobi-english.mobi website itself acted as the scaffolding foundation the learners could always fall back on. It worked as a starting point for each learning episode by providing instructions and directions along with language resources for all tasks. It also served as a repository of students' artefacts and a meeting point for discussions and evaluations. The initial fixed structure of the website was determined by its design and architecture as well as by the fixed roles of stakeholders and rules of activities. Progressively, the website expanded as a result of the user-generated artefacts and information. It evolved as students were adding their own multi-media artefacts stemming from their abstract and creative thinking, which is always coloured by emotions, common sense, and motivation (Capra, 1996).

In terms of motivation, respondents emphasized a strong need for a mobile learning design which engages, rewards, and showcases success. To address those requirements, the prototype solution incorporated game-like language activities, such as Scavenger Hunt or Student Radio. It also promoted peer evaluation and artefact rating resembling the popular social networking rating schemes, such as the *Facebook* Like button. Other forms of immediate or delayed feedback included expert comments either in person or sent digitally, dynamic feedback from a context-embedded discourse, and learner reflection based on the experiential learning. In addition, the motivation theme was addressed through contextualized delivery format, meaningful communicative goals, the appropriate students grouping techniques, and the selection of content relevant to students' needs and interests. The novelty of the mobile technology and the feeling of the ownership of the mobi-english.mobi content proved to be strong motivating factors as well. The choice of tasks which comprised rehearsed and ad-hoc practice of listening and speech (pronunciation) was complemented by the flexibility derived from choice of timing and sequence of task completion. Lastly, the already mentioned presence of a learning community, or more precisely, a learning network, and students' interdependence was supported through the design: no student can learn in isolation and cooperation is needed in the form of exchange of resources, opinions, feedback, support, and energy. The mobile-enabled system supported access to resources both on the device and on the web.

MELLES listening tasks.

The website, thus, introduced language tasks to stimulate the evolving process of co-learning through both collaborative and individual (cognitively focused) activities. The eight interconnected learning tasks guided students through a continuous process of communication and artefact generation, a process of building relationships not only between the learners and experts but also between the constituent tasks. Progressing from one task to the next, students created new content which contributed new information to other tasks in the system and, in turn, could be utilized by any users of the MELL web as a learning resource (for instance, by providing definitions of new terms or illustrating existing content with photos). Using ecological terminology, the content thus was reused and recycled through continuous cycles, namely, feedback loops (Capra, 1994). As the students were gradually developing into more adept users and contributors to the system, they could elect to go on to tasks of higher level of difficulty and complexity in terms of both the linguistic and technological requirements (for example, recording and publishing an audio podcast). By addressing different competencies through different learning strategies, the various tasks progressively contributed to the overall learner progress. Since the relationships between the various tasks, that is, parts of the whole MELL system, are dynamic, they cannot be measured or quantified. Nevertheless, the patterns of interrelations between the various learning tasks are approximated through the task descriptions provided in Table 15.

Table 15.

MELLES Tasks Description

Task Components	Task 1 (Idiom Bank) & Task 2 (Multimedia Dictionary)	Task 3 (Audio Map) & Task 4 (Scavenger Hunt)	Task 5 (Phlogging with iPadio) & Task 8 (Phlogging: Reflections)	Task 6 (Student Radio)	Task 7 (Listen on the Go)
Goal	To contribute to an online repository of idioms/multimedia dictionary by generating audio recordings (definition and illustration) and evaluating peers' recordings	To collaboratively build an online multimedia map of Toronto by recording audio descriptions of Toronto landmarks and posting them to the class website	To exchange your podcasts on topics of interest and share reflections by blogging via phone (phlogging) – exchanging voice recorded speech	To contribute to the student radio by creating an audio interview that provides information pertaining to the topic of interest to the students and peers	To practice listening comprehension skills on-the-go
Input	Audio instructions, written task synopsis, language dictionaries - multimedia, student-generated examples of language usage (audio, visual), examples of audio entries and evaluations, real-life speech and context affordances, Language and techn. knowledge from previously completed tasks Optional: face-to-face instructions and feedback from facilitators	Audio instructions and directions, audio descriptions of landmarks, examples of other students' recordings, written task synopsis, language dictionaries - multimedia, real-life and student-generated examples of language usage (audio, visual), real-life speakers, situations, objects and other context affordances Language and techn. knowledge from previously Optional: face-to-face instructions and feedback from facilitators	Audio instructions, student-generated examples of language usage (audio podcasts on topics of interest), examples of former students' recordings, written task synopsis, language dictionaries - multimedia, students' audio reflections, peer and facilitator audio comments/ responses Language and techn. knowledge from previously Optional: face-to-face instructions and feedback from facilitators	Audio instructions, examples of other students' interview recordings, written task synopsis, language dictionaries - multimedia, real-life and student-generated examples of language usage (audio, visual), real-life speakers, situations, objects and other context affordances Language and techn. knowledge from previously Optional: face-to-face instructions and feedback from facilitators	Audio instructions, written task synopsis, language dictionaries - multimedia, audio and written comprehension questions and language games related to the audio podcast Optional: face-to-face instructions and feedback from facilitators
Output	Rehearsed speech: student-generated audio recordings, peer evaluation Response to audio content: evaluation	Impromptu speech: real-life communication, Rehearsed speech: student-generated audio recordings, peer evaluation Response (written, spoken or visual) to audio content:	Rehearsed speech: student-generated audio recordings, Response to audio content: audio comments, questions, reflections	Rehearsed and impromptu speech: real-life communication (prepared and ad-hoc interview questions, answers, comments), interview recordings	Written responses to audio podcasts

		evaluation, reflection, correction, answers to comprehension questions			
Procedures	• Follow audio instructions • Record vocab. definitions • Optional: take pictures illustrating the usage of vocab. • Upload audio and images to the repository • Listen to other students' creations • Evaluate classmates' contributions (minimum 2)	• Follow audio instructions • Listen to descriptions of landmarks • Record podcasts • Take pictures illustrating landmarks or as for Scavenger Hunt (SH) challenges • Respond (written, spoken or visual) to SH audio challenges • Upload artefacts • Listen to other students' recordings • Comment/ blog on classmates' contributions (minimum 2)	• Follow audio instructions • Record audio podcasts (phlogs) • Take pictures illustrating landmarks or as for Scavenger Hunt (SH) challenges • Respond (written, spoken or visual) to SH audio challenges • Upload artefacts • Listen to other students' recordings • Comment/ blog on classmates' contributions • (minimum 3) • Evaluate classmates' contributions (minimum 2)	• Follow audio instructions • Prepare and conduct an interview • Record the interview • Upload the audio • Listen to other students' recordings • Comment/ blog on classmates' contributions • (minimum 2) • Evaluate classmates' contributions (minimum 2) • Optional: listen as a group in class and exchange feedback	• Follow audio instructions • Listen to audio podcasts selected from the list (minimum 3) • Complete language activities based on the audio (as per handouts)
Setting: Time	No restrictions	Restricted by availability of the group or task partner	No restrictions	Some restrictions (interviewee choice)	No restrictions
Setting: Location	No restrictions	Restricted by the choice of Toronto landmarks and SH directions	No restrictions	Some restrictions (interviewee choice)	No restrictions
Grouping	Recordings: individual or pair Evaluation: individual or pair	Landmark visits: group or pair Recordings: individual or pair Evaluation: individual	Recordings: individual Evaluation: individual	Interview: pair or group of 3 Recordings: pair or group of 3 Evaluation: individual, pair or group/class	Listening: individual Comprehension practice: individual
Interactivity	Peers, teacher, content, technology, real-life language speakers and context	Peers, teacher, content, technology, real-life language speakers and context	Peers, teacher, content, technology	Peers, teacher, content, technology, real-life language speakers and context	Peers, teacher, content, technology

The tasks were designed so that the output of one task becomes the input for another task; for instance, vocabulary and idiom entries created by students in T1 and T2, can be used at a later time to aid the comprehension of audio descriptions in T3-8, or vice-versa: the unfamiliar words and expressions that appear in T3-8 could be selected by the learner as the focus of the T1-2 activities. In fact, students were encouraged to work on vocabulary and terminology found in peers' T3-8 audio recordings. The MELL system also ensured a balanced combination of individual, pair, and group activities which, in turn, allowed for a relatively high level of flexibility in terms of the time and place of learning. It was imperative for most of these activities to be completed in the real-life environment and to optimize the time on learning.

Learning tasks embedded in authentic language situations also allowed for individuals to interact with the context affordances as described in the discussion of Ecological Constructivism (Chapter 4). However, it is worth noting that learners might choose to employ a non-constructivist approach to any of the MELLES activities. They might take a cognitivist or even behaviourist approach, such as rote-memorizing, repeating or drilling vocabulary, depending on the tasks and its circumstances, as well as on individual learner characteristics, including student language proficiency, learning preferences, experience as a language learner, and perception of the particular learning context. As a result, while guided by the Ecological Constructivist framework, MELLES subsumes a number of approaches to language learning.

MELLES user interface.

Access to any of the constituent parts and tasks of the MELL system was provided through the mobi-english.mobi interface. The following visuals illustrate the key components of the prototype solution as viewed either through a desktop Internet browser (Figures 30-32) or in a mobile browser (Figure 33).

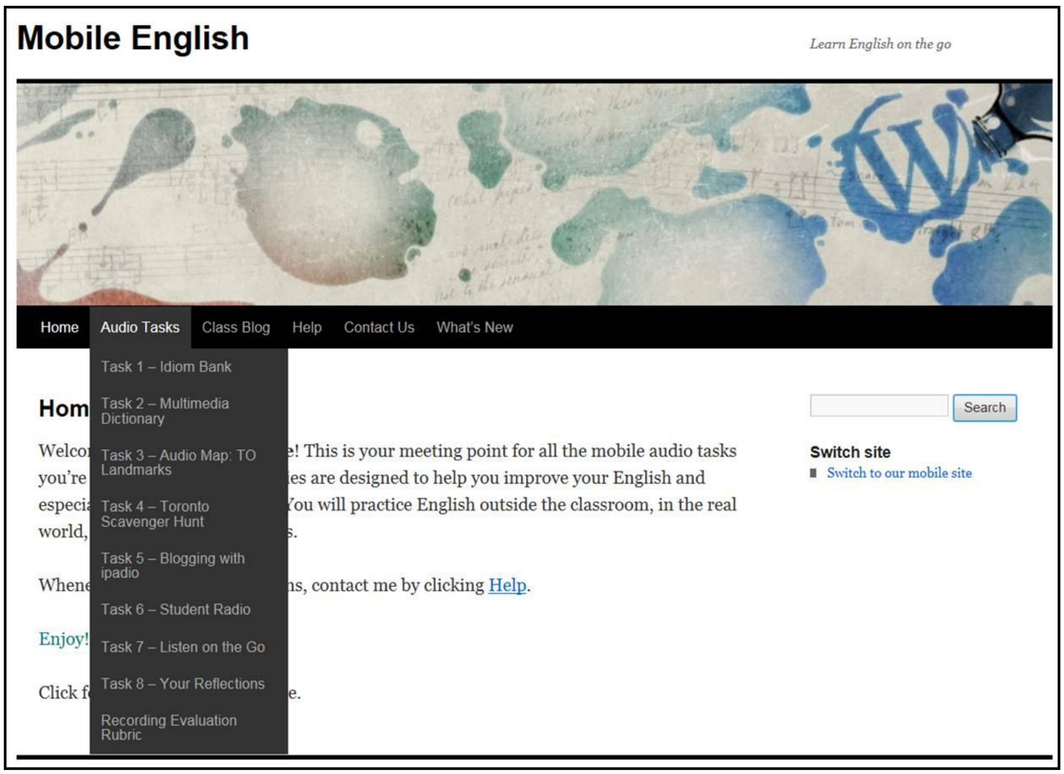

Figure 30. Screenshot of mobi-english.mobi audio tasks (desktop interface)

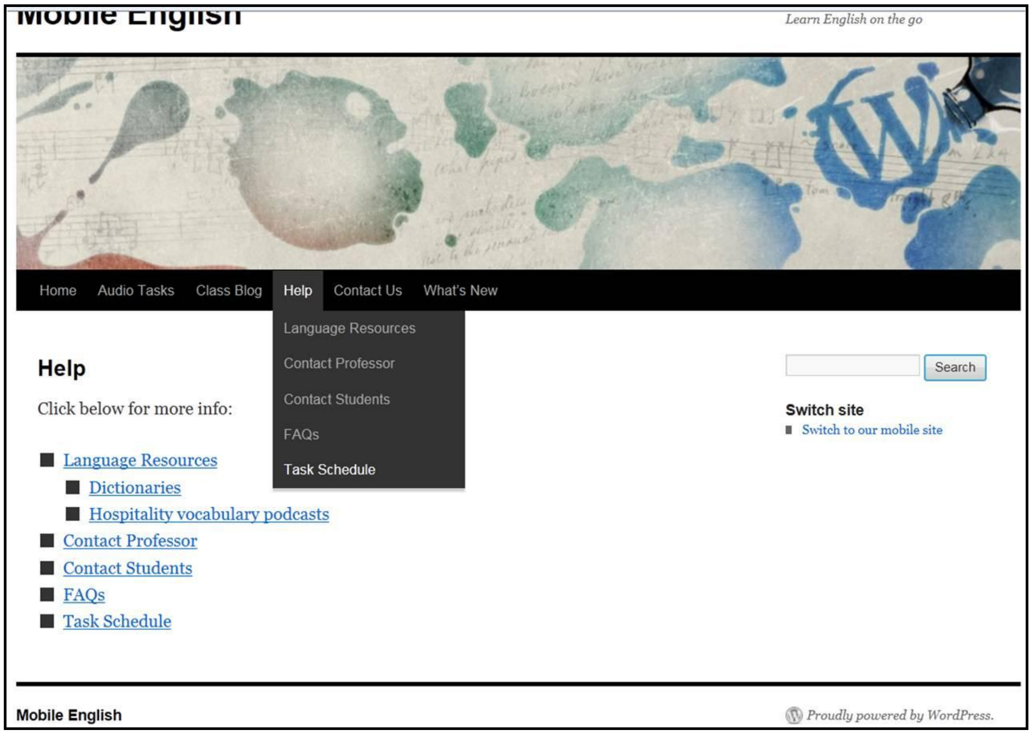

Figure 31. Screenshot of mobi-english.mobi help (desktop interface)

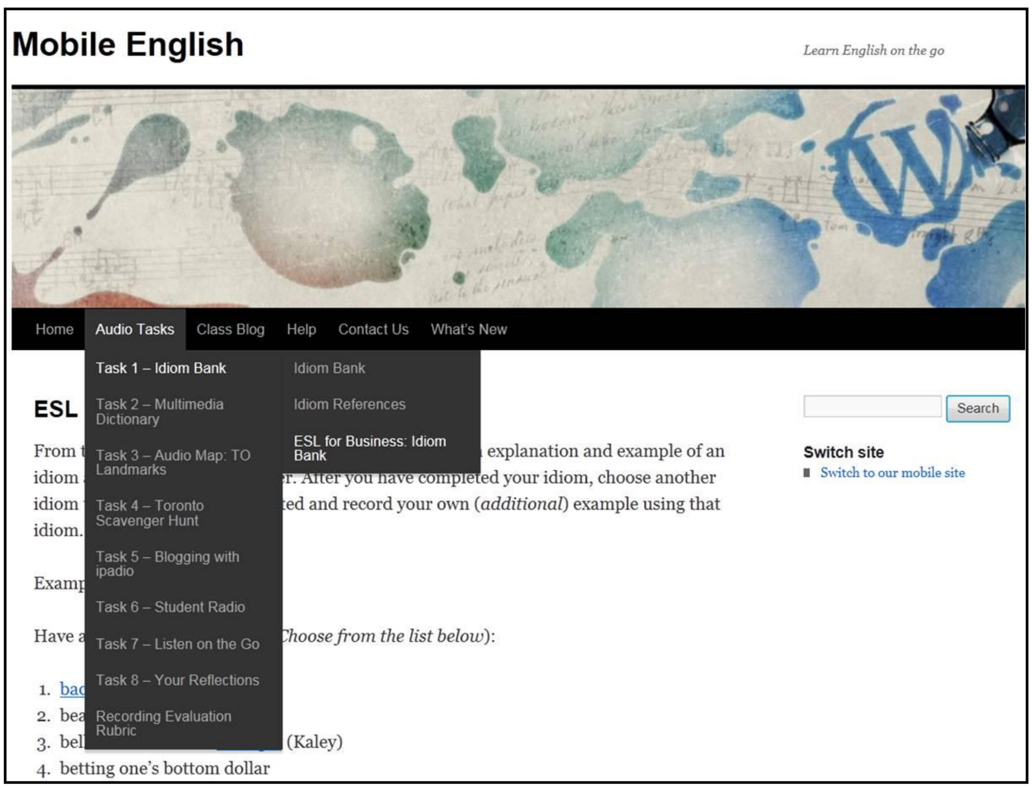

Figure 32. Screenshot of mobi-english.mobi – ESL for Business idiom bank (desktop interface)

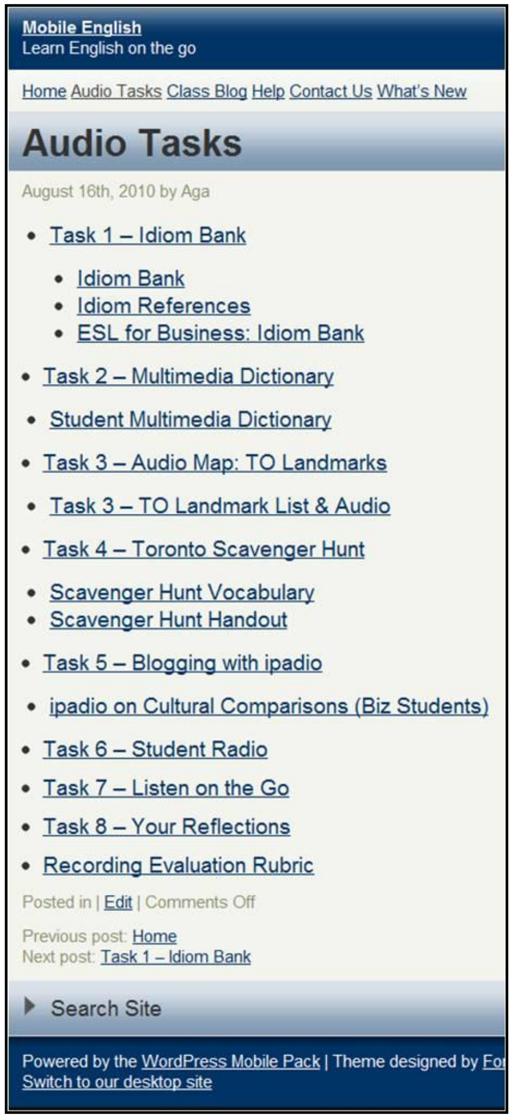

Figure 33. Screenshot of mobi-english.mobi audio asks (mobile interface)

As noted earlier, discussions and tests of the conceptual models, and subsequently the mobi-english.mobi prototype, resulted in the more complex MELLES solution. Before the MELLES solution was finalized and launched for piloting, the Phase 1 design guidelines underwent further modifications. The interim design principles are presented in the following section.

Guidelines Refinement

The design guidelines generated on the basis of Informed Exploration (Chapter 4) continued to be refined during the development work of Enactment. Consequently, Phase 1 design framework was filtered through the practical lens of the MELL production experience. An updated set of principles encapsulated the essential characteristics of the MELL system (substantive emphasis) and the strategies required to operationalize them (procedural emphasis). These procedural recommendations comprise strategies for learners, experts, mobile technology, and the design of learning activities. The refined design principles are summarized in Table 16.

Table 16.

Summary of Phase 2 Design Guidelines

Essential Characteristics (*Substantive Emphasis*)	**Strategy (*Procedural Emphasis*)**
• Motivation through active learning • Group work: interaction and communication within the learning network • Group work: collaboration and peer support within the learning network • Inclusion of collaborative and individual activities (time and place independent) • Scaffolding from experts and peers • Socio-cultural knowledge (including visiting local landmarks and exploring cultural habits) • Rehearsed and ad-hoc communication practice • Dynamic language practice in the real-world setting including	**Learners:** • Actively engage in communication through interaction and discourse with interlocutors who may be more, equally, or less competent • Combine autonomous and collaborative learning • Create artefacts and share them via MELLES (audio, video, images, some text) • Contribute their feedback and evaluation of peers' artefacts (rating system, audio recordings) • Apply creative effort to a communication situation (for instance, create learning materials or other artefacts) **Experts:** • Provide/point to clear instructions and directions for a listening task • Offer in-person (immediate) and recorded (delayed) feedback and evaluation • Moderate the MELLES website (for instance, step in when the instability was apparent) • Ensure constant inflow of information and exchange of ideas • Facilitated the artefact construction • Develop new or modify existing mobile tasks and activities when needed

communicative situations involving authentic speakers of English • Support from linguistic affordances present in the real-world context • Sharing of learner-generated linguistic artefacts (audio, video, images) • Blend of classroom and out-of-class real-life context • Blend of in-person and mobile-mediated communication and interaction • Reliance on inherent audio capability (Mobile technology affordances) • Owning mobile technology • Relevance to academic and professional goals • Continuity and flexibility of practice derived from choice of timing and sequence of tasks completion • Continuity of learning afforded by constituent tasks of MELLES being interrelated and building on each other in a cyclical fashion • Advancement of learning supported by progressively more demanding language tasks (linguistically and technologically) • Accommodation for interrupted episodic learning – modular design with each audio not exceeding 5 minutes or activity within a task – 10-15 minutes • Educational game elements including rewards (ranking, point system), challenges, competition (group or individual), engaging visual interface • Visual support for language content • Metrics on students' progress - user profile and progress report • Support for technology – instructions how to use the system (audio), tips and pointers to web-based resources	• Maintain the steady flow of information and interaction, thus help glue the learning network • Promote learner ownership and agency • Provide technology support and point to tech resources incorporated in MELLES *(mainly in the initial stages of the learning process; mobile technologies tend to become transparent after one-two demos)* **Mobile Technology (MELLES):** • Provide platform to coordinate/direct learning process -flexible structure that learners can always fall back onto • Enable synchronous and asynchronous communication • Act as a repository of students' artefacts and a meeting point for discussions and evaluations • Deliver audio content (instructions, directions, task-related information, pronunciation examples) • Distribute text-based content (brief instructions, task-related information, vocabulary, links) • Offer apps supporting language learning (audio dictionaries, translators, flash cards) • Enable access to the learning resources selected by experts and suggested by others • Facilitate scaffolding support by connecting to experts and peers • Enable linguistic artefacts creation (voice recorder, camera, note taking option, memo app) • Assist with the perception of and interaction with the affordances (for instance, audio directions instruct students to collect evidence of various features of a Victorian style home) • Connect to the MELLES website • Enable exchange of delayed feedback (audio, rating system – such as the Facebook *Like* button, some text) • Provide tools to evaluate peers' artefacts (audio, rating system, some text) • Facilitate immediate feedback (messages, alerts) • Assist in communication within the learning network (voice, text, blogging, phlogging) • Help showcase learner-generated artefacts by offering tools for upload and viewing • Enable authentic assessment of linguistic skills (carry out linguistic functions in real-life situations in response to audio instructions) • Offer simple yet engaging mobile interface to MELLES (clear, coherent, and consistent) • Provide browser-based access from any device by creating platform independent architecture (any mobile or computer platform) • Allow for the MELLES website to evolve to accommodate future learners • Allow for interrupted episodic learning (modular design with pause, replay buttons and records of learner progress) • Build in audio player/recorder controls (locally on the device): play, record, adjust audio speed, pause, fast forward, rewind, replay, delete • Provide user profile and progress report • Integrate technology support– instructions how to use the system (audio), tips and pointers to web-based resources **Activities:**

• Audio player/ recorder functionality: ability to control audio recordings	• Aim at meaning making through meaningful communicative goals • Promote sharing of meaning with others • Promote interaction with others, content, technology, environment • Include individual and collaborative activities • Offer a blend of social, cognitive, and teaching presence • Draw on the affordances of the context and point to those linguistic affordances • Challenge learners linguistically in real-life communication situations • Reflect or include real-world tasks that learners will encounter outside the classroom • Integrate listening, speaking, reading and writing but are guided by listening learning outcomes • Encompass rehearsed and ad-hoc communication • Combine listening with pronunciation practice • Integrate socio-cultural skills • Contribute to the learning network their feedback and artefacts via MELLES • Include task-related linguistic materials (such as a vocabulary list) and pointers to other linguistic resources; provide text-based support • Provide clear instructions and directions • Blend creativity and competition in learner-generated artefacts exchange • Tasks feed into each other forming a web of listening activities yet allowing for choice of timing and sequence of tasks completion • Allow for interrupted episodic learning – modular design with each audio not exceeding 5 minutes or activity within a task – 10-15 minutes • Provide scaffolding through visual representation of audio content - message redundancy

These guidelines drove the final refinement of the mobi-english.mobi prototype before it was launched for piloting by participants in November 2010. This proof-of-concept mobile website served as the base for the evaluation phase presented in Chapter 6.

Chapter 5 Summary

Chapter 5 introduced selected examples of prototypes proposed by student participants and the final product of the Enactment phase, namely the mobi-english.mobi website, which reflected the findings of multiple design, evaluation, and feedback cycles. This prototype of an "ideal" evolved as a result of the findings of the Enactment phase comprising most frequent pedagogy and technology related themes. In addition, the technology themes were then analyzed for their system requirements. The discussion section of this chapter focused on the proof-of-concept mobi-english.mobi website, its features and content, including eight interconnected listening tasks. The components of these tasks were discussed to demonstrate how they emerged from the feedback analysis and followed the ecological framework. The chapter concluded with a presentation of the refined MELLES design principles incorporating recommendations for characteristics vital to the system (substantive emphasis) and strategies needed to operationalize those features (procedural emphasis). The final refinement of the MELLES system was derived from these recommendations.

In the Evaluation: Local Impact phase (Phase 3), the refined MELLES system was implemented and subsequently tested by five ESP classes. Eight practitioners and two external experts shared their insights regarding the optimal m-learning solution for the context under investigation. Results of their evaluation (Phase 3) are presented in the next chapter.

Chapter 6. Evaluation: Local Impact (Phase 3) Findings

The Evaluation phase focused on testing, piloting and assessing the MELL educational intervention within a local context. Based on the findings from this phase collected from more than one hundred participants, the design principles were further refined and recommendations for the complete MELL ecosystem generated. Following the DBR approach and the ecological framework, once the mobi-english.mobi website was launched, the study allowed for the research participant community to experiment with it in a cyclical fashion and provide their feedback at multiple points of the execution of the prototype pilot. This way, some recommended modifications could be implemented in time for the next cycle of tests and feedback collection. The latest refinements introduced into the system were evaluated via new questions asked of participants in successive surveys and face-to-face data collections meetings. Consequently, the final survey, interviews and focus groups conducted in 2011 reflected the updated conceptual framework based on participant feedback to that point. The development of the system was captured by means of participants' comments on the consecutive versions of tasks. Most importantly, the key research question was revisited at each feedback collection point to provide a more comprehensive insight into what elements of the MELL system were deemed critical for the effectiveness of the design.

As stated in the Methodology chapter, qualitative and quantitative data was gathered over a period of time via discrete tasks surveys, focus groups, and interviews, as well as summative MELL system (all tasks) evaluation survey, focus group and interviews. The data collection activities and their details are presented in Tables 1– 4 in the Methodology chapter. Resulting data are summarized below in three parts: (1) juxtaposition of surveys for Task 1 through 8, (2) the summative T1–8 survey, and (3) the analysis of all Evaluation phase qualitative data.

Individual Tasks Surveys

Online and in-person surveys were administered in November–December 2010. Four groups completed individual mobi-english.mobi tasks to extract more in-depth understanding of detail requirements of the perceived optimal design of each constituent task as well as the whole website. With the eight language tasks being interconnected and overlapping each other in terms of design, evaluations were organized around pairs of comparable tasks. Accordingly, T1 (Idiom Bank) and T2 (Multimedia Dictionary) were grouped together, so were T3 (Audio Map) and T4 (Scavenger Hunt), as well as T5 (Phlogging with iPadio) and T8 (Phlogging: Reflections). T6 (Student Radio) and T7 (Listen on the Go) were evaluated separately (see Table 15 for the task details).

While twenty design-specific and three demographic questions repeated across all task surveys, four remaining questions were adjusted to the type of language learning activities being evaluated. Each questionnaire contained 20 Likert scale, six multiple choice (including three demographic items) and one ranking question. To ensure that the ESL respondents comprehended the questions, all survey instruments were piloted and questions were clarified in class prior to the questionnaire deployment. The analysis of the mixed data resulting from the surveys took place in tandem with data collection. This way it reflected the evolution of both the participants' insights and the researcher's meaningful interpretations of the data. The data from the successive surveys were examined by means of descriptive analysis. The findings are presented below, exclusive of the demographic data, the summary of which can be found in the Participants section.

Four survey questions (Q1, Q7, Q13, and Q14) revisited the broader issue of effectiveness of learning ESP listening skills using mobile devices.

Q1. Task x was an effective way of learning English. It helped me learn English (listening).

Table 17.

Survey Q1—Effectiveness of Individual Tasks

Q1	**Task 1 & 2** n= 20		**Task 3 & 4** n= 15		**Task 5 & 8** n= 24		**Task 6** n= 32		**Task 7** n= 47		**Relative Freq Mean**
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	**0.0%**
Disagree	0	0.0%	0	0.0%	1	4.2%	0	0.0%	1	2.1%	**1.3%**
Neutral	2	10.0%	1	6.7%	2	8.3%	2	6.3%	2	4.3%	**7.1%**
Agree	9	45.0%	7	46.7%	10	41.7%	14	43.8%	22	46.8%	**44.8%**
Strongly Agree	9	45.0%	7	46.7%	11	45.8%	16	50.0%	22	46.8%	**46.9%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100.0%**	**32**	**100.0%**	**47**	**100.0%**	**100.0%**

Similar to Phase 1 and 2 feedback, responses to Q1 consistently identified all tasks as effective for learning listening. With the agreement levels ranging from 88% for T5 and T8 to 94 % for T6 and T7, only one person disagreed with the statement for T5 and T8 (4.2%), and T7 (2.1%), respectively (Table 17).

In Q7, which was posed to triangulate Q1, the overall results were equivalent to those summarized above.

Q7. I found this way of learning English not very effective.

Table 18.

Survey Q7—Ineffectiveness of Individual Tasks

Q7	Task 1 & 2 n= 20		Task 3 & 4 n= 15		Task 5 & 8 n= 24		Task 6 n= 32		Task 7 n= 47		Relative Freq Mean
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	9	45.0%	6	40.0%	12	50.0%	14	43.8%	20	42.6%	**44.3%**
Disagree	10	50.0%	8	53.3%	11	45.8%	16	50.0%	24	51.1%	**50.0%**
Neutral	1	5.0%	1	6.7%	1	4.2%	2	6.3%	2	4.3%	**5.3%**
Agree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	2.1%	**0.4%**
Strongly Agree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	**0.0%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100.0%**	**32**	**100%**	**47**	**100%**	**100%**

Almost all respondents (T1–T8: 93–96%) rejected the statement of the m-learning they experienced being not effective, thus reinforcing the observation that the MELL design and its execution, were conducive to successful learning of ESP listening skills (Table 18).

Q13 addressed the effectiveness issue from the mobile technology perspective. Once again, students deemed the mobile-assisted approach an effective way to acquire English language listening skills.

Q13. Using mobile devices is an effective way to learn English.

Table 19.

