Tools for Supporting English Language Learning in the Family Context

by

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Submitted to the Program in Media Arts and Sciences,
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Abstract
This thesis explores how we can help parents learn English through peer-learning experiences with their children. I discuss the design and study of the learning experience facilitated by "Read Out Loud," a mobile application that supports parents who are learning English as they read storybooks with their children. The mobile application and the context of its use provide a new interface to language learning tools such as text-to-speech, word translation, and shared-reading prompts. The thesis develops a set of design and user-testing guidelines that creates affordances for parents who are learning English. It builds on an iterative design process that includes two user studies of parents using the Read Out Loud application while reading with their children. Through observation and interviews, I investigate how technologies like Read Out Loud can be designed to motivate and augment the family reading experience and how familial factors may influence a parent's use of and interaction with the technology.

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"I can’t read to them. Of course that’s leaving them out of something they should have. Oh it matters. You believe it matters! I ordered all these books. The kids belong to a book club. Donny wanted me to read a book to him. I told [him]: ‘I can’t read.’ He said: ‘Mommy, you sit down. I’ll read it to you.’ I tried it one day, reading from the pictures. Donny looked at me. He said, ‘Mommy, that’s not right.’ He’s only five. He know I couldn’t read…”

- Anonymous Mother [1]

Many adults who immigrate to the United States struggle to communicate in English, the dominant language of American society. In fact, 36 million adults living in the United States struggle with
basic literacy [2] and roughly 15 million struggle with spoken English [3]. Everyday tasks can present massive challenges for these adults. If they cannot speak English, they may be unable to converse with hospital doctors or their child's teachers. If they are illiterate in English, they may be unable to read the poison warning on a can of pesticide or the dosage quantity on their child's cough medicine. These are basic necessities that we take for granted in an English literate society.

Adults struggling with English can enroll in government and community-based English language learning (ELL) classes that cater to the specific capabilities of adult learners. Among these capabilities, adult learners are self-directed, draw on their past experiences when learning something new, and are internally motivated to learn when the subject matter is of immediate use [4].

Little technology exists to support adult English language learners in and outside of class. The few digital tools that exist in the sphere of adult learning are adapted from other contexts where learners may have a different set of needs and capabilities. For example, adult ELL technology has been adapted from children's literacy materials, high school curriculum, and generic online translation tools. New digital tools that cater to the capabilities of adult learners are needed [5].

This thesis provides a case study into designing digital tools for adult learners. I focus on designing digital tools for a subset of adult learners in the United States: parents who are learning English as a second language. For these parents, learning English is often motivated by their desire to engage with their child's schooling and be a role-model for their children who are growing up in an English-speaking society [6].

Outside the home, parents who struggle with English often rely on their children to help them communicate with English speaking interlocutors [7]. In these situations, the parent and the child are peer-learners; they communicate and build off each other's work to further their understanding. The child contributes his expertise in English and the parent contributes her knowledge of the social world, skills in her native language, emerging abilities in English, and problem-solving capabilities to navigate the situation [7].

As immigrant parents are often both motivated to learn English by their desire to engage with their
children and practiced in collaborating with their children to navigate English language situations, I pose the following research question: How can we facilitate English language learning as a peer-learning experience between parents and their children?

One widely popular activity that promotes language learning is shared-book reading [8]. Shared-book reading is a collaborative experience where a parent and child read a book together. This thesis focuses on designing technology to support the shared-book reading experience between an ELL parent and her children.

1.1 Contributions

In this thesis, I describe the design and deployment of Read Out Loud, a mobile application (henceforward referred to as “app”) that facilitates and complements the shared-book reading experience between an ELL parent and her children. I also discuss my iterative process of developing a mobile app for and with ELL families over the course of a year and a half.

The goal of this thesis is to investigate how technology can be designed to motivate and augment parent ELL in the context of shared-book reading between family members. This work highlights how familial factors, such as number and ages of children or family members’ comfort with mobile devices, may influence a parent’s use of and interaction with digital ELL tools. The thesis develops guidelines for design and user-testing that make it easier for designers and developers to create learning technologies for ELL parents.

1.2 Overview of the Thesis

In Chapter 2, I discuss some of the literature on language dynamics in immigrant families and the ELL opportunities available for immigrant families in the United States.

In Chapter 3, I present literature on the ELL tools used to create the Read Out Loud mobile app and the interface guidelines that can make these tools accessible to ELL adults. I also discuss related work.
In Chapter 4, I give an overview of the research setting and methodology I followed to create the Read Out Loud app.

In Chapter 5, I present an overview of the Read Out Loud app. I then describe the process of creating the app and the choices made in its design.

In Chapter 6, I detail the design and implementation of two studies to observe how ELL parents used the Read Out Loud app while reading with their children.

In Chapter 7, I discuss the use of Read Out Loud over the course of both studies conducted with ELL parents and their families. I then discuss how and why parents may choose to use particular ELL tools over others embedded in the app. Lastly, I reflect on how familial factors may play into how parents used the app.

In Chapter 8, I pose design and user-testing guidelines for creating technology for and with ELL parents.

In Chapter 9, I conclude by discussing the limitations of and future directions for this work.
In this chapter, I discuss some of the literature on language dynamics in immigrant families and the ELL opportunities available for immigrant families in the United States. As each family dynamic is unique, I use conversations with families that participated in my thesis research to illustrate how the literature presented connects directly to the experiences of families in my user studies.

2.1 Language Dynamics in Multi-Lingual Families

Immigrant children may act as language brokers for parents who struggle with English. Language brokering is defined as “interpretation and translation between linguistically different parties.”
Language brokers differ from interpreters or translators because they “influence the message they convey and may act as a decision maker for one or both parties” [9]. Acting as language brokers, immigrant children use their knowledge of two or more languages and cultures to assist their families in tasks such as reading medical information, answering phone calls, and interpreting between family members and schoolteachers.

All of the parents interviewed in this study provided concrete examples of how their children act as language brokers. For example, one study participant, Victoria, and her son Gabriel illustrated a language brokering scenario when I asked Victoria to describe how she reads storybooks with her children. Gabriel listened to the question, translated the important aspects of the question for Victoria, listened to her response, and replied in English.

Language brokering is a form of peer-learning. In a peer-learning environment, learning is a social activity. People spend time together—sharing ideas, collaborating on activities, and building off each other’s work—to further their understanding [10].

In language brokering situations, parent and child share and collaborate to help each other navigate the interaction [7]. The parent contributes their knowledge of the social world, adult speaker’s ability in their native language, emerging abilities in English, and problem-solving skills to help their children transform brokering events into activities during which the child learns about the world [7]. The child uses their fluency in English to help the parent navigate a new language and culture [7].

As children become fluent in English, families have to negotiate how language is used within the home. A study was conducted to understand how a group of Latino parents living in Texas negotiated language in their homes [11]. The study finds that “for Spanish-speaking parents who speak English poorly or not at all, the risk of allowing English at home is loss of communication and parental authority.” The study explains that parents who want to use Spanish to communicate with their children “note the large influence that schools have on children’s preference for English.

The names of all people and language programs in this thesis have been changed to protect the identity of the individuals.
Schools reinforce the use of English among youngsters not only at school, but also among friends and siblings.

Many parents who participated in my research discussed how their families use a mix of languages at home. One mother, Fatma, explained: “My kids speak all the time English at home. But when I talk with them, I talk in Arabic, because I don’t understand English very good.” Another mother, Isabel, described how she and her daughter have different language preferences: “[My daughter], she’s in English. Yeah. English preferred. Me, Spanish.” Six ELL parents were asked if they felt their children had a language preference (either English or their parent’s native language). Four of the six explained that their children preferred English to their parent’s native language.

Many parents realize that English is changing their family dynamic and they need to learn English to engage with their children’s English-dominant world. Nor explains that she is “learning with my kids, because of my kids.” Olivia echoes this reason, explaining that she is learning English “because for my daughter speak English.” The parents in this study were asked to elaborate on why they were learning English for their children. Among other reasons, these parents explained that learning English will help them understand their children’s media and English-language conversations, gain independence, act as a role model for learning, and help with their children’s schooling.

### 2.2 Family Specific Motivations to Learn English

Parents may learn English to engage in their children’s English-speaking world. Children watch television, read in books, and discuss with friends in English. One mother, Olivia, explained that her daughter “no like TV in Spanish, only English. That’s big problem.” She also struggles to understand her daughter’s conversations in English with her younger sister and fears her daughter will say something mean that she will not understand. She elaborated on this fear when talking about her daughter’s conversations with her bilingual husband who speaks both English and Span-

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2Quotes from study participants are not edited so as to maintain the participant’s original voice. Additional words are added in brackets only when the sentence is unclear without them.
ish fluently. "I don’t like it too much when [my daughter] talk with [my husband in English] and I don’t understand it. Maybe she ask [about] me or say something not nice, you know, and I can’t understand."

Learning English will also allow these parents to independently deal with tough situations in and outside the home [12]. One ELL teacher interviewed in this study explains: “Another motivation for why they [enroll in English] class… because they still need to be the role model who deals with things, you know. How are they supposed to deal with problems if they need a translator all the time?” Five out of the six parents interviewed explicitly mentioned that they need English to navigate tough situations such as interacting with doctors in the hospital emergency room. Olivia explains why English is so important in this context. “I use [English] sometimes when I go to the hospital. When they have a big problem, I can understand everything.”

Parents may want to foster their children’s enthusiasm and appreciation of learning and literacy by being a role-model, modeling positive attitudes and behaviors about literacy through learning English (both spoken and written) themselves [13]. The parents in this study report regularly working with their children on their own English language learning and occasionally doing English homework side-by-side with their children. For example, Victoria explains that when she picks up her son from his after school program, they go to the library and then home where he does his homework while she does her homework from English class.

Many parents also explain that they are learning to engage in their child’s schooling [14], where homework, parent-teacher conferences, and school newsletters use English as the dominant language of communication. For example, Nor explains, “I’m learning English… because I’m going to school and I have meeting with the teacher for my kids.”

2.3 English Language Learning Programs for Immigrant Parents

In the United States, the government and local community organizations support specific adult ELL classes for immigrant parents called family literacy programs (FLPs). These programs focus
on helping “parents who want to really learn English to help their children.” A FLP is an intergenerational program focused on providing direct English language learning services to both parents and children [15]. Two main types of FLPs used in the United States involve use of either “direct literacy instruction to adults in hopes that the effect will trickle down to children, or direct instruction to parent and child together [16].” The parents I worked with for this study are all enrolled in one intermediate FLP class in the Greater Boston Area, called Forrester Family School (pseudonym). Forrester uses the former model, providing direct instruction to the adults and tailoring content to focus on helping parents support their children’s development.

Parent FLP classes are designed to cater to the specific capabilities of the adult language learner. Among these capabilities, adult learners are self-directed, draw on past experiences when learning something new, and are internally motivated to learn when the subject matter is of immediate use, especially when the new knowledge or skill is related to a social role [4]. FLPs help adult learners develop the knowledge and skills needed to fulfill their social roles as parents, workers, and community members [6]. Caregivers gain access to the information they need to pursue further education, training, or employment. They also become more engaged in their children’s education, including developing the strategies and confidence needed to express their concerns, make decisions independently as a parent, and continue to learn and apply new learning [6]. One ELL teacher interviewed in this study explains: “Most parents who do take our class, they want to help their kids with homework. They’ve gotten to a point where, they can’t help their kids and I think it’s a real struggle for them.”

