MOBILE-ASSISTED LANGUAGE LEARNING: APPLICATION DEVELOPMENT PROJECTS WITHIN REACH FOR LANGUAGE TEACHERS

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ABSTRACT

To many, developing language-learning tools for mobile platforms seems out of reach. Mobile app development projects require a wide array of specialized skills that many language teachers do not possess. This article reports on a set of mobile language learning application development projects initiated by language teachers. By setting attainable goals and focusing on collaboration, faculty in these projects have been able to take advantage of the new possibilities mobile devices offer for language instruction. Faculty adopted Design-Based Research methodologies in an Ecological Constructivist framework in order to design, implement, and test their apps in collaboration with students and faculty from across the campus. The results suggest that app development projects are feasible for language teachers, and that pedagogically sound apps can reduce some of the anxiety associated with learning a foreign language.

The long-standing desire to make use of digital technology and multimedia in language learning classrooms has, in part, been satisfied by the recent development of applications for mobile devices. Language teachers can now access a wealth of resources that enrich the learning process with authentic

materials well suited for different levels of acquisition by using mobile applications previously unavailable. There remains and will remain, however, a need to develop new digital language learning tools that address changes in pedagogy and students' needs as they relate to these new platforms. This article presents results from a mobile application development project, as well as brief theoretical considerations that contributed to the application design process. Most importantly, it is argued here that mobile language learning application development projects require pedagogical guidance from skilled language teachers and that these application development projects are possible even for smaller groups of educators working at relatively small institutions.

Significant preparation is required to design applications that are pedagogically sound, make the most of a mobile platform's potential for interactive learning, and are well suited for use in and outside of communicative classrooms. Language teachers should be encouraged, however, to explore the possibility of starting their own mobile language learning application development projects. These projects are feasible when language teachers draw on skills already present in their learning communities. Broad based collaboration is essential when developing applications that benefit from both pedagogical insight and technical know-how, while also drawing more robustly on the functional advantages of mobile devices for language learning. At present, the majority of apps available to language teachers were designed with little awareness of language pedagogy and the needs of a communicative approach to language learning.

This article outlines development projects undertaken by a team of faculty and students at the University of Minnesota Duluth (UMD) from various departments, including Foreign Languages and Literatures, Computer Science, Art & Design, and Communication Sciences and Disorders. Together, these faculty created the Mobile Language Learning Group (MLLG) with the intention of exploring the implementation of mobile devices in language learning classrooms. Soon after the group formed, faculty quickly realized that while an ever-increasing number of applications were being developed for the mobile platform, many lacked pedagogical rigor. As a result, implementation in and outside classroom environments was hampered by a broad set of concerns. In response to this situation, faculty set out to create language-learning applications for mobile devices on their own. Not only have the application development projects of the Mobile Language Learning Group been successful, but through them, faculty and students have also significantly broadened their digital skill set and learned a great deal about the potential of interdisciplinary, collaborative and

student-centered digital tool development projects. This article provides readers with a report on these application development projects, while also reviewing assessments of the impact these applications have on reducing anxiety in learners. This article also considers the results of our usability study and the kind of collaboration required to develop a language learning application from the ground up, in this case using Xcode, Apple's suite of software development tools for developing apps for Apple's mobile operating system.

The key to developing high quality mobile language learning applications is collaboration. Rarely do individuals possess all the skills needed for the programming, project design, graphics work and language pedagogy that are required to develop mobile language learning tools. Universities and other broad-based learning communities, however, often bring together individuals who, as a group, possess the abilities required for these kinds of projects. Fortunately, interest in mobile app development is widespread, and faculty and students working in Graphic Arts, Foreign Languages and Computer Science, as well as other related fields, are often eager to gain and give their students experience with these kind of development projects.

The UMD Mobile Language Learning Group has changed over time, but on average has consisted of approximately 5 faculty members and 10 students. Faculty from different fields have typically contributed on the basis of one area of expertise, while developing their interest in and partial familiarity with another area of any given project. Projects have taken anywhere between one and four years to complete. Larger projects require dramatically larger amounts of planning, and call for much more thorough skills in project management. Often those kinds of skills are acquired in the process of partaking in or leading smaller app development projects first, so starting small is advisable.