Survey Q13—Effectiveness of Mobile Device for Learning

Q13	Task 1 & 2 n= 20		Task 3 & 4 n= 15		Task 5 & 8 n= 24		Task 6 n= 32		Task 7 n= 47		Relative Freq Mean
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	**0.0%**
Disagree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	**0.0%**
Neutral	3	15.0%	2	13.3%	2	8.3%	3	9.4%	2	4.3%	**10.1%**
Agree	10	50.0%	9	60.0%	13	54.2%	16	50.0%	23	48.9%	**52.6%**
Strongly Agree	7	35.0%	4	26.7%	9	37.5%	13	40.6%	22	46.8%	**37.3%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100.0%**	**32**	**100.0%**	**47**	**100.0%**	**100.0%**

While responses to Q13 (Table 19) reflected participants' strong agreement with the claim of effectiveness of mobile technologies (SA+A: T1 & 2 – 85%, T3 & 4 – 87%, T5 & 8 – 92%, T6 – 91%, and T7 – 96%; SD+D: 0% for all tasks), the perspective of employing mobile-assisted English language learning more frequently (Q14) met with a slightly lower level of enthusiasm (Table 20): overall agreement at 90% for Q13 and at 85% for Q14. Only one respondent per task disagreed with the Q14 statement.

Q14. I would like to learn English using mobile devices more often.

Table 20.

Survey Q14—Willingness to Use Mobile Devices for Learning

Q14	Task 1 & 2 n= 20		Task 3 & 4 n= 15		Task 5 & 8 n= 24		Task 6 n= 32		Task 7 n= 47		Relative Freq Mean
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	**0.0%**
Disagree	1	5.0%	1	6.7%	1	4.2%	1	3.1%	1	2.1%	**4.2%**
Neutral	4	20.0%	2	13.3%	2	8.3%	2	6.3%	2	4.3%	**10.4%**
Agree	9	45.0%	7	46.7%	10	41.7%	17	53.1%	24	51.1%	**47.5%**
Strongly Agree	6	30.0%	5	33.3%	11	45.8%	12	37.5%	20	42.6%	**37.8%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100.0%**	**32**	**100.0%**	**47**	**100.0%**	**100.0%**

Overall, for these four questions, the level of concurrence with the claim of effectiveness of the mobile solution ranged from 85% to 96% averaging at 90% across all tasks.

Previously, respondents identified the element of fun as one of the essential characteristics of effective MELL design. Therefore Q2 of the survey aimed to gauge whether that requirement was satisfied across all tasks.

Q2. Task x was a fun way of learning English.

Table 21.

Survey Q2—Fun Factor in Individual Tasks

Q2	Task 1 & 2 n= 20		Task 3 & 4 n= 15		Task 5 & 8 n= 24		Task 6 n= 32		Task 7 n= 47		Relative Freq Mean
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	2.1%	**0.4%**
Disagree	1	5.0%	0	0.0%	1	4.2%	1	3.1%	3	6.4%	**3.7%**
Neutral	1	5.0%	1	6.7%	2	8.3%	1	3.1%	4	8.5%	**6.3%**
Agree	10	50.0%	7	46.7%	11	45.8%	16	50.0%	23	48.9%	**48.3%**
Strongly Agree	8	40%	7	46.7%	10	41.7%	14	43.8%	16	34.0%	**41.2%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100.0%**	**32**	**100.0%**	**47**	**100.0%**	**100.0%**

According to the results (Table 21), the vast majority considered the tasks to be a fun way of learning, with the level of agreement ranging from 83% for T7 to 94% for T6. T7 seemed to be isolated as the least fun (SD: 2.1%, D: 6.4%), which was addressed by a respondent in the comment box: "Listening to the podcasts gets boring and tiring but people need to do that to learn English." One person disagreed with Q2 for T1 & 2, T5 & 8, and T6. No disagreement at all was observed with respect to T3 & 4, both offering highly interactive collaborative activities.

Considering the expressed demand for clear and detailed task instructions, Q3 inquired into respondents' satisfaction with the quality of audio instructions.

Q3. The audio instructions were at the right level of difficulty. The audio challenged me but I understood most of it.

Table 22.

Survey Q3— Audio Instructions Difficulty Level

Q3	Task 1 & 2 n= 20		Task 3 & 4 n= 15		Task 5 & 8 n= 24		Task 6 n= 32		Task 7 n= 47		Relative Freq Mean
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	**0.0%**
Disagree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	**0.0%**
Neutral	2	10.0%	2	13.3%	2	8.3%	1	3.1%	2	4.3%	**7.8%**
Agree	8	40.0%	8	53.3%	12	50.0%	15	46.9%	25	53.2%	**48.7%**
Strongly Agree	10	50.0%	5	33.3%	10	41.7%	16	50.0%	20	42.6%	**43.5%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100.0%**	**32**	**100.0%**	**47**	**100.0%**	**100.0%**

The audio instructions were perceived as appropriate in terms of their complexity and challenge levels (Table 22). All students supported that statement with T1 & 2 total agreement at 90%, T3 & 4 – 87%, T5 & 8 – 92%, T6 – 97%, and T7 – 96%. The following question, Q4, revisited the motivation aspect of learning, asking whether taking learning outside the classroom had impact on students' motivation to learn.

Q4. Learning outside the classroom improved my motivation to learn English (listening).

Table 23.

Survey Q4—Motivational Aspect of Individual Contextual Tasks

Q4	Task 1 & 2 n= 20		Task 3 & 4 n= 15		Task 5 & 8 n= 24		Task 6 n= 32		Task 7 n= 47		Relative Freq Mean
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	**0.0%**
Disagree	1	5.0%	0	0.0%	0	0.0%	1	3.1%	0	0.0%	**1.6%**
Neutral	1	5.0%	1	6.7%	3	12.5%	2	6.3%	3	6.4%	**7.4%**
Agree	9	45.0%	7	46.7%	10	41.7%	15	46.9%	24	51.1%	**46.3%**
Strongly Agree	9	45.0%	7	46.7%	11	45.8%	14	43.8%	20	42.6%	**44.8%**
Total	**20**	**100.0%**	**15**	**100%**	**24**	**100.0%**	**32**	**100.0%**	**47**	**100.0%**	**100.0%**

Consistent with their claims on the effectiveness of learning outside the classroom, most respondents agreed: T1 & 2 total agreement at 90%, T3 & 4 – 93%, T5 & 8 – 88%, T6 – 91%, and T7 – 94%. Only one person disagreed the in case of T1 & 2 (5%) and T6 (3%) (Table 23). Collaborating with others was repeatedly cited as a significant motivator; hence, Q5 looked into whether students considered the collaborative activities helpful.

Q5. Collaborating with other students was helpful. They helped me solve problems...

Table 24.

Survey Q24—Effectiveness of Collaboration in Individual Tasks

Q5	Task 1 & 2 n= 20		Task 3 & 4 n= 15		Task 5 & 8 n= 24		Task 6 n= 32		Task 7 n= 47		Relative Freq Mean
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	2.1%	**0.4%**
Disagree	2	10.0%	0	0.0%	2	8.3%	1	3.1%	5	10.6%	**6.4%**
Neutral	3	15.0%	1	6.7%	3	12.5%	1	3.1%	9	19.1%	**11.3%**
Agree	9	45.0%	6	40.0%	9	37.5%	13	40.6%	20	42.6%	**41.1%**
Strongly Agree	6	30.0%	8	53.3%	10	41.7%	17	53.1%	12	25.5%	**40.7%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100.0%**	**32**	**100%**	**47**	**100.0%**	**100.0%**

The level of agreement for Q5 was substantial, ranging from 68% for T7 to 94% for T6 (Table 24). At the same time, some disagreement was observed, mainly for T7 (13%), somewhat less for T1 & 2 (10%) and T5 & 8 (8%). T6 had a minimal level of disagreement at 3%. It is also worth noting that for the tasks with higher disagreement, “Neutral” was consistently frequent. That tendency reflected the design of the constituent tasks and where they were placed on the individual-to-collaborative-effort continuum (Figure 34). For instance, the predominantly individual character of T7 (Listen on the Go) brought about much lower overall perception of the presence of collaborative support, regardless of the context of shared website and resources.

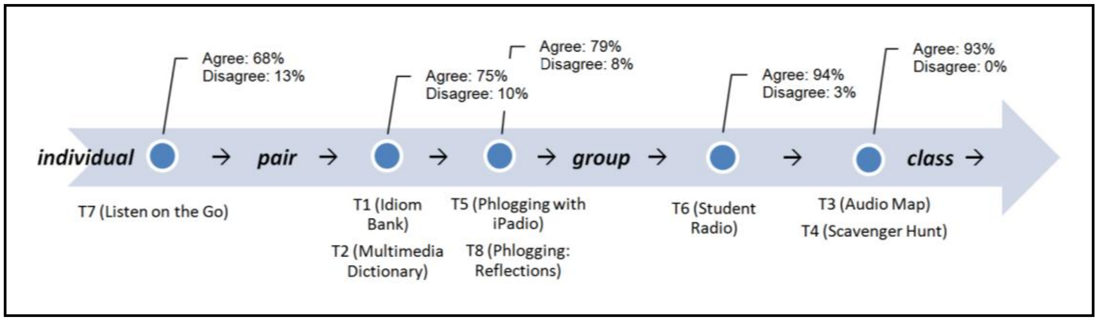

Figure 34. Q5. Collaborating with other students was helpful. They helped me solve problems and find answers.

Following the cooperation theme, Q6 asked about students' preferences in terms of the grouping options for m-learning activities they completed. The questions aimed to gauge respondents' inclination toward mobile-assisted learning offering individual practice.

Q6. I would have preferred to complete this task on my own not as a group/class.

Table 25.

Survey Q6—Individual vs. Group Work Preference for Individual Tasks

Q6	**Task 1 & 2** n= 20		**Task 3 & 4** n= 15		**Task 5 & 8** n= 24		**Task 6** n= 32		**Task 7** n= 47		**Relative Freq Mean**
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	4	20.0%	4	26.7%	6	25.0%	16	50.0%	0	0.0%	**24.3%**
Disagree	8	40.0%	9	60.0%	10	41.7%	14	43.8%	3	6.4%	**38.4%**
Neutral	3	15.0%	1	6.7%	3	12.5%	1	3.1%	5	10.6%	**9.6%**
Agree	3	15.0%	1	6.7%	4	16.7%	1	3.1%	18	38.3%	**16.0%**
Strongly Agree	2	10.0%	0	0.0%	1	4.2%	0	0.0%	21	44.7%	**11.8%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100.0%**	**32**	**100.0%**	**47**	**100.0%**	**100.0%**

On average 63% of students rejected the statement that individual activities are preferred (SD+D: T1 & 2 – 60%, T3 & 4 – 87%, T5 & 8 – 67%, T6 – 94%, and T7 – 6%) and 28% supported the claim (SA+A: T1 & 2 – 25%, T3 & 4 –7%, T5 & 8 – 21%, T6 – 3%, and T7 – 83%) (Table 25). As in the previous finding, students favoured individual practice exclusively for tasks that were designed for more personal learning offering an optimally flexible schedule and focused practice with a minimal collaborative component. Hence, although the general tendency was toward collaborative learning, T7 was isolated as the one that required individual effort.

In view of earlier respondents' observations regarding collaborative learning and support coming from the learning community, Q18 investigated the actual grouping preferences for each type of task.

Q18. Based on the task(s) you completed, indicate whether you prefer to work on mobile tasks by yourself (individually), in a group, or with a partner. Rank the three grouping arrangements from 1 (least favourite) to 3 (most favourite).

Table 26.

Survey Q18—Individual vs. Group vs. Pair Work Preference for Individual Tasks

Q18 I prefer to work:	**T1&2 Mean Score**	**T1&2 Rank**	**T3&4 Mean Score**	**T3&4 Rank**	**T5&8 Mean Score**	**T5&8 Rank**	**T6 Mean Score**	**T6 Rank**	**T7 Mean Score**	**T7 Rank**	**All Tasks Mean Score**	**Overall Ranking**
individually	2.50	1	2.20	2	2.21	1	1.59	3	2.06	2	**2.11**	**1**
in a group	1.75	3	2.27	1	1.63	3	1.94	2	1.91	3	**1.90**	**2**
with a partner	2.00	2	1.87	3	2.00	2	2.44	1	2.26	1	**2.11**	**1**

Although the overall ranking suggested that students preferred to work individually or with a partner rather than in a group, a closer look at each type of task revealed the same trend as Q5 and Q6: it was the design and the setting of the learning activity not the students' individual preferences that dictated respondents selecting individual vs. more collaborative options (Table 26).

Continuing with the collaborative support theme, Q8 inquired about the actual assistance students received from their peers. It was imperative to examine whether students actually used the communication tools to ask for help despite rather sporadic face-to-face communication opportunities.

Q8. I was able to get the help I needed, for example ask about new vocabulary, from my classmates.

Table 27.

Survey Q8— Peer Support Effectiveness for Individual Tasks

Q8	**Task 1 & 2** n= 20		**Task 3 & 4** n= 15		**Task 5 & 8** n= 24		**Task 6** n= 32		**Task 7** n= 47		**Relative Freq Mean**
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	1	5.0%	0	0.0%	1	4.2%	0	0.0%	5	10.6%	**4.0%**
Disagree	4	20.0%	1	6.7%	3	12.5%	1	3.1%	12	25.5%	**13.6%**
Neutral	4	20.0%	2	13.3%	2	8.3%	2	6.3%	6	12.8%	**12.1%**
Agree	8	40.0%	8	53.3%	10	41.7%	17	53.1%	14	29.8%	**43.6%**
Strongly Agree	3	15.0%	4	26.7%	8	33.3%	12	37.5%	10	21.3%	**26.8%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100.0%**	**32**	**100.0%**	**47**	**100.0%**	**100.0%**

Similar to the two previous points, the level of peer help that students identified correlated with the type of activity they completed: the primarily collaborative tasks, such as T6 (SA+A: 91%; SD+D: 3%) and T3 & 4 (SA+A: 80%; SD+D: 7%) attracted more peer support, whereas T7 (SA+A: 51%; SD+D: 36%), T1 & 2 (SA+A: 55%; SD+D: 35%) were not perceived as a good opportunity to receive assistance from classmates (Table 27).

The next two questions, Q9 and Q10, examined the usability of the mobi-english.mobi website.

Q9. The design of Task x website, including the audio feature, was easy to use; it was user-friendly.

Table 28.

Survey Q9—User-friendliness of the MELL Website Design for Individual Tasks

Q9	Task 1 & 2 n= 20		Task 3 & 4 n= 15		Task 5 & 8 n= 24		Task 6 n= 32		Task 7 n= 47		Relative Freq Mean
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	2	10.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	**2.0%**
Disagree	5	25.0%	0	0.0%	1	4.2%	0	0.0%	1	2.1%	**6.3%**
Neutral	4	20.0%	3	20.0%	4	16.7%	2	6.3%	3	6.4%	**13.9%**
Agree	7	35.0%	10	66.7%	12	50.0%	14	43.8%	21	44.7%	**48.0%**
Strongly Agree	2	10.0%	2	13.3%	7	29.2%	16	50.0%	22	46.8%	**29.9%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100.0%**	**32**	**100.0%**	**47**	**100%**	**100.0%**

The majority of students considered the interface user-friendly (overall agreement at 78%), with T3 through T8 rated higher (SA+A: T3 & 4 –80%, T5 & 8 – 79%, T6 – 94%, and T7 – 92%; D: T5 & 8 – 4%, T7 – 2%) than T1 & 2 T1 (SA+A: 2 - 45%; SD+D: 35%) (Table 28). Respondents commented that both T1 and T2 web pages needed improvement in terms of student-generated artefact upload and evaluation tools. Students regarded the audio content of the site and its delivery format conducive to learning listening, which was reflected in their responses to Q10.

Q10. The format of Task x, i.e., using audio instructions, was useful for learning listening skills.

Table 29.

Survey Q10—Effectiveness of the Audio Format for Individual Tasks

Q10	Task 1 & 2 n= 20		Task 3 & 4 n= 15		Task 5 & 8 n= 24		Task 6 n= 32		Task 7 n= 47		Relative Freq Mean
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	**0.0%**
Disagree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	**0.0%**
Neutral	2	10.0%	3	20.0%	3	12.5%	2	6.3%	2	4.3%	**10.6%**
Agree	8	40.0%	10	66.7%	13	54.2%	15	46.9%	22	46.8%	**50.9%**
Strongly Agree	10	50.0%	2	13.3%	8	33.3%	15	46.9%	23	48.9%	**38.5%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100.0%**	**32**	**100%**	**47**	**100%**	**100%**

Respondents all felt, consistently across the tasks, that using audio instructions was useful for addressing listening competencies (SA+A: T1 & 2 – 90%, T3 & 4 –80%, T5 & 8 – 88%, T6 – 94%, and T7 – 96%) (Table 29). At the same time, most students did not experience problems using the technology, as illustrated in Q11.

Q11. Using mobile technology for Task x was a problem.

Table 30.

Survey Q11—Ease of Use of Mobile Technology for Individual Tasks (1)

Q11	Task 1 & 2 n= 20		Task 3 & 4 n= 15		Task 5 & 8 n= 24		Task 6 n= 32		Task 7 n= 47		Relative Freq Mean
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	9	45.0%	4	26.7%	10	41.7%	14	43.8%	21	44.7%	**40.4%**
Disagree	8	40.0%	9	60.0%	11	45.8%	16	50.0%	23	48.9%	**49.0%**
Neutral	2	10.0%	2	13.3%	2	8.3%	2	6.3%	2	4.3%	**8.4%**
Agree	1	5.0%	0	0.0%	1	4.2%	0	0.0%	1	2.1%	**2.3%**
Strongly Agree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	**0.0%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100%**	**32**	**100.0%**	**47**	**100%**	**100%**

One respondent reported encountering technology problems for T1 & 2 (5%), T5 & 8 (4%) and T7 (2%). The remaining respondents disagreed with the statement that the mobile technology was problematic (SD+D: T1 & 2 –85%, T3 & 4 –87%, T5 & 8 – 88%, T6 – 94%, and T7 – 94%) (Table 30). In the following question, Q12, respondents were asked to confirm whether they found the mobile technology easy to use.

Q12. The mobile technology was easy to use.

Table 31.

Survey Q12— Ease of Use of Mobile Technology for Individual Tasks (2)

Q12	**Task 1 & 2 n= 20**		**Task 3 & 4 n= 15**		**Task 5 & 8 n= 24**		**Task 6 n= 32**		**Task 7 n= 47**		**Relative Freq Mean**
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	**0.0%**
Disagree	2	10.0%	0	0.0%	0	0.0%	1	3.1%	1	2.1%	**3.1%**
Neutral	1	5.0%	1	6.7%	2	8.3%	1	3.1%	2	4.3%	**5.5%**
Agree	9	45.0%	6	40.0%	10	41.7%	15	46.9%	22	46.8%	**44.1%**
Strongly Agree	8	40.0%	8	53.3%	12	50.0%	15	46.9%	22	46.8%	**47.4%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100.0%**	**32**	**100.0%**	**47**	**100.0%**	**100.0%**

The results of Q12 validated Q11 with the level of agreement ranging from 85% for T1 & 2 to 94% for T6 and T7; however, once again students commented on the lack of appropriate tools for uploading and rating student-generated artefact on the T1 and T2 web pages. As a result 10% of respondents did not deem T1 & 2 easy to use (Table 31).

The next three questions, Q15 through Q17, asked for feedback concerning audio recordings created by the learners. Q15 looked at utilizing audio produced by language learners as learning resources for their peers.

Q15. Working with audio recordings created by other students helped me learn English (listening) more effectively.

Table 32

Survey Q15—Effectiveness of Using Peers' Audio Artefacts in Individual Tasks

Q15	Task 1 & 2 n= 20		Task 3 & 4 n= 15		Task 5 & 8 n= 24		Task 6 n= 32		Task 7 n= 47		Relative Freq Mean
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	2	10.0%	1	6.7%	1	4.2%	0	0.0%	N/A	N/A	**5.2%**
Disagree	1	5.0%	1	6.7%	2	8.3%	0	0.0%	N/A	N/A	**5.0%**
Neutral	5	25.0%	3	20.0%	2	8.3%	1	3.1%	N/A	N/A	**14.1%**
Agree	8	40.0%	6	40.0%	11	45.8%	14	43.8%	N/A	N/A	**42.4%**
Strongly Agree	4	20.0%	4	26.7%	8	33.3%	17	53.1%	N/A	N/A	**33.3%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100.0%**	**32**	**100.0%**	**0**	**0%**	**100.0%**

Respondents were originally relatively skeptical about the value of other students' recordings for their own learning. They cited accents, lack of clarity and errors as the major caveats of using their peers' audio artefacts. Having tested that option, though, the majority appreciated the approach (SA+A: T1 & 2 – 60%, T3 & 4 – 67%, T5 & 8 – 79%, T6 – 97%; SD+D: T1 & 2 –15%, T3 & 4 –13%, T5 & 8 – 13%, T6 – 0%) (Table 32). T6 was favoured by respondents due to the nature of the audio podcast that was the goal of the task, namely a recording of an interview with an expert, the selected expert usually being a native speaker of English.

An opportunity to evaluate peers' audio and, most importantly, to view the facilitator's evaluation and feedback of those creations, were quoted as the two factors enhancing the value of peers' audio artefacts. Hence Q16 and Q17 gathered feedback around that option.

Q16. Evaluating audio recordings created by my classmates helped me learn English (listening).

Table 33.

Survey Q16—Effectiveness of Evaluating Peers' Audio Artefacts in Individual Tasks

Q16	Task 1 & 2 n= 20		Task 3 & 4 n= 15		Task 5 & 8 n= 24		Task 6 n= 32		Task 7 n= 47		Relative Freq Mean
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	1	5.0%	1	6.7%	1	4.2%	0	0.0%	N/A	N/A	**4.0%**
Disagree	2	10.0%	1	6.7%	1	4.2%	1	3.1%	N/A	N/A	**6.0%**
Neutral	4	20.0%	2	13.3%	4	16.7%	2	6.3%	N/A	N/A	**14.1%**
Agree	8	40.0%	6	40.0%	9	37.5%	15	46.9%	N/A	N/A	**41.1%**
Strongly Agree	5	25.0%	5	33.3%	9	37.5%	14	43.8%	N/A	N/A	**34.9%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100.0%**	**32**	**100.0%**	**0**	**0%**	**100.0%**

Responses to Q16 (Table 33) indicated some hesitance toward the concept of the peer evaluation of audio and its effectiveness (SD+D: T1 & 2 –15%, T3 & 4 – 13%, T5 & 8 – 8%, T6 – 3%); nevertheless, overall, 76% concurred with the statement (SA+A: T1 & 2 – 65%, T3 & 4 –73%, T5 & 8 – 75%, T6 – 91%). More respondents saw the value of feedback obtained from the facilitator, which was reflected in the Q17.

Q17. Teacher feedback on my audio recordings helped me learn English (listening).

Table 34.

Survey Q17—Effectiveness of Teacher Feedback on Audio Recordings in Individual Tasks

Q17	Task 1 & 2 n= 20		Task 3 & 4 n= 15		Task 5 & 8 n= 24		Task 6 n= 32		Task 7 n= 47		Relative Freq Mean
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Strongly Disagree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	N/A	N/A	**0.0%**
Disagree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	N/A	N/A	**0.0%**
Neutral	1	5.0%	1	6.7%	1	4.2%	1	3.1%	N/A	N/A	**4.7%**
Agree	8	40.0%	5	33.3%	9	37.5%	13	40.6%	N/A	N/A	**37.9%**
Strongly Agree	11	55.0%	9	60.0%	14	58.3%	18	56.3%	N/A	N/A	**57.4%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100.0%**	**32**	**100.0%**	**0**	**0%**	**100.0%**

On average, 95% of students reported that feedback from teachers helped them learn listening skills (SA+A: T1 & 2 – 95%, T3 & 4 – 93%, T5 & 8 – 96%, T6 – 97%) (Table 34). Bearing in mind the need for expert scaffolding vis-à-vis the preference for flexible learning outside the classroom, Q19 inquired into the preferred timing of the facilitator’s support.

Q19. I required my teacher's support mostly___________ . Select one: before, during, or after (*follow-up*) the mobile tasks.

Table 35.

Survey Q19—Need for Teacher Support in Individual Tasks

Q19	Before	During	After	N/A
Task 1 & 2	49.4%	25.6%	18.1%	6.9%
Task 3 & 4	65.0%	17.5%	15.0%	2.5%
Task 5 & 8	44.3%	30.2%	20.8%	4.7%
Task 6	55.5%	23.4%	19.1%	2.0%
Task 7	51.3%	23.4%	20.7%	4.5%
Mean	**53.1%**	**24.0%**	**18.8%**	**4.1%**

According to respondents, expert support was required primarily before the mobile tasks (53%) (Table 35). Students commented on the significance of pre-task activities including vocabulary work, review of task directions and appropriate grammar points, as well as the opportunity to ask task-related questions. Fewer respondents indicated that facilitator`s help would be needed during (24%) or after (19%) the learning activity.

Lastly, it was essential to determine what technologies students used to complete the mobile tasks (Q27).

Q27. I used __________ to complete the mobile task. Select the tool that you used the most (cell phone, computer, other).

Table 36.

Survey Q27—Tools Used to Complete Individual Tasks

Q27	**Task 1 & 2** n= 20		**Task 3 & 4** n= 15		**Task 5 & 8** n= 24		**Task 6** n= 32		**Task 7** n= 47		**Relative Freq Mean**
Response	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**%**
Cell phone	8	40.0%	14	93.3%	16	66.7%	21	65.6%	29	61.7%	**65.5%**
Computer (desktop/ laptop)	6	30.0%	0	0.0%	4	16.7%	6	18.8%	6	12.8%	**15.6%**
Other	6	30.0%	1	6.7%	4	16.7%	5	15.6%	12	25.5%	**18.9%**
Total	**20**	**100.0%**	**15**	**100.0%**	**24**	**100.0%**	**32**	**100.0%**	**47**	**100.0%**	**100.0%**

Depending on the nature of the language tasks, some respondents alternated between a cell phone, computer or other devices (iPods, MP3 players, and a tablet) (Table 36). T3 & 4, which were designed for real-life setting practice on the streets of Toronto, invited the usage of portable devices (Cell phone: 93% + Other: 7%). The other tasks, due to their less context-dependent character, lent themselves to the more fixed-place technologies; hence, apart from the most prevalent mobile devices, approximately 20% of student utilized computers as well (excluding T3 & 4). Evidently, fewer (40%) students employed cell phones for T1 & 2 than the remaining tasks. When asked for explanation, respondents isolated two main reasons for choosing computers over handheld devices: (1) the novelty factor in terms of using cell phones for learning (the majority of students started the pilot with T1 and T2), and (2) the preference for the recording software available on the computer, namely Audacity, as opposed to the phone-based software.

The findings presented in this section pertained to individual tasks comprising the MELL system. Feedback obtained through the surveys informed the next steps of the study: not only did it help to hone the final design principles, but it also highlighted certain aspects of the MELL solution that had to be revisited through the final survey.

Final Survey: Complete MELL System (All Tasks)

The final survey aimed to elicit from the ESL learners their summative reflections on the eight tasks integrated into the MELL ecosystem. All survey questions reflected respondents' feedback gathered in the preceding stages of the study. With the purpose of identifying the key elements of an effective MELL design, certain concepts and questions were revisited to validate up-to-date findings and to attain a more holistic perspective on the complete MELL system design. Questions were also asked to shed light on a number of comments shared by students during their focus groups and interviews; for instance, questions regarding talking to real-life speakers on the street or mobile website privacy issues.

In general, two central questions were addressed in the summative survey, namely the perceived effectiveness of the MELL design (did students learn) and the fundamental elements of the system being the essence to its effectiveness.

The survey was administered in February–March of 2011, and answered by 20 George Brown College ESL students. The cross-sectional data collected through the survey is presented below. Respondents were asked 28 questions (19 Likert scale and 2 ranking, 1 dichotomous and 6 multiple choice, including participants' gender and age questions). It's worth noting that all questions were written in simplified English and reviewed with the students to ensure their thorough understanding of the questionnaire. At the same time, the key words of each statement/question were bolded to further clarify the intended meaning.

In order to allow for corroboration of responses, the key concepts, for instance the perceived overall effectiveness of the solution, were addressed by more than one question. Accordingly, the results are clustered into thematic groups.

The analysis of the final survey quantitative data was carried out in three ways, including: (1) frequency distribution, (2) cross tabulation using the age range level as the independent variable; (3) cross tabulations using gender as the independent variable.

The cross-tabulation tests were performed by age range and gender using the Chi-square test (Pearson Chi-square test) which was applied to a single categorical variable from two (gender) or more (age) different populations. With the statistical significance level set at 0.05, no statistically significant differences were found for the gender and age groups.

Considering the small sample group (n= 20) and the fact that no statistically significant results were obtained, these quantitative findings contributed relatively little to the answer to the main research question. Moreover, for the sake of brevity, only one example of these test results is included for reference in Appendix H. All the other results are available upon request and may be revisited in future research.

All remaining findings are summarized by way of descriptive statistics including frequency distribution tables and charts. Any patterns emerging from the analysis of the data are highlighted as well.

To measure the overall students' perception of the MELL eco-system, respondents were asked to rate the following statements:

Q1: Learning listening using **mobile devices** was an **effective** way of learning English outside the classroom.
Q16: Using **mobile devices** was an **effective** way to learn English.
Q17: I would like to learn English using **mobile devices** more **often**.

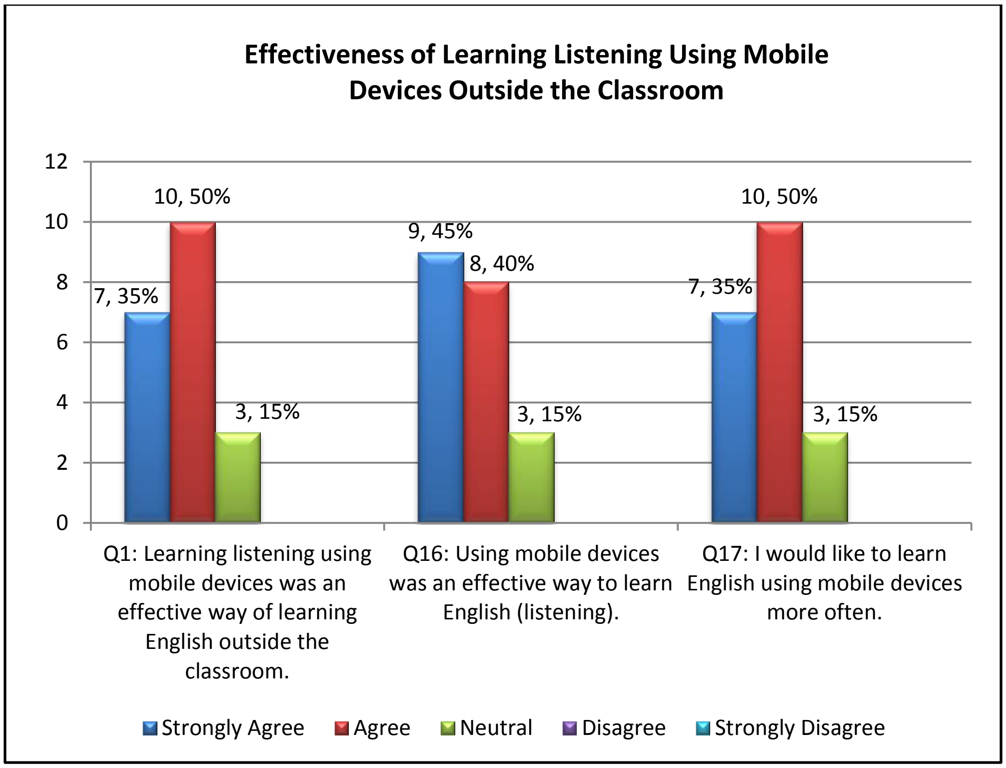

Figure 35. Final Survey Q1, 16, 17: Effectiveness of learning listening with mobile devices

The results presented in Figure 35 demonstrate that the majority of respondents (SA: 35%, A: 50%) agreed with the statement in Q1. While 15% of respondents were unsure about the effectiveness of this approach to learning, none disagreed that learning listening using mobile devices was an effective way of learning English outside the classroom. Likewise, the level of agreement for Q16 was at 85% (SA: 35%, A: 50%). In Q17, respondents reinforced the claim of MELL effectiveness by stating that they would like to engage in MELL practice more frequently (SA: 45%, A: 40%). Overall, as shown through these questions, students reported learning gains resulting from the use of the MELL system.