One important learning practice integral to FLPs is shared-book reading. Sharing books is often recognized, particularly in the United States, as one of the most valuable activities that parents and children can do together to promote early literacy skills [8]. It exposures readers to new vocabulary and contexts, as the language used in children’s books contains 50% more rare words than are present in prime time television or college student conversations [17]. Shared-book reading is a unique activity in a family’s busy schedule; the “child has the undivided attention of an adult who can define, explain, and question the child to facilitate understanding or reinforce new knowledge.

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3Direct quote from an FLP teacher interviewed in this thesis work.
However, in the case of the ELL parent, parent and child may both struggle to understand an English-language storybook. The roles of the expert and the novice are dynamic, flowing back and forth between the parent and the child during this reading experience [7]. Oftentimes the child will define, explain, and question the parent to help facilitate the parent’s understanding, or the parent and child will attempt to decode the storybook’s text together. For example, Fatma explains how her daughter helps her pronounce words as they read storybooks together. “I read with my daughter. And when she tell me, ‘Mom, it’s not like this, it’s like this.’” Gabriel, Victoria’s eleven-year-old son, explains how he helps his mom learn to read in English. “When we read books, what we do is I read like two sentences or a paragraph and [my mom] reads the rest. I let her by herself so she can understand what she’s reading. Like, she’ll read a page, she keeps going, and she’ll learn.”

It is important to recognize there is no “right” way for families to read together. In fact, shared-book reading practices can also differ by culture. One study shows that “Central American mothers’ elicitation style placed greater emphasis on conversational narrative aspects, whereas European American mothers’ style focused to a greater extent on the organizational narrative aspects of the interaction” [19].

In this chapter, I discussed some of the literature on language dynamics and learning practices in immigrant families, contextualizing the dynamics and practices of the families that participated in my thesis research in the literature. In the next chapter, I give an overview of some of the ELL tools that can be used to augment and support English language learning through shared-book reading. I also present and discuss related projects.
In his book *The Connected Family*, Seymour Papert describes how families can create a peer-learning experience using digital technology. He defines this type of learning as "home-style learning." In home-style learning, the pursuit of knowledge is under the learner's control. She has the means to seek knowledge and sources of knowledge [20]. This may mean collaborating with others, as happens when parents and children collaborate to read a storybook together, and turning to resources such as digital tools when needed.

In this thesis, I take the approach of designing the Read Out Loud mobile app to facilitate and complement the shared-book reading experience between an ELL parent and her child. By doing this, I aim to design an app for ELL parents that embraces the home-style learning approach. The
app acts as a resource to the parent, providing them with a means to seek the English language information they want (e.g. translations, pronunciations) during a shared-book reading experience with their children. While in later chapters I talk specifically about the design of this app, in this chapter I present literature on the ELL tools used to create the app and the interface guidelines that can make these tools accessible to ELL adults and discuss related work.

All of the tools discussed in this chapter are commercially available to developers or easily built using open-source technologies. As a goal of this thesis is to create guidelines for design and user-testing that make it easier for designers and developers to create technology for ELL parents, it was important that the Read Out Loud app rely on accessible digital technologies.

3.1 Three English Language Learning Tools: Text-to-Speech, Word Translation, and Shared-Reading Prompts

There are three specific ELL tools that I worked with in the creation of the Read Out Loud app. They are text-to-speech (TTS), word translation, and shared-reading prompts. These tools can be used to support an ELL parent who wants to learn English together with their children. Parents can practice their pronunciation with TTS, look up unfamiliar words with word translation, and ask questions to facilitate discussion about the meaning behind the storybook’s text with shared-reading prompts. I outline literature on each of these tools below.

Text-to-speech can be used to help learners with pronunciation and understanding of words and phrases they may be familiar with but not able to recognize in written form. Pronunciation can be one of the most difficult aspects of learning English for ELL adults. In fact, all of the parents interviewed felt that the most difficult part of learning English is speaking – an act which requires pronunciation. To help learners practice their pronunciation, TTS can repeat a word or sentence when a learner stumbles and monitor and assist a learner’s pronunciation as they read a text aloud [21]. Text-to-speech can also allow learners to engage with words they may know but not able to recognize in written form [22]. As ELL adults are often more familiar with spoken than written
English, this can help them engage with the meaning behind the text, instead of growing frustrated when they cannot decode the text itself.

Word translation can be used to help ELL adults to draw upon existing knowledge in their native language to comprehend the meaning of a word in English. As was described in the previous chapter, adult learners tend to draw on past experiences when learning something new [4]. In the case of ELL, these past experiences include their understanding of a word and their history with a word or concept in their native language. Word translation gives the adult learner the “means to seek knowledge”[20] at her fingertips. For ELL parents, translating a word can help them comprehend a word and prompt a bilingual discussion with their child about the word. For example, a child might point to the word “butterfly” and ask “What’s that?” A parent could quickly translate the word and reply “That’s a butterfly. También se llama mariposa en español.” (Translation: It’s also called a mariposa in Spanish.)

Shared-reading prompts can be used to suggest questions for the parent to ask the child throughout the reading experience. Family literacy literature encourages parents to have a dialogue with their children as they read. A parent can encourage this dialogue through techniques such as asking wh-questions (i.e. who, what, where, when, why) throughout the story. This encourages the family to diverge from the story and discuss [23] topics such as the story’s moral, how the story relates to their lives, or what they think a certain character will do next. This ability to contextualize the information from a story through extended discussion allows for a richer learning experience for both parent and child [24].

However, just as important as the ELL tools used are the interfaces that allow ELL parents to access these tools. These interfaces for ELL adults should be accessible to users who are illiterate or semiliterate in English and have varying levels of familiarity and comfort with digital technology.
3.2 Designing User Experiences for Semi-Literate Users

Mobile interfaces can be designed for users who are illiterate or semiliterate in English. However, it is important to note that many ELL adults are literate in their first language. All of the parents who participated in this thesis research fell into this category. They were illiterate or semiliterate in English and literate in their first language.

Their first languages were either Spanish and Arabic – languages that differ linguistically. Spanish uses an alphabetic writing system similar to English [25]. Arabic uses the Abjad writing system [26]. Keeping these differences in mind, I focused on designing an app that could be used by learners who spoke both languages.

An interface for ELL adults should be accessible by users with varying levels of digital literacy. Digital literacy can be defined as a person’s comfort using technology to find, evaluate, create, and communicate information and troubleshoot when the technology does not behave as expected [20]. In this thesis, I focus specifically on users’ digital literacy on mobile devices, as it is the technology most ubiquitously accessible to ELL adults [5]. Some of the parents in this study report using smartphones daily, relying on mobile apps such as WhatsApp to keep in touch with family in their home country and Facebook to maintain an online presence. Some own smartphones, but report that their children help them navigate their smartphones beyond basic communication functionalities. Others did not own smartphones and had to borrow a smartphone, either from us or from a family member, for the duration of this study. This is in accordance with ELL and other adult basic education classes across the United States, where teachers report that one of the biggest barriers to using technology in classroom is learners’ lack of access to devices and internet outside of class [5]. As such, a mobile interface must be designed to be accessible by learners with a range of digital literacy levels.

Research has been done on mobile interfaces for individual users who have low literacy and digital literacy skills. One such study was conducted to examine the usability barriers of mobile phones facing novice users with low literacy in India, the Philippines, and South Africa [27]. The study
recommends that interfaces for novice users with low literacy provide graphical cues, voice annotation, and local language support in both text and audio. They should also minimize hierarchical structures and avoid using non-numeric text inputs and menus that require scrolling. While the users in this study were illiterate or semiliterate in their native language [27], differentiating them from the parents described in this thesis research who are literate in their first language, both groups display similar struggles with digital literacy and comprehension of text in a language where they are not literate.

Another study also provides recommendations for designing accessible mobile apps for low literacy populations based on research with low-literate users in the United States [28]. The study suggests that mobile interfaces for low-literate users should contain large widgets, a review mechanism to help orient users and prevent premature abandonment of tasks, and a back and home button for shorter and longer recoveries respectively on each page. The study also recommends that an interface allow users to begin every task from the same location and use a hybrid navigation structure that combines linear navigation (i.e. where each page links directly to another page that represents a subsequent step in the process) with a navigation bar [28].

A contribution of this thesis is to extend these general guidelines for low-literate users to ELL parents learning in the family context, where they may be trying to use an interface while engaging with their child and oftentimes a physical object (e.g. a storybook) as well.

3.3 Related Work

The tools and interfaces discussed have been successfully incorporated into language learning experiences for both casual adult learners and children. Learners can listen to a book read aloud using TTS and look up the English definition of words on eBook platforms such as Apple iBooks and Amazon Kindle. Mobile apps such as Duolingo and Babbel use audio recordings and TTS to help learners hear the pronunciation of unfamiliar words and word translation to help make the association between a learner’s knowledge in their native language and the word in the new language.
CHAPTER 3. ENGLISH LANGUAGE LEARNING TOOLS

However, these eBooks and apps do not meet the needs of ELL parents with low digital literacy. The eBooks are geared towards easy consumption of written material rather than the facilitation of a language learning experience. Features like audio narration and word definition are often hidden behind textual menus. For example, in the iBooks version of the children's storybook *Corduroy* (shown in Figure 3-1), a learner needs to understand the terms “manually,” “automatically,” and “start reading” to navigate the menu to read text aloud. The learner needs to highlight, right click, and then click the “look up” button to access the English definition of the word, which may contain more unfamiliar English.

Language learning apps such as Duolingo and Babbel do not explicitly support the specific needs of adult learners in the family context. They do not prioritize information that is immediately relevant for parents (e.g. vocabulary that they will encounter while reading with their children), but rather present similar content\(^1\) to all learners with the same language ability level. They also do not teach subject matter that is immediately useful to a social role (e.g. a parent helping their child learn to read), but rather create a highly individual learning experience that requires a parent to set aside free time to engage with the learning experience separate from their role as a parent.

\(^1\)Babbel gives the learner some ability to customize the content she learns by selecting a reason why she wants to learn the language. The reasons are: language/cultural interest, travel, for family/friends, school, work, to train my language skills, and other. However, the “family/friends” option encompasses a wide range of vocabulary that does not prioritize information immediately relevant for a parent.
As discussed in the previous chapter, the literature on family learning promotes English language learning as a peer-learning experience between parents and their children, emphasizing collaborative activities like shared-book reading. However, to the best of my knowledge, none of the current language learning apps that exist for adult ELL promote this dynamic. Additionally, the eBook interfaces that could promote this dynamic are not designed for language learning or parent-child reading. A contribution of this thesis is to design a mobile app to facilitate and complement the shared-book reading experience between an ELL parent and her children. The ELL tools and interface guidelines outlined in this chapter serve as a starting point for the creation of Read Out Loud, a mobile app that supports shared-book reading in ELL families. In the next chapter, I discuss the research setting and methodology I followed to design, create, and study the use of the Read Out Loud app.
Methodology and Research Setting

The initial idea for Read Out Loud came from observing how ELL parents in an FLP class responded when asked to read a book with their children for homework. Many parents expressed that they felt uncomfortable with shared-book reading because their children ask questions about English that they cannot answer, point out when they mispronounce a word, or read at a pace that is difficult for them to follow along.