Student participation is essential and it is the students, arguably, who gain the most from app development projects like the ones described here. While computer science classes rarely provide instruction for a particular mobile platform, and graphics courses rarely prepare students explicitly for work with mobile devices, students from different fields consistently find that their coursework provides them with a firm basis for collaboration in mobile app development projects. In our experience, it has often turned out to be students in the earlier stages of their undergraduate careers who end up contributing most to app development projects. Students often require several months to acquire the new skills required for projects like these. If those students are near graduation, their input to a project is likely to remain limited.

In the UMD Mobile Language Learning Group, students of varying degrees of capability have contributed to projects. In all cases, students have found the experience rewarding for their future career. Most find that being able to reference work on a complete and publicly available mobile app on one's resume is a strong asset when applying for jobs.

While completing degree work, students' availability is often constrained. Nonetheless, due to widespread enthusiasm for mobile app development, the Mobile Language Learning Group at UMD has consistently been able to rely on significant student contribution to all of our mobile app projects. The bulk of those contributions were made by students who volunteered their time out of personal interest. Other students have competed for and received Undergraduate Research Opportunity Grants, which has proven to be a valuable way to both finance and recognize student contributions.

MALL LITERATURE REVIEW

While still an emerging academic field, Mobile-assisted language learning (MALL) has received significant attention as an approach that enhances a learner's experience through the use of handheld mobile devices, such as mobile phones and tablet computers. Reflecting on available work on MALL is extremely helpful for language teachers who wish to begin app development projects. Most researchers agree that the potential impact MALL can have on second language learning is significant (Lee, 2011). For example, the New Media Consortium's 2013 Horizon Report identifies eTablets and mobile apps as highly valuable near term tools for learning inside and outside the classroom.

A review of literature on MALL shows that approaches to use of mobile devices for language learning have grown both out of interest in Mobile Learning (m-learning) and Computer-Assisted Language Learning (CALL). It is also important to note that many MALL applications have been developed with little or no exposure to the scholarly discourse on the use of rich media for language learning on mobile platforms. As will be expected for a still emerging field, scholarly literature on MALL is characterized by the topical interests and smaller studies that motivate the contributions of researchers.

More general and theoretical frameworks for MALL have predominantly been focused on student-centered learning while encouraging a constructivist or connectivist engagement between the learner and knowledge and between the

learners themselves (Hoven & Palalas, 2011). In a constructivist framework, the teacher takes on the role of facilitator as the students engage in active inquiry with their object of study and with each other. Students are able to access on-demand learning opportunities, as well as contextualized learning opportunities. Mobile devices and applications encourage spontaneous and contextualized learning, mediating the mental activity of learning a language by creating a wide and rich array of auxiliary links between the subject and the object of study.

In this context, Vygotsky's concept of mediation is well suited for describing the link between mental activity and the symbolic tools that individuals use (1986). In simplest terms, a mediation is the introduction of a secondary device (physical or symbolic) into an activity that links humans with the world around them. Well-designed mobile apps operate as mediations by providing an improved learning ecosystem and by mitigating the environmental factors that raise negative emotional responses and impede learning (Krashen, 1982). For these reasons, there is a growing consensus that MALL has the potential to invite the subject into a more active role in the learning of a second language (Kukulska-Hulme & Shield, 2007, 2008; McClanahan et al., 2012). If work on grammar or pronunciation can be shown to produce acquisition-impeding anxiety, well designed applications can harness the familiarity of mobile platforms to mediate those responses, while offering language learners access to content that increases their confidence in speaking and writing.

Language teachers have long recognized that, even without interactivity, access to diverse media can aid language learners and augment acquisition. The development of the personal computer brought with it enormous possibilities for increasing the variety of media available to students in and outside the classroom. CALL sought to take advantage of those possibilities for exposing students to a wide spectrum of language content in a variety of forms, while adding interactivity (Sanders, 1995). In comparison to CALL, educators and practitioners enumerate several advantages of mobile learning, including a tendency to be spontaneous, personal, informal, contextual, portable, ubiquitous and pervasive. MALL offers opportunities for language learning that are thoroughly integrated within daily activities (Kukulska-Hulme, 2005, p. 2).