The following questions Q2, 3, 4, 6, and 7 dealt with expanding language learning outside the classroom into the real world. They inquired about students' experience while completing real-life communication tasks involving not only their peers but also strangers. Students, in addition, evaluated their level of enjoyment and confidence in communicating while completing the MELL tasks in the real-life context. The following questions are juxtaposed to provide more transparent insight into respondents' perceptions.

Q2: Learning **outside the classroom** helped me learn ESL listening skills.
Q3: Some tasks involved asking **strangers** on the street for information. **Talking to people on the street** is a good way to improve my English listening skills.
Q4: I enjoyed learning **outside** the classroom in **the real world** using mobile devices.
Q6: Learning outside the classroom in **the real world** helped me learn listening better.
Q7: Learning outside the classroom in **the real world** helped me gain confidence in communicating in English.

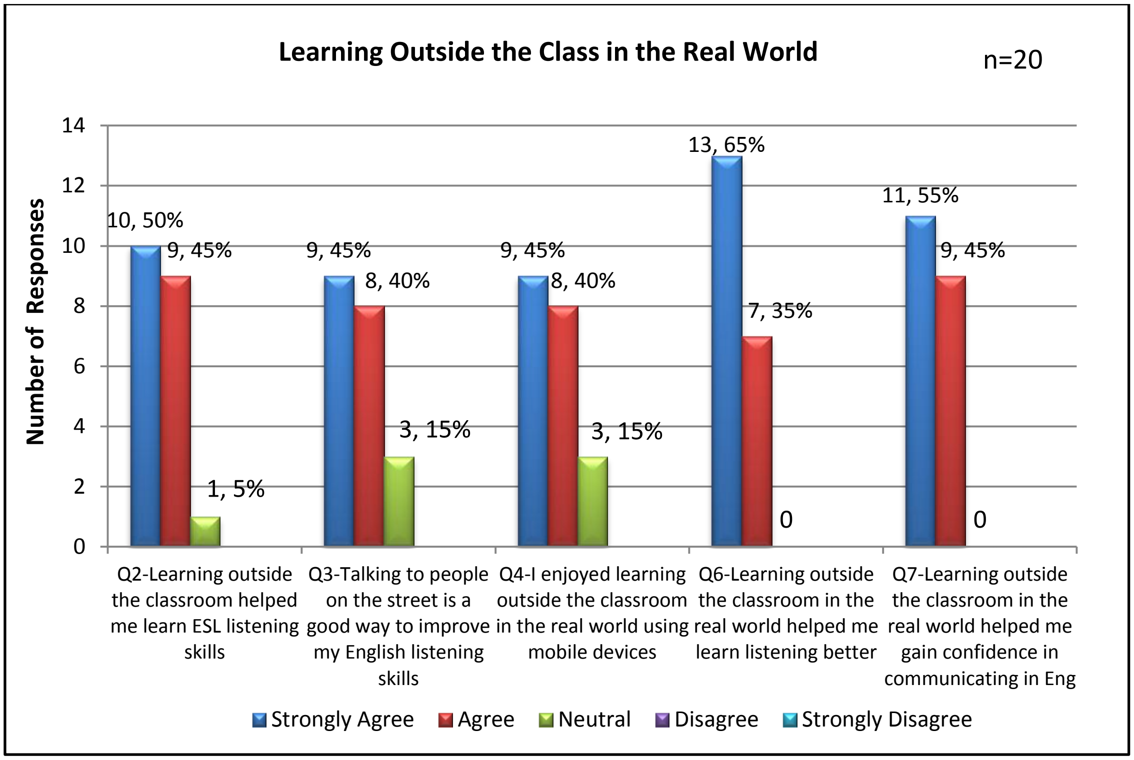

Figure 36. Final Survey Q2, 3, 4, 6, 7: Effectiveness of learning listening outside the classroom on the real-world context

As demonstrated by the above graph (Figure 36), at least 85% students either agreed or strongly agreed that learning outside the classroom using mobile devices and communicating with "real" language speakers helped them improve their listening skills (Q3, 4). There was a small percentage of respondents (Q2: 5%; Q3, 4: 15%; Q6, Q7: 0) who remained neutral. It is worth noting the increase in the level of agreement from Q2 to Q6 (SA: from 50% to 65%, A: from 45% to 35%, and N: from 5% to 0). Considering that the statement in Q6 was modified only by specifying the *real world* learning context, it could be deduced that the addition of the real world practice positively affected students' responses.

Likewise, Q7 data demonstrated a high level of belief that such practice enhances ESL students' confidence while communicating in English.

While students were of the same opinion regarding the learning environment, a debate arose during the focus groups around the issue of collaborative vis-à-vis individual MELL tasks. To gain more understanding of students' individual opinions, the following two questions were asked in the final questionnaire.

Q5: **Collaborating** on MELL tasks with other students helped me learn listening skills.

Q20: MELL tasks (such as the ones I completed) should be completed:

a. individually
b. in groups/pairs
c. some individually and some in groups/pairs.

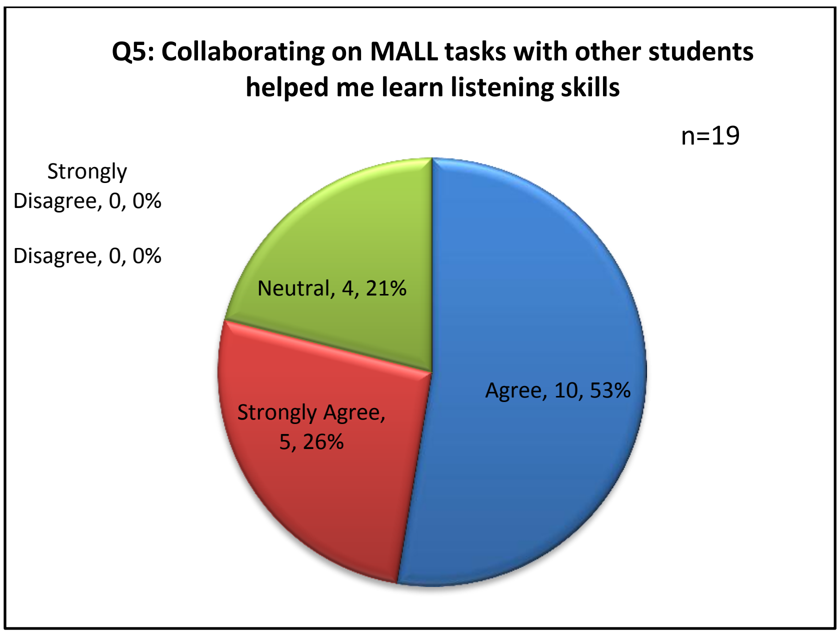

Figure 37. Final Survey Q5: Effectiveness of collaboration in learning listening

Respondents indicated in Q5 that they benefitted from collaborating on MELL tasks which required group or pair work. With 79% agreeing with the statement (SA: 26% and A: 53%) and four respondents being neutral (Figure 37), they seemed to welcome an opportunity to engage in the learning activities as a team. Nevertheless, they indicated their preference for a blend of individual and collaborative activities through their responses to the multiple choice question depicted in Figure 38 below.

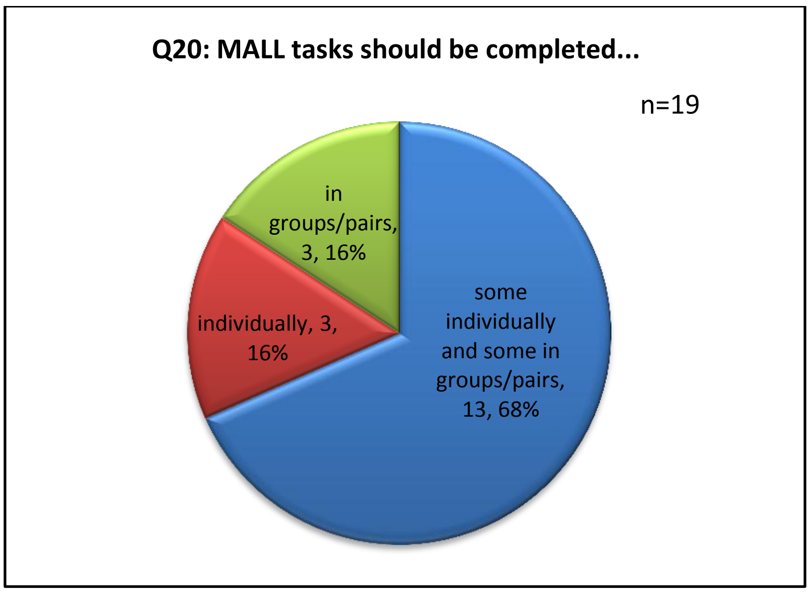

Figure 38. Final Survey Q20: Effectiveness of collaboration vs. pair and individual work

Consistent with respondents' feedback shared in focus groups and interviews as well as previous surveys, the majority of students concurred (68%) that a balanced combination of individual and collaborative tasks would produce the most appropriate MELL design. At the same time 16% of students would prefer to work on all their tasks either in pairs or in groups and the same number would prefer to work on their own (Figure 38).

Sharing audio and photos created by students was another feature of the MELL ecosystem that required a closer investigation. Hence, the next two questions inquired into students' perspective on learning via student-generated artefacts.

Q8: I learned by **sharing my audio recordings** with others.
Q14: Posting **photos** taken by students on the MELL website was beneficial for language learning.

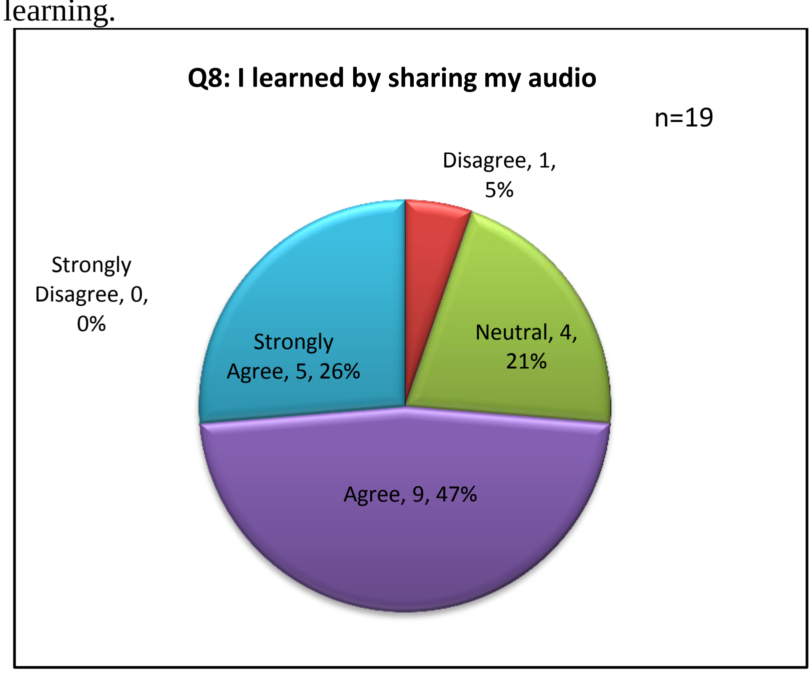

Figure 39. Final Survey Q8: Effectiveness of sharing audio recordings

Overall, students recognized the educational value of sharing their audio recordings. One respondent (5%) disagreed with the statement, whereas 73% concurred (SA: 26%, A: 47%) and four were undecided (21%) (Figure 39). The following question looked into the benefit of photo sharing for knowledge co-creation.

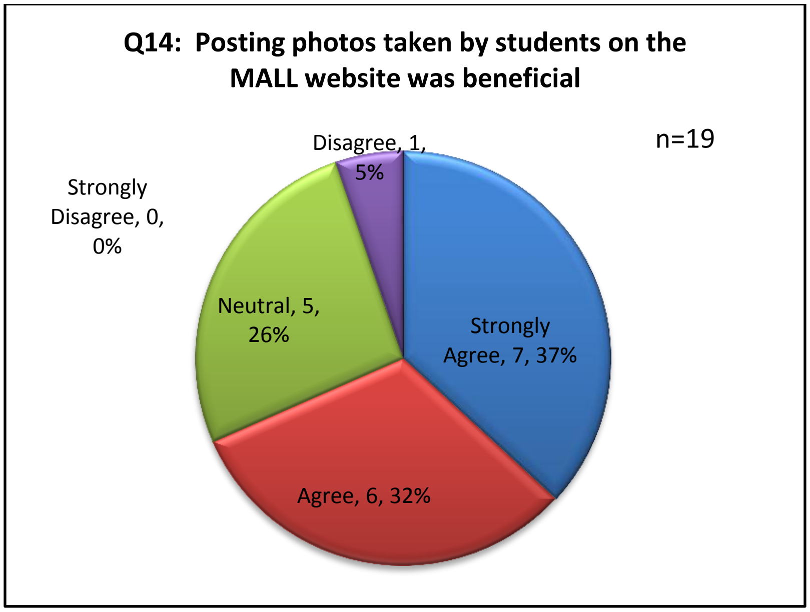

Figure 40. Final Survey Q14: Effectiveness of sharing photos

Similarly, the majority of students considered supporting their audio with photos advantageous for learning (SA: 37%, A: 32%). The same respondent, as in Q8, disagreed (D: 5%), which might indicate either a learning preference or lack of confidence in his/her technology skills. Five students (26%) were not sure whether sharing photos taken by them was beneficial to learning; however, it is worth noting that posting photos was not obligatory in any MELL tasks and approximately 40% of the students did not choose to experiment with that option (Figure 40).

In response to their earlier feedback regarding teamwork, students were encouraged to evaluate each other's audio recordings when working collaboratively. In the initial stages of the study, some hesitance had been observed amongst learners when instructed to evaluate their peers' work and produce an audio summary of their critique. In order to gain more insight into the perceived value of peer evaluation, respondents were asked to comment on this aspect of the MELL solution by the way of Q11 and Q13.

Q11: I learned by **evaluating** other students' recordings (using audio).
Q13: I learned from the **feedback/evaluation** posted by my **classmates** on the MELL website.

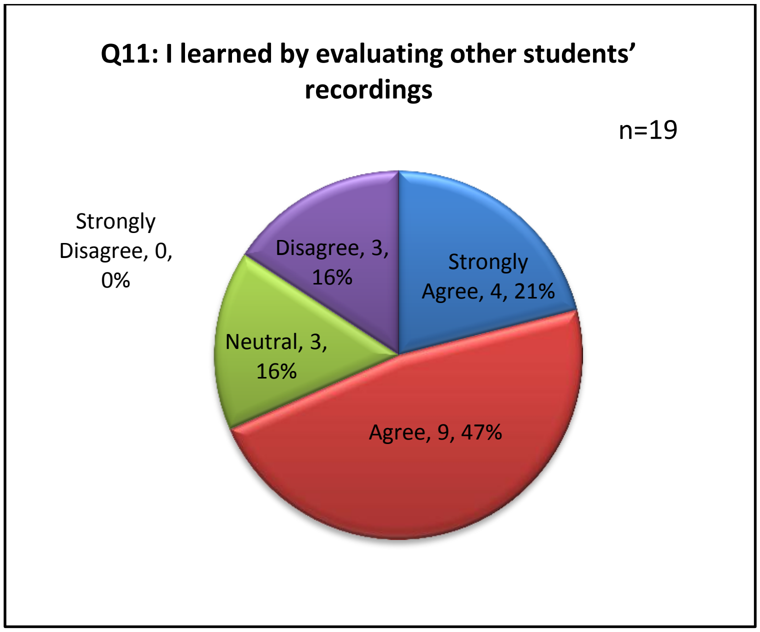

Figure 41. Final Survey Q11: Effectiveness of learning by peer evaluation – audio (1)

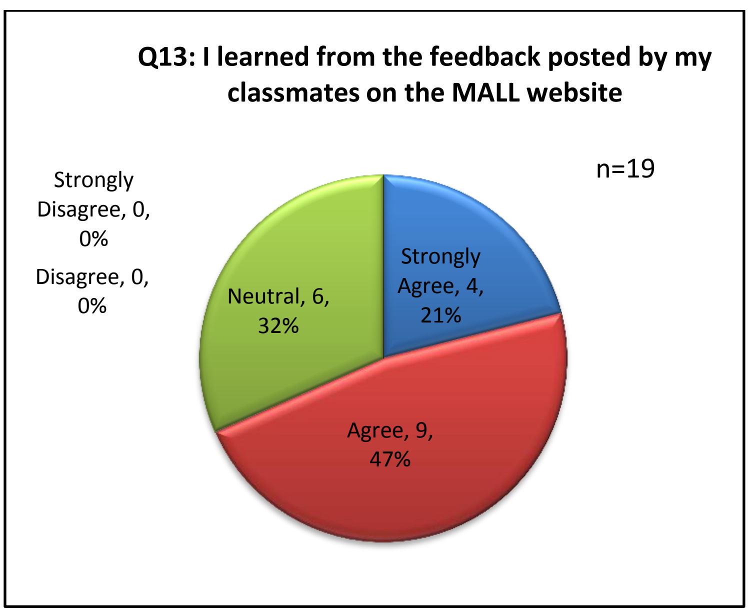

Figure 42. Final Survey Q13: Effectiveness of learning by peer evaluation – audio (2)

While most students agreed (Q13 – SA: 21%, A: 47%, N: 32%) that receiving feedback from their peers was of benefit to their learning outcomes (Figure 42), they were not equally positive about giving feedback (Q11): while the majority were in agreement (SA: 21%, A: 47%), three respondents did not see this as an effective method of learning listening (D: 17%) and three others stayed neutral (N: 17%) (Figure 41). During face-to-face discussions and previous individual task surveys, respondents expressed similar reservations regarding the value of evaluation coming from a non-expert. Likewise, they were cautious about using their peers' recordings as learning resources; therefore, a couple of survey questions addressed that point.

Q9: I learned from other students' recordings only if the **teacher's corrections and feedback** accompanied their recordings. Teacher's corrections and feedback are always **necessary**.
Q10: I learned from other students' recordings even **without teacher's corrections and feedback**. Teacher's corrections and feedback are **optional**.

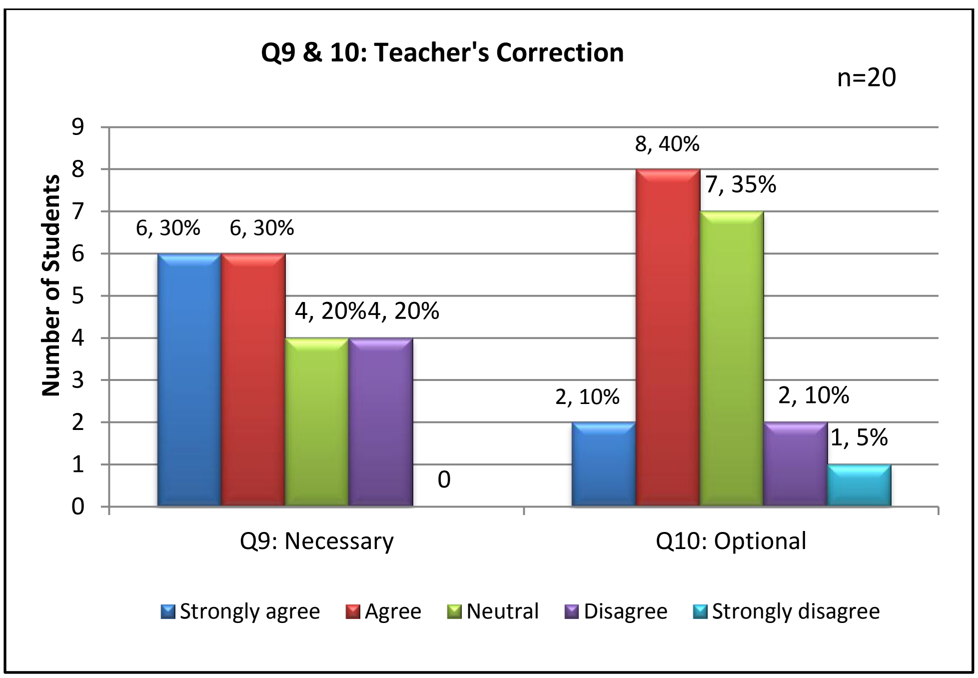

Figure 43. Final Survey Q9 and 10: Need for teacher evaluation

Sixty percent of students believed (Q9 – SA: 30%, A: 30%) that in order to benefit from other learners' recordings posted on the web, these artefacts had to be accompanied by the teacher's, specifically, the expert's corrections and comments. Four (20%) respondents disagreed and the same number were unsure (Figure 43). At the same time, only two respondents (Q10 – SA: 10%) strongly agreed with the claim that they could learn effectively from their peers recordings devoid of the teacher's feedback; eight (40%) agreed with the claim, seven (35%) were not sure, and three disagreed (SD: 5%, D: 10%).

To further understand what type of scaffolding had to be incorporated into the design of the MELL system, an additional three questions inquired about the need for teacher support when working on mobile tasks outside the classroom.

Q18: I needed my **teacher's help** when I was working on MELL tasks outside the classroom.
Q19: I was able to learn **without my teacher's help** when working on MELL tasks outside the classroom.
Q23: When I learned with mobile devices outside the classroom, I needed **help from my teacher**…

a. 80-100% of the time
b. 60-79% of the time
c. 40-59% of the time
d. 20-39% of the time
e. less than 20% of the time

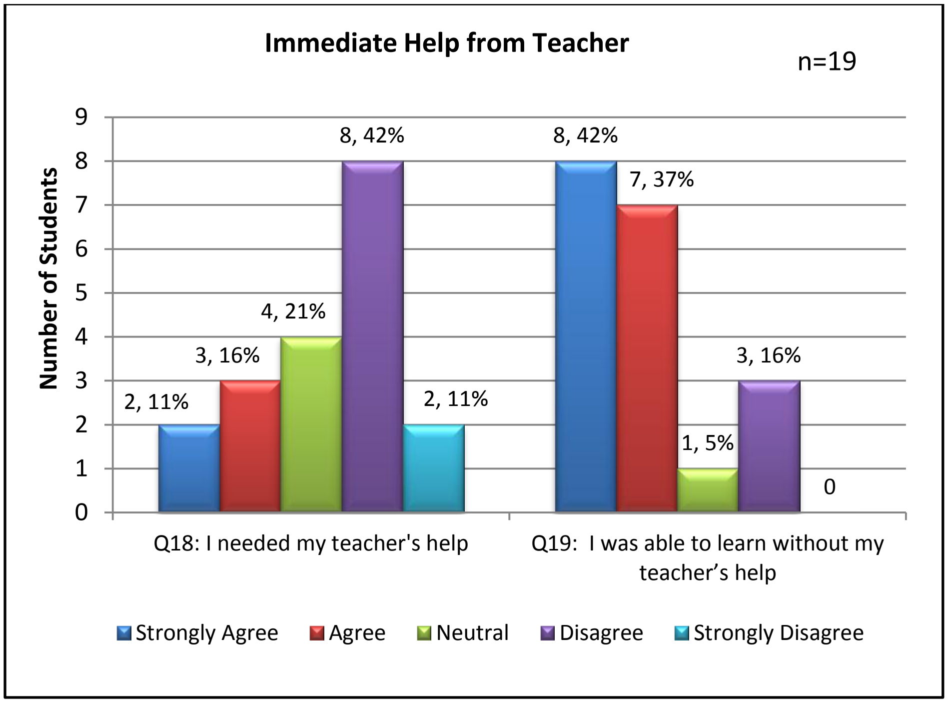

Figure 44. Final Survey Q18 and 19: Need for immediate teacher support

According to the survey Q18 responses, the majority (SD: 11%, D: 42%) disagreed with the claim that they need direct support of a teacher during their out-of-class MELL tasks. Only five (SA: 11%, A: 16%) students believed that they needed the teacher's just-in-time involvement while working on the tasks. Consistent with those responses, 79% observed in Q19 that they were capable of learning without the teacher's "on-the spot" help, whereas only three people (16%) disagreed. The distribution of agreement and disagreement in Q18 and Q19 indicates that learners were prepared to complete the mobile tasks on their own or with help of other students as well as the MELL built-in supports (Figure 44). As discussed later in this section, respondents commented in the focus groups that teacher support was crucial; however, it could occur through pre-task instruction coupled with delayed feedback after the task completion.

In terms of the facilitator help necessitated during the task at hand, Q23 sought to understand the extent to which learners required such assistance.

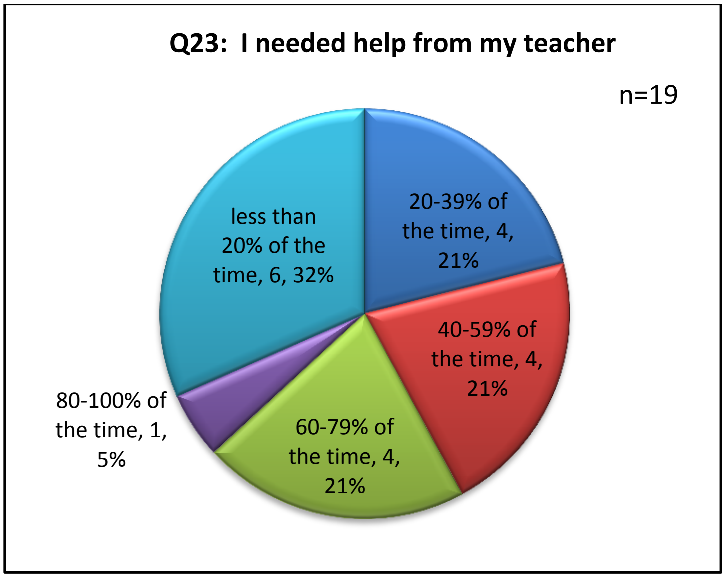

Figure 45. Final Survey Q23: Need for teacher support - frequency

One in three students reported that they required the teacher's assistance less than 20% of the task duration. The same number (21%) stated that they utilized the expert assistance 20–39%, 40–59%, or 60–79% of the time. Only one respondent (5%) needed help for the teacher in excess of 80% of the time (Figure 45).

When discussing scaffolding and help, respondents repeatedly suggested that apart from language supports, students required help with the mobile technology. It was observed, however, that as the study progressed, students' self-efficacy and comfort with the technology increased. Consequently, the responses to the following final survey question represent opinions of learners' who had already been exposed to m-learning through the MELL tasks thus were fairly familiar with the technology.

Q26: Did you need any help with the mobile technology, for example, recording your voice, downloading task files, sending your files, or any other steps necessary to complete the language tasks? If you did, where from did you get technical support? (*Select all that apply*)

a. I got help from my teacher.
b. I got help from other students.
c. I figured out how to use the necessary technology.
d. I found help on the Internet.
e. I didn't need any help at all.
f. Other (*Specify*).

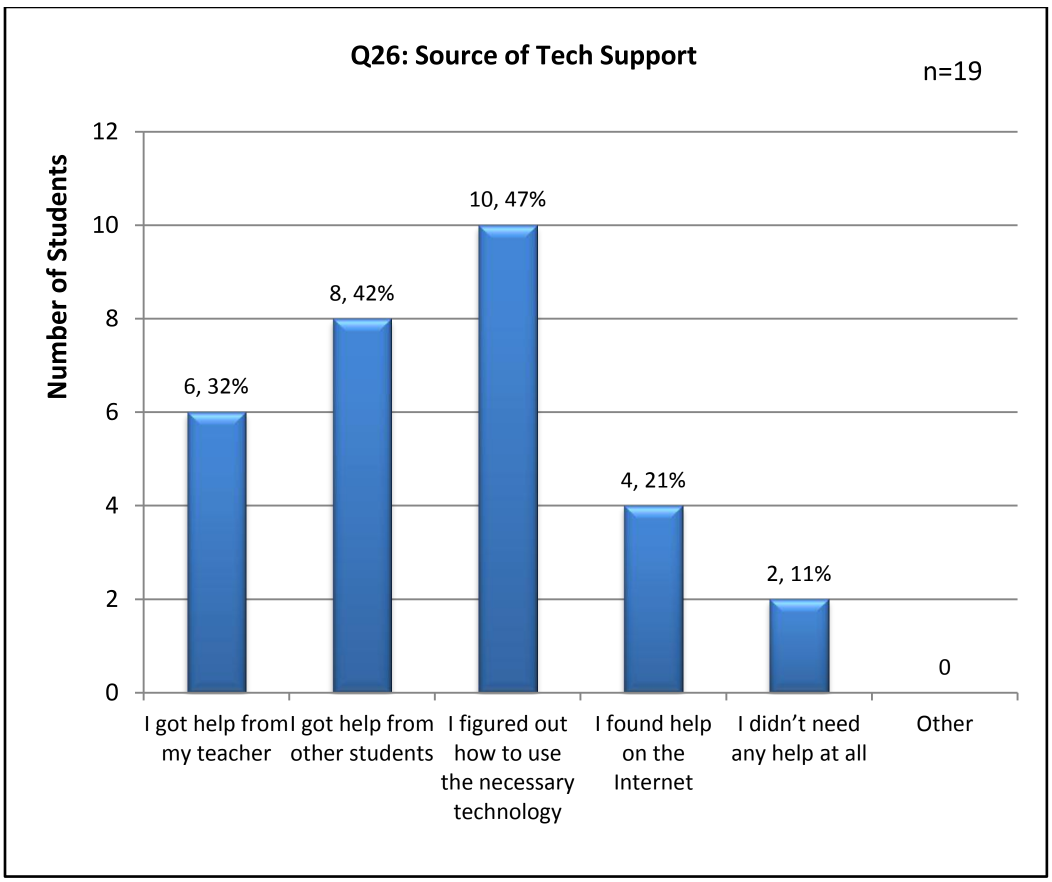

Figure 46. Final Survey Q26: Source of tech support

These Q26 results indicate that students tend to seek technical support from multiple sources. Nevertheless, the majority of respondents (47%) attempted to explore their mobile devices on their own before they turned for help either to their peers (42%) or to the teacher (32%). In addition, a small percentage of respondents (21%) searched the Internet for information on how to use their mobile devices (Figure 46).

It was also essential to gain more insight into how respondents felt about the ease of use of the mobile technology. One general question was posed with respect to the overall experience with mobile devices.

Q15: The **mobile technology** was **easy to use**.