Drawing upon the literature on home-style learning, I decided to design Read Out Loud, a mobile app to support ELL parents by providing them with the language learning tools they need when reading storybooks with their children. I created Read Out Loud as a mobile app because smartphones are the technology most readily accessible to ELL parents [5].
4.1 Methodology

I followed a design-based research (DBR) approach to design and create iterations of Read Out Loud and study its use. DBR in the learning sciences entails both “engineering” particular forms of learning and systematically studying and iterating on those forms of learning within the supporting context. The learners engaged in the DBR process are not subjects assigned to treatments but instead are treated as co-participants in the design [29].

To start, I began with two “tests” in order to develop framing questions and create constraints for the design of Read Out Loud. These tests demonstrated some of the rough ideas for Read Out Loud to ELL teachers and parents. I used the first test to illustrate user experience (UX) ideas for Read Out Loud to a group of ELL teachers and solicit their feedback. I used the second test to observe how a small group of ELL parents interacted with a rough prototype of Read Out Loud.

Using feedback from these tests, I created a stable version of the Read Out Loud app and studied its use by ELL parents and their children over the course of one week (Study 1). I then iterated on the app design and study protocol and conducted a second, five-week user study (Study 2) to better understand how ELL parents were using the ELL tools in Read Out Loud during shared-book reading experiences with their children. The details of all prototype designs and user studies are discussed later in Chapters 5 and 6 respectively.

I used qualitative coding methods to extract quotes and themes from transcripts of learner interviews and shared-book reading experiences conducted during the user studies. I first used a mixture of descriptive, value, and “in vivo” codes in a round of initial coding. Descriptive codes summarize the primary topic of an excerpt, value codes label the participant’s subjective opinions, and “in vivo” codes help maintain the participant’s voice by using their own language to create a label [30]. In this initial coding, the descriptive codes helped me distill the portions of the inter-
views where learners discuss how they used the Read Out Loud app and the “in vivo” and value codes helped surface learners’ opinions in their own voice. I then categorized these codes into themes that describe the learners’ use of the Read Out Loud app.

4.2 Research Setting

The context of this research with Read Out Loud was the Forrester Family School, an intermediate FLP class in the Greater Boston Area. All study participants were enrolled in this FLP class. The study participants were separated into two cohorts based on when they were enrolled in the class. If learners were enrolled in the class during Spring 2015, they were asked to participate in Study 1. If they were enrolled during Fall 2015, they were asked to participate in Study 2. The class’s two teachers, Kate and Alison, were also involved in the study.

Most of the learners in this class range between a high beginning and advanced level of English based on their Best Plus and CASAS test scores. The Best Plus test is an “individually administered, face-to-face oral interview designed to assess the English language proficiency of adult English language learners in the United States” [31]. The CASAS test is broader; it assess reading, math, listening, speaking and writing for adult learners [32]. At Forrester, both exams are administered by an independent third party.

A learner with a high beginning English level can navigate verbalized routine social demands. She can also read and interpret simple material on familiar topics (e.g. maps, signs, bus schedules). A learner with an advanced level of English can satisfy most survival needs. She can navigate verbalized social demands and read and interpret simplified and some non-simplified materials on familiar topics (e.g. payroll stubs, simple forms) [33].

Three learners at Forrester were involved in both user studies of Read Out Loud, while the others were involved in just one study. Averaged biographical information for the learners who participated in either study is shown in Table 4.1.
### Table 4.1: Overview of study participants’ biographic information

As shown in Table 4.1, the participants involved in both studies have similar biographic information. Much of this biographic information is aligned with the neighborhood demographics and the composition of FLPs in general. For example, approximately 73% of the participants were from Spanish-speaking countries and 27% from Arabic-speaking countries\(^1\), with El Salvador being the most common country of origin.

According to Alison, a teacher at Forrester, these languages are in keeping with the demographics of English for Speakers of Other Languages (ESOL) classes in the neighborhood surrounding Forrester. She has mostly Spanish speakers enrolled in the ESOL classes she teaches in this neighborhood and a few students who speak Arabic or Portuguese\(^2\). Additionally, all of the study participants were female. As the vast majority of adult FLP participants are women [6], this is in accordance with the gender composition in other FLPs.

However, there are some important points to clarify about the data in Table 4.1. While all partic-

\(^1\)The three Spanish speakers who participated in both studies were only counted once in these percentages.

\(^2\)Specific demographic information on the neighborhood is not given to ensure the anonymity of the Forrester Family School.
Participants are literate in their native language (discussed in Chapter 3), their literacy levels in their native language vary. Some participants left primary school as early as third grade. According to teachers at Forrester, this may influence their comfort reading and writing in their native language.

I provide demographic information to give a snapshot of the participants in this study. However, demographic information does not begin to explain these learners' stories. To paint a more holistic picture than can be provided by statistics, I illustrate stories from four of the study participants in Appendix A.
In this chapter, I first give an overview of the Read Out Loud app and then describe the iterative process of creating the app and the design choices I made. Throughout this chapter, I highlight how observations of and feedback from ELL parents, their children, and their teachers helped inform the design of Read Out Loud.

5.1 Walk-Through of the Read Out Loud App

A typical use case of the app looks as follows. A mother sits down to read a book with her son. Before they begin reading, she opens up the Read Out Loud app. When she opens up the app, she is
presented with the home screen. By default, the home screen is open to the “read” tab, showing an image and title of each book available in the app (“Read Tab” in Figure 5-1). She selects the image that matches the cover of the physical book her son is holding. This opens up the storybook on the app (“Book Screen” in Figure 5-1).

As she reads with her child, she can turn to the app for support. She can click on the “play” button to listen to the text read aloud (“Feature A” in Figure 5-1), select a word to see the translation into her native language and hear the English pronunciation of the word read aloud (“Feature B” in Figure 5-1), or tap the star button to save a word and review it later (“Star Button” in Figure 5-1). This review capability allows her to save a word that she wants to review without interrupting the flow of the story. Once she is done reading, she can go back to the home screen and click on the
"review" tab, which will show her all her saved words ("Review Tab" in Figure 5-1). If she clicks on a word, a pop-out displays the word, its translation, and the context in which it was read ("Review Pop-Out" in Figure 5-1).

5.2 Initial Tests

At the beginning of my design process, I posed two framing questions that guided me throughout the process. These questions were as follows. Question 1: What information is most useful to ELL parents while reading with their children? Question 2: How should this information be accessible to an ELL parent with varying levels of English and digital literacy?

Before creating an app that ELL families could use at home, I conducted two “tests” at the Forrester Family School in order to refine my framing questions and create constraints for the development of Read Out Loud. In the first test, I created a mobile-optimized web app that demonstrated rough ideas for the Read Out Loud app and walked a group of ELL teachers through the experience of using the app. In the second test, I created an iOS app that incorporated some of the concepts in Read Out Loud. I then observed as ELL parents at Forrester used the app while reading a storybook by themselves in class and recorded their feedback.

These tests focused on trying different approaches of integrating text-to-speech and word translation, two of the ELL tools discussed in Chapter 3, into the shared-book reading experience. In Test 1, learners could select individual words to see the word’s translation in their native language and read the text from an entire storybook page aloud using TTS (see Figure 5-2). After seeing Test 1, the ELL teachers also felt learners might want to look up the pronunciation of a word. Therefore, a new feature was added to Test 2. When a word is selected for translation, it is also automatically read aloud in English and then in the learner’s native language (see Figure 5-3).

These tests also tried out several usability features. In Test 1, learners could input any storybook into the app by taking a photo of the storybook’s pages. For every page added, the app ran optical character recognition (OCR) software to extract the text from the image and display it to the learner.
in real time. The photos of the physical pages were then used as reference points to help the learner navigate through the storybook on the app, as page numbers are not consistently present in storybooks. This system is illustrated in Figure 5-4.

In Test 2, the scanning feature was removed due to feedback from ELL teachers who felt that
it would confuse learners. They pointed out that photographing a page is an unintuitive action for learners with low digital literacy and the text extracted by OCR may confuse ELL learners if extracted incorrectly\(^1\). ELL teachers also felt that learners would like to navigate both of the objects used in the shared-book reading process (the physical book and the app) in the same way. Therefore, "flip" navigation was integrated in Test 2. Instead of changing the page by clicking on arrows or the photos on the top of the screen, learners could swipe left or right (a mobile gesture close to "flipping" a physical page) to change from one page to the next. A photo of the page was still provided as a reference point, but was no longer used to navigate the app (see Figure 5-5).

These tests helped me refine the framing questions that informed the design of the Read Out Loud app. In particular, I observed how ELL parents used the TTS and word translation tools in Test 2 during their individual learning experiences (see Figure 5-6). Some followed along with the TTS voice, some clicked on almost every word to look up the translation, and others ignored the translation feature, instead clicking on the word multiple times to repeatedly hear its pronunciation.

\(^1\)Mistakes in OCR can happen, especially when an image is poorly lit or has blocks of text in many different locations on the page.
5.3 App Design

To design the Read Out Loud app, I began with the first framing question: What information is most useful to ELL parents while reading with their children? From feedback and observations, I noticed that the ELL parents wanted to gather information that helped them follow the story's plotline, assist their children (e.g. answering questions, helping them when they cannot read or pronounce a word), and pronounce words correctly when reading aloud. In Read Out Loud, I included two language learning features – Features A and B. They are clicking on the “play” button to read the text of a storybook page aloud (Feature A) and clicking on a word to see its translation in the learner’s native language and hear its English pronunciation read aloud (Feature B).
Feature A uses TTS to help a learner engage with the meaning behind text that she may struggle to discern in written form. Feature B uses TTS to verbalize the correct pronunciation of an English word. This can help familiarize ELL parents with the sounds needed to compose the word themselves. Additionally, Feature B uses word translation to provide the learner with the translation of the word in their native language alongside the English word. Translating a word can help ELL parents comprehend a new English word by drawing upon their understanding of and history with a word in their native language. How learners access these ELL tools through the Read Out Loud interface is shown in Figure 5-1.

All the ELL tools used in the Read Out Loud app were built with accessible digital technologies. For TTS, the app used Android’s native voice through the HTML5 Speech Synthesis API. For word translation, the app relied on Google Translate.

The app itself was built on the Android platform using AngularJS\(^2\) and the Ionic Framework\(^3\). Though I built an iOS app during Test 2, I chose to build the Read Out Loud app for Android devices because most of the learners at Forrester owned or were familiar with Android devices.

5.3.1 Designing the User Experience for Learners with Low Digital Literacy

The second framing question helped inform how these language learning features were translated into the design of an app for learners with low English and digital literacy. I followed some of the

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\(^2\)AngularJS: https://angularjs.org

\(^3\)Ionic Framework: http://ionicframework.com
design guidelines developed by Medhi et al. [27] and Chaudry et al. [28]. The design decisions made in the app are discussed in the section below.