Earlier scholarly efforts to explore MALL focused on the use of cell phone technology and communication via text messaging (Towns & Loo, 2012). Only with the development of smartphones do interactive software and rich media become possible for language learning with mobile applications. And then, in 2010, the appearance of new multimedia-capable, wifi-connected tablet devices

significantly broadened the possibility for innovation in the development of mobile language learning tools (Webb, 2010; Lys, 2013). It is in this context that the faculty of the UMD Mobile Language Learning Group began to design learning activities around mobile devices with an emphasis on collaborative tasks, interactive activities, scaffolding exercises and mediations across both the language and mobile technologies. While much of the recent research on MALL points to a behaviorist model of user engagement (e.g., reading or studying during time otherwise not used, such as while riding on a bus, waiting in line, or waiting for class to begin, etc.), faculty involved with the Mobile Language Learning Group sought to emphasize a pedagogical framework that would allow their work to evolve as they gathered data on student use and performance. What has been observed, and consciously promoted in the group's activities, is a move toward an ecological constructivist framework and an openness to a connectivist model of learning (Hoven & Palalas, 2011).

The proximity of use experienced by mobile device users is significant for a number of reasons. The relative ease of use associated with mobile devices allows users to interact with content without thinking about the device as a computer. Devices are intentionally designed to maximize this ease of use, and this further enhances users' experience of the device as an extension of their habitual daily practices. The extent to which mobile devices have, in fact, become the instrument of a wide variety of daily practices is noteworthy. In 2013, one out of every three minutes spent online in the U.S. was spent on a mobile device, and 70% of U.S. smartphone users had their phones with them 22 hours a day. "They check their phones as soon as they wake up, and then over a hundred more times until they go to sleep." (Dean, 2013) The mobile environment is clearly an area in which the potential for learning is worth exploring.

While MALL clearly offers great promise, it is also important to consider the limitations inherent in mobile learning applications, including the expense associated with the devices, the tendency towards distraction, and the perceived need to be connected at all times. Faculty and students working on the projects described here reported findings from a 2012-2013 study on multi-tasking that showed the decreased ability of subjects to retain information as they engaged in additional tasks, no matter how seemingly innocuous. When it comes to cognition, even the self-described multi-taskers don't do well in multitasking environments.

Additionally, other hindrances include small screen size on smartphones, a general lack of pedagogically tested apps, and the downsizing or absence of devices such as the keyboard or mouse. While these hindrances are often significant, language teachers should consider adaptation as part of a larger reorientation towards the development of cognitive tools designed for a new generation of language learners. The move away from teachers, textbooks and language labs, and toward a mobile learning environment in language learning mirrors a larger shift away from sources of authority and toward a skill and skill-acquisition oriented connectivist understanding of learning. Students are increasingly taking ownership of their own education, for better and for worse (Mitra, 2005).

METHODOLOGY

Ecological Constructivist Framework

The ecological constructivist framework for learning captures the interconnectedness of psychological, social, cognitive, and environmental processes as well as the co-existence of pedagogical and technological elements interplaying in a dynamic real-life learning environment just as we find when students use mobile technology to learn (Hoven & Palalas, 2011). According to Palalas (2011), ecological constructivism integrates the socio-cultural theory constructs of knowledge co-creation as socially and culturally mediated with the help of tools, and those tools are applied in active learning that targets real-life communicative goals. In addition, ecological constructivism adopts aspects of Vygotsky's (1986) notions of Zone of Proximal Development as well as the modeling and scaffolding of situated cognition and collaborative learning. Learners, in this model, become more active, autonomous, and collaborative as they co-construct meaning for themselves and others (Palalas, 2011).

The organic nature of this group's work has given rise to a community of practice, made up of people from various disciplines. The interdisciplinary and collaborative aspects of this project have both drawn on and aided in the development of applications that target multidimensional learning and the creation of dynamic learning environments.

Creating native applications, or apps developed for use on a specific device coded for the operating system of that device, requires input from a wide range of actors, as discussed above. The capacity to form connections between sources of

information, and thereby create useful information patterns, is required to learn in the current knowledge economy (Siemens, 2004). Such a process moves away from two teachers exchanging notes on classroom teaching methods to a network of faculty, students, and technological resources that makes the creation of native apps not only possible, but easy enough for nearly anyone to contribute. Individuals serve simply as a node of expertise on a much broader network of specialists who find themselves working toward a common goal. The difficulty for many is that ownership of any particular idea or project often appears fleeting. The big question then becomes, how does one assess such a dynamic learning environment and the subsequent products of its many interactions?