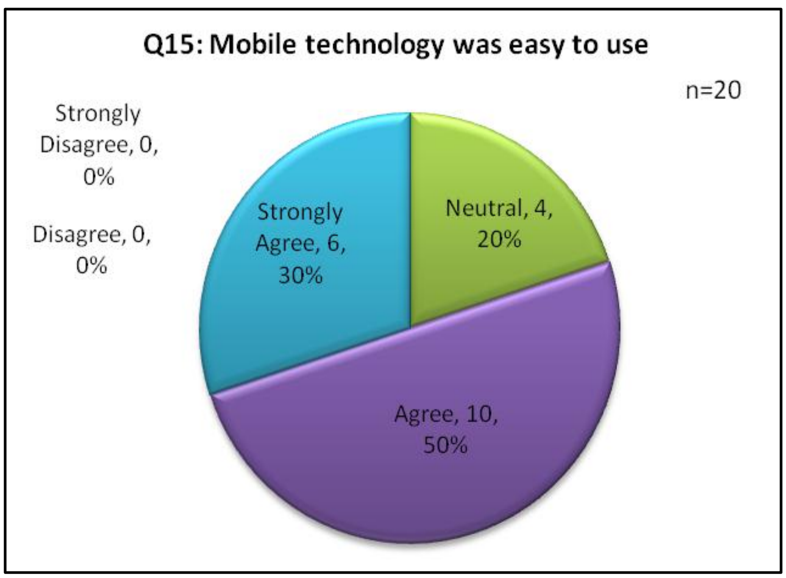

Figure 47. Final Survey Q15: Mobile technology ease of use

Consistent with the findings of the individual task surveys, 80% of respondents reported that the mobile technology was easy to work with (SA: 30%, A: 50%, N: 20%, SD & D: 0%) (Figure 47). This rather general question aimed to identify any usability or technology caveats that would have to be addressed through the refinements of the MELL solution. Respondents did not find the mobile technology problematic. It was the content and organization of the MELL system that respondents primarily focused on in their feedback, especially toward the end of the study as they were becoming more confident with the tools. Therefore, more questions were posed in terms of the key elements of the instructional content.

In response to students' frequent comments about the design of MELL podcasts and the need to incorporate well-formulated task directions and explanations, the final survey revisited that point through Q12.

Q12: Using **audio** directions and explanations helped me learn listening skills.

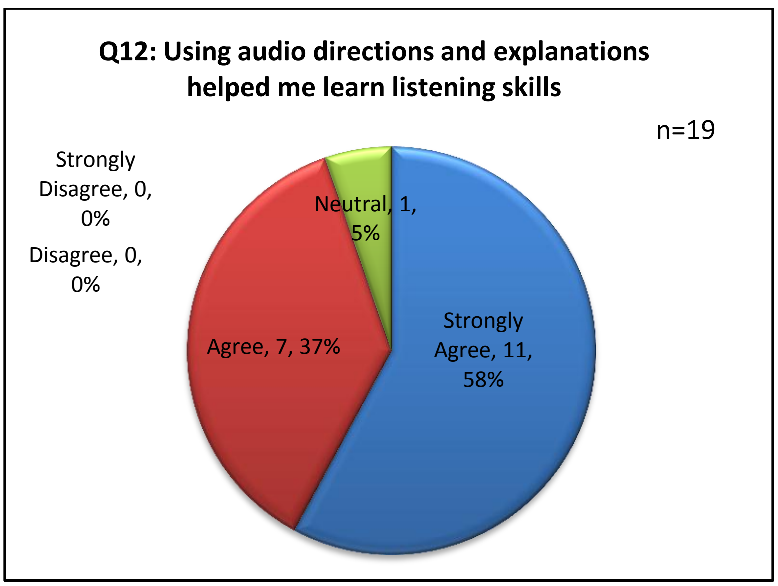

Figure 48. Final Survey Q12: Effectiveness of audio directions and explanation in learning listening

Once again, respondents confirmed the significance of well-designed task directions and explanations, and their impact on learning outcomes. Eighteen out of 19 students (SA: 58%, A: 37%) agreed with Q12, with one respondent remaining neutral (Figure 48).

To better understand learners' take on privacy issues and whether they form any barrier to sharing student-generated content, the following question was posed:

Q22: The class mobile website should be:

a. Private so nobody outside the class can see its content
b. Open to the class and to anybody invited via email
c. Public so everybody can see the content
d. Other (*Specify*)

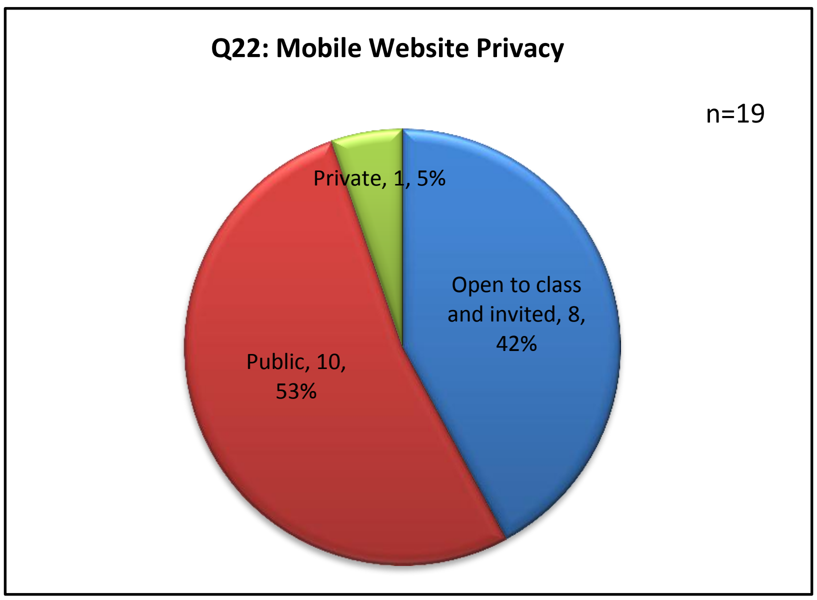

Figure 49. Final Survey Q22: Mobile website privacy

As illustrated in Figure 49, 53% of students believed that the class mobile website should be open to the public, 42 % would prefer it "Open only to the class and to anybody invited via email", and only 1 (5%) student opted for the private option. All in all, students are willing to provide access to their artefacts through a website and did not view their created content created as private: students are prepared to share through the network.

The final survey questions presented thus far examined several dimensions and specific features of the MELL design. To gain more holistic insight into the respondents' learning experience and preferences, two broader questions were posed. While Q24 required students to rank the key functions of the MELL solution, Q25 compared groups of MELL tasks for their perceived effectiveness.

Q24: Based on your mobile learning experience, rate the following MELL system functions on how important they are to your learning outcomes. *For each function, indicate its level of importance from 1 to 5, with 1 being "Not important" and 5 – "Very important".*

The 21 options listed for selection in Q24 represented the MELL system functions which, at the time the survey was created, had been most frequently identified in study as the most vital elements of the design. The results of respondents' feedback are presented in the table below (Table 37) with the system functions arranged in descending order according to their perceived importance.

Table 37.

Final Survey Q24—Mobile System Functions Ranked by Degree of Importance

MELL System Functions	**Importance to Learning Outcomes - *Response Frequency***					**Mean**
	1	**2**	**3**	**4**	**5**	
1. Examples of how to complete the listening task	0	0	1	8	10	4.47
%	0%	0%	5%	42%	53%	
2. Access to audio recordings modeling the pronunciation of new words	0	0	1	8	10	4.47
%	0%	0%	5%	42%	53%	
3. Quick access to help with language	0	0	2	6	11	4.47
%	0%	0%	11%	32%	58%	
4. Language task written instructions and task explanations	0	0	0	11	8	4.42
%	0%	0%	0%	58%	42%	
5. Links to English language dictionaries and vocabulary help	0	0	1	9	9	4.42

%	0%	0%	5%	47%	47%	
6. Pronunciation mini-lessons related to the learning tasks	0	0	2	7	10	4.42
%	0%	0%	11%	37%	53%	
7. Language tasks to be completed outside the classroom in the real world	0	0	1	10	8	4.37
%	0%	0%	5%	53%	42%	
8. Easy way to send recordings and photos created by students to the teacher	0	0	2	8	9	4.37
%	0%	0%	11%	42%	47%	
9. Grammar mini-lessons related to the learning tasks	0	0	1	11	7	4.32
%	0%	0%	5%	58%	37%	
10. Language task audio instructions and task explanations	0	0	1	11	7	4.32
%	0%	0%	5%	58%	37%	
11. Communication with your teacher (via text, email, voice)	0	1	1	11	6	4.16
%	0%	5%	5%	58%	32%	
12. Display of your work (recordings, photos, videos)	0	0	4	9	6	4.11
%	0%	0%	21%	47%	32%	
13. Help on how to use the technology	1	2	1	7	8	4.00
%	5%	11%	5%	37%	42%	
14. Ability to hear teacher's evaluation and comments on other students' work	0	1	3	10	5	4.00
%	0%	5%	16%	53%	26%	
15. Access to other students' recordings, photos, videos	0	0	4	11	4	4.00
%	0%	0%	21%	58%	21%	
16. Quick access to recordings and photos created by students	0	2	4	8	5	3.84
%	0%	11%	21%	42%	26%	
17. Communication with other students (via text, email, voice)	0	2	3	11	3	3.79
%	0%	11%	16%	58%	16%	
18. Ability to see the evaluation of other students' work (such as the mark or points earned for their creation)	0	3	2	11	3	3.74
%	0%	16%	11%	58%	16%	
19. Ability to evaluate each other	0	3	3	9	4	3.74
%	0%	16%	16%	47%	21%	
20. Written scripts for all audio files	0	3	4	7	5	3.74
%	0%	16%	21%	37%	26%	
21. Ability to leave comments under other students' work	0	3	5	10	1	3.47
%	0%	16%	26%	53%	5%	

Students isolated various types of linguistic supports, resources and task directions as the key components of an optimal system design. They also requested that learning take place in the real world and that it be scaffolded through facilitators` feedback and communication. Access to peers and their creations was also considered significant. The ability to evaluate and comment on classmates' work was ranked the lowest along the need for text-based scripts of audio podcasts. It is important to bear in mind that the items included in Q24 represented the refined list of essential functions and characteristics of the system, already distilled from the results of the previous two phases of the study.

Finally, the constituent tasks of the MELL system were compared for their perceived effectiveness. This shed light on the type of mobile learning activities students preferred to work with.

Q25: You completed various types of mobile tasks. Rate the following MELL tasks on how effective they are for learning listening. *For each task or pair of tasks, indicate its level of effectiveness from 1 to 5, with 1 being "Not effective" and 5 – "Very effective".*

Table 38.

Final Survey Q25—Mobile Tasks Ranked by Degree of Effectiveness

	Effectiveness of Mobile Tasks - *Response Frequency*					**Mean**
MELLES Tasks	**1**	**2**	**3**	**4**	**5**	
1. Listen On-the-Go (T7)	0	0	3	6	11	4.40
	0%	0%	15%	30%	55%	
2. Student Radio (T6)	0	1	2	9	8	4.20
	0%	5%	10%	45%	40%	
3. Audio Map & Scavenger Hunt (T3 & T4)	1	1	2	7	9	4.10
	5%	5%	10%	35%	45%	
4. Audio Dictionary & Idiom Bank (T1 & T2)	0	3	2	6	9	4.05
	0%	15%	10%	30%	45%	
5. Phlogging w/ iPadio & Reflections (T5 & T8)	1	1	3	8	7	3.95
	5%	5%	15%	40%	35%	

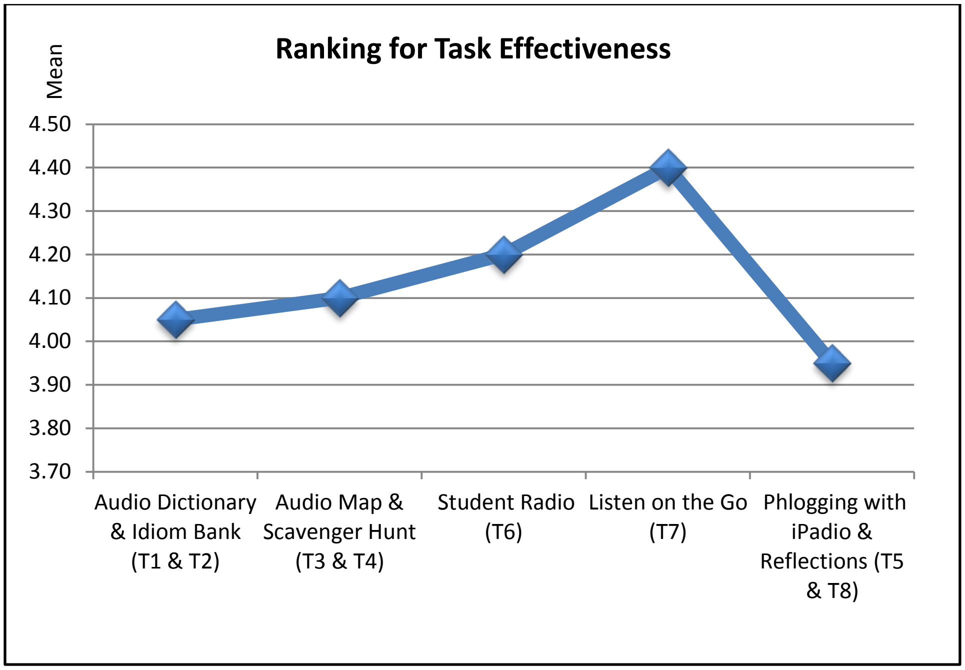

Figure 50. Final Survey Q25: Mobile tasks ranked by degree of effectiveness

Similar to earlier questionnaires findings, responses to Q25 identified T6 and T7 as slightly more effective for learning listening than the other mobile tasks (Table 38 and Figure 50). Once again T5 & 8 were the least popular, however by a small margin: the Chi-square test conducted to compare Q25 responses indicated no statistically significant difference between the task scores in terms of their learning effectiveness.

In correspondence to the task-specific surveys, the final questionnaire inquired into what devices students used to complete the mobile tasks. This time, however, respondents were required to select all devices they worked with rather than the most utilized tool.

Q21: What did you use to complete the tasks? *Choose all that apply*.

a. Cell phone

b. Computer (desktop/laptop)
c. MP3 player
d. Home phone
e. Other (*Specify*)

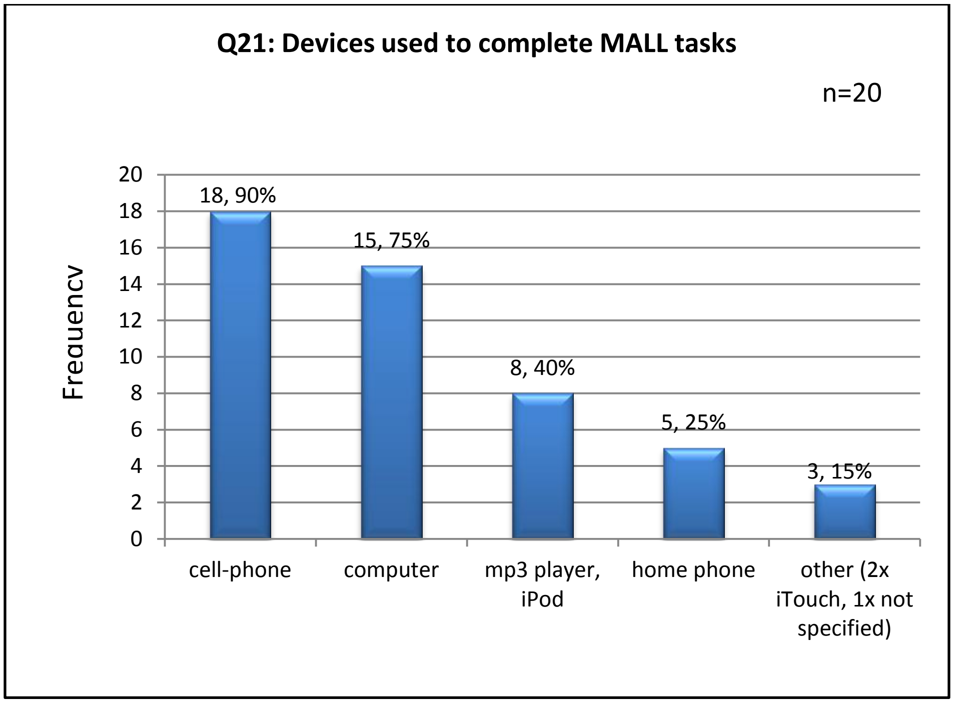

Figure 51. Final Survey Q21: Devices used to complete MELLES tasks

As demonstrated by Q21 responses and earlier surveys findings, students did not opt for one kind of technology (Figure 51[25]). Instead they selected between available technologies depending on the type of task, the user geographical location and other contextual factors. With cell phones being most prevalent (90%), three quarters of students also utilized their computers, 40% reached for their MP3 players, and a quarter of respondents reached for the stationary phone when at home. Using a selection of tools offered a choice of software and

[25]Most respondents selected more than one device, therefore the percentages do not total 100%.

hardware options more appropriate for individual students and the learning situations they found themselves in.

The findings shared in this chapter would not be complete without the discussion of qualitative findings collected through comments in surveys as well as face-to-face meetings. The following section is dedicated to the findings drawn from qualitative data.

Evaluation Phase Qualitative Findings

In conjunction with quantitative data, qualitative data was collected throughout the Evaluation phase to convey meaningful information as seen from the learners' and practitioners' perspectives. "Since meaning is negotiable, it can also evolve and change over time" (Dey, 2005, p. 38). Therefore, qualitative data was gathered over time from 109 respondents through successive surveys, interviews and focus groups as well as participant observation. Similarly to Phase 1 and 2, guided by research objectives, codes (NVivo: nodes) were assigned to the emerging themes in an iterative process of funnelling the data into relevant categories for analysis. Comparing and redefining categories from all consecutive data analysis activities engendered more rigorous conceptualization. As in the Informed Exploration and Enactment phases, data gathered from the participants were first dissected into separate codes which, after their refinements, resulted in 3 levels of subcodes (Level 1: grouping, Level 2: group work, Level 3: peer support and help) which were, in turn, arranged into bigger thematic groups (CONTENT – What), and then into the two super categories of Pedagogy and Technology.

The cumulative Evaluation: Local Impact data is summarized into Table 39 below. Verbatim participant quotes supporting context and interpretation of these data are included in the discussion of the evaluation feedback in Chapter 7.

Table 39.

Evaluation Qualitative Findings—Main Themes

Codes (NVivo Nodes)	Ref Freq Stdnts	Reltv Freq Stdnts (n=101)	Ref Freq Practn	Reltv Freq Practn (n=8)	**Ref Freq Total**	**Reltv Freq Total** (n=109)
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 artefacts	*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 & explanations	**28**	**28%**	**1**	**13%**	**29**	**27%**
Communication skills	**22**	**22%**	**0**	**0%**	**22**	**20%**
Support materials & resource	**23**	**23%**	**1**	**13%**	**24**	**22%**
Socio-cultural 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%**

Note. Ref Freq Stdnts = reference frequency for students; Reltv Freq Stdnts = relative reference frequency for students; Ref Freq Practn = reference frequency for practitioners; Reltv Freq Practn = relative reference frequency for practitioners; Ref Freq Total = reference frequency for both students and practitioners; Reltv Freq Total = relative reference frequency for both students and practitioners.

Note. * Percentages colour-coded blue are the average of their sub-categories.

In the Evaluation phase, both students and practitioners concentrated in their comments primarily on the pedagogical aspects of the design. One of the cited reasons for less focus on technology was the users becoming more familiar with the mobile software and hardware, thus the technology being more transparent and attracting less attention. Another reason was the fact that Phase 1 and Phase 2 feedback had already been built into the tested MELL technology; hence, in their evaluation, students took certain features for granted accepting them as inherent features of the system (Phase 2: Upload and publish students' artefacts).

Bearing in mind the main research question concerning the components of the MELL system which are vital to the effectiveness of this educational intervention, respondents' feedback was once again organized into three major themes for Pedagogy: (1) Pedagogic Procedure (How: strategies and tactics used to optimize learning), (2) Content (What: themes, functions, skills, and resources selected to support learning), and (3) Context (When and Where: time, location and environment which enable an effective learning experience), and one additional category, namely (4) Actors (Who: people essential to the success of the learning experience).

Compared to the findings from the previous phases of the study, parallel themes emerged from the qualitative data; however, the focus shifted away from *Individual practice* (Relative Frequency: 28%) and related *Self-paced paced non-reciprocal audio* (they didn't form own code category in Phase 3), *Rehearsed utterances practice* (no code in Phase 3) or *Support materials & resource (text-based)* (22%). Instead, themes pertaining to collaborative real-world language learning permeated participant feedback. These comprised *Real-life practice* (58%), *Authentic speech* (53%), *Context affordances* (26%), as well as *Group work*

(122%)*: collaboration and peer support* (70%) and *Feedback* (47%). The notion of *Learning community* (37%) surfaced more frequently relative to other aspects of MELLES design, as did *Motivation* (63%). While only one entirely new theme emerged, *Pre and post activities* (31%), several additional subthemes (Level 2 subcodes) appeared, indicating more emphasis on those dimensions of MELL learning of listening skills. These included: (1) *Motivation* (63%): *motivating factors* (28%), (2) *Feedback* (47%): *general need for feedback* (17%), (3) *Integrated skills* (15%): *need for integrated skills* (6%) and *speaking supports listening* (8%), (4) *Authentic speech* (53%): *need for authentic speech* (47%) and *accents* (6%), and (5) *Outside classroom practice* (42%). In addition, the frequency of the following thematic codes remained consistently high with the preceding phase data: (1) *Motivation* (63%): *fun-enjoyment* (36%), (2) *Group work* (122%)*: interaction and communication* (34%), (3) *Recording own voice* (32%), and (4) *Vocabulary* (31%). All in all, the Evaluation data offered a practical perspective on the essential elements of the MELL system, sharpened by the actual *in-situ* application of the MELLES prototype. These findings highlighted the importance of engaging collaborative communicative tasks embedded in the real-life context and mediated by mobile technologies.

Chapter 6 Summary

Both qualitative and quantitative findings gathered in the Evaluation: Local Impact phase were summarized in this chapter. These derive from five surveys offered to five ESP classes evaluating eight MELLES tasks and were presented by way of descriptive statistics. The final survey gathering student feedback on the entire MELLES system was also presented. The Qualitative Findings section of this chapter focused on the results of all qualitative feedback collected via surveys, focus groups, interviews, and observations captured in the researcher's reflections. In addition to the student insights, data from eight practitioners and two external experts were aggregated. Consistent with the process in previous phases, the gist of qualitative feedback was distilled into key themes under two super categories: Pedagogy and Technology. More elaborated discussion of the findings follows in Chapter 7.

Chapter 7. Evaluation of Local Impact (Phase 3): Discussion and Refinement of Design Principles

This chapter draws together the qualitative and quantitative results from the Evaluation phase. Considering the evolution of the MELL system and of the participant perspective, the following discussion of the final phase summarizes well the general feedback of learners and experts studying ESP in a college setting. To facilitate an in-depth understanding of the participant input and future replication of the analysis, direct quotes from participant comments are used, where possible, to present the results. The integrity of the original material is maintained through the use of authentic participant feedback - verbatim quotes which are the essential raw data for qualitative analysis (Patton, 2002). As this material is original to ESL students, it is important to note that it contains numerous errors. These quotes were scrupulously selected from the data corpus to reflect the key points of the findings. The data was then interpreted and the gist of the results is presented below. This account of participant opinions incorporates both qualitative and quantitative findings.

MELLES Design Principle 1

As a result of hands-on tests of the MELL system and its constituent tasks, the list of elements recognized as significant to the design was nearly equivalent to the list from the previous phases. However, new themes came to the forefront. A lot of deliberation concentrated on the issue of Grouping. With 163% relative frequency, individual respondents remarked on more than one aspect of grouping, that is, the organization of mobile learning activities into individual, pair or group work, and the mechanisms required to support collaboration. The quintessence of that feedback was well expressed by a student: “I prefer to work in a group; you can ask the missing part you couldn’t hear yourself, we can discuss what we see and share opinions; we can be socializing and have more fun in a group…when we worked together they did their parts, all of them listened and then discussed and agreed on one answer – working in a team helps to learn English.”

Seventy percent of respondents emphasized the significance of collaboration and peer support. Students felt that when “completing the task as a group, … people learn to talk, share ideas and enjoy,” and that when “[learners] can share their experience and talk to each other, then they can put good information from all in the task” and, in addition, when experiencing problems either with the language or technology they “can always ask their classmates who know.” “Working in a group is helpful too because [students] can exchange knowledge, help each other and finish the task quickly.” Students further elaborated: “I and classmates could get a lot of information about Toronto together and we could exchange our opinion which what we knew about Toronto”; “when you work with group it helps; sometimes they can say a word and if you don’t know the meaning, someone in your group knows better to explain to you”; “if I did the task by myself, it would be really hard; I could enjoy the time because I tried to complete the task with my classmates.” Without this type of peer support, language learners often are unable to overcome affective barriers and attempt authentic communication practice: “This task focused in getting [to a] destination; that's why if I had to do this task alone, it would make [me] feel shy, and I would give it up."

The value of group work was further accentuated by comments regarding interaction and the communication afforded by collaborating with peers. Thirty-four percent of respondents indentified opportunities for interaction and communication as a vital aspect of the MELL design. Students observed that in the MELL context, learning should involve communicative speech situations in which learners have to co-construe meanings with diverse interlocutors: "I prefer[ed] to learn with a group because I had to communicate, especially with other language groups, listen to different accents, guess what they mean, or ask them to repeat many times; …the phone helped me with directions but I had to understand the other people to finish the exercise." In the dynamic situation students were placed during the group activities, they often had to engage in meaning-making and negotiation: "When my partner and I had different thoughts and we had to reach an agreement to go for our destination, we had to talk in English or not finish the task; so it was good to listen together again to agree." Consequently, when communicating in English in the real-world situations, "group interaction is important because it combines more than one brain"; "it can [also] help [learners] improve [their] skills of team work and discussion skills," as well as help "practice interaction and speech with different accents." "People need to practice with others to improve their English." When using language in a social situation, cognitive processes are supported by social processes (van Lier, 2000) and by process of communication.

On the other hand, many respondents (28%) recognized individual practice activities as indispensable. Consistent with the findings of preceding stages, they commented on the importance of focused practice offering an environment for individual cognitive processes and more flexibility in terms of geographical and time restrictions, followed by collaborative learning. One student thus captured this thought: “If I go somewhere I prefer to learn with people; but for focused work is better by myself, with my own space; I love library where there is privacy and quiet to think. Also, when I listened to the ESL podcast it was better by myself because I could listen when I had time.” Another student added that “although is fun to work in group, is almost impossible to fit everybody’s time; if you work with other people, it’s not always effective [because] it’s not easy to design the date to go out; when working individually the time was easy to control.” Respondents also commented that “For audio purposes is easier to listen by myself rather than listen with a bunch of people,” and “Listening skills are different for each person, so before learning with somebody else I prefer study by myself and then finish with my classmates.” In response to a question on the type of mobile tasks that lend themselves to individual work, respondents isolated listening comprehension as the most appropriate learning activity: “Listening to an audio recording and following it to finish tasks by myself can give me lots of experience that I experience through my own ways. Listening to try to understand is also best done alone because you can concentrate.” Some students also observed that “when working individually you can take full responsibility for all the work. Group activities tend to be done by only a few of the group members”;

hence, they found individual MELL activities more rewarding. Other remarks leaning toward the individual learning were rooted in learners' low self-efficacy or lack of self-confidence: "The tasks should be individual because I don't want others to hear what I am saying, at least not at that time. I am not fluent in English so I would rather do it all by myself. I also have some problems with my mobile phone so I don't want to slow people down."

Several respondents (13%) believed that pair work was a solution to some of the problems mentioned above. They deemed pair mobile learning tasks as highly effective for the following reasons expressed in students' own words:

- Working with partner needs higher responsibility than working in the group so you learn more listening;
- Sometimes partner can make some help with language and technology;
- I can gain more ideas from my partner and won't gain too many ideas, which will make me confuse, from a group;
- The partner is very important for everyone; if you have some questions, and you want to get an answer from your teacher normally you will ask for a long time; but if you ask your partner, you will get the answer quickly – you can even call him on the phone now or go together to finish the Toronto map tasks;
- With a partner: because still you can practice your listening/speaking with someone (live), and you can call each other or even meet;

- It's hard to control if you are in a group while with a partner its easier and ease up confusion;
- It is either to learn mobile learning by listening myself or with one more person who I know, and you can go to our website to get vocabulary.

Overall, the majority of respondents agreed that a balanced combination of individual, pair and group activities are what the MELL system should incorporate to offer the advantages and supports of the various settings of learning, and to cater to various needs of the ESP students. The grouping arrangement is contingent on the goal and characteristics of the tasks: “If working individually or in group depends on the task. For example, for Scavenger hunt it’s better with someone, it’s easier, more fun, more support, I’m also not so shy when I’m with someone; but for phlogging by myself was much better- it was easier to rerecord and listen to other people on the website.” The quantitative data indicated that although students preferred to combine individual, pair and group activities, congruent with the design of the task itself, they agreed that collaborative tasks were vital to learning listening. Collaborative activities served students as a *meeting point*, a *forum* and a *milestone.* Students met as a cohort or a group to socialize and to get their questions answered. They also scheduled their learning activities and efforts around the times of group meetings which worked as an extrinsic motivational factor. A recommended design principle resulting from these observations is presented in Table 40.

All guidelines encapsulated in the next eight design principles tables refer to the essential characteristics of MELLES (substantive emphasis) and the strategies needed to realize those features (procedural emphasis). The rationale for the inclusion of the substantive and procedural recommendations is also included in the tables (Tables 40-47).

Table 40.

Evaluation: Design Principle 1

Essential Characteristic (*Substantive Emphasis*)	**Strategy (*Procedural Emphasis*)**	**Rationale *(in order to …)***
1 Balanced combination of individual and collaborative (group work) tasks	• Ensure communication with others in-person and via mobile-enabled channels • Build in interaction with others in person and via mobile-enabled channels • Include discourse with diverse interlocutors • Incorporate language problems requiring negotiation of solutions • Inject fun and challenge • Ensure dynamic meaning-making and negotiation • Maintain regularity of group/class activities • Build individual tasks to feed into the group tasks	• Mediate communicative practice and communication (language usage) • Allow for cognitive and collaborative knowledge creation • Enhance individual and group motivation • Offer peer scaffolding and support in problematic situation • Provide flexibility—time and place independent learning • Accommodate different pace of learning and levels of language proficiency • Support the learning network in and out of class • Support cognitive processes with social process • Glue the MELLES system together

MELLES Design Principle 2

It was observed by both students and experts that a MELL task in which learners actively interacted and searched for language resources engendered more autonomous and more creative learning. One student observed that “Two people makes things creative.” A rather novel element of the MELL solution, namely student-generated ESP content, built on the principle of meaningful learning through construction, creation, and sharing of the artefacts. One of the respondents provided an example of what she believed was an effective way of learning pronunciation using mobile technologies: “Students practice pronunciation by recording videos of them pronouncing words, like karaoke, then they correct each other, both the class and teacher; … you can see the lips moving, and you can go back to the video to see what is correct and what is not correct. Also you remember better after you recorded it.” Other students’ comments elaborated on why incorporating learners’ recordings was beneficial for the creators, for instance, “You can listen to you, and you will see how your voice sound, your accent and sometimes know why people had some problems trying to understand you; and when other people listen they tell you what is wrong,” and for the others, for instance, “By listening to other students’ recordings you learn something; even if they are not the best quality the thought is there, so you learn.” All in all, respondents identified dynamic sharing and evaluation of learner-generated artefacts as helpful in terms of resource building, cooperative learning and motivating language practice.