Read Out Loud employs a navigation bar and a reciprocal navigation system where a learner can linearly move back and forth to the previous or next page in the storybook—just the same as with a physical book (see Figure 5-7). This reciprocal navigation structure is a modified version of the linear navigation structure suggested in the literature [28]. This navigation structure contains a minimal number of hierarchical structures [27]. In total, there are two main screens: the home and book screen. Both the home and book screen utilized partial and pop-out views so that the learner can always see and access one of the main screens (e.g. the “Review Pop-Out” in Figure 5-1).

Vertical scrolling, which is cautioned against [27], was only used to show more of the same elements already displayed on the screen. For example, a learner could vertically scroll to see more of the books available to read on the home screen or to see more of the text of an individual storybook page on the book screen. Horizontal scrolling was used to imitate “flipping” a storybook page on the book screen. However, learners could also navigate using reference photos of the storybook’s pages consistently shown on the book screen. At no point were learners solely dependent on horizontal scrolling for navigation.

After the second test, the ELL parents suggested that I incorporate the ability to save a word for review into the app – a suggestion in line with the guideline to incorporate a review mechanism [28]. As such, the app allowed parents to save a word that they want to review without interrupting the flow of the story (see “Star Button” in Figure 5-1). A parent could access the review tab on the home screen, which will show them all their saved words (see “Review Tab” in Figure 5-1). This allowed them to see the word, its translation, and the context of the storybook page where they encountered it (see “Review Pop-Out” in Figure 5-1).

In the design of the Read Out Loud app, I had to balance English language assistance (graphical cues, voice annotation, and local language support) with the need to let learners try to decipher a word or phrase on their own from the surrounding context. In most cases, graphical cues were
used alongside of text to assist learners with navigation of the Read Out Loud app (see Figure 5-8). This way, learners could associate the graphical cues (images and icons) with the written text, which may help them understand the meaning of the text itself.

It is suggested that interfaces for novice users with low literacy provide voice annotation and local language support [27]. In Read Out Loud, these support mechanisms were used only for engaging with the storybook’s text. This choice was made to help learners focus on engaging with the story.
rather than the app itself. Learners can click to hear the entire page or any individual word on the page verbalized with TTS. They are also provided with local language support in written form for individual words in the storybook. To access this support, the learner clicks on an individual word on the book screen. This conscious “click” action was used to encourage the learner to attempt to derive a word’s meaning from the surrounding context (both text and storybook pictures) before opting to see the translation. The audio pronunciation of the translated word was not provided, as all ELL learners in the studies were literate in their first language.

Additionally, I decided to minimize the number of times an ELL parent needs to click while reading. Observing the parents reading in Test 2, I noticed that they focused on the physical book and relied on the app as a support mechanism – the intended interaction. When they turned to the app for help, they accessed the information they wanted quickly and returned to their attention to the physical book. As such, I folded multiple ELL tools into a single user action to minimize the number of times a parent has to click. For example, when the parent selects a word (Feature B), the app simultaneously shows the word’s translation and reads the English word aloud. More on this design decision is discussed later in Chapter 8.
In this chapter, I presented the design of Read Out Loud and outlined the process of creating the Read Out Loud app. In the next chapter, I discuss the study of Read Out Loud’s use by ELL families over two user studies.
I conducted two user studies of the Read Out Loud app. The first study (Study 1) was one week long, while the second (Study 2) was five weeks in duration. Over the course of these two studies, I worked with 15 ELL parents and their families to study how Read Out Loud was used by parents in a shared-book reading experience with their children. In both studies, participants were allowed to keep the copies of the physical books they used during the study as compensation.

In this chapter, I discuss both Study 1 and Study 2. As an important contribution of this thesis is a set of guidelines for how to design with ELL parents, I discuss the details of how each study was conducted. I also provide examples of how observations of and feedback from ELL families helped me iterate on both the design of the app and the user study protocol. I then draw upon these study
Chapter 6. Studies with ELL Parents and Their Children

descriptions to extract user-testing techniques that are useful when working with learners with low English and digital literacy in Chapter 8.

6.1 Study 1

I conducted a week-long study of the Read Out Loud prototype with 11 ELL parents from the Forrester Family School and their children (see Section 4.2 for details on the study participants).

The study was divided into three parts. In part one, I introduced the ELL parents to the Read Out Loud app and three researchers (myself along with two other MIT researchers) observed as they used the app to support a shared-book reading experience with their children. In part two, I asked the families to select a book to take home and read with Read Out Loud during the following week. In part three, another MIT researcher and I conducted short follow-up conversations with the parents at Forrester to understand more about their reading habits and ask for their feedback on the app.

Part one took place in a 1.5-hour session at the MIT Media Lab. The study was conducted in English. A Spanish-speaking translator was present to assist the participants if they had questions about the study consent forms and app download process. A babysitter was also present to supervise the children during the portion of the session that was just for the parents. Photos from this session are shown in Figure 6-1.

The parents were first asked to download the Read Out Loud app. If they did not have an Android phone, a phone was provided to them for the duration of Study 1. Next, they watched a video walkthrough of the Read Out Loud app. After this, they logged into the app using the study ID provided to them and familiarized themselves with the app. During this time, a collection of physical books that had been selected by the ELL teacher and pre-loaded into the app were placed on the table. As participants finished the app download process, they selected books to read with the app.

Once the parents had time to familiarize themselves with the app and the physical book on their
own, they were asked to read with their children and use the app as needed during this experience. As they read, researchers observed, took notes, and photographed the experience.

Families were then asked to choose a book to take home and read. In the back of each book was a reading log, where parents were asked to record specifics about each time they read the storybook during the week (see Appendix B.2 for an example book log). Specifically, they were asked to record the duration of the reading experience and whether they read with their children or by themselves.

In part two, I monitored the parents' use of the app throughout the week. I tracked their click behavior using the Mixpanel analytics package¹ (see Appendix C for details on how Mixpanel was integrated into the Read Out Loud app). Using Mixpanel, I observed what features they chose to use and how frequently they chose to use them. These observations are discussed in-depth in Chapter 7.

A week later, I conducted part three of the study at Forrester. I surveyed the learners to collect their biographic information (see Appendix B.1 for an example of the survey). Another MIT researcher and I also conducted short individual conversations where learners were asked to describe an example of how they used the Read Out Loud app and discuss their reading habits in general.

¹Mixpanel: http://mixpanel.com
6.2 Observations and Iteration

Through direct observations, conversations, and click data, I observed how parents used Read Out Loud's ELL features. I used these observations to iterate on the design of both the Read Out Loud app and the study itself.

For example, I noticed that some parents looked lost as to how to engage with their children in the reading process. They looked around and talked with other parents as their children read aloud (see Figure 6-2a). Drawing from this initial observation, I added shared-reading prompts (Feature C) to the Read Out Loud app during Study 2 (see Figure 6-3 for screenshot of the prompts in the app). According to the literature presented in Chapter 2, these prompts can provide parents with possible questions to ask their child about the story, giving them a natural place to jump into.
the reading process and engage with their child. Learners could access Features A and B on the shared-reading prompt pages. This allowed them to verbalize the prompts and translate individual words on the prompt pages into their native language.

I also noticed that learners were appropriating Read Out Loud’s language learning functionalities in vastly different ways. For example, one mother listened to her daughter as her daughter read aloud from the book. When her daughter stumbled, the mother looked up the word on the app and they listened to the English word spoken aloud together (see Figure 6-2b). Another mother observed her son reading to his younger sister. As they read, when she came across a word she
did not know, she looked it up but did not interfere with her children’s reading (see Figure 6-2c).

This observation helped me realize that to understand how parents were using the ELL tools in Read Out Loud, I had to understand how familial factors (e.g. family members’ comfort with mobile devices, number and ages of children) might influence how a ELL parent interacts with these tools. I decided to design a second user study to observe how these factors influenced parent use of the ELL tools in the Read Out Loud app.

6.3 Study 2

The second study was longer and more in-depth in order to observe how familial factors might influence parent use of the ELL tools in the Read Out Loud app. It took place over the course of five weeks at the Forrester Family School.

Each week, learners were given physical copies of storybooks that corresponded to digital books in the Read Out Loud app. Learners were given time to read the book and use the app in class and then asked to take the books home and read them with their children, using the Read Out Loud app as needed during the reading process.

Researchers were present in the class roughly once a week. During this time, we distributed physical books, introduced and assisted with app updates, and ran additional activities to gather feedback and narratives about how families engaged with the Read Out Loud app. The particular details of each session are described in Table 6.1.

In the first session, we ran an activity where parents made their own shared-reading prompts and stuck them into a physical storybook to ask their children while reading together at home. To do this, the ELL teacher introduced the concept of a shared-reading prompt. Then we passed out Sticky Notes and asked learners to write down three prompts that they could ask their children as they read together. They shared these prompts aloud and were encouraged to write down their favorite prompts shared by other learners. At the end of the exercise, learners stuck these prompts
CHAPTER 6. STUDIES WITH ELL PARENTS AND THEIR CHILDREN

<table>
<thead>
<tr>
<th>Session Number</th>
<th>App Updates</th>
<th>Books for Learner</th>
<th>Additional Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Basic app installed</td>
<td>1</td>
<td>Activity where learners created and shared their own shared-reading prompts on Sticky Notes</td>
</tr>
<tr>
<td>2</td>
<td>Minor update installed to slow down TTS voice</td>
<td>1</td>
<td>Group discussion on how learners are using Read Out Loud at home</td>
</tr>
<tr>
<td>3</td>
<td>Major update installed that added shared-reading prompts (Feature C) into the app</td>
<td>1</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>None</td>
<td>3</td>
<td>Individual interviews with parents, shared-reading observations</td>
</tr>
<tr>
<td>5</td>
<td>None</td>
<td>None</td>
<td>Individual interviews with parents, shared-reading observations</td>
</tr>
</tbody>
</table>

Table 6.1: Overview of sessions in Study 2

on the corresponding pages of their storybook so that they could ask them later as they read with their children.

In the second session, we divided into two groups for informal discussion. In the fourth and fifth sessions, we individually observed three families reading together using the Read Out Loud app and interviewed all of the parents on their experience using the app (see Appendix B.3 for interview questions). These results are discussed in Chapter 7.

There were many parts of the app that were iterated upon as the study continued. At the beginning of the study, I explained to learners that their feedback would help me iteratively change the app over the course of the study. I did this not only to help me in my co-design process, but also to give the learners a sense of ownership over the app’s design. In session one, learners requested that the voice be slowed down. The following week, the updated app had a slower voice. Though I wanted to integrate shared-reading prompts into the app after Study 1, it was only after observing how excited learners were to make physical shared-reading prompts in session one of Study 2 that...
I integrated shared-reading prompts (Feature C) into the session three update of Read Out Loud.