While constructivist theoretical frameworks have helped guide the development of individual learning activities and interactions among students, objects and teachers, the broader collaboration has called for a reconfiguration of the research approach to encompass the extra-curricular learning that has grown beyond the limited scope of the initial projects. To this end, members of the UMD Mobile Language Learning Group have pursued a design-based research approach that sees research methodologies and interventions conceptualized and then implemented iteratively in situ in order to test the ecological validity of a dominant theory and to generate new theories and frameworks for (re)conceptualizing learning, instruction, and design processes.

Design-Based Research.

The emerging model of Design-Based Research (DBR) pushes educational research out of the laboratory and into the dynamic classroom setting, simultaneously pursuing the goals of developing effective learning environments and using such environments as natural laboratories to study learning and teaching (Sandoval, 2004; Brown, 1992; Edelson, 2002; Van den Akker, 2006.). DBR is a systematic but flexible methodology that aims to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings. DBR encourages contextually-sensitive design principles and theories (Wang & Hannafin, 2005, p. 7), in a way that is informed by several disciplines, including developmental psychology, cognitive science, learning sciences, anthropology, and sociology. On the design side of the work, researchers draw from the fields of computer science, curriculum theory, instructional design, graphic design, and teacher education (Sandoval, 2004, pp. 199-201). DBR intentionally exploits the design process as an opportunity to advance the researchers' understanding of

teaching, learning, instructional design, and educational systems (Edelson, 2002). Researchers embrace such an approach because it is viewed as practical, iterative, and flexible enough to respond to input from practitioners (Joseph, 2004; Van den Akker, 2006).

While the collaborative interests of DBR have been applied most often to classroom settings (Gustafson and Branch, 2002), the DBR described here has been conducted within the broader context of cognitive apprenticeships in which students work with faculty mentors who guide their work and model thinking within a particular discipline. Cognitive apprenticeships, argue Brown, Collins and Duguid (1989), respect the situated nature of knowledge and make visible the processes of thinking, just as apprenticeships in the skilled crafts have historically made visible the process of work. This is the benefit application development teams can draw from members with expertise in their relevant disciplines. Teachers and researchers from languages, computer science, graphic design, and communication sciences possess the relevant forms of expertise to serve as mentors to students, helping them to form communities of practice within the disciplines and to contribute as active collaborators across an entire campus.

CASE STUDIES & RESULTS

Beginning in 2010 the UMD Mobile Language Learning Group began exploring the advantages associated with mobile learning by introducing 15 iPad tablets into several different classroom settings. Initial attempts at implementation revealed problems including slow download speeds and a weak wi-fi network. Then, in a little more than a year later, those problems had been mitigated through the University's investment in upgraded hardware and more robust wireless networks across the campus. While the first generation iPad devices lacked a keyboard and mouse, they had the benefit of a larger touch screen and a tactile interface that students considered familiar and user friendly. Soon after the Mobile Language Learning Group began working with iPads, researchers recognized the need for language learning tools that more directly addressed the needs they encountered in the classroom. The lack of pedagogically tested apps was a major concern for faculty and proved a motivating factor for subsequent initiatives to develop faculty-designed apps, two of which are discussed in detail below.

While, from the beginning, there have been a wide array of language learning applications available for mobile platforms (such as Busuu, Duolingo, and Babbel), few advanced beyond introductory vocabulary training exercises. Beginning in 2011, language faculty sought to develop rich and exciting language learning applications that would take advantage of the benefits that mobile devices offer to language learners. The group concluded, however, that it would be best to begin with a modest challenge in order to acquaint members with the application development process. Even with a modest goal, it is important to note that significant gains can be achieved by combining pedagogical insight, native application coding skills and a well-balanced approach to graphics and user interface design. The first apps developed by the students and faculty were a German Grammar Guide and a Pronunciation App (discussed below), both of which responded to perceived needs in the language classroom.

For each of the applications developed by the UMD Mobile Language Learning Group, the research team sought the cooperation of students and faculty working in Foreign Languages and Literatures, Computer Science and Graphic Arts, as well as other disciplines. From the beginning, each application has been developed with the understanding that collaborators would influence the final outcome with their own distinct expertise. This process has resulted not only in valuable language learning tools, but also a community where faculty and students from across the university have benefited from interaction with and learned from each other.