In their quantitative responses participants agreed that creating their own artefacts, in particular, audio recordings, was conducive to learning. They perceived value in receiving feedback from their peers, but were not equally willing to record evaluations for their classmates. Students’ reservations stemmed from their belief that there was little value in evaluation coming from a non-expert. One technique for addressing that problem would be a scoring system where aggregated and averaged peer ratings are combined with the expert rating. The expert score, though, has a higher weight in the final score than the cumulative peer results. In addition, recorded expert evaluation would be posted on the MELLES website next to a peer evaluation recording. In short, ESP teacher feedback is vital for students to benefit from creating and evaluating learner-generated audio and other supplementary artefacts. The nature of the audio podcast which learners are instructed to create is another significant factor of the appropriate MELLES content. According to the participant feedback, students' audio podcasts should target a clear communicative outcome (for instance, answering a list of accounting questions by interviewing an accountant) and aim to capture samples of authentic speech, preferably from an English speaker at a considerably higher language proficiency than the learner. The recommendations pertaining to the inclusion of learner-generated artefacts are summarized in Table 41.

Table 41.

Evaluation: Design Principle 2

Essential Characteristic (*Substantive Emphasis*)	**Strategy (*Procedural Emphasis*)**	**Rationale *(in order to …)***
2 Learner-generated linguistic artefacts (audio, video, photos, images)	• Include audio recordings (video, images, photos) created by students in response to communicative tasks • Share and showcase learner-generated linguistic artefacts • Provide tools for recording, editing, upload and viewing/listening on-the- go (or demonstrate the usage of device built-in tools) • Provide clear directions on creating artefacts • Build in a rating system for artefact evaluation • Accompany website peer evaluation by expert feedback • Encourage creativity	• Encourage autonomous and creative learning • Promote meaningful learning through creation, construction, and sharing of artefacts • Enhance individual and group motivation (1) • Support cognitive processes through hands-on construction of artefacts • Blend creativity and competition in learner-generated artefacts exchange • Encourage abstract and creative thinking leading to engagement and motivation • Promote learner ownership and agency

MELLES Design Principle 3

The element of motivational support (relative frequency: 63%), which was the most discussed issue in the Enactment qualitative feedback, gained a lot of attention among the Evaluation participants as well. In their debate pertaining to group versus individual activities, students frequently cited motivation as the key benefit of group effort: "when you're part of a group you are motivated; when others do it, it forces you but if they don't then you can be unmotivated; if we work in class or together outside, will have some motivation to do it. Sometimes if I'm at home I will be doing something else that I consider more entertaining"; "By meeting other students it's fun, now I feel more social, in class we don't have contact with too many people; we just study and don't socialize, now we talk more even on the phone."

Twenty-eight percent (28%) of respondents maintained that some type of motivating factors had to be incorporated into a successful MELL design. Even more respondents (36%) isolated the element of fun and enjoyment as the one motivating learners the most: "It has to be fun for us to engage"; "It has to be like a mobile game - it's something new, better than a textbook; now its best time to use novel technologies, textbooks are not interactive, mobile games become like a teacher, they give feedback, answers, and entertainment; books and sitting in the class don't give you fun," so "learning listening with phones has to design fun exercises."

Other students supported that view by referring to their experience during the MELL tasks. This was their account of how the Scavenger Hunt and Toronto

Map activities stimulated their practice of listening and speaking: “We visited many places, it was fun and entertaining; better than sitting in class”; “we [were] enjoying and learning at the same time not like in the class you were there every day; we were learning more because we were enjoying”; “This is a successful way for learning listening because there are not so many people who like to stay long in one place when they’re learning something. Otherwise, that becomes boring and not interesting … you stop learning when it is not fun because you turn off your thinking.” Indeed, respondents were seeking opportunities to entertain themselves but also to practice English: “We were laughing during our recording the whole time and we wanted to have more practice like this so we can learn and be happy”; “It made me want to study because it was exciting, … also I needed to understand what the speaker said. Listening skill was very important to solve the questions. Whenever I had some clues, I was exciting and wanted more clues”; “when we filled in blanks, we felt happy as children and wanted to listen more.”

Apart from the element of fun, students were also encouraged by other strategies built into the MELL design. They pointed out the point system as an inspiring aspect of the task: “When we were solving these questions we had to focus on listening for getting bonus marks, so we listened harder.” Other respondents concurred: “You need some incentive, either prize or a bonus mark” or “maybe if give some reward, it will help some people to do the task.” Additional motivating factors mentioned by respondents included “deadlines with flexibility so you push students to complete the tasks but don’t discourage them by restricting them,” and game-like challenges like “the riddle in Scavenger Hunt that made me talk to strangers." A recommendation derives from this part of discussion pertaining to motivational factors—it advocates a usage of game-like real-life communicative tasks (Table 42).

Table 42.

Evaluation: Design Principle 3

Essential Characteristic (***Substantive Emphasis***)	**Strategy** (***Procedural Emphasis***)	**Rationale** ***(in order to …)***
3 Game-like real-life communicative tasks	• Include element of educational games (challenges, awards, bonus system, group or individual competition, engaging visual interface, progress record keeping) • Inject fun, enjoyment and challenge (1) • 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 (1) • Include contextualized listening challenges aimed at spontaneous communication	• Enhance individual and group motivation (1, 2) • 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 artefacts 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

MELLES Design Principle 4

The following student comment on the facilitator's role as a motivator reflects another focal point of many respondents' feedback. "I need the teacher to push me because we are busy, to motivate me and encourage me"; "we need something or someone to push us to do things, professor to motivate us – even if it is through a text on the phone or some alert message." The next two statements summarized best what the role of an expert would be in m-learning activities: "Teacher has to be available to answer questions and to give us feedback" and "it's very important to have a prof to 1. coordinate you, 2. to help with technology, 3. to help when we are stuck, 4. to give directions when we're lost in the task, 5. to show where to find help and 6. to give marks and comments."

Further observations from respondents addressed the question of how to incorporate that scaffolding into the MELL design. "For mobile tasks we need to have a teacher available to ask questions, better in person but maybe via text or phone; but mainly we need her before to prepare and explain and motivate, and after – to evaluate and give feedback; during we may need her to ask something – just in case, then it is in person." "The role the prof was to prepare them and make sure they feel comfortable; that they were prepared with technology, and to feel they were in a safe environment, [so] you need the prof more in person in class and then on the website and email." Consistent with the students' observations, one of the facilitators admitted that she did not spend an adequate amount of time preparing her students for their Scavenger Hunt beforehand, which resulted in that particular group not performing equally well as other groups during the task and the post-task debrief: "I should have led them to know what to listen for, discussed the questions before hand [*sic*] and pointed to some pre-reading links on the website and mainly the task vocabulary." Apart from mentioning the importance of in-class preparation and directing learners to selected online and phone-based resources, the respondents highlighted the need for pronunciation support (for instance, by exchanging recorded speech samples and audio feedback) and mini-lessons on grammar points which would include feedback on both fluency and accuracy. The majority of students were expecting the teacher support to be offered through multiple channels, including face-to-face pre- and post-activity, language and technology resources built into the MELL system, and personalized feedback exchanged via email. Linked to this is the demand for pre- and post-activities to be incorporated into the MELL system. Approximately 31% of respondents would not consider the MELL solution to be complete without such activities, including vocabulary- and grammar-related instruction and practice, debriefing of questions and answers, and discussion of the mobile tasks themselves. The modes recommended for these activities comprised face-to-face communication, online resources, telephone and email contact.

Students also stressed the importance of communication with their facilitators. One of the learners expressed it rather plainly: "I need personal feedback via email, teacher to give us hints, many times I didn't know about teacher's teaching – I wanted teacher to connect with me in email." While both just-in-time and delayed scaffolding were mentioned as *sine qua non* elements of the effective MELL system, the respondents admitted that the facilitators "did not have to be there all the time"; "I prefer the teacher is close to me once a week; not everything can be virtual, I need the teacher to answer some questions for me personally [yet] if the mobi website has materials what I need…like new words, the teacher can only show me where; "I can also finish my task and attach a file with my homework, and she can mark it and say what is wrong; later I can ask questions." Accordingly, appropriate language and technology resources would serve as effective scaffolding if facilitators pointed them out and discussed them with learners: "In the mobile learning, teacher should share resources, give access to resources for [students] to visit information on their own" but "[students need] help from the teacher because teachers know a lot of good websites where to practice your English," and, as one of the practitioners noted, "during out-of-class language tasks professors can facilitate comprehension by pointing to relevant objects and drawing students' attention to helpful details around them."

Several respondents contradicted the concept of limited teacher's involvement and shifting some of the scaffolding to the MELL application. They maintained that: "frequently language questions appear in the process, teachers should be there to help in the process, some of the help and feedback can be delayed but there is a major benefit to the prof being there in person when students are working on their mobile activities."

Apart from the above-mentioned scaffolding features, respondents would like to also receive learning support from facilitators or the software itself in the form of schedules, timelines, alerts, reminders which assist them in organizing their learning activities. Although, the in-person presence of the expert might be to a degree replaced by the appropriate design of MELLES, his/her teaching presence is crucial for the system to function and produce any learning. The role of the ESP expert is reflected in Design Principle 4 (Table 43).

Table 43.

Evaluation: Design Principle 4

Essential Characteristic (***Substantive Emphasis***)	**Strategy** (***Procedural Emphasis***)	**Rationale** ***(in order to …)***
4 Expert facilitation: scaffolding, feedback, and coordination	• Provide/point to clear instructions and directions for tasks • Offer in-person (immediate) and recorded (delayed) feedback and evaluation • Ensure communication with others in-person and via mobile-enabled channels (1) • Point to web-based and mobile-based resources • 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) • Offer post-task expert (delayed) feedback • Accompany website peer evaluation by expert feedback (2) • Moderate the MELLES website (for instance, step in when the instability is apparent) • Ensure constant inflow of information and exchange of ideas • Facilitate the artefact construction • Develop new or modify existing mobile tasks and activities • Maintain the steady flow of information and interaction • Offer learning activities coordination through schedules, timelines, alerts, reminders • Provide technology support and point to tech resources incorporated in MELLES (mainly in the initial stages)	• Mediate communicative practice, communication (language usage), and learning • Enhance individual and group motivation (1, 2, 3) • Offer expert scaffolding and support • Support cognitive processes through teaching presence • Promote learner ownership and agency (2) • Support the learning network in and out of class (1) • Provide structure and guidance to facilitate the learning process • Ensure the attainment of adequate standards • Provide reliable linguistic and pedagogical expertise • Glue the MELLES system together (1)

MELLES Design Principle 5

Feedback was one aspect of teacher's assistance that was repeatedly identified through all stages of the study as fundamental for optimal learning outcomes. In the Evaluation phase, 47% of respondents listed feedback as vital component to effective MELL design. Seventeen percent (17%) spoke about the general need for feedback, whereas another 17% concentrated on teacher feedback and 12% on peer feedback. Respondents observed that the MELL activities which encouraged them to evaluate their peers and exchange feedback challenged them yet were of benefit to their learning. They also indicated that it is beneficial for feedback to be available in more than one format: "Your friends can tell you what is good and what is not so good"; "You could check answers from handout or from the mobi website"; "My classmates recordings were helpful because they told me what I needed to change"; and, "Prof recorded the comments after I sent her my recording; …that was very helpful." One student remarked that she found the real-life language situation feedback useful: "You can get feedback in the street by asking a wrong question and a stranger going *what do mean …it doesn't exist*."

In terms of peer feedback, students initially expressed their reluctance to openly evaluate each other through voice recordings and the MELL rating system, but in their final feedback they communicated how significant they believed that form of evaluation was to their learning experience: "I was a bit shy about posting my recording and my evaluation; somewhat uncomfortable but that's okay because I learned from it"; "as long as my classmates feedback help me I'm fine, as long as it tells me what needs to be improved and how—both from teacher and classmates." A number of respondents found recorded feedback more convenient than face-to-face comments: "It helps me more when I do it with people because they can tell me what is wrong and I can tell them what is wrong, and even better when they recorded their ideas because I can take more time to understand."

While all respondents agreed that feedback in the audio format accompanied by the rating system was useful, some students strongly believed that the feedback had to come from experts only or at least be moderated by the expert. One of the students admitted: "I found it difficult to listen to my partner because of her accent… I didn't feel very comfortable to evaluate someone else… I don't have enough knowledge to tell them what's right and what's wrong; to say things so that we don't hurt people is tough…but we need to learn that; but I could be wrong in my evaluation…however there was a teacher there overseeing it and making sure that the students do not misinform each other, so that made it to work." Another student commented that he "learned only if the teacher commented because it gives me an idea of what the recording should include and sound like, from peers I can learn mistakes, so it is a very important part of the exercise but only from the teacher." Once again, some responses suggested that the recorded feedback was even preferred over the face-to-face feedback because of its permanent format and personalized character: "If you have some questions in class and you want to get one answer from your teacher, normally you will ask for a long time, but in recordings everybody gets answer." Interestingly, another student commented on this statement by saying that "if you ask your partner, you will get the answer quickly."

Some respondents reflected on the advantage of instant self-feedback:

"When I listened to my recoding, it made me reflect and think what I want to say, I planned, rehearsed, recorded and then corrected my mistakes; when I listened to it afterwards when it was posted I still wasn't totally happy with my recording; I heard what I didn't like and I redid it; I realized that other people might not be able to understand some of my sounds and redid it. I recognized I made some mistakes but it really made me learn."

In general, the majority of respondents agreed that feedback, both audio and through a point system, should be part of the final MELL design. Considering the debate over the source of such feedback, this recommendation of an ESP practitioner might be applicable to the MELL system design: "You can't have one without the other, regardless of the technology used for teaching, a healthy dosage of feedback from professors and classmates, coupled with your own reflection is the winning combination." Strategies and the rationale for inclusion of a well-designed feedback mechanism are presented in Table 44.

Table 44.

Evaluation: Design Principle 5

Essential Characteristic (*Substantive Emphasis*)	**Strategy (*Procedural Emphasis*)**	**Rationale *(in order to …)***
5 Feedback mechanism (immediate and delayed)	• Ensure dynamic feedback in real-world communicative situations • Include mobile-enabled feedback • Build in a rating system for artefact evaluation (2) • Accompany website peer evaluation by expert feedback (2, 4) • Offer post-task expert (delayed) feedback (4)	• Enhance individual and group motivation (1, 2, 3, 4) • Support cognitive processes through feedback exchange • Offer expert scaffolding and support (4) • Ensure the attainment of adequate standards (4) • Provide reliable linguistic and pedagogical expertise (4) • Promote meaning making

	• Include relevant linguistic resources (3) • Assist with the perception of and interaction with the context linguistic affordances (3) • Facilitate immediate feedback (messages, alerts, tips, clues) (3) • Draw on context affordances and point to them through instructions and directions (3) • Include discourse with diverse interlocutors including L1 speakers (1, 3) • Ensure direct or indirect (apps) access to MELLES and its resources (3) • Include contextualized listening challenges aiming at spontaneous communication (3) • Document feedback through audio recordings posted on MELLES site • Build in self-evaluation of learner audio recordings	• Enable authentic assessment of linguistic skills (3) • Prepare students for real-world communication tasks (3) • Provide learning support through context affordances (3) • Offer a *whole* language experience (3) • Accommodate different pace of learning and levels of language proficiency (1) • Encourage autonomous and creative learning (2) • Provide permanent and personalized feedback • Explicitly teach the metacognitive strategies of planning, monitoring and evaluation • Help overcome affective barriers (1, 3)

MELLES Design Principle 6-8

Related to the discussion of pedagogic procedures are the various MELL activities which respondents reported to be the most conducive to ESP learning. Thirty-five percent (35%) of respondents concurred that “to learn listening you have to listen.” While some believed that “well-designed listening comprehension practice was most valuable for learners,” others pointed to the more active and dynamic type of listening activities: “I found using scavenger hunt is very helpful for my English learning especially listening. It makes me listen carefully in order to not get lost, and this can help me with concentration and listening.” Accordingly, listening to audio podcasts (for example, T7) was deemed by some as not engaging enough: “ESLpod was super nice; but just listening is not enough to learn; it’s great as part of a task; I will continue to listen on the go; it’s convenient to just listen but it's good to do something with it too"; "a real conversation has more powerful to improve listening skill." At the same time, it is worthwhile noting that the majority of respondents favoured the individual focused listening tasks for being accessible whenever and wherever: "Listening on the subway is good, but you cannot just listen, you may not learn anything, maybe if you listen many times, but it's still very good because you listen many times when you can."

Having experienced the tasks promoting the recording of the students' own voices, respondents wanted to add that option to the listening component of the mobi learning site. As many as 32% of respondents added students' recordings to the list of most effective MELL activities. Having overcome the initial apprehension, many students reported that "recording my voice was good for many things, like recording a conversation or a description of a picture and analyzing mistakes; also for recording our voice before presentations for practice or recording lectures and listening later." In fact, the following account of a student's experience with voice recordings is representative of the majority opinion:

"It challenged me. I had a hard time explaining what's in my picture but it just like a situation in your real life when you stand in front of someone and you have to explain something and it's hard; so this prepares you for situations when you have to stand in front of someone and talk, describe things. I didn't like recording myself but it's a good thing - I had to repeat many times and this way I learned to pronounce better. Then I had to listen many times and it helped me my listening. When I recorded on the phone I was really nervous, which is good because it's like in real life. First I thought it was boring but then I chose an interesting topic about Boxing Day and my experience on that day and I got involved and interested… I became creative. Then I liked the exercise and I learned speaking and listening from it."

A substantial part of the feedback on students' recording revisited the notion of feedback creation and exchange, as well as the fact that having to evaluate peers resulted in additional listening practice, however it needed an expert's input and endorsement to be of true value to learners. These comments indicated the learning gains that recording students' own voices offer, and the need for facilitator's moderation in the sharing of the students' artefacts.

With regard to pedagogic procedures, one final notion deserves some attention, namely the issue of integrating other language skills to enable learning of listening competencies. Both students and practitioners (15%) observed that "when you can speak better then you can listen better so you need both" and "when it comes to authentic communication you cannot separate the four language skills; likewise in teaching you use one skill to support teaching the other." All in all, respondents believed that to learn listening effectively and in an engaging fashion, speaking, as well as some reading and writing had to be integrated: "Language is most important for spoken language, what you hear is what you speak, I learned most through learning with the phone…maybe not best for grammar, but there is an opportunity to really use language" and "The more I get them to listen the better they write."

In fact, as mentioned in the following paragraph, respondents regard genuine language practice as imperative. In the feedback pertaining to the Content element of the MELL system, the theme of Authentic Speech emerged much more frequently than any other subject. Over half (57%) of the students observed that to provide adequate and pedagogically efficient MELL content, authentic language examples should be incorporated; these “natural and as true to life as possible” language samples should be available by way of audio or spoken native speaker English offered by the target language speech community. Such real-life language activities are essential because “a real conversation has more power to improve listening skills” when “we are challenged to make a conversation…and have real reasons to listen and speak.” According to learners, the authentic practice is crucial: “some of words have totally different meaning between classroom and outside”; “we have different accents in Canada and it’s good for us to listen to different pronunciation of real Canadian speech”; and “we have to understand when they are using slangs.”

As demonstrated through their experience with MELL tasks, students considered interacting with native speakers on the street as fundamental to augmenting their language practice. Some students would “listen to the phone directions and ask questions of strangers and listen carefully and ask again” being “not shy to ask strangers, [because] it’s actually better to ask strangers…you learn more when you are challenged to listen to their answers.” Others would be “a bit nervous but wanted that challenge to push [them]selves and learn.” Besides, “talking to strangers was really good; people were very friendly...I asked a policeman for directions and he told me…he spoke really fast first but then better and showed me on my Google map where it is." Students also reported that the audio instructions modeling task-related questions helped in impromptu communication with native speakers: "when I asked a question first, [that person] did not know what I asked so I listened again and repeated like on the instructions…second time she knew."

Real-life practice was, thus, one of the most frequently mentioned *sine-qua-non* elements of effective MELL, side by side with the notions of authentic speech, grouping, motivation, and scaffolding. Fifty three percent (53%) of respondents isolated learning listening in the real-world setting as the key affordance of mobile devices: "Learning outside the classroom is a great way to learn in a real life. We could get the real knowledge we need in our daily life." Activities located in the streets of Toronto provided examples of authentic language usage combined with opportunities to practice both listening and speaking. Such dynamic practice, often contingent on situations at hand, was supported by the mobile content, the tool itself and the scaffolding pre-activities: "I liked it because you can use what you learned every day; you don't want anybody else's conversation, you want your own and you want to practice the real conversation…but in the task you had some help with the recordings and the vocabulary that the teacher gave us before, this way I could talk with real people." "I learned by doing because in the real world, when you make a mistake, you will remember it easier that if you do it in class, also when you do something it's easier to remember that just read it or listen to. Plus learning occurs slow, in class sometimes is too much information to remember but when I listened and had to find what I heard right there, I could also listen again but still was under pressure…a good pressure [which] made me to listen and talk." In fact, many respondents commented on the instant linguistic feedback offered by the real-world along with the meaning-making practice. They pinpointed the value of such feedback on the learner's linguistic and cultural competence: "If they listened to the same audio in the classroom they would not understand it as well; the surroundings helped them understand and relate the audio to the context." Such in situ language practice offered visual and auditory supports of meaning, as well as motivational influence stemming from interaction and socialization: "When students went out together with a teacher, they practice English in a real-life situation, they had lots of fun and they were listening and talking a lot naturally, they also got signs when they were not making sense." "Make sure that the mobi tasks take students to real places not only landmarks, places like bank, restaurant, bar, etc; that's really useful...the best."

Referring back to the observation regarding visual and auditory supports for learning processes, one in five (26%) respondents identified language cues coming from the surroundings as a capability unique to real-world mobile learning: "We were learning when asking people and other students, by communicating in a natural way; also we were guessing some information from what we saw around us." Such context affordances were enabled by both the audio instructions and others pointing to signs and clues: "When we couldn't understand the name of the hotel, we saw the other group looking at the hotel"; "I was lost so I showed a picture on the phone and ask where it is"; "I asked the rep at CN tower to listen to the question [in the audio directions] because she couldn't understand me." Moreover, actual speakers' reaction and miscommunication repair efforts, and other communicative acts provided additional information to support "just-in-time" acquisition of the target language: "Visual interaction with people was scary but helped me understand." In addition, learning outside the classroom provided a setting conducive to more natural communication: "We were more relaxed than in the classroom, in the class we are stressed and nervous, so with mobile listening we were listening more relaxed and natural."

Students also shared some specific examples of what type of listening activity or discourse a learner should engage in to practice aural skills:

- "The best listening was when we went through the security and we had to listen carefully to follow the instructions of the security officer."
- "Asking people about facts that we didn't know helped us learn English and about Toronto."
- "Sometimes I liked to solve problems from the recording but real-life conversations with my friends and the people we had to talk to…helped me most."
- "Learning in the street – real [communication] and [miscommunication] situations were the best for me."
- "When I had to try how to understand native people when they are speaking to give me answers to the [scavenger] hunt."

- "Even when I listened to my classmates, it was still good to listen to other peoples' conversation… and examples of how to ask and answer questions before I asked the questions."
- "The recording pushed me to ask native speakers, so I had to memorize it first and then repeat to him more than one time...and then he had to repeat many times to me."
- "I asked my native speaker friends, they are the best to learn from."
- "When we practiced natural speech as opposed to just completing some exercise like in the classroom…when we talked to Canadian people in the street…we had no choice but to listen and speak English."
- "Most helpful… I was on the phone talking to customer services – if I don't understand they have to explain with patience, e.g., Fido, Canadian Tire- best lesson in understanding English was through the phone and answering machine; you should add those to the program."
- "Audio recordings of native speakers were really good because you can listen many times without nerves."
- "Audio podcasts were very good but sometimes too slow. Actually, real native talking is faster than some of that audio. So, it is good practice but make it realistic."
- For me the podcasts in Task 7 were also very helpful, especially those real ones like about the travel from The Economist; it was very difficult but I learned a lot."

As mentioned in the discussion of the integrated skills theme, communication was identified by respondents both as a key goal of the MELL practice, and an effectual method of learning listening on-the-go: “Because communication is the most important thing in society…we need to practice for real life” and “By practicing listening more you can improve communication skill.” “For the mobi website to be effective, especially for immigrants, it has to develop the communication skills.” “People need to practice by talking to each other to improve their English, communication sometimes is listening and sometimes is talking” and for the majority of students “clear communication with students and professor” seemed to be the essential target. Hence, the respondents appreciated the opportunity to practice communicative competencies in both the rehearsed and ad-hoc language situations: “I have to talk to people not only listen. That is a reason [for] me to learn English. So learning outside the classroom how to communicate was helpful to me. When I went outside, I listened, asked people about questions and talked with them to solve the questions. I learned how to communicate in English”; “when I recorded and re-recorded my speech or my feedback for [my classmate] I communicated in English…this was most important.”

When discussing learning aural skills with the help of mobile devices, respondents (21%) concentrated on the general need for listening practice and “learning listening by way of active and interactive listening.” Respondents identified certain listening activities as most suitable for their context and needs: “Put exercises when students have to understand a problem and solve it”; and, "Add comprehension questions like multiple-choice and fill-in the blanks questions, listening to a telephone conversation or spotting differences between the audio and script or audio and the reality around them." Students admitted that they "couldn't understand the audio so [they] had to listen several times, which was good for learning." Accordingly, apart from dynamic impromptu listening practice embedded in authentic conversation, focused comprehension practice offered by audio podcasts was required (8%) for students to be able to "give the concentration to listening [so] I can get more idea and more understanding after I listen many times," and "listen when I had time by myself," and obtain help from others: "I asked my brother to listen and tell me what it said." These recommendations were validated by quantitative results which identified learning listening in a real-world context as key to acquiring aural skills and gaining confidence in communicating in English. At the same time, participants ranked self-paced individual tasks higher for their flexibility. All in all, respondents recommended that listening exercises include place- and time-independent individual activities, and more place/time-bound group activities. Such exercises would, thus, allow for listening to a variety of materials—for different purposes, in different ways and levels of participation, and in circumstances that offer a taste of diverse "listenings" present in everyday language situations.

Related to the recommendation on authentic Canadian language practice situated in the streets of Toronto, were the comments on the socio-cultural competencies. Almost a quarter of all respondents mentioned socio-cultural knowledge as a base for successful language learning solution: "Whatever tasks you design, don't forget to give it a Canadian flavor; "Canadian content is what our students need to work with." Students agreed [I'm confused – were the respondents in the previous statements only teachers and thereby, that's who "students" are agreeing with?] recognizing that they "learned more about Canadian culture by visiting…landmarks, and for immigrant students that helped a lot"; and that "it is also very helpful for me to know about Toronto"; and also that it "could be a good way to learn the city that I am living, and it also practices English at the same time." Students explicitly remarked that "in the design of the mobile exercises, you have to put cultural knowledge; teach us more culture, give me some information about Canada first… after listening it gave me information about culture, [for example] names of streets were very difficult, but I learned names and some culture too." Others agreed that "mobile learning is good for learning about new places, new languages, history and traditions" which is significant for "many foreign people who study in our school and don't have that information about the country they now live in." "To discuss anything in life; what happened during the day, in your class; you need new vocabulary, new resources […]" but "even though I understand the words, I don't know the real meaning because of culture." It is, thus, crucial for the MELLES-type solution to support acquisition of socio-cultural competencies.

The following three design principles resulted from the preceding discussion about language activities and listening tasks that are deemed conducive to learning listening out of class with the help of mobile technologies (Table 45).

Table 45.

Evaluation: Design Principle 6-8

Essential Characteristic (*Substantive Emphasis*)	**Strategy (*Procedural Emphasis*)**	**Rationale *(in order to …)***
6 Focus on authentic listening tasks in the dynamic real-world communicative situations	• Ensure active listening by way of two-way listening activities such as task-focused interaction • Include one-way listening activities which comprise interaction with content, technology, speaker, task, and context affordances (meaning-focused listening) – contextualized group tasks • Offer authentic practice of responding to real-time input, such as direct or paraphrased repetition of audio content, or note-taking in a real-time lecture • Integrate impromptu speech component in response to oral input (for instance, responding to ad-hoc questions) • Organize aural tasks around the learning milestones, that is, the collaborative listening tasks situated in the real world, with individual aural practice supporting and leading to the milestone learning objectives • Incorporate comprehension materials offering (a) sufficient (b) language instances (c) whose meaning can be inferred through (d) active (e) meaning-making • Ascertain active contextualized practice leading to output (verbal or non-verbal response) • Build in a social component to enable real-time interpretation and meaning-negotiation • Provide clear audio directions and instructions (3) • Assist with the perception of and interaction with the context linguistic affordances (3, 5) • Include task goals aiming at carrying out linguistic functions in real-life situations in response to audio instructions (3) • Draw on context affordances and point to them through instructions and directions (3) • Reflect or include real-world communication tasks (communicative	• Enable systematic approach to the teaching aural skills (Listening is a complex process) • Practice the ability to deal with real-time input • Explicitly teach the metacognitive strategies of planning, monitoring and evaluation (5) • Ascertain that both “bottom-up” and “top-down” processes are included • Offer relevant context: interaction with oral input, interlocutor, task, listener, process, technology, and context affordances • Promote active interaction to enable interpretation and meaning-negotiation, ultimately leading to output • Offer, in real-life context, visual support for language content: inclusion of paralinguistic cues, esp. visual signals to support oral language processing • Rely on inherent audio capability • Promote meaning making (5) • Enable authentic assessment of linguistic skills (3, 5) • Facilitate provision of instantaneous feedback afforded by the environment • Prepare students for real-world communication tasks (3, 5) • Provide learning support through context

	goals) (3) • 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 (3) • Include discourse with diverse interlocutors including L1 speakers (1, 3, 5) • Include contextualized listening challenges aiming at spontaneous communication (3, 5) • Provide tools for recording, editing, upload and viewing/listening on the go (or demonstrate the usage of device built-in tools) (2) • Include socio-cultural competencies and information (for instance, visiting landmarks, collecting facts about them and exploring cultural habits)	affordances (3, 5) • Offer a *whole* language experience (3, 5) • Accommodate different pace of learning and levels of language proficiency (1, 5) • Help overcome affective barriers (1, 3, 5) • Offer exposure to real-life language including slang and various accents • Acquire socio-cultural competencies • Be motivated by real-life challenges and feedback
Essential Characteristic (*Substantive Emphasis*)	**Strategy (*Procedural Emphasis*)**	**Rationale *(in order to …)***
7 Support of self-paced individual audio tasks feeding into/preparing learners for the real-life tasks	• Provide listening practice preparing learners for the group real-life tasks (for instance, related vocabulary, grammar tips, dialogue examples) • Build in time and place flexibility in the individual activities • Encourage active listening by way of self-paced non-reciprocal audio tasks requiring verbal or non-verbal response (for instance, answer comprehension question for language podcasts) • Incorporate one-way listening activities which comprise interaction with content, technology, speaker, task, and context affordances (meaning-focused listening) – anytime any place individual tasks • Offer authentic practice of responding to recorded input, such as direct or paraphrased repetition of audio content, or note-taking in a recorded lecture (6) • Integrate rehearsed utterance exercises (such as recorded audio reflections, recording student utterances) for self, peer, and expert evaluation • Organize aural tasks around the learning milestones, that is, the collaborative listening tasks situated in the real world, with individual aural practice supporting and leading to the milestone learning objectives (6) • Incorporate comprehension materials	• Enable systematic approach to the teaching aural skills (Listening is a complex process) (6) • Practice the ability to deal with real-time input (6) • Explicitly teach the metacognitive strategies of planning, monitoring and evaluation (5, 6) • Ascertain that both “bottom-up” and “top-down” processes are included (6) • Offer relevant context: interaction with oral input, interlocutor, task, listener, process, technology, and context affordances (6) • Offer, in real-life context, visual support for language content: inclusion of paralinguistic cues, esp. visual signals to support oral language processing (6) • Rely on inherent audio capability (6) • Promote meaning making (5, 6) • Enable authentic assessment of linguistic

	offering (a) sufficient (b) language instances (c) whose meaning can be inferred through (d) active (e) meaning-making (6) • Ascertain active contextualized practice leading to output (verbal or non-verbal response) (6) • Provide clear audio directions and instructions (3, 6) • Assist with the perception of and interaction with the context linguistic affordances (3, 5, 6) • Include task goals aiming at carrying out linguistic functions in real-life situations in response to audio instructions (3, 6) • Draw on context affordances and point to them through instructions and directions (3, 6) • Allow for interrupted episodic learning – modular design with each audio podcast not exceeding 5 or activity within a task – 10-15 min. (3, 6) • Offer choice of timing and sequence of individual tasks completion • Provide tools for recording, editing, upload and viewing/listening on the go (or demonstrate the usage of device built-in tools) (2, 6) • Build in self-evaluation of learner audio recordings (5, 7) • Include socio-cultural competencies and information (for instance, visiting landmarks, collecting facts about them and exploring cultural habits) (6)	skills (3, 5, 6) • Prepare students for real-world communication tasks (3, 5, 6) • Provide learning support through context affordances (3, 5, 6) • Offer a *whole* language experience (3, 5, 6) • Accommodate different pace of learning and levels of language proficiency (1, 5, 6) • Help overcome affective barriers (1, 3, 5, 6) • Offers continuity and flexibility of practice derived from choice of timing and sequence of tasks completion • Acquire socio-cultural competencies (6)
8 Integrate all four language skills but focus on listening outcomes	• Build tasks and activities based on listening learning outcomes • Aim at oral competencies relevant to student academic and professional goals • Include speaking activities to encourage meaning making • Incorporate text-based resources to provide scaffolding and support (reading) • Use text for on-demand communication and to exchange immediate feedback (reading, writing) • Use text for just-in-time comprehension assessment	• Offer a whole language experience (3, 5, 6, 7) • Support listening comprehension and communication which encompasses speaking, and is often supported with text • Promote meaning making (6, 7) • Prepare students for real-world communication tasks (3, 5, 6, 7) – listening not used in isolation

MELLES Design Principle 9

All participants agreed that there was an apparent benefit to listening to authentic dynamic speech as well as recorded podcasts. Findings pertaining to the preferred content of MELLES emphasized a need for linguistic and, to a much lesser degree, technological resources. Participants also recommended inclusion of well-designed learning supports and resources.