In this chapter, I detailed the two studies I conducted to understand how learners used Read Out Loud during shared-book reading experiences. I highlighted how observations of and feedback from ELL parents, their children, and their teachers helped inform both the design of the app and the study. In the next chapter, I discuss the observations and feedback from the studies in detail, using them to understand how familial factors such as family members’ comfort with mobile devices and number and ages of children might influence how a ELL parent interacts with the ELL tools in Read Out Loud.
In this chapter, I discuss the use of Read Out Loud over the course of the two studies conducted with ELL parents and their families. I present parents’ use of the individual ELL tools in Read Out Loud, providing examples from Study 2 that illustrate how each tool was used by parents during a shared-book reading experience. I then discuss how and why parents may chose to use particular ELL tools over others embedded in the app. Lastly, I reflect on how familial factors might play into how parents used the app. While I present findings from both Study 1 and Study 2 in this chapter, I focus on qualitative observations from Study 2, where I was able to observe families using the app individually and conduct in-depth interviews with learners.
7.1 General Use Patterns

Read Out Loud was used by 15 ELL parents over the course of the two studies. In Study 1, learners reported using the app an average of 15 minutes per day over the course of one week. In Study 2, learners accessed the app one day per week on average over the course of five weeks. The majority (70%) of the time they used the app to read with their children. The other 30% of the time they used the app to read on their own.\textsuperscript{1}

As described in the previous chapter, the Read Out Loud app includes three ELL features: (Feature A) clicking on the "play" button to read the text of a storybook page aloud; (Feature B) clicking on a word to see its translation in the learner's native language and hear its English pronunciation read aloud; and (Feature C) discussing the questions on the shared-reading prompt pages. The extent to which learners used Features A and B is recorded by looking at the number of times a learner clicks on the "play" button or an individual word respectively. The use of Feature C is documented by calculating how long a learner remains on a shared-reading prompt page. If they remain on a prompt page for more than 30 seconds, it is assumed that they discussed the prompt with their children.

On average, learners used the language learning functions 32 times in a given book reading session. A "book reading session" is defined as the time from when a learner opens the book screen for a particular storybook on the app to when she closes it and returns to the home screen.\textsuperscript{2}

7.2 Feature A

Some learners primarily used the app to listen to storybook pages read aloud (Feature A). On average, learners did this 11 times per book reading session. To illustrate how a ELL parent might rely on this feature during a shared-book reading experience, I provide an example from Study 2.

\textsuperscript{1}This information was only collected in Study 1 using learner book logs (see Appendix B.2 for example).

\textsuperscript{2}In order to count as "book reading session", a learner must open the book and access more than two of the book's pages before closing it. This helps discard data from when a learner accidentally opens a book or decides to close the book without reading it.
7.2.1 Case Study: Isabel and Maria’s Shared-Book Reading Experience

Isabel and her four-year-old daughter Maria decide to read *The Giving Tree* by Shel Silverstein. Maria sits next to Isabel, who picks up her smartphone and opens up the corresponding book in Read Out Loud. On each page, Isabel clicks on the play button on the app. For shorter pages, she tries to read the text first, then clicks play and moves her finger along the text on the physical page as the app reads the page aloud. For longer pages, she reads the text aloud and moves her finger along with the app’s narration.

Maria splits her attention between following her mother’s finger and looking at the pictures in the physical book. Every couple of pages, Maria will point to a picture and say the word in Spanish. For example, she pointed to the drawing of the tree and said *árbol* (meaning “tree”). Isabel will pause and say a few words about the picture to Maria in Spanish or simply say *sí* (meaning “yes”).

After observing Isabel and Maria read, I asked Isabel why she listened to the pages read aloud by the app. She explained that she has anxiety speaking because she has to think about what she says. In her interview, she elaborated on this fear by saying, “I scared. I scared. To talk with the people in English. I’m afraid of being wrong with people.” It is possible that Isabel’s anxiety extends to reading with her daughter.

In Isabel and Maria’s case, neither are proficient at reading in English. Isabel may rely on Feature A
in order to read a challenging storybook with Maria without needing to ask her English-speaking husband for help understanding the written text (see Appendix A.3 for more details on Isabel's ELL experience).

7.3 Feature B

Some learners primarily used Feature B, where a learner can click on a word in the storybook to both see its translation in their native language and hear it spoken aloud in English. On average, learners did this 21 times per book reading session. To illustrate how a learner might use this tool in the context of shared-book reading, I provide an example from Study 2.

7.3.1 Case Study: Andrea and Camila's Shared-Book Reading Experience

Andrea and her six-year-old daughter Camila decided to read *The Berenstain Bears Don't Pollute (Anymore)* by Stan and Jan Berenstain. They read each page aloud together and sounded out words they did not know. For example, they worked together to sound out the word “deserves.” As they read, if Camila noticed that Andrea mispronounced a word, she corrected her pronunciation. For example, when her mother read the word “something” as “sometime,” Camila gently repeated “sometime” so her mother would notice the difference.

They used the app to look up unfamiliar words. When Andrea looked up a word, she said the Spanish word aloud and nodded or exclaimed “ah!” indicating that she now understood the word’s meaning. She then tried to sound out the word in English. Camila was a very fluent reader, so the words they looked up in the app tended to be rare words such as “professor,” “pollution” and “endangered.”

Both Andrea and Camila are almost literate in English. As both can read most of the text in the storybook, there is no need for them to use the app to narrate the book (Feature A). However, there

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3 This is according to Andrea's Best Plus score. Her Best Plus score is 603, which corresponds to a level past "Advanced".
are still points where they come across a word they both do not know. In these cases, they turned
to the app to look up information about the word (Feature B). Seeing the Spanish translation helps
Andrea immediately understand the word. Andrea and Camila’s actions illustrate how Feature
B can help the roles of the expert and the novice flow back and forth between parent and child
during a shared-book reading experience. Camila corrects her mother when she realizes that her
mother said a different word than was on the page, playing the role of the expert. When Camila
does not know a word, Andrea assumes the expert role, looking up words on the Read Out Loud
app to provide information about words that Camila does not know.

7.4 Feature C

Almost none of the learners used the shared-reading prompts (Feature C). Across all the learners
in Study 2, only one learner accessed the prompt pages for longer than 30 seconds (which she
did a total of two times). To illustrate what learners did when they encountered a shared-reading
prompt page in the app, I look at observations from both Isabel and Andrea’s reading experiences
with their children.

When Isabel encountered a shared-reading prompt, it confused her. She looked at the page in the
physical book and noticed that it did not match the page in the app. She then proceeded to swipe
through to the next page in the app which matched the physical book page. However, Isabel did naturally engage in conversations with Maria about the book. Most of these conversations were in Spanish and driven by the pictures that Maria pointed to in the book (see above example of Isabel and Maria’s shared-book reading experience for more details).

When Andrea encountered a shared-reading prompt, she read it aloud in the app but did not seem to realize that it was a question she could ask Camila. Instead, she would read it just like any other page. For example, she encountered the prompt “What do you think the ‘big story’ is about?” Instead of posing the question to Camila, she proceeded to read the prompt and the possible vocabulary on the page aloud, clicked on the vocabulary she did not know, and proceeded to the next page without discussion.

This was an interesting finding, as learners seemed to love the initial shared-reading prompts exercise with Sticky Notes in the first session of Study 2. In learner interviews, they explained how they used the Sticky Notes to ask their children questions. For example, Olivia explains her daughter’s reaction when she asked one of the questions she had written on a Sticky Note. “I can ask, ‘How many in the picture? What do you like here?’ And [s]he look at my little paper [Sticky Note] and say, ‘Mommy, that’s for me?’”

Learners’ underuse of the shared-reading prompts may be due to both the way the prompts were integrated into the app and the lack of learner agency built into the feature itself. The prompts looked like pages in the app’s storybook, but had bold green text to differentiate them from regular pages. Learners may have not realized that this meant the page was a shared-reading prompt and been confused when they saw a page in the app storybook that did not match a page in the physical book. Perhaps the prompts should have appeared as virtual versions of the Sticky Notes that the learners used to create their own shared-reading prompts. This Sticky Note visual might have suggested to learners how to use the prompts, as they were already practiced in using the Sticky Note prompts.

The prompts may have also failed because they did not give parents agency over what prompts they asked or when they asked them in the story. Unlike the Sticky Note exercise, where learners
created their own prompts, these prompts were created ahead of time by researchers and pre-loaded into the app to correspond with specific storybook pages. This mechanism may have been too rigid. It may not have allowed parents to ask the types questions they wanted or converse with their children in the language they preferred. Perhaps providing the shared-reading prompts in a learner’s native language would have encouraged parents to use the prompts, as conversation about the prompt could flow between the parent and child easily.

Parents may also take their cues on what to discuss from their children, such as in Isabel and Maria’s example. Rather than using the predefined shared-reading prompts in Read Out Loud, parents may use their child’s questions to foster discussion during a shared-book reading experience.

Similar to the shared-reading prompts, almost none of the parents used the save a word capability while reading with their children. This was unexpected, as learners had specifically requested a “review a word” feature after initial tests.

Learners may have chosen not to use this capability for a variety of reasons. It had more steps than the ELL features themselves. On the book screen, a learner had to click on the word to select it and then click on the star button to save it. To review it, they had to exit the book screen and go to the review tab on the home screen. The review capability was also not immediately useful to the parent. It was designed to allow a parent to go back and review words they did not get a chance to learn when reading with their children. This was different than the immediate help Features A and B gave to parents (e.g. Isabel and Andrea) while reading alongside their children.

7.5 Role of Read Out Loud in the Shared-Book Reading Process

However different the ways that learners used Read Out Loud, qualitative coding of learner interviews (discussed in Chapter 4) revealed an overarching reason why learners chose to use the different ELL tools embedded in the app during shared-book reading. The reason they used the Read Out Loud app was to help create a role for themselves in the reading process with their chil-
dren. They used the app to look up their child’s questions, to narrate a story that they could not read to their children otherwise, or to keep up with their English-literate children as their children read aloud. Regardless of the different ways they used the app, all of the parents interviewed described that the app played an integral part in their shared-book reading process.

When asked to describe how they use the app, many parents explained that they used it to answer their children’s questions. Nor explained, “[I use the app] reading with my kids. Helping my kids with any questions, anything hard.” Olivia described how looking up words on the app was her role in the process. “I say [to my daughter] look at the book. When you no understand, I press on the word and you listen.”

Parents also explained that the app helped them narrate a storybook to their child that they might otherwise have struggled to read aloud. For example, Victoria explained that she used the app to narrate when she read with her three-year-old daughter. “[With] my daughter, I using it. I say shhh, quiet, listen [to the app]. For me it’s very very good.”

The app helped some parents keep up with their English-literate children as they read aloud. For example, Clara described using the app while her son read aloud. “This book [gestures to book] my children and I, I’m in the middle and we open up the books and choose what books we want to read and I take the cell phone and my son was reading and my daughter is seeing the pictures and I just listen [listen and look up on the app].” She felt that the app helped her keep up with her son, who understands most of the storybook’s text. She explained, “I think this [app] help me, help me. Not for my children, but for me. Because when I read a book and I hear in the app, I know how to pronounce the word. But they already know.”