German Grammar Guide

For the first project, German language faculty began by identifying areas where the capabilities of mobile devices would have the greatest impact on behaviors that influenced learning practices. The tactile handheld tablets offered students a powerful computer and crisp display, while also offering the ability to present information in a variety of new ways. Unlike many applications developed for CALL, mobile devices offer a computer-aided learning experience that is not situated so much in front of the user as it is in the user's hands, and this ease of use associated with tablet devices remains one of the key aspects for mobile language learning application development. This is especially important because proximity and ease of use have significant consequences for tools used in second language acquisition. The experience of proximity and ease of use is further heightened by the frequent use of screen taps and swipe gestures instead

of the keyboard. With these characteristics in mind, faculty working in German language classrooms identified an area in which the vast potential of tablet devices could be exploited.

German is a complex and highly structured language. For that reason, learning grammar, either implicitly or explicitly, has always been an important part of learning the language. While the importance of explicit grammar instruction has been the subject of controversy in language pedagogy, work in CALL has sought to show that computer mediated grammar practice can "improve students' learning and mastery" (Lys, 2013). By offering a variety of modes of access to grammar content, learners enhance their ability to interact with structured aspects of the language.

This is especially promising for German, where the tabular information required to negotiate grammatical structures is so complex and extensive that German grammar tables often have an intimidating effect on students. While grammar tables provide the information students need, students are often turned off by the daunting task of memorizing large sets of tabular information. Mobile devices allow for a much more versatile presentation of grammatical information, and that can allow language teachers to avoid raising what Krashen refers to as the affective filter, the impediments to language acquisition caused by negative emotional responses.

Krashen's (1982) influential Monitor Theory makes a clear distinction between language acquisition (subconscious) and language learning (conscious), where the latter can only function as an editor, or monitor, for what is produced. Students acquire new structures when they are exposed to comprehensible input (i+1) in the target language (L2), motivated and free from anxiety. Krashen's (1982) Affective Filter Hypothesis further captures the "relationship between affective variables and the process of second language acquisition by positing that acquirers vary with respect to the strength or level of their affective filters" (p. 31). Students with a high affective filter will be less likely to seek out input and be less likely to respond to the input that they do get. Likewise, students with a low affective filter will not only be more open to input, they will actively seek it out. Error correction, according to Krashen, should therefore be minimized in the classroom.

For these reasons, faculty with the UMD Mobile Language Learning Group began developing a multifaceted grammar tool that reduced the affective filter, for use in and outside the classroom. Students and faculty from the Foreign

Languages and Literatures Department, the Department of Computer Science and the Department of Art & Design began work on a tool that would provide users with the right amount of grammatical information at the right pace.
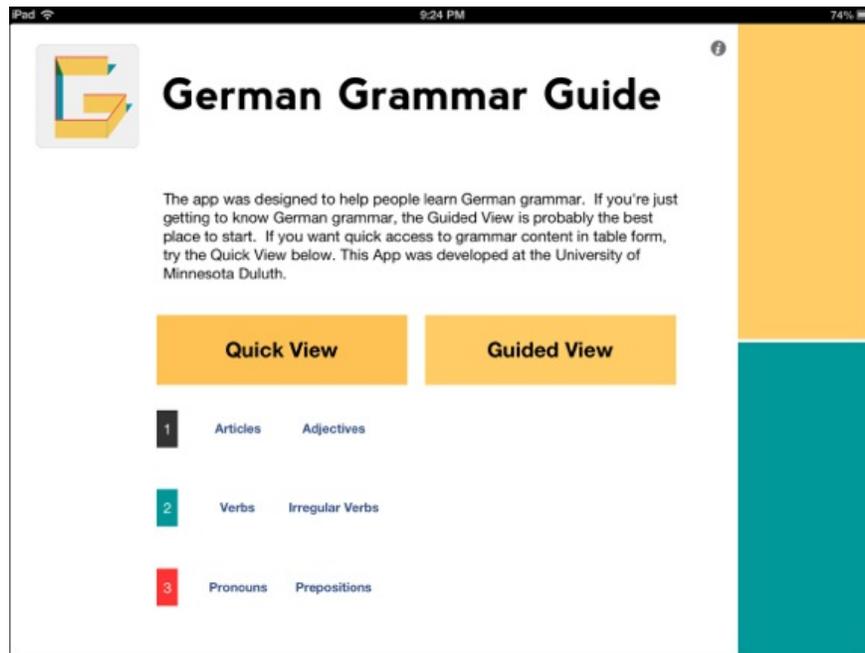

Figure 1. The opening screen of the app offers users an option that allows them to adjust the way grammar content is presented. During the usability study, discussed below, members of the app development team learned to explore different ways of adjusting presentation to fit users' needs. (© 2013, Regents of the University of Minnesota. Used with permission.)