In fact, in the quantitative survey participants ranked the following as the top six MELLES functions: (1) examples of how to complete the listening task, (2) access to audio recordings modeling the pronunciation of new words, (3) quick access to help with language (4) language task written instructions and task explanations, (5) Links to English language dictionaries and vocabulary help, and (6) pronunciation mini-lessons related to the learning tasks (Table 37). One in three respondents stressed the significance of vocabulary practice and related resources. Students claimed that “learning words is one of the most important parts of learning how to understand English.” They elaborated that mobile dictionary apps or web-based glossaries provided the necessary reference for successful comprehension and communication practice. Students were able to “find necessary words and use them as adjectives, verbs, or nouns, and also know how to say them because of the audio dictionary option.” Respondents deemed vocabulary practice crucial and believed that it should precede the mobile tasks: “you should learn words before you listen to something” and “before [going through] through the instructions and exercises.” Accordingly, Tasks 1 and 2, which aimed at co-creating vocabulary and idiom repositories, were regarded as constructive: “It helped me to learn how to pronounce the word, how to do research for the meaning of the word, I also learned the meaning of the idiom – so I learned in three different ways.” “But not any words…it was better to learn vocabulary which is specific for the specific career that I will work in.”

Another building block of the mobile solution, namely clear directions and explanations, was identified by more than a quarter of respondents (27%) as essential for learning listening. Not only did the respondents find directions and explanations imperative for completing the tasks (“Without clear exact directions we were lost in the task”; “We needed more explanation about details so I asked the teacher.”), but they also isolated the competency of following directions as one of the most relevant to their academic and professional success (“To give and receive proper instructions and examples is crucial for school and for work later on.”). In addition, a number of students reported that having to follow audio instructions was an optimal way of practicing listening: “It is an effective way to learn and especially listening because it will practice you to follow instructions” and “With good audio instructions […] clear and understandable, which made the task a little easy to accomplish, we learned better because we had to listen for every detail not to get lost.” “The effective task has to make sure that students understand the instructions, because when the task was about downtown of Toronto, when I went out to complete the task I got a panic…getting an answer was too hard. If I got some information before, it would [have been] easier.” Thus, respondents’ recommendation to ensure the adequate level of task directions and preferably reviewing them before embarking on the mobile task, is critical for a winning MELL design. Directions and instructions in terms of the mobile technology are also to be included: "The most crucial for learning was the well explained mobi website and the instructions how to use the technology"; "Mobile learning sites should always have all explanations about each task, the language and the technology, and should have some examples for better understanding."

Another prevalent theme concerning the functions and skills taught by the MELL system was pronunciation. Discussion of the importance of pronunciation practice wove through all the DBR cycles and many other themes including vocabulary, authentic speech, and communication skills to mention a few. In common with previous feedback, a number of respondents (16%) listed more focus on pronunciation instruction and practice as an element that has to be added to the current version of the MELL solution: "More focus on pronunciation would help." In order to provide that type of practice, the MELL content has to expand beyond listening: "By listening to different recordings to improve your pronunciation is one way" but "to understand what somebody says, we have to know the right pronunciation, I don't learn that by just listening." To the remark that pronunciation is a speaking rather than listening competency, respondents observed that "one has to know to pronounce words both to speak and to understand when he is spoken to," hence, pronunciation instruction and practice has to be explicitly incorporated into the content of the m-learning solution. Respondents recommended including more samples of Canadian English and more interactive communicative activities: "To get help from the phone and the teacher regarding pronunciation… although you can check it online, the authentic

Canadian pronunciation is better, if you can record your teacher and then listen that would help; also then it’s important to talk to use that pronunciation that you learn.”

Still related to the feedback on the content necessitated by an effective MELL system are comments pertaining to the type and characteristics of resources and materials selected for mobile delivery. Twenty-two percent of respondents referred to support resources and materials as the most vital component of the mobile ecosystem. In terms of linguistic resources they listed the following:

- audio dictionaries;
- materials used by teachers in class (“Give access to resources that they use in class for students to visit information on their own”);
- audio podcasts accompanied by written scripts (“Listening can be done on your own if you have the script”);
- pronunciation references (“When help needed with pronunciation, use links to get pronunciation on your own”, “It was good with the youtube pronunciation”);
- “subtitles for videos;”
- “vocabulary from the task either before or once the task has being analyzed…to challenge more;”
- handouts for mobile tasks (“Students can follow the steps and then check answers from handouts if they have them”);

- answer sheets or, alternatively, recorded answers to listening challenges ("Create bonus tracks with answers, therefore we can compare with our answers").

Additional supports suggested by respondents included:

- phone-based or paper-based maps of Toronto ("We really need a map to find the way. I think that if this course comes with a map it will be better");
- "online chat for asking questions that come to our mind, even if not related to the tasks, for example, *How can I ask this and that at the doctors?*...then other people can learn too; nobody is shy to share question or ideas online;"
- "telephone numbers to other students and the teacher so we can call or text;"
- "videos on how to use the phone;"
- face-to-face mobile technology clinics ("It helped when I went to meet [teacher] to learn how to record with my phone; other students could go too").

While most of the resources mentioned referred to either web- or device-based content, students indicated that some of the more traditional supports, such as paper-based handouts and face-to-face contact, were also indispensable for successful learning.

Several respondents (14%) also indicated that it was of importance to their success that the materials were related to their program of study and the future professional career: “Valuable content is biggest concern for me”; “I want to learn something we can relate to”; “topics related to business and vocabulary which is specific for the specific career”; “I learn English to do well at school and then work so more such topics should be in the podcasts.” However, students agreed that a mixture of both the field-related and everyday life content was necessary: “I have to listen to how to go to a student’s center and what questions to ask and how to answer; because when I go there we first make a question in our head and prepare answers for our own questions; you don’t want to be afraid…you want to learn how to listen and talk in [various everyday life] situations.” Consequently, offering a variety of topics (6%) was another requirement germane to the complete MELL solution: “To learn best…listening, listening and listening as much we can to different subjects, as many as possible- you can always choose something for yourself.”

Finally, the appropriate length of a mobile task was isolated as a characteristic of a well-designed mobile solution. Due to the “on-the-go” nature of MELL, respondents expected both the complete tasks and the constituent parts of it, namely the audio podcasts to be manageable in terms of their duration. A number of students complained about the length of Scavenger Hunt that they had to complete on a cold day, and others remarked that they had to complete one task in more than one visit downtown. The majority of students expected one learning episode not to exceed an hour and a half. At the same time, an individual audio recording should not surpass 3–4, at the maximum 5 minutes each with exception for those in Task 7 (Listen-on-the-go podcasts) which can be stopped and revisited at the time convenient for the listener. In response to why the length of individual podcasts should be limited, students reported that they “cannot concentrate on more than 4 minutes” and they “had to listen to the audio tasks many times, so it took a long time to pause and go back, and ask questions for new words, and then go back.” For instance, one of the respondents remarked that she had to listen to some of the audio podcasts approximately 20 times before being able to follow the instructions. Although this was not representative of all students in the sample, it highlighted the need for a careful timing of audio recordings. In fact, the size of the audio files was another restriction around the length of each audio podcast. Respondents observed that the “heavier in length files took too long to download and took a lot of space on my phone.” The preferred length of audio was also influenced by the context in which the listening activity took place and the context affordances available to facilitate comprehension. These findings pertaining to language resources and their characteristics are encapsulated in *Design Principle 9* (Table 46)

Table 46.

Evaluation: Design Principle 9

Essential Characteristic (*Substantive Emphasis*)	**Strategy (*Procedural Emphasis*)**	**Rationale *(in order to …)***
9 Linguistic resources (task-related): • relevant vocabulary	• Include audio dictionaries and glossaries (dictionary apps, web-based dictionary glossaries) • Point to selected web-based language resources including audio and video podcasts	• Enable practice of following directions which I highly relevant to academic and professional requirements

• dictionaries • pronunciation • clear task directions and explanations • examples of language usage	• Point to selected web-based pronunciation resources (such as YouTube) • Encourage learners to co-creating audio vocabulary and idiom repositories • Ensure vocabulary and pronunciation practice preceding the real-life embedded language tasks • Provide clear audio directions and instructions (3, 6, 7) • Combine listening with task-related pronunciation practice • Include task-related linguistic materials (such as a vocabulary list) and pointers to other task-related linguistic resources • Incorporate text-based resources to provide scaffolding and support (such as vocabulary handouts, audio scripts, answer sheets) (8) • Incorporate task-related examples of questions and utterances and modeling • Provide scaffolding through visual representation of audio content - message redundancy • Include subtitles/captioning for videos • Ensure that materials, resources, and tasks are relevant to student academic and professional goals • Allow for interrupted episodic learning – modular design with each audio podcast not exceeding 5 or activity within a task – 10-15 min. (3, 6, 8)	• Offer expert scaffolding and support (4, 5) • Ensure the attainment of adequate standards (4, 5) • Provide reliable linguistic and pedagogical expertise (4, 5)Promote meaning making (5, 6, 7) • Enable systematic approach to the teaching aural skills (Listening is a complex process) (6, 7) • Offer a *whole* language experience (3, 5, 6, 7) • Accommodate different pace of learning and levels of language proficiency (1, 5, 6, 7) • Encourage autonomous and creative learning (2, 5) • Provide on-demand access to language resources and support • Point to permanent record of resources, materials and examples of language usage (contingent on the website)

MELLES Design Principle 10

The discussion now moves to the major theme of Context and the notion of blending MELL practice with in-class learning. Consistent with their appreciation for mobile learning in situ, 42% respondents cited learning outside the classroom a must. They believed that apart from providing authentic practice and exploration of the Canadian reality, expanding learning beyond the classroom contributed to enhanced linguistic performance: “I spent more time actually learning not being lectured, so I learned the language faster.” Students also observed that they were exposed to the “communication different from that in the class [setting].” The more dynamic authentic language environment heightened learners’ motivation levels “It was so much more fun and real than the classroom.” At the same time, a number of respondents (17%) observed that blending that type of learning with in-class instruction would produce optimal results: “Mobile outside the class should be blended with classroom teaching”, when “the teacher can prepare us in class and then apply what you learned outside.” “Combination of both the classroom and the outside is best…it is helpful when combined with other methods; using just this one you would not learn English…classroom is not real-life; it teaches grammar, writing, pronunciation so you can understand more by listening, we need that too… combine the two.” Additionally, students reported a need for face-to-face contact with the facilitator and classroom time focused on drills: “I prefer the teacher is close to me once a week, in person, not everything can be virtual…I prefer to do some grammar exercises and question time and then practice outside.” This final quote summarizes well the gist of student feedback with regard to blending mobile learning out of class with in-class instruction: “One [completes] the other; outside the class gives some pressure so you learn well but studying in class prepares you for that; I’d like to learn outside of the class for part of the time - it’s new, fun, interesting, it’s different from the classroom, more real-life…maybe later not so interesting when you do it all the time, not novelty anymore…you always need both, learning something different and in a different way is important.” Students and practitioners agreed that meeting from time to time in a formalized classroom setting was beneficial to their listening practice and to managing the learning process. *Design Principle 10* sums up the associated strategies and rationale for this recommendation (Table 47).

Table 47.

Evaluation: Design Principle 10

Essential Characteristic (*Substantive Emphasis*)	**Strategy (*Procedural Emphasis*)**	**Rationale *(in order to …)***
10 Support out-of-class MELL with in-class (f2f) instruction and practice (Blend in-class and out-of-class context)	• Offer vocabulary, grammar, pronunciation instruction and drills to prepare learners for real-world communicative challenges • Encourage questions regarding real-life listening tasks • Debrief completed tasks • Review audio directions and instructions (initial stages) • Provide examples and resources reflecting real-world communication tasks • Provide tools for recording, editing, upload and viewing/listening on the go (or demonstrate the usage of device built-in tools) (2, 6, 7) • Point to socio-cultural information (such as facts about landmarks and cultural habits) • Provide personalized feedback	• Provide focused instruction, drill opportunities and feedback (accuracy, fluency) in a less-threatening environment before real-world application • Enable systematic approach to the teaching aural skills (Listening is a complex process) (6, 7) • Ascertain that both “bottom-up” and “top-down” processes are included (6, 7) • Prepare students for real-world communication tasks (3, 5, 6, 7) • Offer a *whole* language experience (3, 5, 6, 7) • Accommodate different pace of learning and levels of language proficiency (1, 5, 6, 7) • Help overcome affective barriers (1, 3, 5, 6, 7) • Enhance individual and group motivation (1, 2, 3, 4) • Offer expert scaffolding and support (4) • Support cognitive processes through teaching presence (4) • Support the learning network in and out of class (1, 4) • Provide structure and guidance to facilitate the learning process (4) • Provide reliable linguistic and pedagogical expertise (4) • Glue the MELLES system together (1, 4)

MELLES Learning Community

When referring to the most desirable learning context, students frequently revisited the notions of collaboration and group work. They also stressed a different aspect of working with others, namely, the need for forming and sustaining a strong learning community: “We can be sociable more and learn more when we [share] time and our recordings,” yet “who will use our recordings later…maybe the new students don’t like them or don’t like to work with us.” As in the previous phases, respondents cited a need of belonging to a learning community as a fundamental element of the MELL learning context which has to be built into the design of the system itself to enhance the learning experience: “This activity [Scavenger Hunt] should be in the first week of the course so that people can meet each other and become friends, this will make us learn better throughout the course.” It is an ingredient which then ought to be nourished through participation in order for the system to evolve and provide content as well as motivation for learners: “When people create something together they are connected by that; people always don’t like do the work alone, they lack fun and passion when alone…we have to meet regularly like for the Christmas party or the mobile clinics; […] we have to work on the recordings together.” All respondents agreed that the feeling of belonging to the group motivated them to invest more in the learning experience. In fact, students remarked that the mobi website, where their artefacts were displayed, served as their meeting place online and a repository of their “shared repertoire” (Wenger, 1998): “We made our recordings for each other so we can all learn but we also helped our friends improve them before they were put in our mobi dictionary."

The need to form a supportive learning community has been already addressed by Design Principle 1, 4, and 10. It is, though, a role of the MELLES system and the technology to help sustain that learning network. The guidelines pertaining to the technology dimension of the MELL design are discussed in the next section.

MELLES Design Principles: Technology

Overall, the Evaluation findings did not focus a great deal on the technology aspects of MELLES. At the final stage of the study, respondents' comfort level with the mobile tools was relatively high. Moreover, their earlier feedback had already been reflected in the MELL solution being evaluated. These factors combined have resulted in mobile technology being highly transparent and, thus, respondents concentrating on the pedagogical concepts and demands.

For consistency with the Enactment chapter, MELLES technology-related findings are summarized in a system requirements chart (Table 48). With the exception of *Inherent device affordances*, no new technology subcodes emerged in the Evaluation phase. Relative Frequency is noted for all seven categories.

Table 48.

Evaluation Findings - Technology (System Requirements Chart)

DESCRIPTION	RATIONALE	TYPE	PRIORITY	CONTENT	FUNCTION
Explain the nature of the requirement	Why is this requirement needed and how it relates to research findings?	Data, user, environmental or usability	Rate according to MoSCoW rules	What content will be needed in the system to address this requirement?	Describe a mechanism or feature needed to meet this requirement
1. Audio player/ recorder functionality: ability to control audio recordings (28%)	Allows learner to review audio at the speed appropriate to their comprehension level Allows to rehearse and record corrected audio clips Provides convenience needed to review and record audio Minimizes affection barriers resulting from lack of control *"You need pause, replay, and record buttons. You can stop it go back and again until you get it; never asked anybody for help just listened many times."* *"I need to play again. I heard first time to take notes and second time to double check if I was missing something."*	Usability	Should	Audio player/ recorder controls	Build in the following controls for audio retrieval, recording and editing: play, record, adjust audio speed, pause, fast forward, rewind, replay, delete
2. Flexible on-the-move access including offline option (17%)	Users need access from wherever whenever they are to optimize learning on-the-go which includes interacting with the system both online and offline; it also allows learners to work at their own pace *"I used mobile because I can do it when commuting and waiting."* *"Books are expensive and heavy, devices are portable and go into the pocket, and I can use them when convenient."* "*I can stop somewhere if I need to review or find*	Usability/ Environmental	Should	Offline and online access to content options; offline storage options; notifications when offline	The system should be aware of the connection availability; notify the user when offline; it should switch to off-line mode when the connection is not available; it should also allow the user to work offline at will

	information." *"If the option to do it on your own time was an option more people would have done it."* *"Access to the mobile at wherever you go through the phone is a must."*				
3. Adequate quality of audio files (12%)	High quality audio not to hinder comprehension or discourage practice *"The system must feature high quality audio as bad sound files are not good for comprehension."*	Data/ Usability	Should		The audio recording and editing tool should produce files which meet certain quality standards and comply with rules
4. Text support (11%)	Provides scaffolding for language learners; text representation of the audio content provides helpful message redundancy and supports comprehension *"Transcripts of audio files would help."* *"I would want to take notes and write down my answers when I'm listening."*	Data/ Usability	Must	Audio transcripts Summaries of audio lessons Video captions Text representation of new vocabulary Text-based instructions	Must be able to store, text input from students either as typed text or text files. Also the system is supposed to keep track of input ownership and other user's access
5. System access from mobile and computer (12%)	Enhances accessibility of the system and flexibility of learning by providing choice of platform and milieu *"Ensure that it is easily accessible by internet website rather than just mobile."* *"I sometimes used my computer and sometimes my cell phone to do the tasks."*	Usability	Should	Mobile and desktop platform interface; mobile switcher between the desktop and mobile interface	Provide various ways of access and usage, include. mobile clients for different platforms and a common web interface for higher productivity; build in switcher detecting mobile vs. desktop visitors

6. Cross-platform design (11%)	For system to be inclusive, it has to be accessible from various mobile platforms owned by learners *"Work with a solution that's cross-platform, like the web, test it for design principles and then start adding other platforms."* *"You can go with web for cross-platform, now it seems to be the only solution."* *"Going forward – HTML5 will support most of the platforms."*	Usability/ Environmental	Must	Separate stand-alone platform-specific applications or various platform-specific clients connecting to the same web-service	Mobile clients must meet specific standards across all different platforms
7. Inherent device affordances (7%)	Learners should be able to use the built-in features of their own devices such as camera, voice recorder, apps *"Before I already used my dictionary, web search and even recorded my voice."* *"You can integrate the inherent features of the phone with the mobile system."*	Usability/ Data	Should	Voice recorder, camera, apps (inherent features of smart phones)	Make use of device built-in features or design a system that integrates those features

These recommendations on MELLES characteristics reiterate the findings from Phase 1 and 2. Nevertheless, reflections on the systemic character of the MELLES solution led to the realization that the interplay between mobile technologies and web-based technologies provides a framework without which the pedagogical procedural strategies would not be possible. In short, MELLES technology enables MELLES pedagogy; and the mobile web is the conduit for MELL process. Moreover, expert evaluation and feedback highlighted a need to replace the web-based technology of the system with a solution that integrates web capacity (processing, storage, permanency of access) with the convenience of users' mobile tools. Hence, the suggested MELLES intervention should incorporate a mobile app providing local services to the user, thus enabling continuity of learning regardless of the Internet connection status, specifically, both on-line and off-line. This aspect of MELLES needs further exploration in future studies. The key requirements resulting from this approach are encapsulated in the final design guidelines synthesized in the following chapter.

Chapter 7 Summary

In this chapter, the Evaluation phase qualitative and quantitative results were aggregated to formulate ten pedagogic design principles (Tables 40-47) and seven technology-related guidelines (Table 48). Verbatim participant quotes supported these recommendations. The need of a supportive learning community was also identified as a crucial aspect of the MELLES network. Overall, the Evaluation phase findings were consistent with those of previous phases, but provided significant additional details. Once all study data were analyzed and organized, patterns and correlations between concepts became more transparent, thereby creating a clearer picture of how the main pedagogical characteristics and strategies are linked to the mobile technology that enables them. These interconnections are reflected in the final MELLES design guidelines synthesized in Chapter 8.

Chapter 8. Synthesized MELLES Design Principles

Interconnected Elements of MELLES

The MELLES intervention is 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. However, it is the mobile technologies that enable the interaction among pedagogy, content, context, actors, and digital communication channels.

Mobile devices mediate individual cognitive processes, relationships and co-construing of meaning by offering access to information and to others. They also connect people and resources by serving as a gateway to the MELLES network. Further, mobile technology promotes continuity of the learning process, by linking in-class and out-of-class learning episodes. It also promotes situated language practice supported by context affordances and real-world listening practice, as illustrated in the discussion of Phase 1 and 2 findings. Mobile technology is thereby one of the *sine-qua-non* elements of the MELLES which interconnect to dynamically mediate the language learning process (Figure 52).

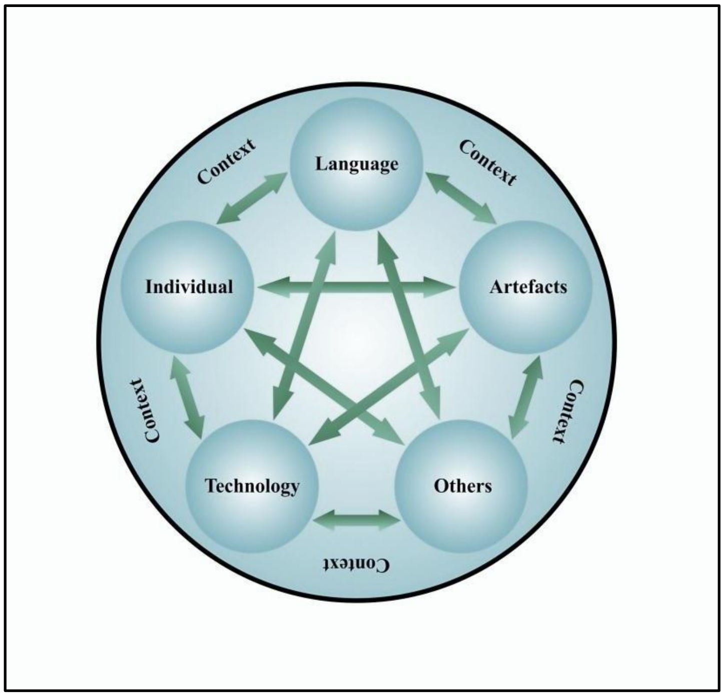

Figure 52. Interconnected elements of the MELLES learning context

To enhance learning continuity and flexibility, in-class learning outcomes should support the situated language practice. Likewise, results of individual tasks should support regularly occurring collaborative tasks (for example, every two weeks), thereby motivating students to appropriately pace their learning process. For instance, before students are asked to complete a *group* task at a local business, *individual* MELLES tasks should concentrate on acquiring vocabulary related to the local business customs. Subsequently, the information and artefacts collected during the collaborative task may be used to refine the vocabulary definition originally contributed by students through the individual activities. Thus, in a cyclical fashion, resources and new knowledge from one task would feed into another task offered by MELLES. Continuity of learning is, in consequence, afforded by constituent tasks of MELLES being interrelated and building on each other to form a coherent whole.

Seamless language practice is also enhanced by the amount of flexibility a student has in executing tasks. Learners should be able to choose the timing, sequence and location of individual task completion. At the same time, learners are directed in their learning process by prerequisites of collaborative contextualized learning events. Learners are also encouraged by reminders and notifications pushed to their mobile devices to complete any assignments or listening activities leading to the collaborative signpost tasks such as a class scavenger hunt downtown Toronto.

Furthermore, to support flexible practice and access to information, it is vital for the MELLES website to be available through student-owned devices and any web-based platform. Participants stressed the importance of having the ability to move seamlessly from device to computer without compromising the continuity of practice. The MELLES system, thus, relies on web-based technologies and mobile client applications to access learning resources, to create artefacts, and to facilitate communication between actors.

To avoid fragmentation of both information and the learning process, the MELLES site serves as a hub where all resources are aggregated and shared. This is where learners can find task-related materials and tips. All materials and resources are selected and validated by experts to aid learners in managing the abundance of language resources available on the Internet. Similarly, the artefacts and information contributed by learners are evaluated and rated by language experts. These artefacts are created and exchanged by means of artefact authoring and management tools, either native to the mobile device or built into the website design.

Being an exchange and communication platform, MELLES also serves as a meeting place for learners and experts. This supports the MELLES network enabling synchronous and asynchronous communication which, in turn, promotes a blend of social, cognitive, teaching and emotional presence (Swan et al., 2008). The individual cognitive processes of language learners are, therefore, facilitated through interactions and expert scaffolding enabled by mobile technology. At the same time, evaluation and feedback exchange are made possible by connection management tools which offer either on-demand or delayed communication. Considering that mobile device users are often out of wireless range or have restrictions on their data plan, it is recommended to integrate off-line and on-line modes of content delivery and interaction.

To further facilitate the implementation of pedagogical design principles, the system requires cross-platform and multi-technology support. With learners and experts using an array of mobile devices, it is vital that MELLES is accessible from any user device and through a web browser. This issue warrants a more in-depth treatment in future studies; nevertheless, the cross-platform design cannot be ignored in the MELLES design guidelines.

With respect to enhanced access, the findings indicate that MELLES-like systems should incorporate both web-based resources and customized apps residing on the user mobile device. To this end, a browser-based MELLES application allowing faster content authoring and usage should be integrated with platform-specific applications residing on the mobile device as well as having full access to the local device resources, such as a camera and memory storage. The resulting mobile technology-enabled access to the web of MELLES components provides improved situated aural skill acquisition experience. The system also connects the learner to peers and experts who mediate that learning. Finally, to ensure that users fully benefit from MELLES tools and customized instruction, it is recommended that technology support resources be incorporated.

MELLES Technology: Refined Design Principles

Table 49 presents the substantive and procedural aspects of the MELLES technology in more detail. Two matrices highlighting the essential characteristics each strategy enables are provided in Appendices F and G (Design Principles Matrix-Pedagogy and Design Principles Matrix-Technology).

Table 49.