7.6 How Familial Factors Affect Read Out Loud Use

It is important to note that parents used different aspects of the app in different reading environments. Familial factors, such as number and ages of children, parent reading level, and comfort with digital devices influenced how a parent used the app.
For example, when parents are using the app to read a book by themselves in class or with a preliterate child (e.g. Isabel reading with Maria), they may use choose to read the storybook pages aloud using the app, as neither parent nor child is literate enough in English to narrate the entire story. When they are reading with an older child who is literate or almost literate in English (e.g. Andrea reading with Camila), they may rely on the app to help them answer questions that their child poses. When they are reading with multiple children where at least one is literate (e.g. the situation that Clara describes in the previous section), they may use the app to help them keep up as their children narrate to each other.

Parent reading level may also affect how they use the app. Learners that struggle to discern basic text or pronounce English words (e.g. Isabel) may choose to read the entire page aloud using the app. Parents who can read most of the text on their own (e.g. Andrea) but need help with specific words may choose to look up the translation and pronunciation of words they are struggling with.

<table>
<thead>
<tr>
<th>Child is preliterate in English</th>
<th>Parent has low English literacy</th>
<th>Parent has high English literacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent uses Feature A to narrate a story that neither parent nor child could read on their own.</td>
<td>As the parent reads aloud, they use Feature B to look up the meaning and pronunciation of unfamiliar words.</td>
<td></td>
</tr>
<tr>
<td>Child is literate in English</td>
<td>As the child reads aloud, the parent uses Feature B to keep up with their child’s narration.</td>
<td>As the parent or the child reads aloud, the parent uses Feature B to look up the meaning and pronunciation of words that are unfamiliar to both parent and child.</td>
</tr>
</tbody>
</table>

Note: The number of children in a given family can affect the likelihood that one or more of the children in the shared-reading experience will be literate. The more children a family has, the more likely that at least one child is old enough to be literate in English.

Table 7.1: How parent and child English literacy levels may factor into how parents use Features A and B in Read Out Loud

Table 7.1 details how parent and child literacy levels may factor into a ELL parent’s use of Features A and B during shared-book reading. However, these are just two of the familial factors that influenced how Read Out Loud was used by parents during shared-book reading experiences with their children. Other factors, such as a parent’s embarrassment speaking English, fear of failure,
and support from their children, may also play a role in how a parent uses the Read Out Loud app. For example, Olivia explained that it hurt her when her daughter did not understand her pronunciation of a word. Therefore, when she did not understand how to read the text of the entire page aloud, she used Feature A so that she and her daughter could listen to the page’s text read aloud together.

Parent digital literacy did not seem to factor into how parents used the app. After being shown how to use the app in class, all parents reported that they were able to use it to access Features A and B during a shared-reading experience with their children. Some explained that they needed help from their children, but that their children were able to teach them how to use the app. Additionally, parents could also ask questions and copy each other’s actions during class to figure out how to access different features on the app. This was apparent in the first session of Study 2, where a group of parents sitting at the same table collectively discovered how to click on words on the book screen of the app.

Where digital literacy became an issue was with troubleshooting the Android operating system. For example, when one learner’s phone had its TTS voice set to Spanish, she needed our help to fix it. Learners also struggled with frequent app downloads for iterative versions of the Read Out Loud app, as they were not used to updating apps on their phones from the Google Play Store. I address these issues and provide guidelines on how to navigate them in Section 8.2.

In this chapter, I discussed how parents used the different ELL tools in Read Out Loud and how familial factors may have influenced their use of these tools. In the next chapter, I build upon these findings and the user-testing practices detailed in the previous chapter to develop guidelines for creating technology for and with ELL parents.
Over the course of the studies, feedback from and observations of ELL parents led to integral changes in the app and study design. However, it was difficult to navigate designing for and testing with a group of learners that are unfamiliar with the concept of user-testing and with whom I did not share a common language.

In this chapter, I build on my experience designing and user-testing Read Out Loud to develop guidelines for creating technology for and with ELL parents. I hope these guidelines are useful to future designers and developers of technologies for parents and other adults learning English.
8.1 Design Guidelines

Below I discuss ways to make ELL tools accessible to adult learners. In particular, I focus on ways to design ELL experiences for parents to collaboratively learn alongside their children and make these ELL experiences accessible to learners with low digital literacy.

8.1.1 English Language Learning Tools

Use flexible language learning tools. For example, TTS and word translation are flexible tools because they allow parents to use them in different ways. The shared-reading prompts serve as a counter example. They are rigid, having a predetermined question and location in the storybook. As such, they require a parent to follow a prescribed way of use instead of allowing a parent the flexibility to incorporate them into their own self-designed reading process. In Study 2, the flexible ELL tools were adopted by learners, while the rigid shared-reading prompts were ignored. The shared-reading prompts could have been made into a more flexible tool by asking the learner to click to view a page’s prompt whenever she wanted to.

Hearing text read aloud by a TTS voice is better than not being able to hear the text read aloud at all. Throughout the two studies, the ELL teachers and I were worried about the TTS voice. We thought that learners might not use the TTS voice, as TTS sometimes uses strange intonations and rhythms when speaking and is not as expressive as a human voice. However, none of the learners interviewed complained about the voice.

8.1.2 Parent-Child Peer-Learning Experiences

Support learning activities that might be driven by both parent and child. How a parent appropriates language learning tools when interacting with their children depends on both the parent and the child’s English competence and their family dynamic. To support a range of different configurations, ELL tools should accommodate both children and parents taking the lead. For example, Read Out Loud acted as a resource to Andrea, allowing her to look up words that her
daughter did not know when she took the lead. It also acted as a resource to Clara, who explained that she used the app to look up words as she followed along with her children’s narration.

**Foster parent confidence.** Many ELL parents reported being afraid to say something wrong in front of others, including their children. Instead of creating features that tell the learners if they answered something correctly or not, build open-ended features where learners can decide for themselves when they have mastered the material. For example, suppose a learner is trying to pronounce the word "dinosaur." Instead of building a way for the technology to listen to the learner’s voice and tell her if she pronounced the word correctly, allow the learner to listen to the word “dinosaur” as many times as she wants and choose if she wants to repeat the pronunciation or sound out the word on her own.

**Allow seamless integration of the digital technology into the physical experience.** When a parent is interacting with a technology alongside their child, they want to focus their attention on the child. For this reason, Read Out Loud was not designed to be the center of the shared-reading experience, but instead designed as a resource that ELL parents can use while reading. I minimized the number of clicks that a parent has to make on the Read Out Loud app during this reading experience. On each app page, it only takes one click to access the most used features and no clicks to access the shared-reading prompts which appeared automatically. Feature B even combined TTS and word translation in order to minimize the number of clicks a learner has to make in the app.

### 8.1.3 User Experience Design for Learners with Low Digital Literacy

**Use cultural affordances from non-digital environments.** Cultural affordances leverage a user’s past experience to help them learn something new [34]. For example, the “flip” navigation integrated into Read Out Loud is a cultural affordance. Using this navigation system, learners can turn a page in the app similarly to how they turn a page in the storybook. This served two purposes. First, learners could perform a similar action to change the page in both the physical and app versions of the storybook. Second, study participants with low digital literacy quickly
understood how to "flip" a page, as it was similar to their actions in non-digital environments.

**Use UX features with big target areas.** Similar to the previous guideline, using UX features with big target areas can help a parent easily navigate a technology without having to concentrate their full attention on it. For example, when Isabel read with Maria, she was able to deftly swipe through the pages of the book in the app while still somewhat focused on the physical book that Maria was reading. One reason for this is the target to "flip" a page was the size of the storybook page (approximately 80% of the screen).

**Account for older children being able to help their parents with digital technologies.** Many children may be more digitally literate than their parents and able to help them navigate digital technologies. When designing for adults with low digital literacy, keep in mind that children may help their parents learn how to navigate a technology. For example, during the first session of Study 1, Clara’s son took her phone and installed the app for her. He then walked her through the app until she felt comfortable using it on her own.

### 8.2 User-Testing Guidelines

In addition to identifying some useful technology design principles, I learned that some of the typical user-testing approaches have to be adjusted for users with low English and digital literacy skills. In this section, I propose a few guidelines for user-testing technology with ELL parents. In particular, I focus on ways to prepare for and conduct user-testing sessions and learner interviews.

#### 8.2.1 General Guidelines

**Use a mix of direct observations, learner interviews, and analytics to record learner feedback and observations.** This mix can help create a fuller picture of how the learner engages with the technology. For example, a learner may engage with a technology one way under direct observation but describe their use of the technology differently due to lack of English vocabulary. Analytics can help understand if and how a learner uses a technology throughout the study. They
can help clarify a learner’s own description of how they used the technology and provide data to see if a learner used the technology in a consistent manner when using the technology at home or outside the research environment.

**Be extremely conscious of learner’s time.** Adult learners are taking time out of their day to attend English class. If they see a user-testing session as irrelevant to their learning, they may choose not to participate. This was the main reason why I conducted all user-testing sessions and interviews in English.¹ Learners embraced the user-testing sessions as opportunities to practice their English and learn new vocabulary. For example, in one of the sessions, the teacher introduced vocabulary (e.g. “graduate school” and “research”) to help learners understand why the user-testing session was important.

### 8.2.2 Before User-Testing

**Review the vocabulary used in forms, surveys, and interview questions and adjust it to the users’ literacy levels.** After the first round of interviews in Study 1, the ELL teacher corrected the way I was asking questions. For example, I asked learners, “Would it be possible for me to ask you a few questions?” She explained that the ELL parents had not yet learned about conditionals (e.g. “would”) and might not understand what I was saying. I changed the questions to be more direct. Instead of using conditionals, I used statements such as “I want to ask you a few questions. Is that okay?” From then onwards, I sent the ELL teachers copies of the forms, surveys, and interview questions so that they could correct any overcomplicated vocabulary or grammar used before I posed the questions to learners.

**Work with the ELL teacher to design user-testing sessions to fit with her curriculum.** The teacher may have ideas on how to make the user-testing sessions correspond with her ELL curriculum. For example, I asked the ELL teachers to select books for Read Out Loud that were in

¹There was a Spanish-speaking translator or an ELL teacher (who also spoke Spanish) present. However, they only resorted to Spanish as a last resort. No Arabic-speaking translator was present. However, there were Arabic speakers in the class who were very proficient in English and could help with translation if needed.
line with the books learners might choose to read for their weekly school assignments. This way, instead of asking learners to do an activity in addition to their school assignments, user-testing the app blended into their learning experience. Learners may have been more likely to use the app since it could help them with these assignments.

**Be flexible about updating the user-testing protocol to match learner needs.** For example, I increased the number of books given to learners each week. Originally, I had decided to give the same book to each learner so that I could have a standard corpus of text to compare how the same book was read by different learners. However, the teacher reported that learners were growing bored with only one book, especially those with older children who wanted to read more advanced books. Therefore, I changed the user-testing protocol, providing three books of varying difficulties to learners in the later weeks of Study 2.