The German Grammar Guide (UMD German Grammar Guide, 2013) provides two distinct ways of accessing and learning about the structure of the German language. Language learners at different levels of proficiency can access grammar content at the pace that is right for them. For instance, advanced learners can use the Table View to access easily scanned and conveniently organized grammar tables, and quickly reference relevant grammar content, for example:

Figure 2. "In the Table View, users can access grammar content quickly. While the app does not emphasize tabular presentation of grammar content, it does seek to provide the inevitable look-up option as conveniently as possible. (© 2013, Regents of the University of Minnesota. Used with permission.)

For those new to learning German, however, there is also Guided View:

Figure 3. In the Guided View, users are invited to explore grammar topics as needed and at their own pace, both in and outside of classroom settings. (© 2013, Regents of the University of Minnesota. Used with permission.)

The Guided View introduces a wide variety of easily digestible grammar topics at a comfortable pace without overwhelming users with too much complex grammar content at one time. Learning German and communicating in German remains the primary focus, and it is emphasized that grammar is, once again, merely a helpful tool. The German Grammar Guide is easily accessible and will work on all versions of the iPad. Members of the UMD Mobile Language Learning Group plan on developing versions for iPhones as well as for devices with the Android operating system.

It is important to note that the mode of presentation built into the German Grammar Guide remains versatile in a number of significant ways. The grammar content itself is written by faculty and students working together. This helps achieve a mode of presentation that remains accessible with little preparation. By interlinking sections of the grammar guide, researchers have been able to remove the need to introduce grammatical concepts in a hierarchical or pre-established order. Instead, students can choose the path that makes the most sense to them. This means that language learners can access those pieces of grammar they need without the direct intervention of a teacher. It also means that the application can be used in a wide set of different language learning contexts.

One unforeseen but important aspect of application development is the access to data on usage of the app, frequency with which it is downloaded and location of users downloading the app. While apps are often developed with an eye to immediate classroom implementation, it is helpful to keep in mind that over half of all downloads of apps developed by the Mobile Language Learning Group at UMD are downloaded outside the U.S. At the time this article was written, the German Grammar Guide was the most frequently downloaded application published and licensed by the University on Apple's App Store. With application development projects like this one, students at a regional university campus can play an essential role in the development of applications for learning that truly have a global reach.

As the first language application developed by the Mobile Language Learning Group, the German Grammar Guide has served as a model for future application development. Researchers have sought input from several different partners, both internal and external, on the development, release, and review of the application. The most involved testing performed on the German Grammar Guide has been a usability study at a Usability Lab. Staff at the Usability Lab

recruited six participants, three each from beginning and advanced German classes. Each participant was invited into the lab, given a series of problems to solve using the German Grammar Guide on an iPad.

During the study, participants were asked to give voice to their thought process as they worked their way through the grammar problems using the application as an aid. Faculty and IT personnel sat on the other side of a two-way mirror and took notes on the perceived strengths and weaknesses of the application for each participant and made a prioritized list of recommendations for future modifications. Researchers then brought this data back to the Mobile Language Learning Group, and identified a practical strategy based on student availability. Adaptations to the Grammar Guide were then put into a workflow and groups were setup to suggest, evaluate and implement solutions. Through collaboration and conversation with Computer Science and Graphic Arts faculty and students, teams adopted a modified agile methodology of adaptive planning, evolutionary development, and an iterative approach that encourages a rapid and flexible response.

The immediate results of the study were generally positive. Most importantly, the application allowed participants to access the grammar content that was most valuable to them, without overwhelming users with too much complex grammar at one time. Instead, participants were able to navigate either to the quick reference sections they needed to deal with a grammar concept they already understood, or they were able to navigate to the grammar explanation section to acquire the grammar explanation they sought.

Participants were asked six questions each. Questions were formulated in such a way as to challenge the grammatical proficiency of the participant, given the level of proficiency anticipated based on past course work. For 89% of the prompts given to novice level participants, students were able to navigate to the section of the app most relevant to the solution they sought, and for 94% percent of the prompts given to advanced participants, students were able to navigate to the section of the app where they were able to find the grammar content they needed.