MELLES Technology: Refined Design Principles

Essential Characteristic (*Substantive Emphasis*)	**Strategy (*Procedural Emphasis*)**
1 One-point access to all resources	• Act as a hub: a meeting place to support social presence in learning • Serve as a library of carefully selected task-related linguistic materials and resources • Act as a repository of students' artefacts and a meeting point for evaluation and discussion of the artefacts • Deliver adequate quality audio content (instructions, directions, task-related information, pronunciation examples) • Distribute (push to user devices and provide on the MELLES site) supplementary text-based content to accompany audio files (brief instructions, task-related information, vocabulary, links) • Enable access to the learning resources selected by experts and suggested by others (provide links to task-related valid existing resources)

	• Support audio tech support resources with traditional text-based materials • Offer apps supporting language learning: point to existing apps or custom develop MELLES-specific apps (audio dictionaries, translators, flash cards) • Provide a common user-friendly interface for the MELLES functions including managing author's artefacts • Provide alternative ways to access and use MELLES, include mobile clients (different platforms) and a common web interface for higher productivity; build in switcher detecting mobile vs. desktop visits • Provide connection management tools for users to aggregate, validate, and point to relevant information (learners sharing resources on the MELLES site) • Provide easily accessible audio/video instructions on how to use the technology and features of the MELLES system, including examples and demos • Provide platform to coordinate/direct learning process (including scaffolding mechanism such as sending context-sensitive help, pushing notifications, alerts, reminders) • Provide tools and instructions to encourage creative effort in generating learning materials and other artefacts
2 Exchange and communication platform	• Act as a hub: a meeting place to support social presence in learning (1) • Serve as a library of carefully selected task-related linguistic materials and resources (1) • Act as a repository of students’ artefacts and a meeting point for evaluation and discussion of the artefacts (1) • Assist with the perception of, and interaction with, the context affordances by way of podcasts and on-demand feedback mechanism (for instance, audio directions instruct students to collect evidence of various features of a Victorian style home) • Build in an artefact evaluation (rating) system which aggregates average peer ratings, combines them with the expert rating (a higher weight in the final score), and concludes with a recorded expert evaluation • Enable exchange of delayed feedback and evaluation (audio, rating system, some text) • Enable linguistic artefacts creation: make use of device built-in tools (voice recorder, camera, note taking option, memo app) or construct tools for creation of learner-generated multimedia artefacts • Enable synchronous and asynchronous communication with peers and experts (within pre-arranged times) to support a blend of social, cognitive, teaching and emotional presence (Swan et al., 2008) • Facilitate scaffolding support by connecting to experts and peers (directly on-demand and indirectly: delayed feedback and support) and offering personalized feedback • Incorporate tools to create, store, exchange, upload, download and listen to audio podcasts • Demonstrate how to use the built-in device tools to create, store, exchange, upload, download and listen to audio podcasts • Provide a common user-friendly interface for the MELLES functions including managing authors’ artefacts (1) • Provide alternative ways to access and use MELLES; include mobile clients (different platforms) and a common web interface for higher productivity; build in switcher detecting mobile vs. desktop visits (1)

	• Provide connection management tools for users to aggregate, validate, and point to relevant information (learners sharing resources on the MELLES site) (1) • Provide platform to coordinate/direct learning process (including scaffolding mechanism such as sending context sensitive help, pushing notifications, alerts, reminders) (1) • Provide tools and instructions to encourage creative effort in generating learning materials and other artefacts (1)
3 Scalability, flexibility and adaptability	• Allow learners to complete listening tasks following their own progression path, yet display reminders regarding prerequisites for milestone collaborative activities; flexible structure that learners can always fall back onto • Enable linguistic artefacts creation: make use of device built-in tools (voice recorder, camera, note taking option, memo app) or construct tools for creation of learner-generated multimedia artefacts (2) • Enable synchronous and asynchronous communication with peers and experts (within pre-arranged times) to support a blend of social, cognitive, teaching and emotional presence (Swan et al., 2008) (2) • Follow specific standards across all different mobile client platforms • Incorporate tools to create, store, exchange, upload, download and listen to audio podcasts (2) • Offer apps supporting language learning - point to existing apps or custom develop MELLES-specific apps (audio dictionaries, translators, flash cards) (1) • Demonstrate how to use the built-in device tools to create, store, exchange, upload, download and listen to audio podcasts (2) • Provide a common user-friendly interface for the MELLES functions including managing author's artefacts (1, 2) • Provide alternative ways to access and use MELLES; include mobile clients (different platforms) and a common web interface for higher productivity; build in switcher detecting mobile vs. desktop visits (1, 2) • Provide tools and instructions to encourage creative effort in generating learning materials and other artefacts (1, 2) • Seamlessly integrate off-line and on-line modes (locally on the mobile device) so that the user can work offline at will for improved continuity and flexibility of learning • Accommodate interrupted episodic learning through modular design with each audio not exceeding 5 mins or activity within a task not exceeding 10–15 mins
4 Scalable rating system (from artefact to learning structures to the whole system)	• Act as a repository of students' artefacts and a meeting point for evaluation and discussion of the artefacts (1, 2) • Build in an artefact evaluation (rating) system which aggregates average peer ratings, combines them with the expert rating (a higher weight in the final score), and concludes by recorded expert evaluation (2) • Enable exchange of delayed feedback and evaluation (audio, rating system, some text) (2) • Facilitate scaffolding support by connecting to experts and peers (directly on-demand and indirectly: delayed feedback and support) and offering personalized feedback (2) • Provide a common user-friendly interface for the MELLES functions including managing authors' artefacts (1, 2, 3)

	• Provide connection management tools for users to aggregate, validate, and point to relevant information (learners sharing resources on the MELLES site) (1, 2) • Provide tools and instructions to encourage creative effort in generating learning materials and other artefacts (1, 2, 3)
5 Multimedia (including text) artefact authoring, management and usage capabilities	• Act as a repository of students' artefacts and a meeting point for evaluation and discussion of the artefacts (1, 2, 4) • Assist with the perception of and interaction with the context affordances by way of podcasts and on-demand feedback mechanism (for instance, audio directions instruct students to collect evidence of various features of a Victorian style home) (2) • Build in controls for audio retrieval, recording and editing: play, record, adjust audio speed, pause, fast forward, rewind, replay, delete • Build in an artefact evaluation (rating) system which aggregates average peer ratings and combines them with the expert rating (a higher weight in the final score) concluded by recorded expert evaluation (2, 4) • Distribute (push to user devices and provide on the MELLES site) supplementary text-based content to accompany audio files (brief instructions, task-related information, vocabulary, links) (1) • Enable linguistic artefacts creation: make use of device built-in tools (voice recorder, camera, note taking option, memo app) or construct tools for creation of learner-generated multimedia artefacts (2, 3) • Facilitate scaffolding support by connecting to experts and peers (directly on-demand and indirectly: delayed feedback and support) and offering personalized feedback (2, 4) • Incorporate tools to create, store, exchange, upload, download and listen to audio podcasts (2, 3) • Support audio tech support resources with traditional text-based materials (1) • Demonstrate how to use the built in to create, store, exchange, upload, download and listen to audio podcasts (2, 3) • Provide a common user-friendly interface for the MELLES functions including managing author's artefacts (1, 2, 3, 4) • Provide connection management tools for users to aggregate, validate, and point to relevant information (learners sharing resources on the MELLES site) (1, 2, 4) • Provide platform to coordinate/direct learning process (including scaffolding mechanism such as sending context sensitive help, pushing notifications, alerts, reminders) (1, 2) • Provide tools and instructions to encourage creative effort in generating learning materials and other artefacts (1, 2, 3, 4) • Seamlessly integrate off-line and on-line modes (locally on the mobile device) so that the user can work offline at will for improved continuity and flexibility of learning • Accommodate interrupted episodic learning through modular design with each audio not exceeding 5 mins or activity within a task not exceeding 10–15 mins
6 Cross platform and multi-technology support	• Follow specific standards across all different mobile client platforms (3) • Demonstrate how to use the built in to create, store, exchange, upload, download and listen to audio podcasts (2, 3, 5) • Provide a common user-friendly interface for the MELLES functions

	including managing author's artefacts (1, 2, 3, 4, 5) • Provide alternative ways to access and use MELLES; include mobile clients (different platforms) and a common web interface for higher productivity; build in switcher detecting mobile vs. desktop visits (1, 2, 3) • Seamlessly integrate off-line and on-line modes (locally on the mobile device) so that the user can work offline at will for improved continuity and flexibility of learning (3, 5)
7 Integrated technology support and tutoring /instruction	• Deliver adequate quality audio content (instructions, directions, task-related information, pronunciation examples) (1) • Distribute (push to user devices and provide on the MELLES site) supplementary text-based content to accompany audio files (brief instructions, task-related information, vocabulary, links) (1, 5) • Follow specific standards across all different mobile client platforms (3, 6) • Support audio tech support resources with traditional text-based materials (1, 5) • Demonstrate how to use the built in to create, store, exchange, upload, download and listen to audio podcasts (2, 3, 5, 6) • Provide easily accessible audio/video instructions how to use the technology and features of the MELLES system, including examples and demos (1) • Provide platform to coordinate/direct learning process (including scaffolding mechanism such as sending context sensitive help, pushing notifications, alerts, reminders) (1, 2, 5) • Provide tools and instructions to encourage creative effort in generating learning materials and other artefacts (1, 2, 3, 4, 5)
8 Personalized user progress tracking capabilities	• Allow learners to complete listening tasks following their own progression path yet display reminders regarding prerequisites for milestone collaborative activities -flexible structure that learners can always fall back onto (3) • Enable exchange of delayed feedback and evaluation (audio, rating system, some text) (2, 4) • Facilitate scaffolding support by connecting to experts and peers (directly on-demand and indirectly: delayed feedback and support) and offering personalized feedback (2, 4) • Provide platform to coordinate/direct learning process (including scaffolding mechanism such as sending context sensitive help, pushing notifications, alerts, reminders) (1, 2, 5, 7) • Provide reports on user activity and progress (profile data and related information must be stored in a centralized database, all in compliance with personal information security policies) • Provide tools and instructions to encourage creative effort in generating learning materials and other artefacts (1, 2, 3, 4, 5, 7) • Accommodate interrupted episodic learning through modular design with each audio not exceeding 5 mins or activity within a task not exceeding 10–15 mins (3, 5)

This list of technological strategies and procedures is based on the aggregate study findings. It represents the opinions of users and creators of the MELLES solution; however, due to the study scope limitations, technical and procedural details of the features implementation, both on the client side (device) and the website (web-server), will have to be explored further in future studies. Likewise, technical and resource requirements for the inclusion of all the recommended system features will have to be revisited.

Technology and Pedagogy Interdependencies

As demonstrated in the study and discussed previously in this chapter, the relationships among the various characteristics and strategies required by an effective MELLES intervention are manifold. One characteristic usually necessitates interplay of many procedural methods. Likewise, one individual strategy can produce more than one function of the system. Moreover, mobile technology characteristics are directly connected to the pedagogical function which they enable. This web of interconnections is illustrated in the following chart (Table 50) to provide a clear representation of how the design principles interact to offer the MELLES solution. A complete list of design principles including matrices of strategies and essential characteristics recommended for the technology and pedagogy elements of the MELLES design are provided in the Appendices section (Appendices F and G).

Table 50.

MELLES: Pedagogy Strategies and Technology Essential Characteristics Mapped Out

Strategy - Pedagogy (***Procedural Emphasis***)	**Essential Characteristic-Technology** (***Substantive Emphasis***)							
	1. One-point access to all resources	2. Exchange and communication platform	3. Scalability, flexibility and adaptability	4. Scalable rating system (artefact, learning structures, the whole system)	5. Multimedia (including text) artefact authoring, management and usage capabilities	6. Cross platform and multi-technology support	7. Integrated technology support and tutoring /instruction	8. Personalized user progress tracking capabilities
1. Accompany website peer evaluation by expert feedback		x		x				
2. Aim at oral competencies relevant to student academic and professional goals								x
3. 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			x					
4. Ascertain active contextualized practice leading to output (verbal or non-verbal response)		x						
5. Assist with the perception of, and interaction with, the context linguistic affordances	x	x						
6. Build in a rating system for artefact evaluation				x				
7. Build in a social component to enable real-time interpretation and meaning-negotiation		x	x					
8. Build in interaction with others in person and via mobile-enabled channels		x						
9. Build in interactivity with others, content, technology, environment (context affordances)	x	x						
10. Build in self-evaluation of learner audio recordings				x	x			
11. Build in time and place flexibility in the individual activities			x			x		
12. Build individual tasks to feed into the group tasks	x				x			
13. Build tasks and activities based on listening learning outcomes	x				x			
14. Combine listening with task-related pronunciation practice	x							
15. Debrief completed tasks				x				
16. Develop new or modify existing mobile tasks and activities	x	x	x		x			
17. Document feedback through audio recordings posted on MELLES site				x	x			
18. Draw on context affordances and point to them through instructions and directions		x						
19. Encourage active listening by way of self-paced non-reciprocal audio tasks requiring verbal or non-verbal response (for instance, answer comprehension question for language podcasts)	x	x			x			
20. Encourage creativity		x		x	x			x
21. Encourage learners to co-creating audio vocabulary and idiom repositories	x				x			
22. Encourage questions regarding real-life listening tasks	x	x			x			
23. Ensure active listening by way of two-way listening activities such as task-focused interaction	x	x						
24. Ensure communication with others in-person and via mobile-enabled channels		x						
25. Ensure constant inflow of information and exchange of ideas	x	x			x			
26. Ensure direct or indirect (apps) access to MELLES and its resources	x	x						
27. Ensure dynamic feedback in real-world communicative situations		x		x				

28. Ensure dynamic meaning-making and negotiation	X	X		X				
29. Ensure that materials, resources, and tasks are relevant to student academic and professional goals		X		X				
30. Ensure vocabulary and pronunciation practice preceding the real-life embedded language tasks	X							
31. Facilitate immediate feedback (messages, alerts, tips, clues)	X	X		X				
32. Facilitate the artefact construction					X			
33. Include audio dictionaries and glossaries (dictionary apps, web-based dictionary glossaries)	X				X			
34. Include audio recordings (video, images, photos) created by students in response to communicative tasks				X	X			
35. Include contextualized listening challenges aimed at spontaneous communication	X	X						
36. Include discourse with diverse interlocutors		X						
37. Include element of educational games (challenges, awards, bonus system, group or individual competition, engaging visual interface, progress record keeping)	X	X						X
38. Include mobile-enabled feedback	X	X						X
39. Include one-way listening activities which comprise interaction with content, technology, speaker, task, and context affordances (meaning-focused listening) – contextualized group tasks	X		X					
40. 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)	X		X					
41. Include relevant linguistic resources	X			X				
42. Include socio-cultural competencies and information (for instance, visiting landmarks, collecting facts about them and exploring cultural habits)	X	X						
43. Include speaking activities to encourage meaning making		X			X			
44. Include subtitles/captioning for videos	X	X	X					
45. Include task goals aiming at carrying out linguistic functions in real-life situations in response to audio instructions	X			X				
46. Include task-related linguistic materials (such as a vocabulary list) and pointers to other task-related linguistic resources							X	
47. Incorporate comprehension materials offering (a) sufficient (b) language instances (c) whose meaning can be inferred through (d) active (e) meaning-making	X							
48. Incorporate language problems requiring negotiation of solutions			X					
49. Incorporate one-way listening activities which comprise interaction with content, technology, speaker, task, and context affordances (meaning-focused listening) – anytime any place individual tasks	X					X		
50. Incorporate task-related examples of questions and utterances and modeling	X	X						
51. Incorporate text-based resources to provide scaffolding and support (such as vocabulary handouts, audio scripts, answer sheets) (8)	X			X			X	
52. Inject fun and challenge	X	X			X			
53. Integrate impromptu speech component in response to oral input (for instance, responding to ad-hoc questions)	X	X						
54. Integrate rehearsed utterance exercises (such as recorded audio reflections, recording student utterances) for self, peer, and expert evaluation				X	X			
55. Maintain regularity of group/class activities		X				X	X	
56. Maintain the steady flow of information and interaction	X		X			X		
57. Moderate the MELLES website (for instance, step in when the instability is apparent)	X	X			X			

58. Offer authentic practice of responding to real-time input, such as direct or paraphrased repetition of audio content, or note-taking in a real-time lecture		X		X				
59. Offer choice of timing and sequence of individual tasks completion								
60. Offer in-person (immediate) and recorded (delayed) feedback and evaluation					X			
61. Offer learning activities coordination through schedules, timelines, alerts, reminders	X	X						
62. Offer post-task expert (delayed) feedback			X			X		
63. Offer vocabulary, grammar, pronunciation instruction and drills to prepare learners for real-world communicative challenges	X							
64. Organize aural tasks around the learning milestones, that is, the collaborative listening tasks situated in the real world, with individual aural practice supporting and leading to the milestone learning objectives		X						
65. Point to selected web-based language resources including audio and video podcasts	X		X					
66. Point to selected web-based pronunciation resources (such as YouTube)	X		X					
67. Point to socio-cultural information (such as facts about landmarks and cultural habits)	X	X						
68. Point to web-based and mobile-based resources	X	X			X			
69. Provide clear audio directions and instructions	X						X	
70. Provide clear directions on creating artefacts					X		X	
71. Provide examples and resources reflecting real-world communication tasks	X							
72. Provide listening practice preparing learners for the group real-life tasks (such as related vocabulary, grammar tips, dialogue examples)	X				X			
73. Provide personalized feedback				X				X
74. Provide scaffolding through visual representation of audio content - message redundancy	X				X			
75. Provide technology support and point to tech resources incorporated in MELLES (mainly in the initial stages)							X	
76. Provide tools for recording, editing, upload and viewing/listening on-the- go (or demonstrate the usage of device built-in tools)				X				X
77. Provide/point to clear instructions and directions for tasks	X						X	
78. Reflect or include real-world communication tasks (communicative goals)	X	X			X			
79. Review audio directions and instructions (initial stages)	X	X						
80. Share and showcase learner-generated linguistic artefacts	X	X						
81. Use text for just-in-time comprehension assessment	X	X	X					
82. Use text for on-demand communication and to exchange immediate feedback (reading, writing)	X	X						

The substantive and procedural knowledge captured in the design principles recommended in Tables 40-47 and 49 as well as Appendices F and G, come together to form a design framework for a MELL educational intervention. Formulated on the basis of user and expert knowledge as well as in situ evaluation, these recommendations encapsulate essential pedagogical components and strategies required to generate a mobile-enabled system supporting aural skills acquisition.

Chapter 8 Summary

This chapter revisited the essential interplay among the major characteristics of the MELLES system and focused on the role of technology within this system. The substantive and procedural recommendations from the previous phase were further elaborated together with the interdependency between the pedagogical strategies and technological features.

The final MELLES design principles were expressed as heuristic statements: addressing the applicability of MELLES and its constituent elements in the specific context of the study. These design principles deriving from the creation of the MELLES solution prototype presented in Chapter 5, represent a fundamental outcome of this DBR research study. Further exploration of both the design guidelines and the educational intervention are discussed as part of suggestions for future investigation which are outlined in the next and final chapter of this dissertation together with the summary of outcomes.

Chapter 9. Summary, Significance, Limitations, and Recommendations

This chapter summarizes the overall conclusions drawn from this study as well as the significance of its contributions to scholarship. In addition, the limitations of the study are outlined here, followed by recommendations to guide practitioners and future research. To conclude, final reflections on the process and outcomes of the DBR study are presented.

Summary of Study Outcomes

The eighteen-month-long DBR process of data collection and analysis (June 2010–December 2011) resulted in two major outputs, namely (1) replicable MELLES design principles and (2) a prototype of a learner-centred MELL system that facilitates acquisition of ESP listening skills. Other key outcomes of the study include (3) an enhanced understanding of the broader context of learning ESP using mobile devices and (4) the role of the constituent elements of that environment. In addition, the study contributed the real-life praxis of (5) the Ecological Constructivist framework and the (6) DBR methodology which suited the dynamic character of the intervention under study.

Purpose of the research.

The DBR study aimed to address the problem of inadequate aural skills instruction for George Brown College ESP students by augmenting in-class learning through effective utilization of students' mobile devices. This objective was attained through the iterative processes of design, development and evaluation of a MELL intervention applied in the actual college setting. The realization of the study purpose was facilitated by time, effort and expertise contributed by over one hundred GBC students and practitioners. As a result, the research outcomes have already improved educational practices at the college and are expected to have further impact on approaches to teaching and learning. The key outcomes are briefly summarized below.

MELLES conceptual model and design principles.

This multipart study, tied together by the Ecological Constructivist framework, produced two key outputs, namely a set of design principles for a Mobile-Enabled Language Learning system and a prototype of a corresponding educational intervention. The DBR methodology provided context for a comprehensive study which examined both the theory and praxis of the mobile-enabled solution for learning aural skills. The iterative process of the design, development and evaluation of the MELL solution, facilitated the creation of consecutive instantiations of the design theory. In turn, enhanced understanding of the essential features and functions of the educational intervention resulted in MELLES design principles which encapsulate the findings of this DBR study. Substantive and procedural knowledge conveyed through the final version of the design recommendations represent a comprehensive response to the key research question:

What are the characteristics of an effective, pedagogically-sound MELLES for students' mobile devices, through which adult ESP students in a community college enhance listening skills, while expanding their learning outside of the classroom?

An exhaustive cyclical examination of the components of the MELL intervention under study, together with their interconnections, resulted in a wealth of feedback contributed by experts and students. Thus, rigorously gathered and analyzed mixed data were repeatedly distilled to eventually generate a MELL design framework. These design guidelines, presented in detail in Chapters 7 and 8, reflect both the pedagogical and technological dimensions of the intervention. Although participant feedback put more emphasis on the pedagogical components than the mobile technology, it clearly emphasized the role of mobile technology as the enabler of the pedagogical procedures, content delivery, interaction of actors and the context of learning. Presented in the following matrix are the key design characteristics that have been established as essential for the MELLES system to effect the learning of listening in the out-of-class context. The matrix also illustrates how the inclusion of a technological function enables multiple and, in most cases, all pedagogical components recommended for the system.

Table 51.

Essential Characteristics: Technology-Pedagogy Matrix

Essential Characteristics – Pedagogy	**Essential Characteristics – Technology**							
	1. One-point access to all resources	2. Exchange and communication platform	3. Scalability, flexibility and adaptability	4. Scalable rating system	5. Multimedia artefact authoring, management and usage capabilities	6. Cross platform and multi-technology support	7. Integrated technology support and tutoring instruction	8. Personalized user progress tracking capabilities
1. Balanced combination of individual and collaborative (group work) tasks	x	x	x	x	x	x	x	x
2. Learner-generated linguistic artefacts (audio, video, photos, images)	x	x	x	x	x	x	x	x
3. Game-like real-life communicative tasks	x	x	x	x	x	x	x	x
4. Expert facilitation: scaffolding, feedback, and coordination	x	x	x	x	x	x	x	x
5. Feedback mechanism (immediate and delayed)	x	x	x	x	x	x		x
6. Focus on authentic listening tasks in the dynamic real-world communicative situations	x	x	x	x	x	x		x
7. Support of self-paced individual audio tasks feeding into/preparing learners for the real-life tasks	x	x	x	x	x	x		x
8. Integrate all four language skills but focus on listening outcomes	x	x		x	x		x	
9. Linguistic resources (task-related): relevant vocab. • dictionaries • pronunciation • clear task directions and explanations • ex. of lang. usage	x	x	x	x	x	x	x	
10. Support out-of-class MELL with in-class (f2f) instruction and practice	x	x	x	x	x			x

In fact, the interdependencies between pedagogical and technological procedures form a network of relationships (Chapter 8, Table 50) which, combined with the actors and the learning context, result in the Mobile-Enabled Language Learning Eco-System (MELLES).

The concept of a mobile-enabled learning system gradually evolved from the DBR processes and data analysis to replace the original concept of a MELL intervention. The holistic approach encapsulated in Ecological Constructivism put more emphasis on the interdependence of the MELL solution elements and the context in which they were intended to be used. Consequently, MELLES was derived from the study findings as one of its key outcomes.

MELLES encompasses several elements which were demonstrated in the study to be vital to the effective acquisition of aural proficiency. Enabled by the system, new knowledge and language skills are engendered based on the interactions among content, pedagogical procedures, mobile technology, learners and experts, as well as the context of learning. Consistent with the ecological paradigm, MELLES relies on collaboration in the real-world context which mediates communication and, thus, language learning. While the real-life language situations create communicative challenges, the linguistic affordances offered by the environment provide support for meaning-making which, in turn, stimulates and generates language acquisition. In addition, the MELLES network of peers, experts and authentic language speakers facilitates learning by way of authentic discourse, feedback, resource sharing and social support. Both transitory communication experiences (such as a one-time encounter with a passerby) and longer lasting connections with sustained continuity between the actors (such as exchange of emails for four weeks) contribute to learning episodes which mediate individual learning processes.

Mobile devices can enable communicative exchanges and help capture linguistic evidence by way of learner-generated artefacts. Learning support and scaffolding come from MELLES resources accessed via the device, whereas artefacts are created using the technology tools. Any verbal and non-verbal actions or objects can support the learning of listening if the learner perceives them and uses them for linguistic action. These linguistic affordances can be noticed and utilized through active interaction with the environment; therefore MELL task instructions and resources should be designed to stimulate noticing of potential affordances by students.

To decode the meaning offered by the real-life language situations, MELLES instruction should encourage dynamic interaction with the English speaking environment. Listening should be practiced as part of a *whole* language experience that integrates all four language skills in a *whole* context of real-world communication. Regular in-class instruction should also be integrated with the out-of-class practice and linked into a cohesive learning experience by way of the MELLES platform and communication management tools. The frequency of such face-to-face instruction would depend on the specific setting of the ESP program. Furthermore, offering on-demand links to the system promotes social, cognitive, teaching, and emotional presence. This results in a collaborative network which has become the predominant structure of the recommended MELLES solution.

The web of connections between learners and experts engenders integrative thinking usually associated with the values of cooperation, partnership, quality and conservation (Capra, 1996). Adult language learners engaged in meeting the regular demands of everyday life, need the support of a learning community to provide help and motivation. Considering how significant the notion of motivation was to participants, MELLES encourages continuity of practice through its emphasis on collaboration and communication as well as the design of its learning modules (Chapter 5). MELL modules integrate time- and place-flexible individual listening tasks with collaborative game-like tasks completed in the dynamic authentic language setting. These situated group tasks occur regularly throughout the semester to provide face-to-face peer interaction and motivate learner engagement. Individual tasks, at the same time, target language competencies required for these milestone collaborative events. Continuity of practice should also be encouraged by means of feedback and expert facilitation referred to in the next section.

The broader context of MELLES and its selected constituent elements.

One of the primary findings of the study is the understanding of how the elements of the recommended MELL system must co-exist for the solution to effect learning. In fact, it is imperative for the MELLES components to interact and maintain a dynamic balance, as exemplified by the combination of collaborative and individual language activities. On a macro scale, this ecosystem needs to be in a flexible state where its various parts adjust according to the changing environment, including learner needs and the advancement of mobile technologies. Such flexibility of the MELL solution based on the feedback coming from the system is required for MELLES to remain scalable and sustainable. For future students to benefit from and contribute to the system, it must adapt to changing conditions. Although, further research is required to explore what strategies are needed to ensure the scalability, adaptability and sustainability of MELLES, the study demonstrated that the ESP expert plays a key role in this type of MELL learning system.

Thus, another important finding of this study is the significance of this expert support. Due to the nature of language learning instruction and the character of the second language adult learner, the role of an ESP expert in the MELL environment is multifold. The emphasis of his/her teaching shifts in this more fluid context, from in-person instruction, immediate feedback or modeling of language usage, to the role of a MELL facilitator. The MELLES teacher is an instructional designer, website and dialogue moderator, motivator, learning experience organizer and coordinator. He/she creates learning materials, selects and points to valid resources, records feedback, communicates and evaluates learner creations. He/she also meets occasionally with students to reinforce their mobile-enabled practice through in-person contact. In MELLES some of these teaching roles are designed to be shared with peers and technology, for instance provision of feedback or modeling of language. Although in the MELL context some power shift granting more learner flexibility and responsibility might be observed, the need for an intermediary agent and an ESP expert has been demonstrated throughout the study.

The notion of *context* is another important element highlighted by the findings. The term *context* has been used in this work to denote (1) *a setting in which the learning event occurs,* (2) the *holistic (contextual) character* of the ESP learning process, and (3) *the MELLES web of interwoven elements* (Chapter 4, 7, 8). Accordingly, the MELLES approaches the learning of listening within the context of *whole* language learning, namely, (1) practicing listening as part of a *whole language system* (for instance, supporting listening with the other three language skills, practicing communication rather than focusing on the parts of speech, and integrating socio-cultural competencies), (2) learning it in the *whole context of students' life* (accommodating students' busy schedules, focusing on themes relevant to their interests and careers), (3) co-construing knowledge as part of the *whole learning community*, and (4) actively practicing listening in the *whole communicative context* of the particular language situation that learners encounter. The more observable meaning of *context* is *the real-world setting of MELLES activities.* Owing to the English speaking milieu, MELLES students can benefit from authentic meaning-making practice within dynamic language circumstances. They can also support their learning processes with linguistic affordances offered by the context (Chapter 4). Therefore, the importance of the real-world context is captured in the MELLES design principles (Chapters 7 and 8).

All in all, the systemic perspective on the MELL intervention stresses the connectedness of the constituent parts of the learning environment. The many characteristics of these elements are distilled in the discussion of design guidelines (Chapters 4–8); however, several significant technological features warrant a summative reiteration.

A number of mobile technology tools and functions, required to collectively enable authentic communication practice, have been identified in the study (Chapter 8). One of the novel features introduced by MELLES was a scalable rating and evaluation system which offers peer evaluation, combined with expert scores and comments to indicate the weight of peer evaluation. In addition, personalized user progress tracking capabilities allow learners to follow their own progression path while displaying reminders to motivate and direct their learning experience. These and other building blocks (Tables 40-51) of the recommended MELLES must be integrated into the system to ensure its flexibility is balanced with customization. Further, since the system should be easily accessible to all students and experts who are part of the network, the issue of cross-platform development arose in the study. The proof-of-concept mobi-english.mobi site was originally the prototype of the gateway to the system. It exemplified the web-based mobile access approach with all devices connecting to MELLES resources via the Internet. Evaluation of this approach demonstrated that, due to data plan and wireless connection limitations, the recommended MELL model should combine resources residing locally on the student's device with resources available online (on the server). Further research into the design and implementation of such a cross-platform solution is required.

Ecological Constructivism framework.

Apart from the MELLES design and corresponding design principles, the study resulted in an ecological framework (Chapter 4) which was demonstrated to be an appropriate paradigm for exploration of a MELL educational system. The specific context of learning listening in a real-world setting with the help of mobile technologies necessitated a theoretical framework which supports a holistic approach to the process of learning. After the Informed Exploration phase, the focus of the study shifted from investigating individual solutions to exploring a whole (ecological) intervention which enables learning mediated by technology, interaction with other people, and context.

The need for co-existence of pedagogical and technological elements which interconnect in a dynamic language learning environment, led to the emergence of the Ecological Constructivist paradigm. It integrates the SCT constructs of (1) knowledge co-creation being (2) socially and culturally mediated with the help of (3) tools which are applied in (4) active learning targeting (5) real-life (6) communicative goals. It also melds the elements of (7) co-dependence of individual cognition and collaborative learning, (8) ZPD and (9) scaffolding. The ecological perspective allowed further elaboration of the role of technological tools enabling mediation of learning and communication in the dynamic real-life context. Ecological Constructivism, in fact, stresses that the fluid nature of the changing context and the active engagement of learners are both required to co-construe knowledge. It introduces the concept of context affordances mediating the process of learning by providing linguistic cues and other meaning-making supports to those who perceive them. Moreover, it emphasizes the wholeness of the learning system and the interconnectedness of all its elements. Bearing in mind the contextual emphasis of the ecological paradigm, research guided by Ecological Constructivism should reflect the complexity and "messiness" of real-world learning. The DBR approach echoed this multiplicity of processes and elements within the education context.

Design-Based Research approach.

Lessons learned from the application of the DBR methodology, have both theoretical and practical implications for future research. Firstly, DBR was demonstrated to be the appropriate method for theory-driven design of the complex MELLES intervention. It accommodated the need for multiple iterations of design, development, testing and deployment of a technology-based educational solution. Secondly, it allowed for evaluation of subsequent versions of the intervention prototype, thereby enabling empirical testing in the educational setting under investigation.

While the theory expressed through the design guidelines enabled the progressive development of a practical MELL model, the MELLES model, in turn, informed the underlying theory. This cyclical approach was required to facilitate the overlapping iterations of testing, feedback gathering, data analysis, and results-driven design refinement. It also allowed for experimentation and reflection over the period of longitudinal data collection from the target population. Although coordinating the interdependent DBR macro and micro-cycles proved to be problematic at times, the findings from these overlapping research activities resulted in the formation of a well-informed cohesive theory. The resultant framework reflected the interconnectedness of the elements that were present and actively contributing in the process of the intervention design and piloting. Moreover, the MELLES framework drew together knowledge from L2 students and experts in the fields of mobile computing, programming, second language acquisition and pedagogy. This interventionist research has therefore resulted in enhanced MELL theory and a practical educational solution addressing real needs of real adult students at a community college.

To afford a clearer understanding of the complexity and density of the design process, the DBR procedure, benefits, and limitations, (discussed in detail in Chapter 3) also warrant inclusion in this summary of the outcomes of the study. A researcher needs to combine solid coordination and management skills with rigorous research practice to benefit from the rich data emerging in a DBR study. Only through systematic data collection and analysis, followed by aggregation of more data and re-analysis, can DBR findings be filtered into valid theory. The significance of this finding is reinforced in the following section.

Significance: Theoretical and Practical Contributions

The contributions and implications of the study were introduced in the preceding section; nevertheless, the essence of their significance is highlighted in this section.

The study produced and tested the applicability of an innovative MELL solution for the learning of language listening skills outside the classroom. It resulted in an improved understanding of what characteristics and design strategies such an educational intervention requires and how these essential elements of the system interplay. Empirical tests of these theoretical findings demonstrated that the resulting design guidelines are effective in the particular context under study.

The MELLES solution recommended therefore provides a model for replication in similar educational contexts. In addition, the MELLES design principles come together into a design framework to guide development of a practical and innovative mobile learning intervention targeting aural skills of adult ESP students. MELLES design guidelines are formulated to guide ESP practitioners by letting them select and apply substantive and procedural knowledge suitable for specific design and development tasks in their own contexts. The MELLES conceptual model and reusable design principles, thereby, contribute to the mobile design theory.