### 8.2.3 During User-Testing

**If possible, form discussion groups by native language so that learners can help each other with English comprehension.** I discovered this technique when learners divided into two groups for informal discussion during one session. Learners naturally formed groups based on native language. There was one group that spoke mostly Spanish and another that spoke mainly Arabic. In these groups, learners conversed in their native language to figure out the meaning of a word or phrase they did not understand in the discussion (e.g. learners conversed in Spanish to figure out the meaning of the English word “hopeful.”) They also used their common native language to discuss what the correct way to say something in English was before answering a question.

**Use visual cues to help learners follow verbal discussion.** During the learners’ visit to the MIT Media Lab, I projected slides with visual cues to help learners follow along during each part of the user-testing session. At Forrester, as there was no projector to show slides, I used a large tabletop easel pad instead of a slide deck. Before the session, I hand drew the content of the slides on the easel pad pages. During the session, I flipped through the pad the same way as I would
Step 5: Login to Read Out Loud

![Figure 8-1: Examples of visual cues used during user-testing: slides used during Study 1 (left) and easel pad pages used during Study 2 (right)](image)

Figure 8-1: Examples of visual cues used during user-testing: slides used during Study 1 (left) and easel pad pages used during Study 2 (right)

advance a slide deck to provide the learners with visual cues throughout the user-testing session. Figure 8-1 shows an example of the slides and easel pad pages used to provide these visual cues.

Use color-coding as a visual cue. Color is language agnostic and easy to recognize. It can be used as a quick way for learners and researchers alike to receive immediate visual feedback for an action. For example, color was used to help learners follow along during the login process. Their login information was placed on a green sheet (shown in Figure 8-2). When they arrived at the step in the setup process where they needed to input their login credentials on the app, I referenced the “green sheet” visually by holding the sheet up. Learners could easily find this sheet even if they did not understand the verbal instructions.

The color of the app’s navigation bar was changed in each app update to provide a visual indicator of the app’s version. This way, learners and researchers alike could immediately see if the app had been successfully updated. For example, halfway through Study 2, learners were asked to update to the “green” version of the app (shown in Figure 8-2). If their navigation bar was green, learners knew their app had updated. Researchers could also quickly identify learners who did not have the green navigation bar showing on their Read Out Loud app and assist them with the update process. Without this color change, the app update process was problematic, as learners had to navigate to the app’s details in the Google Play Store and compare the version number to see if
8. GUIDELINES FOR DESIGNING FOR AND TESTING WITH ENGLISH LANGUAGE LEARNING PARENTS

8.2.4 Interviewing

Provide a list of numbered interview questions for learners. For each question, provide both the English and the native language translation in written form. When learners came in for their interviews, they were handed a copy of all the interview questions and asked to look them over. This way, they knew what sort of questions I would be asking during the interview ahead of time—a tactic that may have helped ease their anxiety about being interviewed. As the interview progressed, if they did not understand a question, I could reference the number of the question or point to the question on the page and they could read the question in their native language. This helped learners alleviate confusion about the content of the question. A copy of the interview questions is shown in Appendix B.3.

If possible, include children in the interviews to facilitate conversation. Many of the children I worked with during this study were well practiced at being language brokers for their parents. Having them present in the parts of the interviews helps parents communicate easily, as their children can help them with English and switch between the two languages. For example, Gabriel helped translate for his mother Victoria as she described how she and Gabriel read story-

Figure 8-2: Examples of using color as a visual cue to help learners with the login process in Study 1 (left) and changing the color on the navigation bar to indicate the app update version (right)
books together. However, it is also important to talk with parents individually, as there may be topics that a parent does not want to discuss in front of their child.

**Do not highlight if a learner makes an English language mistake.** Many of the learners explained that they are afraid to speak English because they do not want to make mistakes in front of others. As such, I did not want to highlight when a learner made an English language mistake during their interview. I would instead try to rephrase the question once or twice to see if they used different vocabulary in their answer and then move on to another question, returning to the former question later in the interview. For example, I asked the question, "When do you use English with your family?" to which one learner replied "a little." I then repeated the important part of the question, "when?" She understood and replied, "I going in the store. I go shopping. The train... take the train. In the bus, the people have question for me.”

**Reference visual cues during learner interviews.** During the interviews, I had storybooks and a mobile phone with the Read Out Loud app on the table. If a learner was confused about a question related to storybooks or the app itself, I picked one of them up to reference it. Learners could also do the same to illustrate their points. For example, when describing how she reads with her children, Clara picked up a storybook, opened it, and pointed to each side of the bench she was sitting on to describe how she sat in the middle holding the book with her children on either side.

In this chapter, I presented guidelines for creating technology for and with ELL parents based on my work with Read Out Loud. In the next chapter, I pose some future directions for this work.
Conclusion and Future Directions

The goal of this thesis was to investigate how technology can be designed to motivate and augment parent ELL in the context of shared-book reading between family members. To do this, I designed, built, and tested Read Out Loud, a mobile app that provides ELL parents with access to language learning tools they can use during a shared-book reading experience with their children.

Shared-book reading is a collaborative, peer-learning activity between family members. As such, familial factors, such as number and ages of children or family members’ comfort with mobile devices, influence how a ELL parent interacts with language learning tools during this collaborative experience.

Based on learner interviews, direct observation of shared-reading experiences, and data on learner
actions on the Read Out Loud app, I described how familial factors influenced parents’ use of language learning tools during a shared-book reading experience. I then developed guidelines to design for and user-test with ELL parents based on my experience working with the families at Forrester. My hope is that these guidelines can help other designers and developers create technology for parents and other adults learning English.

9.1 Reflection

One of the most interesting aspects of this work has been to observe the nuanced collaboration methods that ELL parents and their children develop to learn English together. It is not straightforward. Factors such as parent embarrassment, fear of failure, and child support for the parent’s learning process play a role in negotiating how parents and children engage in an ELL experience together.

However, all of the parents who participated in this research expressed that working with their children to learn English is an important part of the experience. One of the learners, Nor, expressed this sentiment succinctly when she said she is “learning with my kids, because of my kids.” As such, I hope the work detailed in this thesis can encourage those who build tools for ELL parents to design technology that embraces and supports collaborative ELL experiences between parents and their children.

9.2 Limitations and Possibilities for Further Work

The Read Out Loud app was designed, built, and studied over a limited time period. This is why I focused on testing three key language learning features. With more time, I would have experimented with other features and also further iterated upon the design of the three features in Read Out Loud. For example, I would have liked to test a second iteration of the shared-reading prompts to allow parents to record their own questions and decide when to access a shared-reading prompt. I would have also liked to add in the ability for parents to request books to read on the app and
create an interface for ELL teachers to input books into the app (possibly through crowd-sourcing book transcriptions from images of book pages).

Read Out Loud was tested with a small group of ELL parents at the Forrester Family School. These parents were highly motivated to learn English (as shown by their choice to enroll in English class) and expressed their desire to learn English to engage with their children’s English-language world. While these learners may be representative of parents enrolled in FLP programs, many parents learn English outside the FLP context. Thus, limitations of this work come from studying the app’s use with a relatively small group of ELL parents enrolled in one FLP class in the Greater Boston Area.

Limitations of this work also came from the dynamics of the Forrester classroom. While I chose to conduct the interviews in English to give learners a chance to practice speaking English, I may have received more detailed feedback if I had conducted these interviews in their native languages. Due to learners’ limited proficiency in English, I often had to use specific vocabulary and avoid deviating far from the preselected questions during interviews (so that they could reference written questions provided to them in their native language). Thus, I was not able to ask follow up questions based on learner responses during the interview. As discussed in Chapter 8, the interviews were designed in this manner to integrate the Read Out Loud user-testing into the Forrester curriculum and make the studies relevant to the ELL parents in the class, but this created some limitations regarding the information collected throughout the study.

9.3 Future Directions

This thesis provided a case study into designing digital tools for adult learners. While I provided design and user-testing guidelines for working with ELL parents with a range of digital literacy levels, some of these guidelines could be extended to a larger audience—adults learners with low English and digital literacy.

For example, I suggest that designers use flexible language learning tools when designing for ELL
parents. However, this may also apply to adult learners other than parents. In general, adult learners do not want to be told what to do. Instead, they want to be able to choose options based on their and their family’s individual needs [4]. Using flexible language learning tools can allow ELL adults to choose how to appropriate these tools into their own self-designed learning experience.

I also suggest that designers built language learning technologies that support parent confidence. This guideline was suggested because ELL parents expressed that they are afraid of failing in front of their children. However, research shows that many adults who drop out of high school, regardless of being a parent or not, may be frustrated and self-conscious about school failure [35]. Building technology that supports learner confidence could help ELL adults alleviate this fear.

A future direction of this work could be to find more commonalities between designing for ELL parents and ELL adults with low digital literacy skills. This could be used to create a more general set of design and user-testing guidelines for ELL adults with low digital literacy skills. By creating these types of guidelines, my hope is that I can make it easier for designers and developers to build technologies that support some of the learners who need it the most—the 36 million adults living in the United States that struggle with basic literacy [2].
To provide a richer portrait of the study participants than can be provided by statistics, this chapter details four learners' stories: Olivia, Victoria, Isabel, and Nor.

A.1 Olivia

Olivia is a 35-year-old woman from Colombia. Back in Columbia, she finished 5th grade before she dropped out of school. She met her husband, David, when she moved to the United States 14 years ago. He is also originally from Colombia, but moved to the United States as a child and is fluent in both English and Spanish. They have two children, Alicia, who is six years old, and Carmen, who is two. Olivia is four months pregnant with their third child.
Olivia knows that not only does she need to learn English for her family, but for her own independence in American society. Recently, she was offered a promotion at the catering company where she works. The new role would put her in charge of things like ordering the raw ingredients for cooking. "I'm nervous. I'm so nervous. Sometimes they call and make a big order or something and I don't understand or the other person don't understand me." She ended up turning down the promotion, as she was nervous that she would place an order for the wrong number of ingredients (e.g. 300 instead of 30 carrots) which could endanger her job.

Olivia began studying at Forrester Family School about nine months ago, sparked by her desire to engage with her daughters, who prefer to speak in English with each other and with their father. In her words, she enrolled in Forrester, "because for my daughter and my husband speak English."

Communicating with her older daughter Alicia in English has become more difficult as Alicia gets older. Olivia reflects on one time she tried to compliment her daughter on the way home from school, telling her that she was "the best".

"Alicia, you're the best."
Her daughter replied, "Mommy, my bed's in my home."
"Alicia, you're the best."
Alicia was confused. "My bus goes to the school."

At this point Olivia gave up – it was clear that Alicia did not understand her pronunciation of the word “best”. This was not the first time. Sometimes, when she tries to speak in English with Alicia and forgets a word, she uses Google Translate on her smartphone to look it up. Despite Olivia’s attempts to speak in English, Alicia will say, "Please call my dad. My dad understands. You don’t understand." Olivia feels like Alicia does not want her there, and it brings tears to her eyes.

Olivia feels left out of conversations in her own family. She gets upset when she hears her husband speaking with her daughters in English. "What if she say something not nice and I can't understand?"

She tries to engage Alicia in her English learning process, typically having a short conversation
in English on the way home from school. She says, “Alicia, what is that?” providing the Spanish equivalent for the word to engage Alicia is practicing Spanish as well. Sometimes she will ask Alicia, “What’s the good pronunciation?” repeating the word or sentence after Alicia.