The most helpful aspect of the usability study came from the participants' expressions about their experiences with the app while they were performing the tasks of the study. Researchers noted that participants repeatedly mentioned how the application made dealing with grammar appear easy, and how they felt

applications like this one would make learning the language more fun. This ease of use is central to the goals of the project.

Pronunciation App

The second app under development is a pronunciation tool that addresses the interest in form in language instruction (Lochtman, 2003). The app allows learners to practice their pronunciation with a machine rather than a live interlocutor, thereby reducing some of the stress associated with corrective feedback. UMD Researchers in French and Spanish collaborated with faculty in the Department of Communication Sciences and Disorders (CSD) to discuss their strategies for accent reduction in learners of English. How, for example, should one work with learners who have difficulty pronouncing the American /r/ or ⟨th⟩? Many pronunciation guides jump right to the phonemic level to show students how the sound is formed in the mouth. By working with CSD, researchers learned the advantages of focusing on listening tasks where students developed the ability to hear their own mistakes. Work in speech pathology suggests that 80% of learners will change their pronunciation if they can simply hear their errors. This app provides a scaffolded approach to pronunciation that starts by identifying individual phonemes difficult for speakers of English.

For the French Pronunciation App, users see phonemes in a French sentence and are provided an oral example of a male and female native speaker. The learner is then asked to record him or herself saying the phrase and then listen to it next to the native speaker's voice, which is recorded and available for playback in the app. Speakers who hear the error and have difficulty mastering the particular phoneme are then given the opportunity to dig deeper by performing listening exercises where users are asked to identify the word being spoken. From there, they are asked to pronounce a select group of words that highlight the phoneme being practiced and, once again, compare them to the native speaker's pronunciation. If they are able to correct their mispronunciation, they are then given the opportunity to speak the initial phrase again. Those still having difficulty with the words are taken to the phonemic level and shown how to form the mouth to create the sound along with a few additional exercises meant to elicit the correct pronunciation. Learners then go back to the word level and then on to the sentence again. Learners go only as deep into the program as they need in order to identify and correct the errors they have recognized.

This app can be used either in classrooms or for self-directed study. Language teachers can assign specific phrases to their students based on errors they identify in the classroom. The students can do the exercise individually in the privacy of their dorm room or apartment, avoiding the anxiety of addressing pronunciation in front of their classmates and the inefficiency of choral repetition. Pronunciation exercises with dictation software in the language classroom have been very popular with students, many of whom express reduced anxiety and a greater interest in correct pronunciation.

CONCLUSION

Cross campus collaboration and student involvement make the otherwise daunting task of native mobile app development feasible for language teachers. Without input from language teachers, MALL will continue to be hampered by a lack of awareness of the needs encountered in communicative classrooms. Beyond the classroom, mobile language learning tools open spaces for learning far wider and more nuanced in terms of content delivery than has previously been the norm. As digital tools work their way deeper into the niches of everyday habitual practices, the opportunities for learning increase exponentially, but along the way the models used to understand that learning need to be reconsidered. MALL offers a striking example of the potential for developing technologically enhanced learning practices.

Certainly, future work in MALL holds many possibilities that go well beyond the projects described above. The UMD Mobile Language Learning Group is already engaging in larger app development projects that aim to exploit the full spectrum of advantages that mobile devices can offer language learners, including digitally delivered immersive experiences, game-like virtual language learning environments, and real time, interactive and project based language use collaborating with native speakers internationally.

ABOUT THE AUTHORS

Dana Lindaman, Assistant Professor of French in the Department of Foreign Languages and Literatures at the University of Minnesota Duluth (PhD, 2008 Harvard University), helped to found the Mobile Language Learning Group, where he develops apps with colleagues and students, including a pronunciation app that allows learners of a second language to improve their confidence in speaking through a series of exercises targeting specific phonemes.

Dan Nolan, together with faculty in the Computer Science, Art + Design and Foreign Languages and Literatures Departments, also helped to found the Mobile Language Learning Group. Dan uses his background in the Digital Humanities, German Studies and Russian Studies to create mobile applications that help students learn foreign languages. Dan is an Assistant Professor of German and Russian Studies in the Department of Foreign Languages and Literatures at the University of Minnesota Duluth (PhD, 2010 Northwestern University).

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