The study highlighted the effectiveness of the MELL approach to language learning contextualized in the dynamic real-world language environment. The understanding of how adult learners perceive contextualized mobile-enabled language practice and its relative significance to authentic communicative practice has implications for second language pedagogy. Furthermore, the emphasis on out-of-class learning, collaborative knowledge co-creation, and the usage of mobile devices for mediation of flexible learning experiences highlights the importance of MELL methods and techniques. Changes in societal communication practice and in the usage of digital communication tools should be reflected in language learning theories and practice. Hence, the enhanced understanding of the needs of 21st century ESP students combined with the design guidelines recommended for MELLES aim to further optimize ESP instruction by improving its methods and increasing its appeal.

The study also contributes a deep understanding of a MELL innovation and the factors affecting its improvement in the local context of study. Although the DBR study did not seek universal solutions, this document offers a thick description of the DBR process, the resulting data and findings, thereby allowing for research replication and data validation. Given that DBR is a relatively recent methodology, the detailed account of the data collection and analysis procedures should aid in planning future research.

Finally, the ecological metaphor applied to the MELLES solution offers an innovative holistic lens through which the complex process of learning should be viewed. The Ecological Constructivism framework, which emerged in the early phase of this study, integrates the multiple dimensions of Ecological Linguistics and SCT in the situated and context-embedded learning engendered by these novel uses of mobile devices. This framework contributes a new ecological perspective to theories of learning.

Most importantly, this study contributes the MELLES prototype, an innovative model for learning aural skills using mobile devices. It completes this practical model with a theoretical design framework for MELL solutions. Furthermore, the study findings enhance the understanding of contextualized

MELL learning and offer practical knowledge pertinent to adult ESP education and mobile-enabled learning.

Limitations

As noted earlier, the resultant MELLES conceptual model encompasses many components which are connected into a rather complex system. All of these constituent elements contribute to a whole MELL solution and none can be separated cleanly to be examined in isolation. Consequently, the in-depth examination of such elements as expert facilitation, multimedia artefact authoring tools, and cross-platform development, could not be part of this already lengthy study. Due to its focus on the systemic character of the MELL solution, rather than its constituent parts, the study provided a broad all-encompassing perspective on the educational intervention. Consequently, it did not provide more in-depth treatment of the essential features and contributing elements of the system.

Related to the issue of the breadth versus depth of investigation is the limited evidence on actual learning effected by the MELLES approach. Although students reported high satisfaction with the effectiveness of MELLES based on their perceived learning and positive learning experience, no evidence of learning was collected through formal assessments of students' progress. This limitation resulted from the multiplicity of other variables and time constraints of the DBR study.

Other limitations resulting from the nature of the DBR methodology included overwhelming amounts of data, difficulty maintaining the cooperation and participation levels of participants over the stretch of the study, small sample size with regard to the quantitative data analysis, possible reactivity effects, complexity and messiness of the study, as well as difficulty in making generalizations outside of the local context. These have been comprehensively summarized and discussed in the Limitations section of Chapter 3.

Two chief limitations pertaining to outcomes were also noted in this study. Firstly, the MELLES prototype was created as a proof-of-concept solution and, therefore, does not incorporate all the features and functionalities recommended by the refined guidelines. It is, thus, not a complete “ideal model” but a prototype, the evaluation of which produced the final MELLES design principles. Certain features of the mob-english.mobi website had to be simulated and some functions had to be performed manually. For example, some rating and evaluation steps had to be performed with the help of email. Due to limited time and financial resources, more advanced features of the recommended solution were not automated until after the completion of the study. Presently, work on the more advanced version of the system is being conducted.

Secondly, the matrix of MELLES characteristics and procedures required for their implementation needs further streamlining. Overlaps between certain strategies exist with some being partial sub-strategies to others. Bearing in mind that these technological and pedagogical procedures form a web with no one-to-one correspondence between characteristics and strategies, the substantive and procedural elements of the design principles require further refinement through future iterations of the research study. Additional recommendations for future studies are offered in the following section.

Recommendations

The main recommendations emerging from the study are encapsulated in the Summary of Study Outcomes at the beginning of this chapter. The recommendations for ESP practitioners include the proposed ecological approach to designing a Mobile-Enabled Language Learning system which facilitates augmenting classroom learning with contextualized practice. Accordingly, it is recommended to design MELL instruction which promotes continuity of learning and dynamic communicative practice in the authentic language context. Design principles and a conceptual model for such a MELL system are provided for reuse and replication.

The DBR method is recommended as an appropriate approach for future studies of complex multi-layered educational interventions. However, some caution is recommended with regard to the length and planning of a DBR project: rigorous and synchronized research activities must be supported by sufficient time, monetary and human resources for a DBR study to result in valid findings. This DBR study generated an abundance of data but, at the same time, created some gaps in the understanding of the impact of the many elements of the recommended MELLES intervention.

Future Research.

Thus, in providing a perspective on a MELL solution, this study gives rise to a number of further questions, some of which are directly related to the MELLES framework. Firstly, as this study was limited to one specific context, further research in diverse settings will determine whether these findings can be generalized across other language learning and cultural settings. In addition, the applicability of a MELLES-like system in a context where the target language of instruction is not spoken outside of the classroom should be explored. Research into adapting the proposed design framework for other learning contexts, including different subject matter and educational settings, is needed.

Secondly, the study should be replicated and its results enhanced by measuring the actual acquisition of aural skills over time. The impact of the MELL practice was not sufficiently investigated, nor was the actual learning adequately evaluated. Longitudinal data are also needed to provide evidence of sustained aural skill acquisition. Future research thus needs to demonstrate effectiveness of MELLES measured by the outcomes and permanence of learning.

Thirdly, further research is required into the actualization of the MELLES theory, in particular the design and development of the technological features and functions recommended by the study. Thus, questions must be answered regarding methods of providing cross-platform access to the MELLES system by combining resources residing locally on devices with those available online (on the server). Furthermore, more advanced technological solutions are needed to promote scalability, flexibility and adaptability of MELLES. The empirical implications of future investigation into these affordances of a MELLES-like platform will promote learner engagement and sustainability of the system. The remaining technology functions will require ongoing examination and refinement due to the fact that mobile technology advancements provide novel solutions, which in turn trigger changes in learners' needs.

Fourthly, it is important to revisit the extent to which language learning may be defined by contextualized real-world practice enabled by mobile technologies. More research is also required to understand how situated collaborative practice can be seamlessly integrated with individual time- and place-independent learning.

Finally, future investigation into the role of the teacher in a MELL system would provide insight into how the expert can provide scaffolding, feedback and resources while motivating learners and keeping them engaged. More studies are needed to tackle questions on the role of experts in aggregating and selecting valid resources, sharing resources, and weaving them together into a coherent whole to, at some point, possibly approximate a self-organized MELLES.

These studies are necessary to create a solid foundation for the application of the MELLES solution as a theoretical and practical framework for mobile-enabled language learning.

Work related to the future directions recommended in the previous section is already underway. The researcher is privileged to be able to continue the MELLES project, and thus further contribute to the investigation of how to ensure the most appropriate blend of learning resources, activities, technologies and people in the context most conducive to the circumstances of the particular learning experience.

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Appendices

Appendix A: Bookkeeper/Entry-level Accountant Language Profile

This profile is based on the *Canadian Language Benchmarks 2000* (CLB), a descriptive scale of communicative proficiency in English as a Second Language (ESL) expressed as 12 benchmarks or reference points. The document contains statements and descriptions of communicative competencies and performance tasks in which the learner demonstrates application of language knowledge (competence) and skill. As a framework, CLBs provide a common professional foundation of shared philosophical and theoretical views on language education.

Comprehensive workplace language benchmarking was conducted at 8 workplaces that employ bookkeepers and entry-level accountants. The following profile is a summary of the language competencies that bookkeepers/ entry-level accountants exercise in a typical day on the job. These benchmarks were observed by OSLP researchers through job shadowing, conducting interviews with bookkeepers and their managers and/or supervisors, and analysis of workplace materials. The profile shows the language skills competencies and the CLB levels that bookkeepers should be able to function at in order to succeed in the workplace. The final CLB benchmark assigned to each language skill reflects the minimum level of language proficiency required to function effectively in the workplace. This benchmark reflects the summative evaluation of benchmarks identified at the individual workplaces. A range of CLB levels are assigned due to the broad array of tasks that are associated with this particular occupation and workplace. Each of the four language skills (speaking, listening, reading, and writing) were analyzed separately. For this language profile, benchmarks that were observed in at least two different workplaces are included and the frequency of the benchmark appearing in the workplace is indicated. These CLB values are assigned only with respect to the language requirements of workplace tasks; they do not represent the language proficiency of the bookkeepers/ entry-level accountants observed.

Job titles synonymous to Bookkeeper:

Accounts Receivable/Payable Coordinator/Clerk, Accounting Assistant Manager, Accounting Clerk, Fund Accounting

LEGEND

Types of Benchmarks

GPD: Global Performance Descriptor
WPCD: What the Person Can Do
PI: Performance Indicators
PC: Performance Conditions

Other abbreviations:

CLB: Canadian Language Benchmarks
CLB p.#: Page number of the reference in the Canadian Language Benchmarks 2000 document
FQ: Frequency of the benchmark appearing in the workplace

Table 52.

Listening Benchmarks

LISTENING (CLB 8)				
Benchmark	CLB Descriptor	Type	CLB p.#	FQ
7	Can understand an expanded inventory of concrete and idiomatic language.	GPD	p. 74	7
7	Understand sets of instructions related to simple technical and non-technical tasks.	WPCD	p. 81	5
7	Topics are familiar.	PC	p. 80	4
7	Can understand routine work-related conversation.	GPD	p. 74	3
7	Demonstrate comprehension of details and speaker's purpose in directive requests, reminders, orders and pleas.	WPCD	p. 81	3
7	Identifies functional value of utterances (e.g. thanking, complaining, hoping, etc.); Identifies situation, relationship, mood/attitude of participants.	PI	p. 81	3
7	Identifies functional value of utterances as directive requests/reminders, orders or pleas.	PI	p. 81	3
7	Identify stated and unspecified details, facts and opinions about situation and relationship of participants containing expression of and response to gratitude and appreciation, complaint, hope…satisfaction, dissatisfaction, approval and disapproval.	WPCD	p. 81	2
7 - 8	Speech is clear at a normal rate; instructions are clear and coherent.	PC	p. 80, 82	6
7 - 8	Can follow short predictable phone messages on familiar matters; can follow clear and coherent messages on unfamiliar topics.	GPD	p. 74	3
7 - 8	Can follow most formal and informal conversations on familiar topics at a descriptive level, at a normal rate of speech, especially as a participant; some technical, work-related discourse in own field at a normal rate of speech.	GPD	p. 74	3
8	Can comprehend main points, details, speaker's purpose, attitudes, levels of formality and styles in oral discourse in moderately demanding contexts of language use.	GPD	p. 74	7
8	Follow an extended set of multi-step instructions on technical and non-technical tasks for familiar processes or procedures.	WPCD	p. 83	6
8	Identifies situation, relationships between participants and speaker's purpose; identifies some attitudinal nuance, emotional tone and register of the text.	PI	p. 83	5
8	Can follow clear and coherent phone messages on unfamiliar and non-routine matters.	GPD	p. 74	5
8	Identifies functional value of utterances as warnings, threats, suggestions or recommendations.	PI	p. 83	3
8 - 9	Follow an extended set of multistep instructions on technical and non-technical tasks for familiar processes or procedures. Integrate several detailed and extensive pieces of oral information to carry out multistep complex instructions for a familiar process or procedure.	WPCD	p. 83, 136	2
9	Sufficiently grasps the meaning to paraphrase or summarize key points and important details.	GPD	p. 132	2

Appendix B: Student Information Letter

For further information:
Aga Palalas
Tel: (416) 415-5000 ext. 6868
Fax: (416) 415-4112
Email: apalalas@georgebrown.ca
November 20, 2009

Design guidelines for Mobile-Assisted Language Learning objects supporting the development of ESP listening skills.

Student Information Letter

Dear (COMM/CESL Class) Student,

You are invited to take part in the research project conducted by Aga Palalas from the International and Immigrant Education department at George Brown College.

This research project seeks to produce effective listening tasks for college ESP (English for Special Purposes) students. The main purpose of the research project is to create mobile listening tasks, for your mobile devices to promote the development of aural language skills for ESP learners. ESP students involved in previous research studies at George Brown College have identified mobile learning as an effective and flexible option to extend their learning outside of the classroom. We wish to pursue this line of research further to benefit ESP learners, and students in general, at George Brown College.

Who can participate in the research?

Students enrolled in a COMM class associated with this project.

What choice do I have?

Participation is **entirely voluntary** and your decision to participate or not participate will not affect your standing in your courses. You may withdraw from the project at any time without giving a reason and without consequence.

What will I be asked to do?

Using a mobile device, either your own or the one provided, you will be asked to complete GBC-created listening tasks. A variety of tasks will be created to help students develop language skills. You will be asked to provide feedback on the effectiveness of the listening tasks by filling out a survey and participating in researcher-led focus groups and/or interview. You will also be asked to participate in a listening test at the beginning and end of the course.

What are the risks and benefits of participating?

There are no known risks associated with participating in this research. If at any time you should feel uncomfortable answering any questions, you can omit the question or discontinue your participation in this research. By participating you support your language practice and share your feedback regarding effective language tasks.

How will the information collected be used?

Your responses will be held confidential and anonymous. Your responses will be reported as part of a group and your name will not be associated with any of your responses. Data will be stored on a computer that is password protected. Records of your responses will be stored in a locked area and then destroyed after 5 years. At no time will any individual be identified in any reports resulting from this study.

What do I need to do to participate?

Please read this Information Letter and be sure you understand its contents before you consent to participate. If there is anything you do not understand, or you have any questions, please contact Aga Palalas at 416-415-5000 ext. 6868.

If you would like to participate, please sign the attached consent form and return it immediately to your instructor or Aga Palalas.

Thank you for considering this invitation,

Aga Palalas
Curriculum Specialist, International and Immigrant Education Dept.

Appendix C: Consent Form

For further information:
Aga Palalas
Tel: (416) 415-5000 ext. 6868
Fax: (416) 415-4112
Email: apalalas@georgebrown.ca
November 20, 2009

Effective Mobile Listening Tasks for College ESL Students

Consent Form

I, *(please print)*____ have read and understood the information on the research project **Effective Mobile Listening Tasks for College ESL Students** which is to be conducted by Aga Palalas and all questions have been answered to my satisfaction. I agree to voluntarily participate in this research and give my consent freely. I understand that the project will be conducted in accordance with the Information Letter, a copy of which I have retained for my records. I understand I can withdraw from the project at any time, without penalty, and do not have to give any reason for withdrawal.

I consent to:

Using a mobile device, either my own or the one provided by the project, complete GBC-created listening tasks. Yes/No

Provide feedback on the effectiveness of the listening tasks by completing a survey and participating in researcher-led focus groups and/or interview. Yes/No

Participate in a listening test at the beginning and end of the course.

Yes/No

Print Name: ____

Signature: ____

Date: ____

Appendix D: Glossary

App: (also called mobile apps, or mobile applications) software made for mobile devices including any mobile platforms, for instance, Apple, Android, Windows

CALL: Computer-Assisted Language Learning

CELL: Computer-Enhanced Language Learning

CLB: Canadian Language Benchmarks

CLBPT: Canadian Language Benchmark Placement Test

COMM: Communications Courses

DBR: Design-Based Research

ESL: English as a Second Language

ESP: English for Special Purposes

GBC: George Brown College

ILDF: The Integrative Learning Design Framework model

MALL: Mobile-Assisted Language Learning

MELL: Mobile-Enabled Language Learning

MELLES: Mobile-Enabled Language Learning Eco-System

OSLP: Occupation-Specific Language Profile

LO: Learning Object

SLA: Second Language Acquisition

SCT: Socio-cultural Theory

Wireframe: A visual guide used in interface design to demonstrate the layout of a learning object/website and relationships between its elements/pages.

ZPD: Zone of Proximal Development

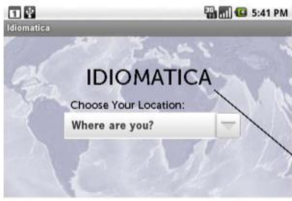
Appendix E: Preliminary Designs from the DBR Pilot Contributed by Design Students.

Interface Design 2009
Mobile Learning Object

IDIOMATICA

Vicky Peters

The interface for Idiomatica is based on design and "best practices" guidelines as set out for the new Android operating system.



The baseline screen suggested is 320 x 480, from which the Android system adjusts per individual device screens.

For the initial Idiomatica interface, I have devised a horizontal layout. Both horizontal and vertical should be ideally made available to the user.

1. The initial screen asks the user to choose their location from a drop-down menu.

Font: Museo Sans 500

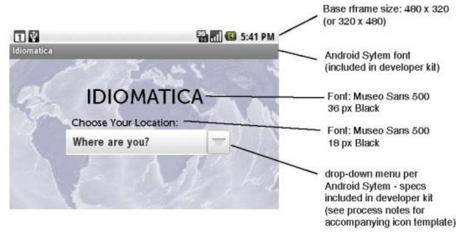
2. The user in the example has chosen a clothing store. The Idiomatica offers a choice of four sound clips: two are easy, and two are hard.

Note that the Android devices are equipped with a touch screen interface, and the assumption in the interface design is a device with touch screen capabilities.

3. Once a clip is chosen, the user is taken to a screen with the playbck function. Idiomatica offers user control of playback, including pause and slow speed functions, as well as a mute button.

The user is asked to identify the idioms contained in the clip, and to type them in the text boxes using the phone's keyboard. The system should recognize the number of idioms in the clip, and provide the correct number of text boxes. In this case, there are three idioms.

Developer's note: The interface layout above is primarily a wireframe architecture, with some aspects of Android interface from the developer's guide (like the initial drop-down menu). The Android developer's available for free from Android, includes stylable system architecture such as buttons, and audio playba Some of the system architecture will further determine the look of the Idiomatica interface.



4. Here the user has mispelt one of the idioms from the audio clip. The correct answer is number three. The multiple choice option only appears when the initial guess is incorrect. It should serve to support the audio with visual clues.

Note that each option is tied to a button, and once pressed that choice is submitted as the user's guess.

5. The correct answer is supported with a repeat of the right choice.

The user is asked to choose (via buttons) whether they would like to quit Idiomatica, to try again, or to move on to play part two.

6. Part two is simply directions for the user to repeat one or more of the idioms they have just heard by using the idiom in a sentence with someone around them.

In future developments of the system, this could be expanded to have the user collect a new idiom from someone in their environment, and to submit the new idiom to the Idiomatic database.

Appendix F: Design Principles Matrix (Pedagogy)

Table 53.
Design Principles Matrix (Pedagogy)

	Essential Characteristic-Pedagogy (*Substantive Emphasis*)									
Strategy - Pedagogy (*Procedural Emphasis*)	1. Balanced combination of individua and collaborativ (group work tasks	2. Learner-generated linguistic artefacts (audio, video, photos, images)	3. Game-like real-life communicative tasks	4. Expert facilitation scaffolding feedback, and coordinatio n	5. Feedback mechanism (immediate and delayed)	6. Focus on authentic listening tasks in the dynamic real-world communicat ive 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 vocab • dictionaries • pronunciation • clear task directions and explanations • ex. of lang. usage	10. Support out-of-class MELL with in-class (f2f) instruction and practice
Accompany website peer evaluation by expert feedback		X		X						
Aim at oral competencies relevant to student academic and professional goals								X		
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			X			X	X			
Ascertain active contextualized practice leading to output (verbal or non-verbal response)						X	X			
Assist with the perception of, and interaction with, the context linguistic affordances			X		X	X				
Build in a rating system for artefact evaluation		X			X					
Build in a social component to enable real-time interpretation and meaning-negotiation						X				
Build in interaction with others in person and via mobile-enabled channels	X									
Build in interactivity with others, content, technology, environment (context affordances)			X							
Build in self-evaluation of learner audio recordings					X		X			
Build in time and place flexibility in the individual activities							X			
Build individual tasks to feed into the group tasks	X									
Build tasks and activities based on listening learning outcomes								X		
Combine listening with task-related pronunciation practice									X	
Debrief completed tasks										X
Develop new or modify existing mobile tasks and activities				X						
Document feedback through audio recordings posted on MELLES site					X					
Draw on context affordances and point to them through instructions and directions			X		X	X				
Encourage active listening by way of self-paced non-reciprocal audio tasks requiring verbal or non-verbal response (for instance, answer comprehension question for language podcasts)							X			
Encourage creativity		X								
Encourage learners to co-creating audio vocabulary and idiom repositories									X	
Encourage questions regarding real-life listening tasks										X
Ensure active listening by way of two-way listening activities such as task-focused interaction						X				

Ensure communication with others in-person and via mobile-enabled channels	X			X						
Ensure constant inflow of information and exchange of ideas				X						
Ensure direct or indirect (apps) access to MELLES and its resources			X		X					
Ensure dynamic feedback in real-world communicative situations					X					
Ensure dynamic meaning-making and negotiation	X									
Ensure that materials, resources, and tasks are relevant to student academic and professional goals									X	
Ensure vocabulary and pronunciation practice preceding the real-life embedded language tasks									X	
Facilitate immediate feedback (messages, alerts, tips, clues)			X		X					
Facilitate the artefact construction				X						
Include audio dictionaries and glossaries (dictionary apps, web-based dictionary glossaries)									X	
Include audio recordings (video, images, photos) created by students in response to communicative tasks		X								
Include contextualized listening challenges aimed at spontaneous communication			X		X	X				
Include discourse with diverse interlocutors	X		X		X	X				
Include element of educational games (challenges, awards, bonus system, group or individual competition, engaging visual interface, progress record keeping)			X							
Include mobile-enabled feedback					X					
Include one-way listening activities which comprise interaction with content, technology, speaker, task, and context affordances (meaning-focused listening) – contextualized group tasks						X				
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)				X						
Include relevant linguistic resources			X		X					
Include socio-cultural competencies and information (such as visiting landmarks, collecting facts about them and exploring cultural habits)						X	X			
Include speaking activities to encourage meaning making								X		
Include subtitles/captioning for videos									X	
Include task goals aiming at carrying out linguistic functions in real-life situations in response to audio instructions			X			X	X			
Include task-related linguistic materials (such as a vocabulary list) and pointers to other task-related linguistic resources									X	
Incorporate comprehension materials offering (a) sufficient (b) language instances (c) whose meaning can be inferred through (d) active (e) meaning-making						X	X			
Incorporate language problems requiring negotiation of solutions	X									
Incorporate one-way listening activities which comprise interaction with content, technology, speaker, task, and context affordances (meaning-focused listening) – anytime any place individual tasks							X			
Incorporate task-related examples of questions and utterances and modeling									X	
Incorporate text-based resources to provide scaffolding and support (such as vocabulary handouts, audio scripts, answer sheets) (8)								X	X	
Inject fun and challenge	X		X							
Integrate impromptu speech component in response to oral input (for instance, responding to ad-hoc questions)						X				
Integrate rehearsed utterance exercises (such as recorded audio reflections, recording student utterances) for self, peer, and expert evaluation							X			
Maintain regularity of group/class activities	X									
Maintain the steady flow of information and interaction				X						
Moderate the MELLES website (for instance, step in when the instability is apparent)				X						

Offer authentic practice of responding to real-time input, such as direct or paraphrased repetition of audio content, or note-taking in a real-time lecture						X	X			
Offer choice of timing and sequence of individual tasks completion							X			
Offer in-person (immediate) and recorded (delayed) feedback and evaluation				X						
Offer learning activities coordination through schedules, timelines, alerts, reminders				X						
Offer post-task expert (delayed) feedback				X	X					
Offer vocabulary, grammar, pronunciation instruction and drills to prepare learners for real-world communicative challenges										X
Organize aural tasks around the learning milestones, that is, the collaborative listening tasks situated in the real world, with individual aural practice supporting and leading to the milestone learning objectives						X	X			
Point to selected web-based language resources including audio and video podcasts									X	
Point to selected web-based pronunciation resources (such as YouTube)									X	
Point to socio-cultural information (such as facts about landmarks and cultural habits)										X
Point to web-based and mobile-based resources				X						
Provide clear audio directions and instructions			X			X	X		X	
Provide clear directions on creating artefacts		X								
Provide examples and resources reflecting real-world communication tasks										X
Provide listening practice preparing learners for the group real-life tasks (such as related vocabulary, grammar tips, dialogue examples)							X			
Provide personalized feedback										X
Provide scaffolding through visual representation of audio content - message redundancy									X	
Provide technology support and point to tech resources incorporated in MELLES (mainly in the initial stages)				X						
Provide tools for recording, editing, upload and viewing/listening on-the- go (or demonstrate the usage of device built-in tools)						X	X			X
Provide/point to clear instructions and directions for tasks				X						
Reflect or include real-world communication tasks (communicative goals)			X			X				
Review audio directions and instructions (initial stages)										X
Share and showcase learner-generated linguistic artefacts		X								
Use text for just-in-time comprehension assessment									X	
Use text for on-demand communication and to exchange immediate feedback (reading, writing)									X	

Appendix G: Design Principles Matrix (Technology)

Table 54.
Design Principles Matrix (Technology)

	Essential Characteristic-Technology (*Substantive Emphasis*)							
Strategy - Technology (*Procedural Emphasis*)	1. One-point access to all resources	2. Exchange and communicati on platform	3. Scalability, flexibility and adaptability	4. Scalable rating system	5.Multimedi a artefact authoring, management and usage capabilities	6. Cross platform and multi-technology support	7. Integrated technology support and tutoring instruction	8. Personalized user progress tracking capabilities
Accommodate interrupted episodic learning through modular design with each audio not exceeding 5 mins or activity within a task not exceeding 10–15 mins			x		x			x
Act as a hub: a meeting place to support social presence in learning	x	x						
Act as a repository of students' artefacts and a meeting point for evaluation and discussion of the artefacts	x	x		x	x			
Allow learners to complete listening tasks following their own progression path, yet display reminders regarding prerequisites for milestone collaborative activities; flexible structure that learners can always fall back onto			x					x
Assist with the perception of, and interaction with, the context affordances by way of podcasts and on-demand feedback mechanism (for example, audio directions instruct students to collect evidence of various features of a Victorian style home)		x			x			
Build in an artefact evaluation (rating) system which aggregates average peer ratings and combines them with the expert rating (a higher weight in the final score) concluded by recorded expert evaluation (2, 4)		x		x	x			
Build in controls for audio retrieval, recording and editing: play, record, adjust audio speed, pause, fast forward, rewind, replay, delete					x			
Deliver adequate quality audio content (instructions, directions, task-related information, pronunciation examples)	x						x	
Demonstrate how to use the built-in device tools to create, store, exchange, upload, download and listen to audio podcasts		x	x		x	x		
Distribute (push to user devices and provide on the MELLES site) supplementary text-based content to accompany audio files (brief instructions, task-related information, vocabulary, links)	x				x		x	
Enable access to the learning resources selected by experts and suggested by others (provide links to task-related valid existing resources)	x							
Enable exchange of delayed feedback and evaluation (audio, rating system, some text)		x		x				x
Enable linguistic artefacts creation: make use of device built-in tools (voice recorder, camera, note taking option, memo app) or construct tools for creation of learner-generated multimedia artefacts		x	x		x			
Enable synchronous and asynchronous communication with peers and experts (within pre-arranged times) to support a blend of social, cognitive, teaching and emotional presence (reference for emotional?)		x	x					

Facilitate scaffolding support by connecting to experts and peers (directly on-demand and indirectly: delayed feedback and support) and offering personalized feedback		X		X	X			X
Follow specific standards across all different mobile client platforms			X			X	X	
Incorporate tools to create, store, exchange, upload, download and listen to audio podcasts		X	X		X			
Offer apps supporting language learning: point to existing apps or custom develop MELLES-specific apps (audio dictionaries, translators, flash cards)	X		X					
Provide a common user-friendly interface for the MELLES functions including managing author's artefacts	X	X	X	X	X	X		
Provide alternative ways to access and use MELLES, include mobile clients (different platforms) and a common web interface for higher productivity; build in switcher detecting mobile vs. desktop visits	X	X	X			X		
Provide connection management tools for users to aggregate, validate, and point to relevant information (learners sharing resources on the MELLES site)	X	X		X	X			
Provide easily accessible audio/video instructions on how to use the technology and features of the MELLES system, including examples and demos	X						X	
Provide platform to coordinate/direct learning process (including scaffolding mechanism such as sending context-sensitive help, pushing notifications, alerts, reminders)	X	X			X		X	X
Provide reports on user activity and progress (profile data and related information must be stored in a centralized database, all in compliance with personal information security policies)								X
Provide tools and instructions to encourage creative effort in generating learning materials and other artefacts	X	X	X	X	X		X	X
Seamlessly integrate off-line and on-line modes (locally on the mobile device) so that the user can work offline at will for improved continuity and flexibility of learning			X		X	X		
Serve as a library of carefully selected task-related linguistic materials and resources	X	X						
Support audio tech support resources with traditional text-based materials	X				X		X	

Appendix H: Chi-square Test Example

Q1: Learning listening using **mobile devices** was an **effective** way of learning English outside the classroom.

Statistical Analysis

Due the fact that no respondents disagreed with the statement, the hypothesis testing was conducted between agreement (Agree and Strongly Agree) and Neutral. A two sample proportion Chi-square test was used.

Hypothesis: $H_0 : p_{agree} = p_{unsure}$ vs $H_a : p_{agree} \neq p_{unsure}$

Pearson Chi-Square Test for Equal Proportions

Chi-Square	7.2000
DF	1
Asymptotic Pr > ChiSq	0.0073
Exact Pr >= ChiSq	0.0118
Sample Size =	20

The test resulted in a Chi-square value of 7.2 with both p-values (asymptotic = 0.0073 and exact = 0.0118) less than the significant level of 0.05. These results are statistically significant leading to the rejection of the null hypothesis in favour of the alternative hypothesis. Consequently, it is concluded that the data support the statement that learning listening using mobile phone is an effective way of learning English outside of the classroom.

Cross-tabulations by gender

Frequency Percent Row Pct (percentage)	Agree	Strongly agree	Neutral	Total
female	6	4	4	14
	31.58	21.05	21.05	73.68
	42.86	28.57	28.57	
male	2	3	0	5
	10.53	15.79	0.00	26.32
	40.00	60.00	0.00	
Total	8	7	4	19
	42.11	36.84	21.05	100.00

Frequency Missing = 1 (one person missing)

Statistical Testing:

H_0 : There is no association between gender and perception of the effectiveness of learning language using mobile devices.

H_a : The association exists between gender and perception of the effectiveness of learning language using mobile devices.

Pearson Chi-Square Test

Chi-Square	2.4235
DF	2
Asymptotic Pr > ChiSq	0.2977
Exact Pr >= ChiSq	0.2776

The tests indicated no association between gender and the perception of the effectiveness of language learning using mobile devices. Thus, the data did not provide enough evidence to support the hypothesis that there is any difference between male and female students' perception of the effectiveness of this approach to learning English.

Cross-tabulations by age

Frequency Percent				
Age	Strongly agree	Agree	Neutral	Total
18-24	2 10.53	3 15.79	1 5.26	6 31.58
25-34	2 10.53	3 15.79	3 15.79	8 42.11
35+	3 15.79	2 10.53	0 0.00	5 26.32
Total	7 36.84	8 42.11	4 21.05	19 100.00

Statistical Testing:

H_0 : There is no association between age and perception of the effectiveness of learning language using mobile devices.

H_a : The association exists between age and perception of the effectiveness of learning language using mobile devices.

Pearson Chi-Square Test

Chi-Square	3.3222
DF	4
Asymptotic Pr > ChiSq	0.5054
Exact Pr >= ChiSq	0.5359

The test demonstrated no association between gender and the perception of the effectiveness of language learning using mobile devices. According to these data, age difference may not be a factor in whether learners perceive this approach to learning English as effective or not.