Olivia has a crazy schedule. She wakes up at five o’clock, helps her daughters get ready for school, gets ready for work herself, and drops her daughters off at her sister’s house. The bus picks up her daughters from her sister’s, along with her nephews, who all go to the local public elementary school co-located with Forrester. After work ends at 4 p.m., she runs to Forrester Family School. In her words, “I run. I run. Coming here to the school.” After class, she picks up Alicia from the school’s daycare and Carmen from her sister’s. Then she goes home, makes dinner, and she and Alicia do homework together—she does her homework for Forrester and Alicia does her schoolwork. If they get time, they read a storybook. And then it is bedtime around 7:30 or 8 p.m. because they have to wake up early. “When they no go to bed, hah, that’s big problem for next day in the morning. I need to sleep!”

A.2 Victoria

Victoria is a 45-year-old woman from El Salvador. She has two children, Gabriel, who is 11 years old, and Marisol, who is three. She moved to the United States 13 years ago, and has been studying English at Forrester for the past year and a half. In El Salvador, she learned how to read in Spanish before leaving school in 6th grade.

She enrolled in Forrester because of her children and her job. She cleans houses for many English-speaking clients. She wants to be able to communicate with her clients when she goes to clean their homes. In her own home, Spanish is the language of communication. Both her children speak Spanish and she feels they enjoy speaking Spanish more than English. However, their homework is in English and she wants to be able to help them with homework and engage in activities where English is the primary language of communication, such as watching TV with her kids. Her family switches between English and Spanish naturally. Her kids will speak to her in English and she will respond in Spanish. Her son will also translate for her when they are outside the home. Her English
Appendix A. Learner Stories

Comprehension is very good, as she has lived in a predominantly English-speaking society for 13 years, but she feels that she cannot speak well and always worries that she mispronounces words.

Victoria has a hectic schedule. After school, Gabriel goes to the after school program at the elementary school while Victoria is at Forrester. Afterwards, they head to the public library to select new books to read together, and then they go home, where they both do their homework and eat dinner. After dinner, Gabriel helps Victoria learn English by reading with her for 20 minutes each day. Victoria is incredibly proud of Gabriel; especially how articulate he is in English. When talking about how they read together, Gabriel explains: "When we read books, what we do is I read like two sentences or a paragraph and she reads the rest. I let her by herself so she can understand what she's reading." During the times while Gabriel is narrating, Victoria follows along, mouthing the words so she can understand the pronunciation. Gabriel can see that in the past year, Victoria has really improved her English, as she used to be uncomfortable reading full sentences in English.

Victoria is somewhat comfortable with smartphones and Gabriel loves them. Victoria restricts Gabriel's use of the phone. He is only allowed to play games on it during the weekend. It surprises Victoria how much Gabriel knows about the phone. He is always the one she turns to when she needs to install something on her phone. Gabriel enjoys helping his mom with both technology and English—Victoria can see the pride and joy on his face when she learns something new.

A.3 Isabel

Isabel moved from El Salvador to the United States seven years ago, when she was in 11th grade. Isabel met her husband Daniel in the United States. Daniel, who grew up in the U.S. and speaks English and Spanish fluently, is always encouraging Isabel to learn English and find friends who she can practice speaking in English with.

She has one daughter, Maria, who is four years old. Isabel started studying English at Forrester about a year and a half ago, when Maria joined the Head Start program at their local elementary school. Her husband is responsible for helping Maria with her homework, as the homework is
in English. Though she wishes she could understand English to help Maria with her homework, she does not feel a real necessity to learn English to help her daughter with schoolwork, as her husband is happy to help and the predominant language spoken at home is still Spanish.

She is learning English for the “outside”. She needs English when she goes to the store, takes the train, and rides the bus. “[What if] the people [in the bus] have a question for me?” Though she usually understands what others are saying—if they speak slowly enough—she is afraid that she will not be able to respond. “I scared. I scared. To talk with the people in English. I’m afraid of being wrong with people.”

Sometimes, Isabel gets frustrated with her husband when she wants his help translating something into English and he refuses to help her. She knows he does this because he wants her to learn. He says, “No, no, no. [If I help, you] no learn English.” However, she knows that she can turn to Google Translate for help looking up a word. In fact, Isabel uses her smartphone for everything. She talks to her friends on WhatsApp, posts on Facebook, and relies on Google Translate to help her figure out words in English.

She is always practicing her English by asking her husband and her daughter for help with pronunciation. She also reads storybooks with her daughter Maria, who is starting to learn to read. As Isabel knows how to read in Spanish and Maria knows how to pronounce words in English, they will work together to read a storybook. Together, they try to understand the story from the pictures in the storybook and the words they understand, but often turn to Google Translate to look up difficult words. Her daughter also loves Isabel’s smartphone. She has installed about half the apps on Isabel’s phone and is constantly trying to borrow the phone to play games.

A.4 Nor

Nor is a 43-year-old woman from Morocco. In 10th grade, she dropped out of school in Morocco, married, and started a family. In Morocco, she and her husband had two children, ages 14 and 11 years old, before they decided to move to the United States. After moving to the US, they had three
more children, twins who are eight years old, and a daughter who is seven years old.

Nor began studying English at Forrester two years ago because she wanted to be able to communicate with her five kids, who all speak English amongst themselves. In her words, “I am learning English with my kids, for my kids. Because I’m going to the school, and I have meeting[s] with the teacher for my kids. I go to the hospital, sometimes I don’t see an interpreter. I go to shop. Because if not, nobody can give me an interpreter, I can’t communicate with the people [I need to interact with].”

She also wonders if English will help her understand her older children’s homework, or if she still will not be able to understand the concepts that her daughter is learning. “I don’t understand anything. [When they entered third grade], I said, that’s it. My daughter in 8th grade, I don’t understand [her homework].”

She quickly made friends at Forrester. In particular, she is close friends with Paula, a Brazilian woman who joined the class nine months ago. She and Paula practice English together. It is hard because they have no other common language, Paula speaks Portuguese and she speaks Arabic, so they have to use English. But she knows it is helping her learn, and she can already see the results.

She wants Arabic to remain the language of her home and is constantly telling her kids that they need to learn Arabic. But Arabic is hard for them. “They speak English more than Arabic. English is easy for my kids because they go to school, but Arabic is hard [for them].”

Her children often help each other with homework. She explains that she will sit with her son and daughter while they are reading to each other and try to decipher what they are saying. “They are reading and reading, because I don’t understand.” As she listens, she tries to use the pictures in the book to help her understand. However, when a word is very hard, “I’m going to Google.” Sometimes she tries to speak with her children in English so that she can learn. “If I need anything, [I ask them] ‘Can you give me that?’ Sometimes I repeat the word that my children say. Or what I don’t understand, I ask them.”
In this appendix, I present all the surveys, book logs, and interview questions given to the learners.

B.1 Biographic Survey

Participants of both user studies filled out a paper survey in person. During Study 1, this survey was administered at the conclusion of the study. During Study 2, this survey was administered at the conclusion of each learner interview. In both cases, researchers were present to provide instructions and answer questions about the survey.
Biographic Information

- Name: _______________

- How old are you? _______________

- How old are your kids?
  1.) Age: _______________ years old
  2.) Age: _______________ years old
  3.) Age: _______________ years old

- How long have you been living in the United States? _______________

- What country are you from? _______________
B.2 Book Log

In Study 1, I requested that participants log their reading experience with the application daily. The purpose of this log was to document how long parents read with the app each day and if they read with their children or on their own. An example book log is shown below. The ELL teacher discussed with learners how to fill out the log.

<table>
<thead>
<tr>
<th>Date</th>
<th>Reading Time</th>
<th>Wednesday, May 6th</th>
<th>Thursday, May 7th</th>
<th>Friday, May 8th</th>
<th>Saturday, May 9th</th>
<th>Sunday, May 10th</th>
<th>Monday, May 11th</th>
<th>Tuesday, May 12th</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>□ Read the book by yourself</td>
<td>□ Read the book by yourself</td>
<td>□ Read the book by yourself</td>
<td>□ Read the book by yourself</td>
<td>□ Read the book by yourself</td>
<td>□ Read the book by yourself</td>
<td>□ Read the book by yourself</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ Read the book with your kids</td>
<td>□ Read the book with your kids</td>
<td>□ Read the book with your kids</td>
<td>□ Read the book with your kids</td>
<td>□ Read the book with your kids</td>
<td>□ Read the book with your kids</td>
<td>□ Read the book with your kids</td>
</tr>
</tbody>
</table>

Book Log

Name: ____________________
B.3 Interview Information Sheet

In Study 2, I conducted in-depth learner interviews. Before each interview, learners were given a copy of both the Interview Information Sheet in English and their native language. Next, the introduction was read aloud in English. The Interview Information Sheet is shown below.

**Interview Questions**

**Introduction**

We would like to ask you a few questions to learn more about how parents who are learning English read with their children. There is no right or wrong answer to any of these questions. Anything you tell us will be incredibly helpful for our research. If you need to answer a question using words or sentences in (Spanish / Arabic), that is fine. We can record your response and translate it later.

**Questions**

1. When do you use English with your family and community?
   (a) How often do you speak English at home?
   (b) How often do you speak (Spanish / Arabic) at home?
   (c) What is an example of a time you use English?
2. What do you find hard about learning English?
3. Why did you decide to join English class?
4. Are storybooks helpful for learning English? Why or why not?
5. How do you find out the meaning of an English word you want to know?
6. Who do you ask if you need help with English?
7. How did you use the Read Out Loud app at home?
   (a) What did you like or dislike about the app?
8. (Question for children.) How did you use the Read Out Loud app at home?
   (a) What did you like or dislike about the app?
9. Do your children like speaking English?
10. Do your children like using mobile phones?
    (a) What do they like to do on the phone?
Analytics Implementation

The Mixpanel analytics package was used to track learners' clicks and page loads on the app. Each tracked click and page load is detailed below. Angle brackets are used to indicate text specific to individual events.

1. Home screen (containing both the library and the review tabs)

   - **Open - Library**: Records when the home screen open to the library tab is viewed.

   - **Open - Review**: Records when the home screen open to the review tab is viewed.

   - **Open - <Book Name>**: Records when a book is opened. Stores name of the book.
2. Book screen

- **Page Viewed**: Records when a page is viewed.

- **Click - Slide to Next**: Records when a learner swipes right to "flip" to the next page of the app storybook.

- **Click - Slide to Previous**: Records when a learner swipes left to "flip" to the previous page of the app storybook.

- **Click - Slide to #<Page Number>**: Records when a learner clicks on a reference image on the navigation bar to open a page.

- **Click - Play: <Page Text>**: Records when a learner uses Feature A.

- **Define and Play - <Word> and Replay - <Word>**: Records when a learner uses Feature B. Stores what word is clicked.

- **Save - <Word>**: Records when a learner saves a word for review. Stores which word is saved.

- **Click - Close Book**: Records when a learner closes a book.
Bibliography


BIBLIOGRAPHY


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